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Exploring the risk and protective factors associated with obesity amongst Libyan adults (20 -65 years)

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By

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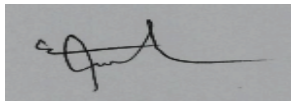
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Declaration

I declare that this thesis is my own unaided work. It is being submitted for the degree of Doctor of Philosophy at the University of Bedfordshire. It has not been submitted before for any degree or examination in any other University.

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Date: 22 February 2016

Abstract

Background

Obesity is a highly complex, chronic disorder with a multifactorial aetiology that includes biological, psychosocial and cultural factors. Since the discovery of oil in 1959, Libya has been undergoing a nutrition transition. Despite obesity reaching epidemic proportions in Libya, there is a lack of information about obesity in Libyan adults.

Aims

The aims of this study were to investigate the risks and protective factors associated with obesity among adult men and women in Libya; to estimate gender differences in the prevalence of obesity among Libyan adults; and to explore key informants' views about obesity within the context of Libyan culture.

Design of study

An adapted mixed-methods sequential explanatory design was used, consisting of two phases: a quantitative study in the form of a cross-sectional design, and a qualitative study in the form of semi-structured interviews, which followed up on the findings of the first phase.

Method

A multi-stage cluster sampling technique was used to select participants from the Benghazi electoral register. With a response rate of 78%, the sample consisted of 401 Libyan adults, aged 20-65 years, who have lived in Benghazi for over ten years; 63% were female. A survey questionnaire was used to examine the relationship between Body Mass Index (BMI) and the following four-predictor variables, derived from the Socio-Ecological Model (SEM): socio-economic status; unhealthy eating habits; physical activities and sedentary lifestyle; and neighbourhood environment. Anthropometric measurements were collected from participants in their homes. For the qualitative phase, 9 Libyan healthcare professionals and 12 Libyan community leaders (key informants) were individually interviewed. A mixed-methods approach to study obesity has not previously been used in Libya.

Results

The prevalence of obesity among Libyan adults was found to be 42.4%, whereas that of being overweight was 32.9%. A significant positive association was found between obesity and two SES components (education level and income) in Libyan adults of both genders, while

occupational status was significantly positively associated with obesity in women only. Obesity was significantly positively associated with fast-food consumption, and the consumption of large food portion sizes, in Libyan adults of both genders. In contrast, the consumption of sugar-sweetened beverages was significantly positively associated with obesity in Libyan women but not in men. A significant inverse association was found between breakfast consumption and obesity in Libyan adults. Obesity was significantly negatively associated with physical activity in Libyan women, while significantly positively associated with sedentary behaviour in Libyan women but not in Libyan men. Finally, a significant association exists between the BMI of Libyan adults in 6 of the 12 neighbourhood environment attributes. For Libyan men and women these were: street connectivity, 'unsafe environment and committing crimes at night', and neighbourhood aesthetics. For men only, these were: access to public transport, access to recreational facilities, and 'unsafe environment and committing crimes during the day'. Finally, 'residential density zones' was significant for women but not for men.

Three main risk factors were identified from the qualitative study. The first concerned the heavy subsidisation of staple food commodities in Libya; the second is Libya's deteriorating health sector performance; and the third is the effect of the neighbourhood environment on physical activity and food, including the current political and economic instability in Benghazi which is potentially fuelling the obesity epidemic. These themes and additional sub-themes were categorised as belonging to one of the five spheres of the SEM (individual; interpersonal; institutional and organisational; community and physical environment; and public policy), resulting in the final conceptual framework of this study. Some of the qualitative results contradicted the quantitative results, resulting in some inconclusive findings.

Conclusion

These findings could inform Libyan health policies and the interventions that are urgently needed for preventing or controlling the obesity epidemic in Libya. Key recommendations are that an electronic health information system needs to be implemented and awareness about obesity and its causes and consequences needs to be raised among the public in order to dispel the many myths and misconceptions held by Libyans about obesity.

Dedication

This thesis is dedicated to the two most precious people in my life: my parents. To my lovely father in recognition of his generous support and encouragement, which have enabled me to complete this course. To the dearest person on the face of the earth, my mother, for her constant encouragement as I began this process. May her soul rest in peace. I regret that she did not live long enough to be present at my graduation and to see the culmination of a dream. Thank you both for instilling in me the commitment to continue my education and to live life fully while pursuing my dreams.

I dedicate this work to my lovely family. I owe particular heartfelt thanks to my brothers, my sisters and my wife, whose unconditional patience, love and support of prayers and advice have enabled me to complete this work.

Acknowledgements

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List of abbreviations

BIA	Bioelectrical Impedance Analysis
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
DoH	Department of Health
EST	Ecological Systems Theory
FPS	Food portion sizes
GPAQ	Global Physical Activity Questionnaire
HBM	Health Belief Model
HNEC	High National Election Commission
ICF	Informed Consent Form
LCLs	Libyan community leaders
LHCPs	Libyan Healthcare professionals
MCS	Multistage Cluster Sample
NCDs	Non-Communicable Diseases
NE	Neighbourhood Environment
PA	Physical activity
PANES	Physical Activity Neighbourhoods Environment Survey
PIS	Participants Information Sheet
RR	Response Rate
SB	Sedentary behaviour
SCT	Social Cognitive Theory
SEM	Socio-Ecological Model
SES	Socio-economic status
SSBs	Sugar-sweetened beverages
TPB	Theory of Planned Behaviour
TTM SOC	Trans-theoretical stages of change model
WC	Waist Circumference
WHO	World Health Organisation
WHO-EMR	WHO - Eastern Mediterranean Region
WHR	Waist-to-Hip Ratio

Chapter One : Introduction

1.1 Background

Obesity is understood to be an energy imbalance between calories consumed and calories expended which results in abnormal or excess fat accumulation in adipose tissue, typically at least 30% above the recommended body weight, and leading to health impairment (CDC, 2015d ; WHO, 2016d). A large body of literature describes obesity as a highly complex, bio-psychosocial medical condition with a multifaceted aetiology (CDC, 2015d; WHO, 2016d). According to the World Health Organisation (WHO, 2016d), obesity is a chronic disorder that affects all ages and socio-economic groups, increasing the risk of many diseases and health conditions and having adverse social, psychological and economic implications.Therefore, the Obesity Scientific Committee, affiliated to the American Association of Clinical Endocrinologists (AACE), agreed at the 2014 Obesity Consensus Conference to officially recognise obesity as a chronic disease (Garvey et al., 2014). Obesity is a leading cause of numerous non-communicable diseases (NCDs), including heart disease, strokes (Lavie et al., 2009; Winter, 2008), type 2 diabetes mellitus (T2DM) (Gatineau et al., 2014), certain cancers such as colon and rectal cancer (Huxley et al., 2009 ; Larsson & Wolk, 2007), and other health problems, which can lead to further morbidity and mortality (Bellanger & Bray, 2005; Guch, 2009; Lenz, et al., 2009). High body mass index (BMI) is recognised as the third most common risk factor for global deaths, after high blood pressure and tobacco use (Forouzanfar et al., 2014).

According to the WHO (2016d), the worldwide prevalence of obesity more than doubled from 1980 and 2014. Furthermore, the organisation estimated that in 2014 more than 1.9 billion adults (aged 18 years and older) worldwide were overweight, with over 600 million being clinically obese (WHO, 2016d). In addition, according to the National, regional, and global trends in BMI between 1980 and 2008,the mean global BMI increased by 0.4 and 0.5 kg/m2 per decade for men and women respectively (Finucane et al., 2011). Having observed an exponential rise in obesity worldwide, obesity researchers and experts now concur that a global obesity epidemic exists – termed "globesity" – in that it is a major

public health crisis both nationally and internationally (Campos et al., 2006; Karnik & Kanekar, 2012) . Given that obesity is a severe public health crisis (Haslam & James, 2005) that has serious economic implications (Philipson & Posner, 2008), an 'Anti-Obesity Day' (AOD) is observed globally every year on 26 November, to promote awareness of the measures that are available to control obesity and reduce its impact upon individuals and society (Shrivastava, 2012). The first 'Anti-Obesity Day' campaign was launched in 2001 in India.

The WHO has identified numerous aetiological factors that might promote or protect against obesity and has categorised them based on the strength of the evidence ranging from 'convincing' and 'probable' to 'possible' and 'insufficient' (WHO, 2003). Obesity is thought to be shaped by a variety of cultural, historical and social factors, and is associated with its own disabling capacities, pathophysiologies and comorbidities (Sobal, 2001; Vandenbroeck et al., 2007). The question of how these factors interact to promote or protect against the development of obesity is complex and likely varies by country (World Obesity Federation (WOF), 2015a). Having recognised obesity as a biopsychosocial phenomenon, with cultural values and norms about body weight differing substantially between cultures (Sobal, 2001), however, it is not yet known how the cultural norms in particular countries are contributing to the global obesity epidemic. To fill this gap in the literature, it is necessary to explore the risk and protective factors associated with obesity, particularly in countries that have so far failed to prioritise obesity in their public health agenda (e.g. Libya).

It has been argued that some risk factors such as overeating are independent risk factors in that they may cause obesity single-handedly, that is, without involving other risk factors (Prentice, 2001; Tuma, 2007). Obesity experts have however criticised this claim, arguing that obesity is not caused by a single factor but rather by multiple factors. Accordingly, any interventions for obesity need to take multiple factors into account, including both environmental and genetic factors (Silventoinen et al., 2007).This underscores the necessity of exploring risk factors of obesity in various cultures in order to gain a better understanding of the key measures required to develop and promote strategies for obesity prevention. It has been suggested that interventions that will reduce a person's weight will

also contribute significantly to prolonging their life (Nagai et al., 2012). Thus, in addition to helping to control the obesity epidemic, exploring the risk factors associated with obesity could contribute to the development of intervention policies and measures that improve the quality and quantity of life.

1.2 Rationale for this thesis

Within the Libyan context, obesity has become a critical problem due to its prevalence amongst adults aged 20-74 years (MoH, 2010; WHO, 2009). Obesity has more than doubled, from 12.6% in 1984 to 30.5% in 2009 (El-Mehdawi & Al Barsha, 2012; MoH, 2010; World Obesity Federation, 2015b; WHO, 2009). Accordingly, Libya was ranked 35th on the list of the world's fattest countries based on this last estimation, in 2009. (The Central Intelligence Agency (CIA) World Factbook , 2011). However, the Global Burden of Disease Study (GBD), coordinated by the Institute for Health Metrics and Evaluation (IHME), estimated the prevalence of obesity and overweight in Libyan adults at 71.9% in 2013. According to the estimation of the GBD and the IHME, Libya ranks ninth in the list of the world's fattest countries (Ng et al., 2014).This change in ranking from 35th in 2011 to 9th in 2013 may be attributable, at least in part, to the Libyan political revolution of 2011, which has resulted in ongoing conflict among various radical militias, creating an unstable political, social and economic environment. This unsafe environment is currently [2016] having an impact on Libyans' daily activities, for example, encouraging citizens to remain indoors for extended periods of time. This increased level of inactivity has likely exacerbated the epidemic of obesity in Libya.

Although there is a paucity of studies in Libya on overweight and obesity in children (Buzgheia et al., 2007; El Taguri et al., 2009) and in adolescents (Musaiger et al., 2012; Musaiger et al., 2013; Salam et al., 2012), these studies have nevertheless resulted in many significant findings that have contributed to the obesity in children and adolescents. These studies converged on a number of risk factors that could contribute to an increase in the prevalence of overweight and obesity among children and adolescents. Significant risk factors include: a lack of physical activity; unhealthy eating patterns involving skipping breakfast, high fast-food consumption, frequent snacking. Such findings are aligned with

those of studies conducted all over the world in both developed and developing countries (Braithwaite et al., 2014; Yoon et al., 2010) as well as in undeveloped countries, especially Arabic countries (Ng et al., 2011; Kerkadi, 2003).While these studies have increased our knowledge of the risk factors in these populations, there is a dearth of information concerning Libyan adults. A large body of scientific literature confirms that there is a lack of information about obesity in adults in North African Arab countries, including Libya (Finucane et al., 2011; Musaiger, 2011). Consequently, studying Libyan adults in order to identify the risk and protective factors related to obesity can help to fill this lacuna in the literature.

Aside from the possibility that the current, unstable political situation is contributing to obesity in many Libyan adults, cultural values have also been shown to play a role. These include misunderstandings about religion, for example, constraints against women engaging in physical activity (Benjamin & Donnelly, 2013 ;Caperchione et al., 2011); poor knowledge about what constitutes a healthy diet and lifestyle, for instance, consuming olive oil in the mistaken belief that this helps to reduce cholesterol (Dontas et al., 2007); and fattening rituals for women before marriage (Rguibi & Belahsen, 2006). According to Christakis and Fowler (2007), obesity is 'socially contagious' and spreads from person to person in a social network. In Libyan culture, especially at social gatherings, guests are presented with plenty of food and over-eating is encouraged (FAO, 2005; Sehib, 2013). These cultural factors suggest that it is necessary to gain a deeper understanding of how Libyan adults perceive, understand, think and feel about obesity in order to develop more effective interventions that take the prevailing Libyan culture into account.

Since the discovery of oil in 1959, Libya has witnessed dramatic social, economic, and political transformations in the past five decades, including notable shifts in dietary and physical activity patterns (FAO, 2005). Collectively known as 'the nutrition transition', these shifts include consuming more 'Western' foods such as fast foods, and have been demonstrated by obesity scholars to be a one of the primary risk factors contributing to the obesity epidemic (Jeffery et al., 2006).

Overall, obesity has profound consequences for Libyan society as a whole. It is important to understand more about obesity because of its detrimental impact on the individual's physical and mental health, and on social and family life, and the financial burden it places on the state. The next section reviews these four areas that are adversely affected by obesity.

1.2.1 Detrimental effect on the individual's health

Obesity is associated with a significantly increased risk of several deadly diseases, as well as being a cause of disability and premature death (Bellanger & Bray, 20105; Guch, 2009; Lenz, et al., 2009) Non-Communicable Diseases (NCDs) are the leading cause of death in the world, representing 63% of all deaths annually (WHO, 2013b). In the Eastern Mediterranean Region (EMR), such diseases represent over 50% of annual deaths, while in Libya they represent an estimated 78% of deaths annually, which is the highest percentage in the EMR (MoH, 2010; WHO, 2014a). The most common of such disease in Libya are cardiovascular disease, cancer, and diabetes. In addition, Libya is now among the countries with the highest T2DM prevalence in the EMR and it constitutes 39% (Elkharam et al., 2013; Eltobgi ,2009; Shambesh et al.2015). Studies carried out in Benghazi report that being overweight or obese are risk factors for chronic diseases such as heart disease (Greiw et al., 2010), stroke (Tran et al., 2010), T2DM (Roaeid & Kablan, 2010; Sheriff et al., 2012), and certain types of cancer (Buhmeida, 2007), while the main causes of death among the Libyan population are: cardiovascular diseases and diabetes, cancer, and respiratory diseases (MoH, 2010; WHO, 2014a). In order to slow the obesity epidemic and contain the public health crisis, it is necessary to improve our understanding of the risks and protective factors associated with the prevalence of obesity.

1.2.2 Social consequences

Obesity poses many practical challenges in daily life, such as a lack of mobility, the effect on an individual's social life, difficulty in buying clothes, and even a lack of comfortable seats on various modes of transport (Schafer & Ferraro, 2011; Sutin & Terracciano, 2013). In addition, many obese individuals encounter social expectations about or cultural ideals of slimness, as well as social perceptions of obese individuals as being gluttonous and lazy

(Collins & Bentz, 2009; Wellman & Friedberg, 2002) or weak-willed and unmotivated (Collins & Bentz, 2009). As a result, the obese are more likely to suffer from prejudice in the employment market, at school, and in social situations (Wellman & Friedberg, 2002). Moreover, the negative feelings that accompany obesity may lead to a strain on the individual's intimate and romantic relationships (Collins & Bentz, 2009).

Although Islamic culture prohibits all forms of discrimination (Bin Ahmad, 2011), the tendency persists to direct ridicule and derision at obese individuals, which can have serious psychological consequences for obese individuals such as poor self-esteem, shame, or depression (Schafer & Ferraro, 2011). Accordingly, many obese persons are very obstinate and unwilling to attend the social events to avoid meeting and interacting with others in public places. My study may form a foundation for sociologists and psychologists to undertake further research on the social consequences of obesity in Libya.

Significantly, obesity has been found to be 'socially contagious' in that it can spread from person to person in a social network. Christakis and Fowler (2007) found that if one person becomes obese, those closely connected to them have a greater chance of becoming obese themselves. Surprisingly, the greatest effect is seen not among people who share the same genes or the same household but rather amongst friends. This suggests that culture may shape an individual's eating habits. Aligned with Arab culture, overeating is often encouraged in social gatherings in Libya because of the abundance of food. Additionally, some ethnic groups value the 'fattening' of a woman before marriage (Rguibi & Belahsen, 2006).

1.2.3 Psychological consequences

Psychological sequelae of obesity can be divided into moderate disorders, such as lowered self-esteem and heightened anxiety, and serious disorders, including depression and eating disorders (Collins & Bentz, 2009; Wellman & Friedberg, 2002). According to an assessment report conducted in 2010 by the WHO-EMR, public hospitals in Libya are forced to function as a front-line contact with patients with psychological disorders, whatever their nature and causes, since Libyan Health Authorities have not established

facilities for treating psychological distress (El-Fallah, 2014; Shibib, 2011; Weissbecker, 2011). Although documentation of diagnoses is poor in Libya, due to a dwindling health infrastructure, it is conceivable that obesity plays a key role in promoting psychological distress (Harvard University & NATO, 2013)

1.2.4 Financial burden on the Libyan public health sector

Obesity places a financial burden on Libyan society as a whole. The cost of obesity in Libya in 2012 was estimated to be (1.3 billion Libyan Dinar (LYD) = £ 638 million) (Harvard University & NATO, 2013; MoH, 2012). The direct costs are spent in connection with the treatment of obesity-related co-morbidities such as diabetes and cardiovascular diseases, while indirect costs include work-days and productivity lost, unemployment, travelling to seek treatment (often in European countries because many Libyans perceive Libyan health services to be unsatisfactory) (El-Fallah. et al., 2014), benefit payments, premature retirement, and premature mortality, the costs of which have not yet been estimated (MoH, 2012; WHO, 2010). With the rise in obesity, these figures are likely to increase.

These four consequences of obesity collectively can lead to rise in morbidity and mortality and economic losses. Although there is consensus among researchers, clinicians, government policy-makers and others about the general aetiological factors of obesity, there are still controversies in understanding the risk and protective factors associated with obesity in Libyan adults. This understanding has crucial implications for the actions that are needed to tackle and reverse the epidemic.

In recent years, the second largest city in Libya, Benghazi, has experienced a rapid increase in chronic diseases that have been linked to obesity, leading to disability and premature death (Beshyah, 2010; WHO, 2014a). Benghazi is an extremely wealthy economic city, characterised by a higher pace of urbanisation, modernisation, and affluence than many other cities in Libya. These attributes might be predisposing factors that contribute to nutritional and epidemiological transitions. This makes Benghazi a particularly suitable place for gathering data on this ongoing predicament. According to the 2012 population

census, the population of Benghazi was 541,104 inhabitants (the Libyan Bureau of Statistics and Census (BSC), 2012). Given that Benghazi is ethnically diverse and multicultural, sampling from this city would capture a broad range of lifestyle influences (Bredeloup & Pliez, 2011). Furthermore, no previous studies have addressed obesity in Benghazi.

1.3 Research questions, aims and objectives

Based on these gaps in the literature, the following research questions, aims and objectives have been formulated to address this issue, with the first aim addressed through quantitative approach and the second addressed through qualitative approach.

1.3.1 Phase 1: Quantitative approach

1.3.1.1 Aim:

To investigate the risks and protective factors associated with obesity amongst Libyan men and women aged 20-65 in Benghazi, Libya.

1.3.1.2 Research question:

What are the risks and protective factors associated with obesity amongst - Libyan men and women aged 20-65 in Benghazi, Libya?

1.3.1.3 Objectives:

1. To examine the statistical relationship between the body mass index (BMI) of Libyan men and women and the following four variables:

- Socio-economic status (SES).
- Unhealthy eating behaviour patterns.
- Physical activity (PA) and sedentary behaviour (SB) patterns.
- Neighbourhood environmental factors.

2. To estimate and describe the prevalence of obesity amongst Libyan men and women aged 20-65 in Benghazi, Libya.

1.3.2 Phase 2: Qualitative approach

1.3.2.1 Aim:

To explore the views of Libyan healthcare professionals and community leaders about the risk and protective factors associated with obesity among Libyan men and women, within the context of Libyan culture.

1.3.2.2 Research question:

What are the views of Libyan healthcare professionals and community leaders in Benghazi with regards to the risk and protective factors associated with obesity among Libyan men and women from Benghazi, within the context of Libyan culture?

1.3.2.3 Objectives:

- To explore the views of Libyan healthcare professionals and Libyan community leaders about:
1. Socio-economic status, eating habits, physical activity and sedentary lifestyle patterns, and neighbourhood environmental factors, which may contribute to obesity.
2. The protective factors that guard against obesity, within the context of Libyan culture.

1.4 Research methodology

The research philosophy I have chosen for the present study is pragmatism, along with deductive and inductive approaches. My research strategy is an adapted mixed-methods sequential explanatory design, using a survey questionnaire for the quantitative component and one-to-one, in-depth, semi-structured interviews for the qualitative component.

To address my first research question ("What are the risk and protective factors associated with obesity amongst Libyan men and women aged 20-65 in Benghazi, Libya?"), I proposed four hypotheses which were derived from the Social Ecological Model (SEM). As argued in Chapter Three, the variables selected for these hypotheses are the most relevant for addressing my first research question. A deductive research approach in the

form of a cross-sectional survey was used to examine the relationships between BMI and the following four predictor variables: (i) SES; (ii) poor diet and unhealthy eating habits; (iii) physical activities and sedentary lifestyle; and (iv) the neighbourhood environment.

To address my second research question ("What are the views of Libyan healthcare professionals and community leaders in Benghazi with regard to the risk and protective factors associated with obesity in Libyan men and women, within the context of Libyan culture?"), an inductive research approach was adopted in the form of a semi-structured interview, which were conducted with the Libyan healthcare professionals (LHCPs) and Libyan community leaders (LCLs).

1.5 Structure of the thesis

Chapter One: This chapter introduces the topic of obesity and the concept of an obesity epidemic, and explains the rationale for conducting a study of obesity in the Libyan context. This leads to a formulation of two main research questions, followed by the aims and objectives of this study on the obesity epidemic in Libya. It then outlines the research design (deductive and inductive) used to address the research questions. Finally, it provides a summary of the structure of this thesis, which is divided into 11 chapters.

Chapter Two: This chapter presents a review of the literature and provides a background to the study by focusing on current knowledge about the risk and protective factors associated with obesity. It examines and critically evaluates contemporary themes concerning obesity in a global context, and contextualises the present research within the extant literature. In addition to providing insights that can help explain the findings of the present study, it also discusses the strengths and limitations of previous studies about obesity in adults.

Chapter Three: This chapter presents a theoretical framework for this thesis. This framework provides a general explanation of the relevant concepts in the literature, and presents them in terms of a 'ready-made map' of the phenomenon being studied (obesity). In addition, it discusses the most prominent and relevant behavioural and social science

theories and models used for the development, implementation and evaluation of public-health and health-promotion interventions. After assessing the strengths and limitations of the aforementioned theories and models, the chapter presents a conceptual framework for this study, consisting of concepts that are placed within a logical and sequential design. From this, the four hypotheses were devised to address my first research question (quantitative).

Chapter Four: This chapter provides an overview of the research process, conceptualised according to a modified version of the 'onion' model. The chapter also discusses the use of a sequential explanatory mixed-methods design in terms of the following factors: the researcher's worldview assumptions; the nature of the research problem being addressed; previous evidence-based studies on obesity; and the data collection techniques used. In addition, it explains the choice of a deductive research approach in the form of a cross-sectional survey. It also gives some background on the history of the qualitative approach in the Libyan cultural context, as well as explaining the choice of an inductive research approach adopted in the form of a semi-structured interview. This chapter concludes with a visual model depicting a flowchart of the essential procedures for implementing an exploratory mixed-methods design in this study.

Thus, the subsequent three chapters (5, 6 and 7) addressed the following aspects of the quantitative approach: methodology, presentation and analysis of the numerical data, and discussion and interpretation of the quantitative findings. While, the last four chapters (8, 9, 10 and 11) addressed the following aspects of the qualitative approach: methodology, presentation and analysis of the qualitative data, and discussion and interpretation of both approaches findings, before concluding with the final discussion and directions for future research.

Chapter Five: This chapter presents the constituents of the deductive approach in the form of a cross-sectional design, including: an overview of the target population; the eligibility criteria selected for the participants of this study; the sampling frame (an accessible population) (the Benghazi Electoral Register); the sample-size calculation and the rationale

for selecting a multi-stage cluster sampling technique. In addition, it discusses data-gathering methods in terms of the following: the compilation of and rationale for using four pre-existing questionnaires to devise the questionnaire used in the present study; the translation process in the quantitative protocol; pre-testing of the survey questionnaire; administering the questionnaire; recruitment of the participants; and response rate. Furthermore, it discusses ethical considerations, before giving a more detailed description of the pilot study for this phase. Finally the chapter provides the details of the main fieldwork procedure and fieldwork challenges.

Chapter Six: This chapter presents the quantitative data analysis and findings. The chapter opens with normality tests to determine if a data set is well-modelled by a normal distribution. The next section explains how the data was cleaned, grouped and regrouped (recorded). It also presents the descriptive statistics that were computed to describe the characteristics of the sample in relation to demographic data, SES and anthropometric measurement data, while frequency statistics showed percentage distributions, percentiles, means, standard deviations, and medians. Prevalence figures for overweight and obesity are then presented. Following the univariate analysis, bi- and multivariate inferential statistical tests were conducted by computing cross-tabulations of selected variables. Finally, the chapter discusses the relationship between BMI and socio-demographic and anthropometric measures and the four predictor variables for testing the four proposed hypotheses.

Chapter Seven: This chapter discusses and interprets the quantitative study results with respect to the association between BMI and the major four predictor variables: socio-economic status (SES); unhealthy eating habits; physical activity and sedentary behaviour patterns; and neighbourhood environmental factors, respectively, in association with obesity. In addition, it discusses and interprets the results of the prevalence of overweight and obesity in Libya, as one of the most prominent and notable findings in this study. Other prominent factors are also considered in this chapter, in association with obesity including: demographic data (age, gender, marital status, religion and ethnic groups and residence in Benghazi).

Chapter Eight: This chapter outlines all components relevant to the deductive approach in the form of the semi-structured interviews. These include: an overview of the target population and the eligibility criteria selected for the participants of this study. It also discusses sample-size considerations and the rationale for selecting a purposive sampling technique. In addition, the chapter presents data collection methods in terms of semi-structured interviews, the recruitment of the participants, and the translation process in the qualitative protocol. Furthermore, it presents ethical considerations, before discussing in detail the pilot study for the qualitative approach. Finally, it outlines a method of qualitative data analysis known as Framework Analysis (FA). Finllay, it summarises the five stages of the FA method used to analyse the qualitative data of this study.

Chapter Nine: The chapter presents the findings of the qualitative data analysis. Derived from the 21 interview transcripts, this data was entered into the qualitative data analysis software package NVivo 10 and analysed using the FA method. The chapter also presents the set of themes and sub-themes that denote the risk and protective factors influencing body-weight. The chapter prioritises the themes relevant to the four main hypotheses, addressing SES, unhealthy eating habits, physical activities and sedentary lifestyle, and neighbourhood environment, respectively. The chapter then presents the other themes that emerged, relevant to the risk and protective factors associated with obesity. In total, the chapter discusses 11 themes which were categorised according to the different levels or spheres of the SEM. These findings were presented in the form of comparisons and contrasts between the two distinguishable groups of interviewees: Libyan healthcare professionals and community leaders. Finally, the chapter presents a theoretical model derived from the qualitative research findings.

Chapter Ten: This chapter discusses and interprets the results revealed by the qualitative data analysis in the form of 11 main themes elicited from 21 interview transcripts, and positions the themes in the appropriate domains of the SEM. The findings are compared and contrasted with current literature on obesity to produce the final findings of this thesis. The second part of this chapter draws together the findings from both the quantitative and qualitative analyses, by outlining how the qualitative findings can explain and elucidate the

unanticipated results from quantitative findings through convergence and divergence between both types of results. Finally, the chapter presents a visual outline of the final conceptual framework of this mixed-methods design.

Chapter Eleven: This chapter presents the implications of my findings are considered from three perspectives: theoretical, methodological and application-related. The chapter also discusses the strengths and limitations to the study are then considered from a quantitative, qualitative, and mixed-methods perspective. Finally, it concludes by making recommendations for future research, policy and practice, followed by the main conclusions of the study.

Chapter Two : Literature Review

2.1 Introduction

This chapter reviews the literature with a focus on the epidemiological aspects of obesity. First, it discusses the Libyan context of this study. It then review the different methods for measuring body composition, before justifying the selection of Body Mass Index (BMI) as the optimal technique for measuring and classifying obesity. It then reviews the prevalence of obesity at the global, regional, and national level, with special emphasis on obesity trends in Libya. Finally, it discusses the health consequences and economic impact of obesity.

Through focusing on current knowledge of obesity in a global context, this chapter provides a critical review of potential risk and protective factors that may promote or protect against obesity. The literature review, informed by the social ecological model (SEM), investigated potentially contributing factors of obesity in Libyan adults. This chapter then navigates through the literature to identify and broadly review the diverse potential risk and protective factors that could be associated with obesity in the Libyan context. Priority was given to non-modifiable and the most important common modifiable risk factors (e.g., socio-economic factors, lifestyle changes such as unhealthy eating habits, physical activity, sedentary lifestyles, and the built environment), over other factors because these factors have been prioritised by public health researchers and obesity experts for investigations into obesity in those countries that have not previously been studied in terms of obesity. Finally, the chapter discusses 'other risk factors' that are likely to be relevant to this study but are not increasing as much as the aforementioned factors.

2.2 Overview of the Libyan context

Libya is located in North Africa on the southern coast of the Mediterranean Sea. It has a total land area of 1,775,500 square kilometres, making it the third largest country in Africa, with a coastline of about 1,900 kilometres along the Mediterranean Sea (FAO, 2005; WHO, 2010, WHO-EMR, 2007). The Libyan economy depends heavily on oil revenues, while agriculture is the second largest sector in the country's economy. However, in the present

context of political instability, severe disruptions to the oil sector since mid-2013 have driven the economy into recession. According to the Libyan Bureau of Statistics and Census (BSC) (2012), the population of Libya is 5,173,062 with 2,608,030 males and 2,565,032 females. The main ethnic groups in Libya are the Arabs and Berber, comprising 97% of the population, while the Tuareg, Toubou and other indigenous minority peoples, including sub-Saharan Africans, make up most of the minority ethnic groups (MEGs) (3%) (CIA World Factbook, 2015). Islam is Libya's official religion and the government publicly supports a moderate practice of Islam. Accordingly, the overwhelming majority of Libyans are Muslim and they adhere to the Sunni branch of Islam (UNHCR, 2015). In addition, there are also some Christian communities, composed exclusively of foreigner workers and their families (UNHCR, 2015).

The average life expectancy in Libya at birth is 75.0 years (73 years for males and 77 years for females), according to United Nations World Population Prospects 2012 Revision for the period 2010-2013 (United Nations World Population Prospects, 2015; WHO, 2015b). Libya is considered to have one of the highest Human Development Indices in Africa and its HDI is ranked 55th in the world, which signifies that Libya is listed with high-income countries in terms of measures such as life expectancy, education, and per capita income (UNDP, 2014). However, based on a classification issued by the International Monetary Fund (IMF) (2014) and the Department of Economic and Social Affairs of the United Nations Secretariat (UN/DESA) (2014), Libya is a developing country.

2.3 Measuring obesity

Several methods for measuring body composition exist, with each body-fat assessment method having strengths and limitations. Some techniques that are relatively simple, quick, non-invasive, and effective are used in clinics and community settings, as well as in large epidemiological research studies. So called 'field methods' include simple methods, requiring only a tape measure to compute body mass index (BMI) (using a BMI Tape Measure), waist circumference (WC), waist-to-hip ratio (WHR) and waist-to-height ratio (WHtR) (Public Health England, 2015). Additional methods include a special calliper to measure skin-fold thickness and body fat scales as part of the bioelectrical impedance

analysis (BIA) technique (Duren et al., 2008; National Obesity Observatory (NOO), 2009; Public Health England, 2016).

Other contemporary techniques that use sophisticated equations and expensive equipment to precisely estimate fat mass, muscle mass, and bone density are typically used only in research studies to confirm or validate the results from the body measurement techniques. So-called 'reference measurements' include underwater weighing (densitometry), air displacement plethysmography (ADP), dual energy X-ray absorptiometry (DEXA), the dilution method (Hydrometry), magnetic resonance imaging (MRI), and computer tomography (CT) (Harvard School of Public Health (HSPH), 2016d). However, these methods are unfeasible for large epidemiological research studies due to being expensive and requiring "highly trained professionals" to implement them. In addition, several of these techniques are unsuitable for being standardised across observed experts or instruments per se, which may confound comparisons across epidemiological studies and time periods.

2.3.1 The use of BMI as a measurement proxy for obesity

Despite several anthropometric measuring tools for assessing obesity risk, particularly those termed 'field methods', BMI remains the most widely used tool for measuring the prevalence of obesity at the population level in large epidemiological research studies (Bhurosy & Jeewon, 2013). BMI is defined as weight in kilograms divided by height in metres squared. The World Health Organisation (WHO) and Centre for Disease Control and Prevention (CDC) categorise underweight, overweight and obesity in adults based on different cut-off values, which denote the risk of co-morbidities associated with BMI (CDC, 2015a; WHO, 2006). In addition, the National Institute for Health and Care Excellence (NICE) has stipulated the corresponding BMI cut-off points for ethnic-specific groups, in particular, black, South Asian and other minority ethnic groups (NICE, 2016). See Table 2.1 (overleaf) for details. Another strength of the BMI tool is that the BMI cut-point values associated with obesity in different ages, genders, and ethnic groups have been formulated, validated and applied effectively to accommodate specific populations such as the Asian population (NICE, 2013). This may result in feasible

measures for obesity prevention programmes. Measuring the individual's body-weight/stature (kg/m^2), BMI is alleged to be simple, quick, and non-invasive. Used globally, it has been in use for some time, enabling comparisons globally, nationally and even regionally over time. Consequently this method has been considered the most accepted and adopted method for assessing body composition (Harvard School of Public Health, 2016d; Public Health England, 2016).

Table 2.1 The international classification of body weight in Adults adult.

Classification	Principle BMI cut off point (kg/m2)	Risk of co-morbidities	Asian BMI cut off points (kg/m2)	Risk of co-morbidities
Underweight	<18.5	Low [a]	<18.5	
Healthy weight	18.5–24.9	Average	18.5–22.9	Low
Overweight (or pre-obese)	25–29.9	Increased	23-27.4	Moderate
Obesity, class I	30–34.9	Moderate	27.5–32.4	High
Obesity, class II	35–39.9	Severe	32.5–37.4	Very high
Obesity, class III	≥40-	Very severe	≥37.5	Very high

[a] Other health risks may be associated with low body mass index (BMI).
Source: Adapted from WHO, 2006.

However, one limitation of the BMI is that factors such as age, sex, ethnicity, puberty, and bone and muscle mass, can influence the relationship between BMI and body fat, resulting in distorted readings (CDC, 2014; Public Health England, 2016; Bhurosy & Jeewon, 2013). Older adults are predisposed to have more body fat than are younger adults for an equivalent BMI. Similarly, women have a higher total body fat than do men for an equivalent BMI, while Asians have a higher total body fat than do other groups, even though they have a lower BMI. Another consideration is that the BMI of highly trained athletes may be high due to an increase in muscle mass rather than an increase in body fat.

This discussion of the potential drawbacks of using body mass index (BMI) suggests that using BMI alone as a tool for assessing weight status is unfeasible indicator; the use of other anthropometric measures, such as waist circumference (WC), waist-to-hip ratio (WHR), in conjunction with BMI, is also highly recommended by 'obesity researchers'

and 'obesity experts' to assess abdominal obesity or other body-specific areas (Bhurosy & Jeewon, 2013). Thus, in order to minimise limitations with respect to using the BMI alone in this study, a portable Segmental Body Composition Analyser was used in conjunction with a BMI reading. From this Analyser, other anthropometric measure readings can be obtained such as Percent Body Fat nearest to 0.1% and Visceral Fat Level (see Chapter 5, Section 5.5.3 for the details). Recently, in 2015, the Bioelectrical impedance analysis (BIA) method and the Tanita Body Composition Analyser were used to analyse body composition in Shariati hospital staff in Iran (Payab et al., 2015).By adopting this Analyser, more than one anthropometric reading can be obtained which would eliminate any ambiguous results and minimise any distortions in the findings of this study.

2.4 The prevalence of obesity: Global, regional, and national

This section reviews the prevalence of obesity internationally and nationally. Comparing the prevalence of obesity between countries is not straightforward because it depends on several factors such as the criteria of the target population, methods used to measure obesity, and the location of the study (National Obesity Observatory (NOO), 2009). In order to compare estimates of obesity accurately and meaningfully between countries, the WHO and the International Obesity Task Force (IOTF), as well as the NHS in the UK, stipulate that methods of data collection, including the sampling technique used and the methods of measuring body composition ,need to be taken into account (IOTF, 2015; NOO, 2009). Some studies present prevalence data for obesity based on accurate anthropometric measurements taken by well-trained professional staff, using modern portable or fixed instruments. In contrast, other studies have relied on self-report measures to provide country-wide prevalence figures for obesity. However, studies that derived the prevalence of obesity from self-report measurements are less likely to be effective compared to those that are based on physical measurements. Nevertheless, due to the scarcity of data in some regions of the world, the WHO has disregarded these stipulations, and included data for height and weight derived from both physical measurements and self-report measures.

The highest prevalence of obesity in the world was found to be among adults in Nauru in the Central Pacific, where the obesity rate is 71.7%. This is followed by Samoa, the

Federated States of Micronesia, American Samoa, and several Arab countries of the Middle East. Conversely, the lowest prevalence of obesity was found to be in the WHO Region of South East Asia, where the obesity rate is 3% (World Obesity Federation, 2015b). On the other hand, according to the latest data from the Organisation for Economic Cooperation and Development (OECD, 2014), ten OECD countries confirm that the obesity epidemic has spread further and rates have been increasing at a slower pace in the past five years than previously seen. Obesity and being overweight have remained practically unchanged, or have grown modestly, in Canada, England, Italy, Korea, Spain and the US, but have increased by a further 2 to 3% in Australia, France, Mexico and Switzerland (OECD Obesity Update, 2014).

Currently, the prevalence of obesity in five of the Arab Gulf countries rivals and exceeds that of the US. According to the latest World Obesity Federation estimates, released in December 2014, there were the highest prevalence of obesity in five of the Arab Gulf countries was found to be among adults in Kuwait, where the obesity rate is 43.4% (men) and 58.6% (women). Conversely, the lowest prevalence of obesity was found to be in the UAE, where the obesity rate is 27.1% (men) and 33.2% (women) see Figure 2.1 (overleaf) (ALNohair, 2014; World Obesity Federation, 2014). These figures have enabled the Arab Gulf countries to rival and occupy the 'top ten' most obese countries in the world (World Obesity Federation, 2014). Although obesity rates are higher among women than men in the Middle East and North Africa region (MENA), they appear to be escalating more rapidly among men than among women (Harvard School of Public Health, 2016a; Ng et al., 2011).
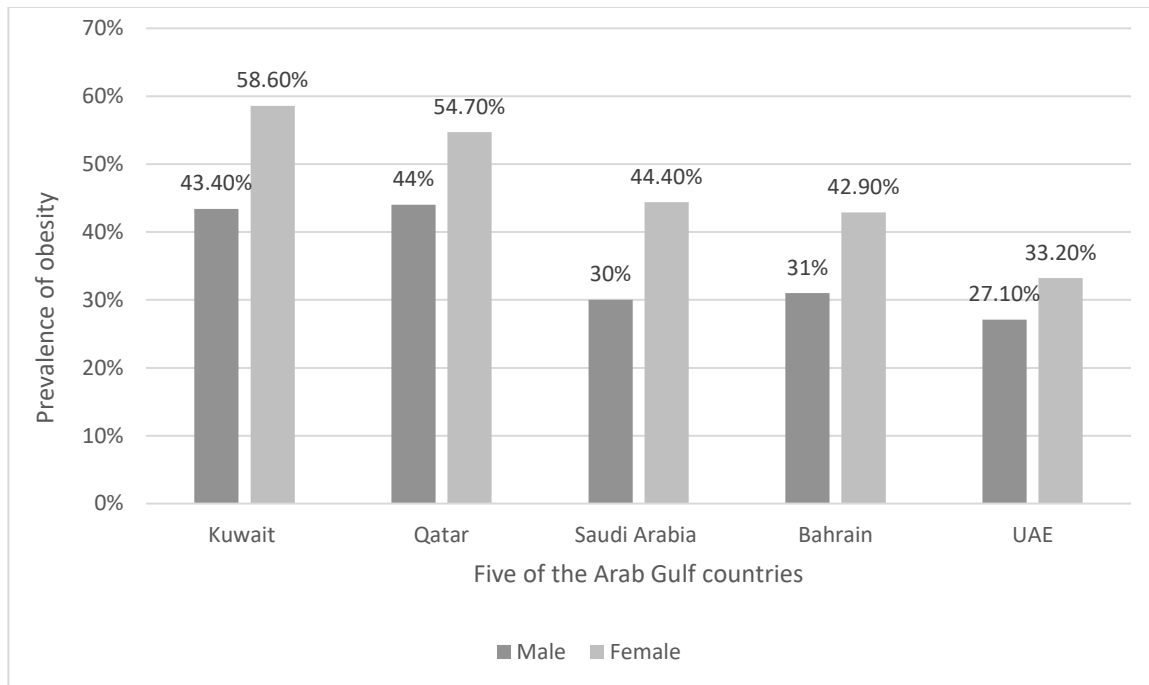
Figure 2.1 The prevalence of obesity among adult in five of the Arab Gulf countries.

A recent comprehensive study conducted by Ng et al. (2014), entitled 'Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013', revealed that Nauru is the world's fattest country, with an average BMI of 34 to 35 kg/m², while Bangladesh is the world's thinnest nation, with an average BMI of 20.5 kg/m² for women and 20.4 kg/m² for men. Additionally, this study has revealed that Kuwait was ranked the fourth most obese country in the world, while Libya was ranked ninth in the list of the world's fattest countries.

2.5 The prevalence of overweight and obesity: Libyan population

Libya is following the trend observed in other developing countries of steadily becoming more obese, such that obesity in Libya has reached epidemic proportions in the twenty-first century, with the numbers of overweight and obese adults, adolescents and children continuing to grow (El-Mehdawi & Al Barsha, 2012; MoH, 2010; World Obesity Federation, 2014; WHO, 2010). According to the last Libyan National Survey, in 2009, the rates of both overweight and obesity in Libya were 63.5% in adults, 21.5% in adolescents,

and 18.3% in children. The prevalence rates of overweight and obese children have also been rapidly increasing. In recent decades, the prevalence of obesity has increased dramatically among Libyan adults aged 20 to 74 years, while the prevalence of overweight (Body Mass Index or BMI ≥25 kg/m²) increased from 19.5% in 1984 to 63.5 % in 2009. Although the obesity rate (BMI ≥30 kg/m²) more than doubled from 12.6 % in 1984 to 30.5% in 2009, the results showed that Libyan women had higher rates of overweight and obesity than men, where 69.8% of women and 57.5% of men were overweight, while 40.1% of women and 21.4% of men were obese. Additionally, the mean BMI was 27.7 kg/m² for both women and men, while the mean BMI was varied for women and men (29.0 kg/m² and 26.4 kg/m² respectively) (El-Mehdawi & Al Barsha, 2012; MoH, 2010; World Obesity Federation, 2014;WHO, 2009).

The Global Burden of Disease Study (GBD), coordinated by the Institute for Health Metrics and Evaluation (IHME), estimated the prevalence of obesity and overweight in Libyan adults at 71.9% in 2013. According to the estimation of the GBD and the IHME, Libya ranks ninth in the list of the world's fattest countries (Ng et al., 2014). See Appendix 2.1 shows in details the summary of prevalence of overweight and obesity among Libyan children, adolescents, and adults, 1999-2014. The next section reviews the health impact (morbidity), mortality and economic consequences of obesity.

2.6 The health and economic impact of obesity

2.6.1 Health consequences of obesity

It has long been recognised that obesity is associated with premature mortality. Obesity reduces life expectancy on average by between 3 and 13 years (Jebb, 2004; Pi-Sunyer, 2009; Swanton, 2008). With respect to obesity-related morbidity, several epidemiological studies identified both overweight and obesity as major causes of co-morbidities which can lead to further morbidity and mortality (Guch et al., 2009; Jarolimova, et al., 2013; Pi-Sunyer, 2009; Schelbert, 2009). Table 2.2 (overleaf) summarises the approximate relative risk of physical health problems associated with obesity (Chan & Woo, 2010; WCRF-AICR, 2007). The WHO (2003) categorises health problems associated with obesity as

life-threatening and non-fatal. The more life-threatening problems fall into four main aspects: (1) cardiovascular diseases; (2) conditions associated with insulin resistance such as type 2 diabetes; (3) several types of cancer (colorectal, kidney, breast, endometrial, ovarian and pancreatic cancers); and (4) gallbladder disease. In contrast, the non-fatal but debilitating health problems associated with obesity include: respiratory difficulties; chronic musculoskeletal problems; skin problems; and infertility. Furthermore, obesity is associated with a higher chance of premature death and disability in adulthood (CDC 2015; Pi-Sunyer, 2009; WHO, 2016d&h). Nevertheless, it is unfeasible to calculate the precise number of deaths in any study population that are attributable to obesity (Public Health Agency of Canada and the Canadian Institute for Health Information, 2011).

Table 2.2 Relative risks of health problems associated with obesity.

Greater increased risk (Relative risk >3)	Moderate increased risk (Relative risk 2–3)	Mild increased risk (Relative risk 1–2)
·Type 2 diabetes ·Insulin resistance ·Gallbladder disease ·Dyslipidaemia ·Breathlessness ·Sleep apnoea	·Coronary heart disease ·Hypertension ·Stroke ·Osteoarthritis (knees) ·Hyperuricaemia and gout ·Psychologic factors	·Cancer (colon, breast, endometrial) ·Reproductive hormone abnormalities ·Polycystic Ovary Syndrome ·Impaired fertility ·Lower back pain ·Anaesthesia complications ·Foetal defects (associated with maternal obesity)

▪Note: All relative risk estimates are approximate.
▪ Source: World Cancer Research Fund/American Institute for Cancer Research (WCRF-AICR, 2007).

In the Libyan context, numerous studies conducted in Benghazi have established that overweight and obesity are potential risk factors for co-morbidity and premature mortality. These can be mapped onto the WHO classification of diseases, similar to those described above, as follows. Firstly, serious and potentially life-threatening conditions related to obesity include: (1) coronary heart disease (CHD) (Greiw et al., 2010); hypertension (Jarari et al., 2009); and stroke (EL-Zunni et al., 1995); (2) type 2 diabetes mellitus (T2DM) (Roaeid & Kablan, 2007; Sheriff et al., 2012); (3) types of cancer that are related to obesity include: colon and rectum (Buhmeida, 2007), kidney (Singh & AL-Sudani, 2001), gallbladder (Sarma et al., 1998), oesophagus (Singh & Al-Sudani, 2001), pancreas (El-Mistiri et al., 2006), breast (Peela et al., 2012), and endometrium (Najem et al., 2008).

Other research, also conducted in Benghazi, found the following non-fatal or debilitating conditions to be related to obesity: sleep apnoea (Al-Sharbati, 2003) and gallbladder disease (Elmehdawi et al., 2009), although either of these conditions could become life-threatening. Furthermore, the main causes of death in Libya, as reported by the Libyan Heath Ministry, are cardiovascular diseases and diabetes (45%), cancer (13%), and respiratory diseases (4%) (MOH, 2009). These figures suggest that obesity has become a serious health problem in Libya and they indicate a growing problem in Benghazi that needs urgent intervention through intensifying the healthcare efforts of the Libyan authorities.

2.6.2 The economic impact

Obesity burdens the healthcare system, strains economic resources, and has far-reaching social consequences. The Libyan government has acknowledged that obesity has become a major health problem because of its association with numerous health, economic, sociological and psychological risks (Harvard University & NATO, 2013; MoH, 2012). As a consequence, Libyan authorities have attempted to estimate the expenditure on treating a number of comorbidities, including several forms of heart disease and cancers associated with obesity. They accounted for (1.3 billion Libyan Dinar (LYD) = £ 638 million) of total health care expenditure in 2009, which does not include expenditure on the treatment of diseases related obesity outside of Libya; due to distrust of Libyan health services, there is a trend for Libyans to seek treatment in Europe, even though the Libyan services are completely free (Harvard University & NATO, 2013; MoH, 2012; El-Fallah. et al., 2014). According to the Libyan former health minister Dr Fatima Hamroush, a sum approaching(2.8 billion LYD = £ 1.3 billion) was spent by Libyans in 45 countries in 2013; it was spent on treating those wounded in the fighting as well as on treating patients suffering from serious diseases caused by obesity (Harvard University & NATO, 2013; MoH, 2012).

While direct costs pertain to the treatment of obesity-related comorbidities such as diabetes, cardiovascular diseases, and certain types of cancers, indirect costs include work days lost, physician visits, disability pensions and premature mortality (MoH, 2012; WHO, 2016d).

So far, such indirect costs have not been determined. It is likely that this expenditure will continue to rise unless the government takes urgent action to make obesity a priority on its agenda in terms of investigating its etiological factors and putting measures in place to prevent and control it. The next section discusses the risk and protective factors associated with obesity.

2.7 Factors promoting or protecting against obesity

Obesity is a complex biopsychosocial phenomenon whose development is influenced by a diversity of social and cultural factors (Sobal, 2001). There is a large consensus in the literature that there are several multifaceted behavioural and societal factors that combine to contribute to the causes of obesity (Public Health England, 2015). However, cultural contexts impose values and norms that influence body-weight or perceptions of body-weight and alter weight through adaptive predispositions to the phenomena of modernisation, migration and acculturation (Sobal, 2001). The WHO has suggested various aetiological factors that might promote or protect against obesity. These factors have been categorised based on strength of evidence, namely 'convincing', 'probable', 'possible' and 'insufficient' (WHO, 2003), as depicted in Table 2.3 (below).

Table 2.3 Summary of strength of evidence of the factors promoting or protecting against obesity.

Strength of evidence	Decreased risk	Increased risk
Convincing	▪Regular physical activity. ▪High dietary intake of fibre.	▪Sedentary lifestyle. ▪High intake of energy-dense foods.
Probable	▪Home and school environments that support healthy food choices for children. ▪Breastfeeding.	▪Adverse socio-economic conditions in developed countries.
Possible	▪Low glycaemic index foods.	▪Large portion sizes. ▪High proportion of food prepared outside the home (developed countries). ▪Rigid restraint/periodic disinhibition eating patterns.
Insufficient	▪Increased eating frequency	▪Alcohol

Source: WHO (2003)

Risk factors refer to those factors that have the potential to increase the possibility of developing a particular disease (e.g., obesity). The risk factors that can contribute to a

person's overall likelihood of developing obesity may be divided into non-modifiable and modifiable factors (Australian Institute of Health and Welfare, 2011). Non-modifiable risk factors for obesity are genetically determined traits such as age, gender and race/ethnicity, which are always given priority when studying the aetiological factors of any chronic disease. In contrast, modifiable factors are those that can easily be targeted in order to design effective interventions. Modifiable risk factors result from lifestyle changes such as unhealthy eating habits, physical activity, sedentary tendencies, obesogenic environments, and cultural factors (National Heart, Lung, and Blood Institute (NHLBI), 2012). When considering factors that may contribute to or protect against obesity, it is important to consider both sides of the energy-balance equation: on the one hand, the factors related to energy intake (involving food consumption and beverage intake) and, on the other hand, the factors related to energy expenditure (involving physical activity and sedentary lifestyle).

It has been suggested that the more risk factors an individual has, the greater the chance of that person developing obesity and dying from it (NHLBI, 2012; WHO, 2016 b&d). It is therefore vital that we increase our understanding of the risk factors that might contribute to obesity, particularly in an under-researched population such as Libyan adults, who possess different cultural norms from those typically studied. The following section discusses various aetiological factors that might promote or protect against obesity. Risk factors for obesity may be divided into modifiable and non-modifiable factors. Non-modifiable factors will be discussed first.

2.8 Non-modifiable risk factors

Non-modifiable factors largely pertain to intrapersonal factors including biological and socio-demographic factors such as genes, age, gender, and race and ethnicity.

2.8.1 Genetic factors

Several epidemiological studies have established that genetic factors play a major role in individual susceptibility to obesity and remain the most important determinant of BMI; for instance, the off-spring of two obese parents are more likely to become obese than are the

offspring of two parents of normal weight (Fuemmeler et al., 2013). However, these studies have not yet determined which actual genes and numbers of genes are responsible for causing obesity (Williams & Frühbeck, 2009). Despite numerous studies addressing the topic of obesity and its genetic associations, only a few have been successfully replicated (Lyon & Hirschhorn, 2005). While a recent study argues that more than a fifth of the weight variances between people can be attributed to "obesity genes" (Williams & Frühbeck , 2009), most cases of obesity probably result from complex interactions between multiple genes and environmental factors that remain unclear due to the multifactorial causation of obesity.

The 'thrifty gene' hypothesis was originally proposed by Neel in the 1960s. This proposed that the same genes that predispose an individual to obesity would have had a selective advantage in populations that frequently experienced starvation and would have helped their ancestors to survive occasional famines (Franks et al., 2013). As a consequence, people who possess these genes in today's obesogenic environment might face challenges that lead them overreact, not simply becoming overweight but becoming obese (de Castro, 2004). Some populations may be more vulnerable to obesity than are others, such as Pacific Islanders and Native Americans because they possessed thrifty genotypes (Hu, 2008; Sellayah et al., 2014;Speakman, 2006). Those who possess this gene may face struggles with their weight regardless of whether they exercise and eat a healthy diet, as their bodies may store the fat as if in a famine females in particular are more susceptible to gaining body weight than males at the earlier time (de Castro, 2004).

It has been suggested that any elucidation of the obesity epidemic should take into account both aspects: genetics and the environment. Hu (2008) argues that genetic changes do not entirely explain the swift spread of obesity all over the world, which obesity researchers and experts consider to be a pandemic. Hu (2008) contends that the "gene pool" – that is, the frequency of different genes across a population – changes too slowly in human populations to be responsible for the obesity epidemic; it remains fairly stable across several generations and it takes a long time for new mutations to appear and spread across the generations (Qi & Cho, 2008). Another phenomenon that has potential to explain

excessive weight-gain is 'gene-environment interaction', referring to a situation in which adaptation to an environmental agent or a change in behaviour is restricted to the genotype of the individual for both genders (Bouchard, 2009).

In contrast, Qi and Cho (2008) attribute the recent surge in overweight and obesity and the spread of obesity epidemic to environmental changes. They argue that if the neighbourhood environment fails to support healthy lifestyle habits, it promotes obesity, through two distinguishable pathways: a lack of access to healthy foods and a lack of neighbourhood areas for recreation. This attribution is aligned with the view that it is possible to be obese without having a genetic predisposition, and it contradicts the more widespread suggestion that the development of obesity is most likely due to a combination of the obesogenic environment and a genetic predisposition to obesity for both genders (Bouchard et al., 2009). Other non-mutable risk factors associated with obesity include: age, gender, and race and ethnicity (NHLBI, 2012), discussed next.

2.8.2 Age

The causes of weight-gain with aging are indisputably multifactorial (Grundy, 1998), as weight-gain involves both biological and psycho-social components, both of which are important influences on body-weight (Sobal, 2001). In contemporary societies, a significant positive relationship has been identified between being overweight and the individual's age; however, this correlation tends to reverse direction in the last decades of an individual's life, such that the association between age and weight-gain is an inverted 'U' or 'J' shaped pattern (Flegal et al., 1998).

Numerous epidemiological studies in the form of cross-sectional studies conducted with large sample sizes reveal that BMI gradually increases throughout adult life and peaks at age 50-59 years in both men and women; however, after the age of 60, mean body-weight and BMI tend to decrease (Flegal et al., 1998; Hedley et al., 2004). Previous cross-sectional studies have been supported by other studies which suggest that men generally continue to gain weight up until their mid-fifties, when their weight begins to decrease; and this decrease accelerates in their late sixties and seventies. In contrast, women tend to gain

weight until their late sixties; thereafter weight-loss tends to be less than that of men (Sheehan et al., 20003; www.faqs.org, 2015). However, according to consecutive longitudinal cohort studies conducted by Fogelholm et al. (2000) and Grinker et al. (1995), body-weight and BMI do not change, or they decreases only slightly, in older adults (60-70 years old at study entry).

Numerous studies reported the findings of several prospective cohort studies which revealed that men and women gain weight consistently until age 65 (Chumlea et al. 1999 and Guo and Chumlea (1999). Similarly, according to data reported by Employment and Social Development Canada (ESDC), Canada, where both men and women aged 45-64 were reported to have the highest rates of obesity (ESDC, 2016).Similar results were obtained in the EMR according to a comprehensive review study conducted by Musaiger (2011), which concluded that, in most EMR countries, obesity increases with age up to 60, when obesity starts to decline in both men and women. In the Libyan context, despite Libyan belonging to the EMR, no studies have been conducted to investigate the relationship weight changes as adults age.

2.8.3 Gender

In most countries throughout the world, the prevalence of obesity is estimated to be greater in women than in men; however, the magnitude of the difference between the sexes varies substantially within and between countries or regions (Garawi et al., 2014). Similarly, a 2015 WHO report reveals that, in six WHO regions "Africa, Americas, South-East Asia, Europe, the EMR and the Western Pacific", women were more likely to be obese than men. In addition, in three WHO regions, Africa, the EMR, and South East Asia, women were estimated to have roughly double the obesity prevalence of men (WHO, 2016e). The scenario in Libya conforms to this pattern, according to the last survey in Libya, in 2009, which estimated the prevalence of obesity to be 40.1% in women compared to 21.0% in men (MOH, 2010; WHO, 2009; World Obesity Federation, 2015).

However, a few studies in the European Union (EU) have reported deviations from this pattern, with men generally being more obese than women in Norway, Malta and Italy

(OECD-European Union, 2014). Findings of the Health Survey for England (HSE) (2010), however, vary from those of both the WHO and the OECD-European Union; instead, the HSE found that the prevalence of obesity is similar among men and women, but men are more likely to be overweight (41.1% of men compared to 33.3% of women) (Public Health England, 2016).

Although explanations for the gender variance of obesity prevalence have been discussed and debated in literature, most explanations pertain to developing countries rather than to developed counties, for example, Arab women in developing countries are less likely to take time to exercise due to religious and culture barriers. Barriers that such women face in engaging in physical activities include a lack of time, parenting demands, and gender stereotyping whereby child-rearing and domestic chores are considered to be 'women's work' (Al-Lawati & Jousilahti, 2004; Abul-Hajj, 2013; Musiager, 2011). However, there is a lack of information about the reasons for the higher prevalence of obesity in men than women in some European countries (Public Health England, 2015).

Socio-cultural beliefs and practices in developing countries and within minority ethnic groups in developed countries play an important role in shaping gender disparities in overweight and obesity (Kanter & Caballero, 2012) . Throughout both North and Sub-Saharan Africa, for example, obesity and physical inactivity among both genders carries connotations of high social prestige, fertility, good health, and affluence. Moreover, gender differences in cultural (regional) dress may intensify gender differences in obesity; for example, women who wear a long, traditional loose-fitting dress may be hiding their body-shape in terms of "hidden obesity" or the converse phenomenon of "hidden hunger" (Kanter & Caballero, 2012). Cultural restrictions among North and Sub-Saharan African women and socio-cultural beliefs common in the EMR may indirectly deter women from engaging in leisure-time physical activity and thus may lead to weight-gain among women in these regions more than among men. In conservative societies, such as in the MENA region, women are often overprotected because of cultural or religious barriers (Benjamin & Donnelly, 2013; Musiager, 2011). As a result, they are not allowed to engage in physical activity in public places. In contrast, in developed countries, such as Greece, cultural beliefs

associate obesity with social status among men but place increasing pressure on women to be thin (Kapantais et al., 2006). Such cultural factors can account for the observed gender disparities in overweight and obesity(Kanter & Caballero, 2012).

Although women are more likely to report consuming healthier foods, they seem to prefer and consume more foods high in added sugars than do men, including energy-dense processed foods (Kanter & Caballero, 2012). Several epidemiological studies have reported a substantial upsurge in the consumption of SSBs in developing countries which may be attributed to the gender disparities in overweight and obesity in these countries (Babey et al., 2008; Payab et al., 2015; Trumbo & Rivers, 2014). In some countries, women consume more diet beverages than do men, whereas men consume more SSBs than do women (Barquera et al., 2008). For example, in Mexico, men had nearly twice the consumption of fizzy drinks as women, and a greater overall energy intake from SSB than women (Barquera et al., 2008). Women are more likely than men to consume fruits and vegetables (Blanck, 2008) and to meet recommended guidelines (WHO, 2016f). Another issue for gender differences in obesity is that females have to contend with the biological and hormonal changes of menopause, which affect fat distribution and may increase the risk obesity or exacerbate the negative effects of obesity on health (Christensen & Pike, 2015).

2.8.4 Race and ethnicity

According to National Obesity Observatory, 2011, the relationship between ethnicity and obesity in the UK is unclear and requires further exploration. It could be that minority groups are predisposed to being influenced by complex multifactorial interactions in the host environment. In addition, differences between specific ethnic groups have been found. For example, a comprehensive study by Misra and Khurana, (2009) found that despite a lower BMI in South Asians, South Asians have high levels of body fat and are more prone to developing abdominal obesity, which carries a high risk of type 2 diabetes and cardiovascular disease. Although the prevalence of obesity is high among all US and the UK population groups, substantial disparities exist among racial and ethnic minority groups for both adults and children in the US and the UK and vary on the basis of age, sex,

and socio-economic status (Table 2.1. The international classification of body weight in Adults adult) (Gatineau & Mathrani, 2013; Karlsen et al., 2014; National Obesity Observatory, 2011; Siriwardena, 2004).

It has been suggested that the estimation of adult obesity prevalence by ethnic group varies according to the measurement used. For example, the Health Survey for England (HSE) (2004) (Sproston & Mindell ,2004) revealed that Black African women have the highest obesity prevalence when using waist circumference as a measure, and Bangladeshi women have the highest prevalence when using waist-to-hip ratio (WHTR) – WHTR having been proposed as a good measurement for use across all ethnic groups. In contrast, Chinese men and women appear to have the lowest obesity prevalence regardless of which measure is used (NICE, 2016; National Obesity Observatory, 2011).

Due to a mismatch among BMI values among ethnic minorities in the UK and the unfeasibility of generalising the BMI cut-off values across all populations (see Table 2.1 for further detials), the WHO then convened an expert consultation panel on the issue of BMI in Asian populations. The panel proposed a new cut-off threshold for the Asia-Pacific region, based on the risk factors and morbidities specific to this population. The WHO has in fact recommended lower cut-off points for classification of overweight and obesity in black, Asian and other minority ethnic groups (NICE, 2014; National Obesity Observatory, 2011). The following BMI thresholds have been recommended: for increased risk of chronic conditions, a BMI of 23 kg/m^2 or more; and for high-risk of chronic conditions, a BMI of 27.5 kg/m^2 or more. These cut-off points may well be applicable to the Libyan context, particularly for the many minority or tribal groups such as the Tuareg and Toubou who have been migrating from the drought-stricken Sahara to the big cities in the north.

The following section discusses modifiable factors. Broadly, they belong to the following spheres: interpersonal, organisational, community, physical environment, and public policy. They include socio-economic factors, lifestyle factors, government and religious policies, environmental factors, and cultural factors.

2.9 Modifiable risk factors

2.9.1 Socio-economic status (SES)

Although socio-economic status (SES) is considered to be a significant predictor of obesity (Sabanayagam et al., 2008), the association between SES and obesity varies worldwide, and in developing countries it has been inconsistent and contentious (Kim et al., 2014; Sabanayagam et al., 2008; Xiao et al., 2013). As a result, a substantial body of research has emerged to shed light on the complexity of the association between SES and obesity (Pei et al., 2015; Xiao et al., 2013). Most studies addressing this issue were implemented in developed countries, and, although some studies exist in developing countries, the association between the two variables is not as well understood as that in developed countries (Pei et al., 2015; Xiao et al., 2013). In their exhaustive review of 144 published studies on the association between SES and obesity from the 1960s until the mid-1980s in both the developed and developing world, Sobal and Stunkard (1989) found that, in developed societies, SES has a strong, consistently inverse association with obesity in women, with a higher likelihood of obesity among women of lower SES, and an inconsistent and contentious association in men. In developing countries, however, a consistent positive correlation was established between SES and obesity among both genders and among children, that is, the higher the SES, the higher the rate of obesity.

However, three subsequent comprehensive reviews ascertained a different scenario. The first review, by Monteiro et al. (2004), reviewed all studies published between 1989 and 2003. Exploring the relationship between SES and obesity in adult populations in developing countries, they found a reversal of the usual, positive relationship between SES and weight, specifically that obesity is no longer widely considered to be a condition that affects people of higher SES, but also affects those of lower SES. In contrast, the second comprehensive review, by McLaren (2007), updated Sobal and Stunkard's (1989) study. Reviewing approximately 333 published articles addressing the issue, it revealed that lower SES tends to be associated with higher levels of obesity in countries with a high Human Development Index (HDI), whilst in countries with a lower HDI an inverse SES-obesity relationship has been observed. The third review was conducted by Dinsa et al. (2012).

Reviewing all papers published between 2004 and 2010 on the association between SES and obesity in men, women and children in developing countries, their conclusion provides compelling evidence that the association between SES and obesity is positive for both men and women in low-income countries or in countries with a low HDI, that is, the more affluent and/or educated individuals are, the more likely they are to be obese. However, in middle-income countries or in countries with a medium HDI, the association becomes largely mixed for men and mainly negative for women. This particular shift appears to occur at an even lower level of per capita income than that suggested by an influential earlier review.

The recent World Health Survey (WHS) was conducted in 67 countries, representing all the regions of the world, during 2002 and 2003 (Pampel et al., 2012). Using individual- and combined-level data to examine how economic development, SES and obesity were related, Pampel et al. (2012, found not only that BMI, being overweight, and being obese increase with national product but also that the associations of SES with being obese shift from positive to negative. In lower-income countries, people of higher SES were more likely to be obese. Conversely, in high-income countries, those of higher SES were less likely to be obese.

The same pattern of association to that found in developed Western countries has been found by several recent extensive studies carried out in developing countries and in newly industrialised countries in Asia – including China, Thailand, and the Philippines – by Pei et al. (2015), Seubsman et al. (2010) and Dahly et al. (2010) respectively. These revealed the same pattern of correlation to that found in developed Western countries, namely, an inverse relationship between SES and obesity in women, and an inconspicuous relationship in men. In 2014, Libya ranked 55th in the UN's Human Development Index, out of 163 countries. This meant that Libya was classified as a 'high human development' country. Accordingly, it might be expected that the association between SES and obesity is similar to that in countries within the same ranking. If it was not in fact the same, further explanation was required.

Libya is overwhelmingly dominated by tribal society. Because of the unstructured nature of Libyan society – it is essentially a classless society, there is a dearth of references for classifying and describing social classes in this country (Cherstich, 2014; Poljarevic, 2012; Obeidi, 2001). Thus social strata were ruled out for analysis in the present study; SES was measured instead using a combination of three indicators: education level, income and occupation, in keeping with the American Psychological Association (APA) and a substantial body of previous research, which ascertained that the most common indicators used to measure SES are a combination of education, income and occupation (APA, 2015; Krieger et al., 1997).

2.9.1.1 Education

A substantial body of literature emphasises a significant inverse correlation between education level and obesity, particularly among women in developed societies, while in men this association is less consistent (Hermann et al., 2011; Tzotzas et al., 2010; Williams et al., 2013). Although this inverse association is a pattern commonly found in Western societies, the same association has been found by studies undertaken recently in developing countries (Janghorbani et al., 2007; Xiao et al., 2013) and in Arab countries, such as Lebanon (Chamieh et al., 2015), Syria (Fouad et al., 2006) and Jordan (Khader et al., 2008). A possible explanation is that these countries are more likely to accept a Western lifestyle, where an inverse association between education level and obesity prevails (Dinsa et al., 2012). In contrast, other epidemiological studies found that an inverse association exists between education and BMI in both genders (Groth et al., 2009; Janghorbani, et al., 2007; Soriguer et al., 2004).

Although the three studies undertaken in the EMR (Lebanon, Syria and Jordan), cited above, concluded that the same pattern of association exists as that found in developed countries, this was not the case for other studies in the EMR. Other studies conducted in the EMR have found a positive association between educational status and obesity in Saudi (Al-Nuaim et al., 1997) and in Bahrain (Al-Mahroos & Al-Roomi, 2001). However, two recent comprehensive reviews on overweight and obesity in Arabic-speaking countries, and another in the EMR, concluded that the association between education level and

obesity is contentious and requires further research (Badran & Laher, 2011; Musaiger, 2011). It is clear that more research and debate is required among researchers in the EMR before consensus can be reached. Libyans have the potential to improve their understanding of health and obesity and achieve good levels of education, through Libyan education policy which grants free tuition to Libyan students in higher education, thereby helping to achieve a the literacy rate of is 86% for Libyans of over 15 years of age (91% for males, 81% for females) (WHO, 2007).

2.9.1.2 Income

Considered to be the principal determinant of SES in connection with obesity, income has been more widely researched than has occupation (Cawley et al., 2010; Kpelitse et al., 2013; Schmeiser, 2009). Income is considered a powerful indicator because it represents the ability of a family to acquire material resources and the potential to access different lifestyles and provide a sense of security (Duncan et al., 2002). A large number of epidemiological studies conducted in developed societies have all found an inverse association between obesity and income level for women, with higher-income women being less likely to be obese than low-income women, while there was an inconsistent and contentious association in men (García Villar & Quintana-Domeque, 2009; National Obesity Observatory, 2012; Martín et al. 2008). However, a recent study in China found significant gender differences in terms of the correlation between obesity and income: no association was found in women but a positive association was identified in men between income and obesity (Xie et al., 2013).

Another study in China found no significant correlation between obesity and income (Jin et al., 2013). Turning to the Arab region, parallel comprehensive reviews of obesity in Arabic-speaking countries by Badran and Laher (2011) and Musaiger (2011) converged on the finding that income is a potential risk factor associated positively with obesity in Arabic-speaking, oil-exporting countries. Numerous epidemiological studies carried out in the Arab region reached the same conclusion: in Saudi Arabia (Al-Nuaim et al., 1996), in Bahrain (Al-Mahroos & Al-Roomi, 2001), and in both Tunisia and Algeria (Atek et al., 2013). These studies concluded that those with a higher income tend to have a higher rate

of obesity. Nevertheless, the latest studies in the Arab region have revealed that the association between higher SES and obesity tends to turn into an inverse association in women, but remains ambiguous in men. This association was found in Lebanon (Chamieh et al., 2015) and in Egypt (Aitsi-Selmi et al., 2014), which aligns with the findings observed in Western societies. It can be concluded that these countries likely imitate and practice the common lifestyle patterns seen in developed countries, despite both Lebanon and Egypt being classified as medium-income countries.

2.9.1.3 Occupation

Occupational change is considered to be a substantial social determinant of obesity risk as many low- and middle-income countries proceed to develop (Popkin et al., 2012). Due to globalisation, the world is getting wealthier, which in turn is likely to enhance the quality of daily living (Loureiro & Nayga, 2005). A reason for this increase in global wealth is the substantial shift from agricultural to non-agricultural or industrialised economies. Globalisation has influenced employment status in terms of increasing the number of more sedentary occupations. In addition, due to a flux of migration from rural to urban environments, people are increasingly exposed to fast foods, which are acceptable, and affordable even for minority groups (Aitsi-Selmi et al., 2013). Factors that influence employees' weight in developed countries include the tedious nature of many jobs, coupled with other factors such as physical neighbourhoods and the transportation system (Aitsi-Selmi et al., 2013). The Working Hours Act (ATW) stipulates that estimated that empolyees must spend as much as 7-8 hours per day, namely, more than 45–50% of their waking hours, at their workplace, as well as the maximum average weekly working time shall not exceed forty-eight hours (Allman-Farinelli et al., 2010; International Labour). Given the changing nature of occupations in developing countries, it is necessary to explore the association between occupation and obesity further in developing countries.

A number of epidemiological studies have suggested that obesity prevalence varies substantially by occupation (Bonauto et al., 2014; Steeves et al., 2012). A recent study was undertaken on 8,639 participants (aged ≥ 20 years) in the STEPS Survey 2011 in Iran, under supervision of the WHO. This study found that employed adults had a lower

prevalence of obesity than did their unemployed counterparts. A possible explanation is the level of physical activity that accompanies the occupational role. Supporting this explanation, a study by Bonauto et al. (2014) undertaken on 37,626 employed Washington State respondents, using the Behavioral Risk Factor Surveillance System in odd numbered years, from 2003 to 2009, showed that workers with physically demanding occupational physical activity had a significantly lower prevalence of obesity compared to those with non-physically demanding jobs.

However, a recent study conducted in Australia found that the prevalence of obesity among occupations varies by gender, with employed men having a higher risk of obesity than unemployed men and employed women, regardless of their type of occupation, and whether the nature of their work was labour- intensive or sedentary (Allman-Farinelli et al., 2010). Similarly, numerous studies conducted in the EMR converged on the conclusion that obesity and employment status in women are significantly negatively associated, with employed women being less likely to be obese than their non-working counterparts; while the association was ambiguous in men (Ainy & Azizi, 2007; Fouad et al., 2006; Musaiger & Al-Ahdal, 2010).In the Libyan context, the nature of occupations offered by the Libyan government has not been specifically investigated. There is also a lack of information on the relationship between occupation and obesity or other diseases.

Numerous epidemiological studies have examined the association between obesity and occupation using unemployment status as variable. A study of Korean adults found that unemployment is significantly related to an increased risk of obesity in an elderly Korean population, regardless of age, lifestyle and socio-economic factors (Kang et al., 2013), while a study in the US revealed contrary results – that unemployment rates were negatively associated with obesity in women but not in men – but using different variables: the longer that women were unemployed for, the lower the rate of obesity (Zhang et al., 2014). The Health Survey for England (2010) relies on classification of occupations rather than employment status, for both employed men and women. The Survey found that those in unskilled or lower classification occupations had a higher prevalence of obesity than those in professional occupations (National Obesity Observatory, 2012).

2.9.1.4 Marital status

Little clarity exists about the relationship between obesity and marital status (Janghorbani et al., 2008). Although most cross-sectional studies have found a positive correlation between obesity and being married (Leahy et al., 2014; Veghari et al., 2010), a few studies have found no association (Reynolds et al., 2008). However, in general, married men and women in developed and developing countries alike tend to have a higher risk of being overweight and obese than do never-married individuals (Khader et al., 2008; Tzotzos et al., 2010). A review on obesity in the EMR conducted by Musaiger (2011) concluded that married men and women are more predisposed to being overweight and obese than their never-married counterparts. Janghorbani's (2008) study in Iran supports this claim. Based on a nation-wide cross-sectional survey to investigate the association of BMI and abdominal obesity with marital status in adults, this study concluded that marital status appears to influence the likelihood of developing overweight, obesity, and abdominal obesity in both men and women in Iran. However, a recent national study in Lebanon found an association between obesity and being married in men, but not in married women (Chamieh et al., 2015). Since no study has yet been conducted to address marital status and obesity in Libyan adults, we can speculate that the nature of the association probably does not differ from that of previous studies, revealed that married men and women are more likely to being overweight and obese than their single counterparts.

2.9.1.5 Duration of residence

Several sociological perspectives maintain that immigrant children can acculturate successfully in a new host country within 3 to 5 years (Kopala & Esquivel, 1994). For adults, on other hand, a cross-sectional study using data of the 2000 National Health Interview Survey (NHIS) in the US conducted by Goel et al. (2004) found that BMI among different immigrant subgroups starts to rise after 10 years' residence in the US. Similarly, a study conducted in the UAE found that migrants living in the UAE for more than 10 years were significantly more prone to acculturating to an obesogenic environment than those who had lived there for fewer than 10 years (Shah et al., 2015). Furthermore, despite the lack of association found between the duration of residence of immigrants and obesity in Spain (Marín-Guerrero et al., 2015), Delavari et al. (2015) assert that the association

between the degree of acculturation and BMI has previously been established, and the role of obesogenic behaviours in the host culture exacerbates the obesity epidemic among the long-term resident migrants to a greater extent than among the current immigrants. It may be concluded that the greater the length of stay in a place, the greater the tendency towards acculturation to an obesogenic environment, which probably increases the obesity rate. In general, a lack of studies on the relationship between both acculturation and adaptation in a new society and obesity in the EMR means that it is difficult to draw any conclusion regarding this matter.

2.9.2 Unhealthy eating behaviours

Nutrition transition is a shift from a traditional diet towards a modern one, as a result of economic growth and the accompanying modernisation and urbanisation (Harvard School of Public Health, 2016c; Popkin et al., 2012). Considered a potential risk factor leading to an increase in the obesity epidemic, it is a shift in dietary consumption and energy expenditure that coincides with economic, demographic, and epidemiological changes. The nutrition transition has been categorised into five key patterns including: cheap calories, animal foods, refined grains, sugary drinks and fast food restaurants (Hansford, 2010; Harvard School of Public Health, 2016c; Popkin et al., 2012; Zarei & Ahmadi, 2015). Characterised by a high intake of red meat, refined sugars and saturated fat but little fibre, the 'Western' diet is spreading worldwide (Popkin et al., 2012). Consequently, nutrition transition is considered an important factor which can affect dietary intake through unhealthy eating habits, particularly in many low- and middle-income countries and can result in a rising epidemic of overweight and obesity among adults and adolescents, as well as widespread diet-related, non-communicable diseases (DR-NCDs) (Harvard School of Public Health, 2016c; Popkin et al., 2012; Singh et al., 2014).

Unhealthy eating habits has been recognised by numerous epidemiological studies to be one of the main risk factors for a range of chronic diseases, including obesity (Sun, 2014; Swinburn et al., 2004; WHO, 2016b). The priority given to the investigation of the most common unhealthy eating habits could include: an excessive consumption of fast foods; an excessive consumption of sugar-sweetened beverages (SSBs); eating less than five daily

portions of fruit and vegetables; a high frequency of skipping breakfast; and consumption of large food portion sizes (FPS) (Greenwoo et al., 2008; Swinburn et al., 2004)., which are discussed in further detail in subsequent sections.

2.9.2.1 Fast-food consumption

The WHO (2003) classifies a high intake of energy-dense, macronutrient-poor foods as a potential etiological factor of obesity. Such foods have been considered to be a convincing risk factor for obesity (Swinburn et al., 2004). A number of studies and reviews have supported this classification. A prominent study was a comprehensive investigation of 25 high-income countries belonging to the Organisation for Economic Co-operation and Development (OECD), which established that fast-food consumption is an independent predictor of mean BMI in high-income countries (De Vogli et al., 2010). Similarly, several cross-sectional studies conducted in developed countries have determined that fast-food consumption is positively associated with increased BMI (Burgoine et al., 2014; Cummins et al., 2005; Maddock, 2004). Likewise, numerous cross-sectional studies conducted in the EMR indicate similar associations between fast-food intake and increased BMI (Ghazali et al., 2010; Musaiger et al., 2014; Al-Otaibi et al., 2005; Pereira et al., 2005).

However, other epidemiological studies have revealed disparate results. For instance, a prospective longitudinal study in the USA found that fast-food consumption was positively associated with energy-intake and BMI in women, but not in men (Jeffery & French, 1998). In comparison, although some previous studies have clarified that fast food consumption plays only a modest role in contributing to the obesity epidemic (Anderson & Matsa. 2011; Sturm & Datar, 2005), other studies in developing and developed countries have revealed no significant relationship between the frequency of consuming fast foods and BMI (Alfawaz, 2012; Haines et al., 2007; Simmons et al., 2005). Therefore, addressing the topic in the present study could help to elucidate the relationship between fast-food consumption and obesity among the Libyan population in particular and in the EMR population in general.

2.9.2.2 Consumption of sugar-sweetened beverages (SSBs)

The effects on health of increased consumption of SSBs, artificially sweetened beverages, and fruit juice has become a significant theme for study by public health experts (CDC, 2010; Studdert et al., 015). Despite the WHO recognising an increase consumption of SSBs and fruit juices as a probable risk factor for obesity (WHO, 2003), recent rigorous epidemiological studies have converged on the finding that an increased consumption of SSBs is in fact a convincing risk factor for weight-gain and obesity (Hu & Malik, 2010; Malik et al., 2010). The studies that have categorised SSBs as a convincing risk factor for obesity include a systematic review and meta-analysis of 88 studies by Vartanian et al. (2007), who established clear associations of SSBs intake with increased caloric intake and obesity. In addition, large prospective cohort studies among adults conducted in developed societies found that higher SSB consumption was associated with significant weight-gain for both genders (Dhingraet al., 2007; Odegaard et al., 2010; Schulze et al., 2004). Likewise, three recent comprehensive reviews concluded that a positive association exists between intake of SSBs and obesity (Malik et al., 2006; Trumbo & Rivers, 2014; Woodward-Lopez et al., 2010).

Furthermore, several observational studies (including cross-sectional, longitudinal, and nationally representative studies), conducted in both developed and developing countries, were similar to the aforementioned studies in their findings. These found that SSB intake among adults is significantly associated with greater adiposity (Babey et al., 2009; Rasheed et al., 1998; Rhee et al., 2012; Woodward-Lopez et al., 2010). A recent study conducted by Basu et al. (2013) concurs with the findings of previous studies; in their comprehensive analysis of 75 countries, they found that soft-drink consumption is significantly associated with overweight, obesity, and diabetes worldwide, in both low- and middle-income countries. However, several cross-sectional studies have revealed no association between intake of SSBs and weight-gain in either gender (Odegaard et al., 2012; Sun & Empie, 2012). In the Arab region, the majority of studies address adolescents (Musaiger, 2011); only one study conducted on adults found a positive association between increased consumption SSBS and obesity in Saudi women (Rasheed et al., 1998). It is important to

repair this lack of studies on the association between SSB and obesity in the Arab region, through conducting such study in Libya.

2.9.2.3 Eating less than five daily portions of fruit and vegetables (FV)

According to a recent WHO/FAO expert consultation report on diet, nutrition and prevention of chronic diseases, low fruit and vegetable intake is among the top 10 risk factors contributing to attributable mortality, and it recommends a minimum daily intake of 400g (Johnson et al.,2014; WHO, 2005; WHO. 2016). Health promotion campaigns often refer to 'Five-a-Day'; this message highlights the health benefits of getting five 80g of fruits and vegetables per day for the prevention of chronic diseases such as obesity. A large body of literature has shown that the association between increased fruit and vegetable intake and BMI is inverse and statistically significant for both males and females; through numerous cross-sectional studies (Azagba & Sharaf, 2012; Radhika et al., 2008 Goss et al., 2005) as well as through prospective cohort studies (Buijsse et al., 2009; Davis et al., 2006; He et al., 2004; Vioque et al., 2008) and randomised controlled trials (RCT) (Ortega et al., 2006; Tanumihardjo et al., 2009). However, a few studies have shown a positive relationship between mean BMI and consumption of fruit and vegetables (Goss & Grubbs, 2005; Xu et al., 2007).

In terms of gender, several studies have reported that women generally consume more fruit and vegetables than do men across many countries and cultures (Charlton et al., 2014 Nicklett et al., 2013; Prättälä et al., 2010). Schroder (2010) notes that most studies that have investigated the relationship between FV consumption and change in body-weight have used and analysed both FV intake as a combined variable (i.e., meeting at least five daily servings of FV). However, Schroder (2010) investigated the association between FV intake separately with change in human body-weight, and found that vegetable and fruit consumption differed in their associations with body-weight and weight-loss. He concluded that increases in fruit consumption were associated with subsequent weight-loss. However, a recent study conducted by Charlton et al. (2014) to investigate FV intake and BMI in a large sample of 246,995 Australian adults revealed a lack of clear association between fruit and vegetable intake and weight status for both women and men. In general,

a dearth of studies on the relationship between both fruit and vegetables and obesity in the EMR (Musaiger, 2011), means that it is difficult to draw any conclusion regarding this matte. The literature does however indicate the importance of studying gender variance in this association.

2.9.2.4 A high frequency of skipping breakfast (BF)

According to the Dietary Guidelines for Americans Advisory Committee (2010), there is some evidence that skipping breakfast increases the risk of weight-gain and obesity, although the evidence is stronger in children, especially teens, than it is in adults. Multiple studies have shown that skipping breakfast is associated with a significantly higher risk of obesity in developed countries (Harding et al., 2011; Laska et al., 2012; William, 2007), and developing countries alike (Kim & So, 2012; Nurul-Fadhilah et al., 2013 ; So al., 2011). In contrast, the association between skipping BF and obesity is ambiguous in numerous studies and very often no association was established (Kim & So, 2012; Nicklas et al., 2004; Williams et al., 2009). From a different perspective, several intervention studies have shown that regular breakfast consumption is associated with lower prevalence of overweight and obesity in adults (Kent & Worsley, 2010; Song et al., 2005; Williams, 2005). Regular consumption of breakfast appears to be associated with more healthy body-weights across all age groups.

Most of the studies in the EMR on the association between skipping breakfast and weight-gain have been among children (Maddah & Nikooyeh, 2010) and adolescents (Rashidi et al., 2007; Yahia et al., 2008). The results of these studies have converged on the finding that skipping breakfast is independently related to overweight/obesity. A systemic review in the EMR conducted by Musaiger (2011) cited only one study on skipping breakfast in Saudi women (Musaiger & Al-Ahdal, 2010). This study revealed that the more women skipped breakfast, the more weight they gained. Therefore, addressing the topic in the present study could help to clarify the association between skipping breakfast and obesity among the Libyan population in particular and in the EMR population in general.

2.9.2.5 Consumption of large food portion sizes (FPS)

There is considerable evidence that the portion and packaging sizes of many foods has increased over the last three decades with the concern that this may be one factor that has contributed to the rise in obesity (Piernas & Popkin, 2011; Steenhuis &Leeuwis, 2010). The marketing of 'supersize' portions, particularly in fast food outlets and stores, is now common practice worldwide. Pre-packaged meals, consumed at fast-food restaurants or purchased and then eaten at home, are much larger today than they were over the past three decades. Even those who rarely eat at restaurants are still confronted with the large portion sizes of pre-packaged or convenience foods, which is concomitant with the rise in the prevalence of obesity (Benton et al., 2015; Vermeer et al., 2014).

Consistent consumption of large FPS has been classified as a possible causative factor of unhealthy weight-gain (Nielsen & Popkin, 2004; WHO, 2003). However, there is sufficient scientific evidence to classify the consumption of large FPS as a risk factor for obesity (Vermeer et al., 2014). Systematic studies have shown that increases in the consumption of large FPS, both inside and outside the home, have coincided with the rise in the prevalence of obesity, suggesting that larger portions may play a role in the obesity epidemic in in both genders (Almiron-Roig et al., 2015; Ledikwe et al., 2005; Rolls, 2014). In addition, numerous controlled, laboratory-based studies have shown that providing individuals with larger FPS and beverages results in substantial and sustained excesses in energy intake, which in turn can override the regulation of energy balance in the body and have persistent effects that could lead to obesity in both genders (Ledikwe et al., 2005; Rolls, 2014; Rolls et al., 2004, 2005). However, epidemiological studies to investigate the association between FPS and obesity are still absent in many part of the world, including in the EMR (Albar et al., 2014; Ledikwe et al., 2005; Lioret et al., 2007).

Other common unhealthy eating habits may well constitute risk factors for obesity but fall outside scope of this study. Attributed variously to individual, social and psychological factors, these habits were placed in the appropriate sphere in the SEM, as categorised by researchers and experts. These eating habits include: the frequency of consuming food away from home (FAFH); unhealthy snacking; emotional eating; food binging; eating

during other activities; distracted eating; eating late at night; eating when thirsty; irregular eating; and drinking too much alcohol. However, to develop our understanding of the aforementioned unhealthy eating factors further, which were ignored in the quantitative study, eliciting the perspectives of Libyan healthcare professionals (HCPs) and Libyan community leaders (LCLs), who might raise and report other common unhealthy eating habits pertaining to Libyan culture, which may be fuelling the obesity epidemic.

Since oil in Libya was discovered late in the 1950s, Libya has followed the trend of transition in the following spheres: economic (a dramatic change from a low to a high HDI country), demographic (mortality and fertility are decreasing), and epidemiological (in which infectious, communicable and acute diseases are decreasing and chronic diseases are increasing). These transitions have a collective impact on the health status of the society, and, in Libya's case, constitute a nutrition transition in that they include a poor diet and sedentary lifestyle (FAO, 2005; Lachat et al., 2013; WHO, 2007). Although healthy foods are generally more expensive than unhealthy foods (Darmon, & Drewnowski, 2015; Rao, et al., 2014), in the Libyan context, the scenario is somewhat different from neighbouring countries in that food is available, affordable and accessible to all Libyans, meaning that healthy foods are no longer difficult to obtain (FAO,2005; Sehib et al., 2013). However, this situation is not necessarily stable, considering the current fighting between rival militias which is resulting in a rapid deterioration of living conditions including restricted access to healthy foods (Chivvis, & Martini, 2014; International Institute for Counter-Terrorism (ICT), 2015; United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), 2014).

While studies in developed and developing countries have demonstrated extensively how unhealthy eating habits tend to promote obesity, there is a dearth of evidence for Arabic countries. Therefore, addressing this topic in the present study could help to elucidate the relationship between unhealthy eating habits and obesity among the Libyan population in particular and in the EMR population in general. The next section discusses factors pertaining to community-, physical-environment- and societal-levels of the SEM, comprised of physical activity and sedentary lifestyle.

2.9.3 Physical activity (PA)

Physical activity (PA) can occur in all domains of life, including transportation, recreation, leisure time or play, household activities and occupation (Sallis et al., 2012). Globally, according to the WHO (2008) around 3.2 million deaths each year are attributable to insufficient physical activity (WHO, 2016g). In addition, prevalence of insufficient PA was highest in the Americas and in the EMR, where almost 50% of women were insufficiently active in both regions. The prevalence of insufficient PA for men was lower, at 40% and 36% in the Americas and Eastern Mediterranean respectively (WHO, 2016e). Numerous international organisations and institutions – including the WHO, the Physical Activity Guidelines for Americans (PAG), the NHS, and the UK Physical Activity Guidelines – concur with the levels of PA recommended for adults, namely, they should engage in aerobic physical activity of a moderate intensity for at least 150 minutes (2.5 hours) throughout the week (CDC, 2015c; The U.S. Department of Health and Human Services (HHS). (2008); UK Physical Activity Guidelines (UK,PAG), 2011; WHO, 2016f).

There is convincing evidence in the literature that regular physical activity protects against obesity, while a sedentary lifestyles is a risk factor for obesity, due to the associated decline in energy expenditure, and the increase in the use of motorised transportation, labour-saving devices at home and at work, and physically undemanding leisure activities. Several epidemiological and intervention studies have consistently shown a strong inverse relationship between PA and obesity in both developed (Besson et al., 2009; Banks et al., 2011; Cho et al., 2009) and developing countries (Fan et al., 2015; Labban, 2014; Momenan et al., 2011). There is consensus in the literature that the more active people are, the more likely they are to keep their weight constant (Mekary et al., 2009; Seo et al., 2010), however, the more sedentary their lifestyle, the more likely they are to develop obesity and die from it due to reduction in their life expectancy (Pi-Sunyer, 2009; Swanton, 2008).

Men and women in the EMR face numerous obstacles to engaging in PA. A number of studies and comprehensive reviews undertaken in Arab region explored these barriers (Al-Kaabi et al ., 2009; Benjamin & Donnelly, 2013; Musaiger et al., 2013; Sallis & Glanz,

2009). These studies found that the factors that impede physical activity can be categorised into three levels: the individual; socio-cultural and policy-related; and environmental.

Firstly, barriers on the individual level include a lack of money and time, and physical distress (e.g., co-existing diseases, fear of injury, and feelings of tiredness) (Brodie & Perera, 2014; CDC, 2011; Jones & Paxton, 2015; Komar-Samardzija et al., 2012). Barriers on the socio-cultural and policy level include women's traditional dress known as *abayas* that impede them from engaging in certain types of physical activities, and cultural and religious strictures that deter them from attending public gyms, sport clubs and recreational centres (Benjamin & Donnelly, 2013; Musaiger et al., 2013). They may also indulge in an affluent lifestyle (e.g., an abundance of housemaids; a tendency to use cars excessively; being distracted by TV or video games), and engage in gender stereotyping, for example, women who believe that child-rearing ,looking after both children and aging parents and domestic chores are 'women's work'(Benjamin & Donnelly, 2013; Musaiger et al., 2013). . As a result of such stereotypical views, women are less likely to engage in PA (Caperchione et al., 2009; Serour et al., 2007; Thomas et al., 2004). Finally, barriers to PA on the environmental level include: hot weather (e.g., 30-40 degrees Celsius in summer); a lack of local exercise facilities; and the distance between homes and exercise facilities in deprived areas (Al-Kaabi et al ., 2009; Benjamin & Donnelly, 2013; Musaiger et al., 2013).

Physical inactivity is widely recognised as a major risk factor for the development of obesity (Brock, et al., 2009; Baba et al., 2006). The majority of studies conducted in the EMR on adolescents found that low levels of physical activity and prolonged screen-time (e.g., watching TV or using a computer) are the main predictors of overweight or obesity (Al-Haifi et al., 2013; Al-Nozha et al., 2007;; Fouad et al., 2006; Al-Hazzaa et al., 2012). However, a few studies in the EMR reported a high prevalence of inactivity among adults, with inactive females being more prevalent than inactive males (Al-Nozha et al., 2007; Alsaif et al., 2002; Esteghamati et al., 2012). This finding was confirmed by a comprehensive study conducted by Kahan (2014) who estimated physical inactivity in 38 Muslim countries. The study also found the prevalence of physical inactivity in the Muslim

world to be higher than that in non-Muslim countries, and attributed the difference primarily to higher rates among Arabs, however, some Arabs are Christian (Kahan, 2014).

Although there is a lack of studies on the impact PA on obesity in the EMR, a recent study conducted in Lebanon reported a negative association between obesity and PA, which was significant among women, but not in men (Chamieh et al., 2015). It is possible that the individual, socio-cultural and environmental impediments to PA, that are peculiar to the EMR, could result in a different association between PA and obesity in the EMR compared to other (non-Arab) regions.

2.9.4 Sedentary behaviour (SB)

Sedentary behaviour is not simply a lack of physical activity, but a cumulation of time spent in low energy-expenditure activities such as sitting, screen-time (e.g., watching TV or using a computer), reclining at home, using motorised transport, reading, (Ekelund et al., 2010; Owen et al., 2010). Sedentary behaviours may occur in various settings including work, school, home, and during commuting.

Numerous epidemiological studies, mostly in developed countries, provide compelling evidence of a consistent, direct relationship between sedentary behaviours in adults and obesity, even after controlling for levels of leisure-time physical activity and diet (Banks et al., 2011; Heinonen et al.,2013; Healy et al., 2008; Hu et al., 2003; Mozaffarian et al., 2011; Owen et al., 2010; Pearson & Biddle; 2011) For some reason, most extensive epidemiological studies have not addressed total leisure-time sedentary behaviours (LTSB) categorised into diverse behaviours; instead, researchers tend to restrict themselves to TV-viewing only.

Arguably this sedentary activity (TV-viewing) resembles 'time spent sitting or lying down all day', which collectively termed a LTSB. Numerous studies have found direct associations between TV-viewing time and risk for obesity (Aadahl et al., 2007; Heinonen et al., 2013; Hu et al., 2003; Rosiek, et al., 2015). From a different perspective, intervention studies and prospective studies have reached a similar conclusion but using different

variables; they found that reducing prolonged TV-viewing and other sedentary behaviours help to prevent obesity (Hu et al., 2003; Frieden, et al., 2010; Swinburn & Shelly, 2008). However, a recent longitudinal study found little evidence of an association between BMI and the amount of time spent on TV-viewing (Stamatakis et al., 2012).

Although several intervention studies argue that interventions to reduce sedentary behaviour have generally been successful in reducing weight (Greaves et al., 2011; Howlett et al., 2015), other studies argue that reducing sedentary behaviour alone, without other effective interventions (e.g., combined diet and physical activities), is unfeasible for reducing obesity (Liao et al., 2014; Must & Tybor, 2005). Nevertheless, the perspective that successful interventions entail both increasing physical activity and reducing sedentary behaviour is still debatable, particularly for prospective studies that take a long-term perspective for evaluation (Greaves et al., 2011; Howlett et al., 2015). Despite the association between sedentary behaviour and obesity being well established in many WHO regions, research is needed in the EMR to identify the nature of relationship between sedentary behaviour and obesity in adults.

The next section discusses additional factors pertaining to institutional, community, physical environment and societal levels of the SEM, comprised of: neighbourhood environment, food-related cultural factors, and the Libyan food subsidy policy.

2.9.5 Neighbourhood environment

To understand the reasons behind a dramatic increase in obesity epidemic globally, it is necessary to investigate causes not only at the individual (intrapersonal) level – comprising changes in genes, biology, and psychology – but also at the level of the local environment, including the urban built environment (Sallis & Glanz, 2009). Public health researchers and obesity experts have blamed city-planners for creating 'obesogenic environments' through land-use patterns and transport systems planners which encourage people to eat unhealthily and not exercise enough, thereby fuelling the obesity epidemic (Jones et al., 2007; Lake & Townshend, 2006; Swinburn et al., 2004).

The Social Ecological Model of health lends itself to showing the influence of the environment on obesity, along with the influence of changes in physical activity levels and diet (Humpel et al., 2002). The following aspects of the environment have been found to be relevant to the study of obesity in conjunction with dietary behaviour and physical activity behaviour: (1) Accessibility, referring to distance to shops and work; distance to a green space or park; travel time to a healthy food outlet; opening hours of a healthy food outlet; cost of healthy food; cost of a physical-activity facility; (2) Availability, referring to types of food outlets available in the local area; the quality of green space; and the quality of food in the local area; (3) Perceptions, referring to perceptions of safety in parks and perceptions of food provided in food outlets and the value of healthy foods (National Obesity Observatory (NOO), 2011).

Three main dimensions of the environment have been found to potentially impact on human health and contribute to weight-gain: (1) its physical design (the built environment); (2) the socio-cultural rules that govern these environments; and (3) the SES of these environments (Lake & Townshend, 2006). It has been suggested that three key data collection techniques have been identified for investigating food and physical activity environments: (1) physically visiting the areas to collect primary data and recording the data about the neighbourhood environment on a map or another type of audit tool; (2) administering self-report questionnaires to assess people's perceptions of their food and physical activity environment; (3) using sources such as Google Earth and Google Street View to collect secondary data relating to the nature of a physical landscape and built environment (Brownson et al., 2009)

2.9.5.1 Influence of the built environment on physical activity

There is a growing interest in the relationship of built environmental attributes to physical activity, and obesity. Despite most studies to date that examine associations between built environments, physical activity and obesity being conducted in developed countries (Brownson et al.,2009 ; Feng et al., 2010; Ross et al., 2007; Sallis& Glanz, 2009), there are a few such studies in developing countries, including China (Gao et al., 2015; Kondo et al., 2009; Su, et al., 2014;), South Africa (Kolbe-Alexander et al., 2015), Iran (Soltania &

Hoseini, 2014), and Nigeria (Oyeyemi et al., 2014). There is, however, a lack of such studies in the Arab region. Some studies address only a single characteristic of the built environment in relation to physical activity and its impact on health outcomes (Forsyth, 2008; McCormack et al., 2008; Sugiyama et al., 2012), while other studies have examined multiple characteristics of the built environment (Berke et al., 2007; Frank et al., 2010).

The prominent attribute of built environment is termed 'neighbourhood walkability', often categorised according to the '3Ds': population Density, land-use Diversity, and pedestrian-friendly streets Design (Brown et al., 2009; Cervero & Kockelman, 1997; Stevens & Brown, 2011; Yamada et al., 2012). In contrast, other common characteristics of the neighbourhood environment include a safe and unsafe environment and household vehicle ownership (Saelens & Handy, 2008; Sallis & Glanz, 2009; Sugiyama et al., 2010).

The '3Ds': population Density, land-use Diversity, and pedestrian-friendly streets Design includes: the first 'D' – Density – is discussed first. Numerous epidemiological studies have shown that higher residential density is associated with significantly lower BMIs (Boarnet et al., 2008; Frank et al., 2005; Kirk et al., 2010; McCormack & Shiell, 2011; Rundle et al., 2007) In contrast, other studies suggest that urban sprawl often generates low-density residential areas, which is associated with an increased risk of obesity through contributing to inadequate levels of physical activity in both gende (Garden & Jalaludin, 2009; Gordon-Larsen et al., 2006; Leal & Chaix, 2011; Lopez, 2004). However, other studies have failed to find a significant association between residential density and BMI, in either gender (Frank et al., 2004; Ross et al., 2007). Such disparities in the associations between the residential density and body-weight outcomes, make it difficult to draw inference about such relationship.

The second 'D' – land-use Diversity – is common attribute of built environment that encourages neighbourhood walkability. Mixed land use (heterogeneity) is operationalised as 'access to commercial places' and 'access to public places and walkable destinations'. Numerous of studies have shown a reverse association between land-use mix and body-weight: the greater the land-use mix, the lower the BMIs of both genders (Ding et al., 2013;

Durand et al., 2011; Ewing, 2010; Frank et al., 2004, 2008; Saelens & Handy, 2008). However, other studies have found a positive association between the two: the greater land-use mix, the higher the BMIs of both genders (Rutt & Coleman, 2005). It appears that those localities that can offer mixed land-use often attract a variety of people to live in the area, from visitors and workers to residents. Thus, those neighbourhoods with a higher residential density are likely to support and encourage people to engage in physical activities, such as walking and cycling, with the ultimate result being that they may reduce of obesity epidemic of both genders.

The third 'D' – pedestrian-friendly streets Design – is a feature of neighbourhood walkability referring to pedestrian- and transit-friendly street design and streetscape design. It is operationalised as follows: access to public transport; pedestrian infrastructure; cycling infrastructure; access to recreational facilities; street connectivity; traffic safety; pedestrian safety; and neighbourhood aesthetics(Brown et al., 2009; Yamada et al., 2012). A number of epidemiological studies have shown mixed and inconsistent results regarding the association between factors belonging to pedestrian- and transit-friendly street design and obesity of both genders (Lovasi et al., 2009; Kostova et al., 2011; Oyeyemi et al., 2011), whether the neighbourhood attributes were assessed using objective indicators or respondents' perceptions(National Obesity Observatory (NOO), 2011). Nevertheless, there is consensus among researchers that a better designed neighbourhood tends to be associated with a lower likelihood of being overweight or obese of both genders (Pearce & Witten, 2010).Studies consistently suggest that increased access to and use of public transit are negatively correlated with BMI, while those who use private transport have higher BMI (Edwards, 2008; MacDonald et al., 2010; Rundle et al., 2007). Similarly, a recent study showed that switching from private motor transport to active travel or public transport was associated with a reduction in BMI of both genders (Martin et al., 2014).

Many studies have shown that the presence of parks, open spaces and other recreational facilities, or access to appropriate leisure opportunities, is consistently linked with higher physical activity, and is a key factor in the prevention and management of obesity levels (Godbey et al., 2005; Kaczynski et al., 2007). However, a variety of other studies show

that racial and ethnic minority groups and low-income people have poor access to recreational facilities and maintained or safe parks, and this is associated with a high risk of obesity among racial or ethnic minority groups (Babey et al., 2008; Powell-Wiley et al., 2013). Interestingly, some studies have found that living in neighbourhoods with a high level of recreation facilities may discourage people from engaging in physical activities rather than encouraging them (Boehmer et al., 2007; Ding et al., 2011; Feng et al., 2011). This is because there may be other barriers that prevent people from doing PA such as the cost (Harvard School of Public Health, 2016b; Lovasi et al., 2009).

Although numerous studies investigating the association between characteristics of the built environment and adiposity (e.g., BMI, overweight/obesity) have revealed mixed results, the majority of them concentrate on the association between built neighbourhood features that support physical activity and reduce of obesity in both genders. Numerous studies have found that a decline in obesity rates in residents living in such environments is significantly associated with the following features of built environment: perceived aesthetics of the neighbourhood environment (Oyeyemi et al., 2013; Noonan et al., 2016; Powell-Wiley et al., 2013); good street connectivity (De Bourdeaudhuij et al., 2015; Saelens & Handy, 2010); the presence of pavements and well-maintained of pavements (Cerin et al., 2013; Pucher et al., 2010); the presence of cycle lanes and well-maintained of cycle lanes (Oliveira et al., 2013; Pucher et al., 2010; Pucher & Dijkstra, 2003); good traffic safety (De Bourdeaudhuij et al., 2015; Strath, et al., 2007); the presence of good pedestrian safety items (Bracy et al., 2014; De Bourdeaudhuij et al. 2015; Saelens &. Handy, 2010); and a low level of crime (De Bourdeaudhuij et al. 2015; Mota et al., 2007; Oyeyemi et al., 2013).

Other studies, however, have focused on built neighbourhood features unsupportive of physical activity and which promote obesity of both genders. They found that being obese was significantly associated with the following features of the BE: poor neighbourhood aesthetics (Boehmer et al., 2007; Oyeyemi et al., 2011. 2012); a lack of street connectivity (Giles-Corti et al., 2003; Powell-Wiley, 2013); poor pavement quality (Boehmer et al., 2007; Giles-Corti et al., 2003; Powell-Wiley, 2013); poor cycle-lane quality (Dunton et

al., 2009; Slater et al., 2010); the absence of traffic safety (Joshu et al., 2008; Oyeyemi et al., 2011, 2012); the absence of a pedestrian safety system (Ferrão et al., 2013 Timperio et al., 2004); and low perceived safety from crime (Brown et al., 2014; De Bourdeaudhuij et al. 2015;Oyeyemi et al., 2012). In contrast, other studies revealed that several built environment characteristics were less consistently associated with obesity (Lovasi et al., 2009; Kostova et al., 2011; Oyeyemi et al., 2011). Numerous studies on the associations between the built environment and obesity have shown inconsistent associations in adults, which may be attributed to the disparities of methods and measures used, or to differences in the context or locations of the study.

Numerous studies have found that car owners have higher BMIs than do non-car owners, both men and women (Behzad et al.,. 2013; Bell et al., 2002; Frank et al., 2004; Jacobson et al., 2011; Martin et al., 2014; McCormack & Virk, 2014). The design of suburban communities encourages car dependency and discourages walking. However, another study found that car ownership was not in fact a statistically significant predictor of BMI of both genders (Du et al., 2015). Glazier et al. (2014) argue that people in environments unsupportive of physical activity and healthy eating were generally more car-dependent. In contrast, people in environments supportive of physical activity and healthy eating are were significantly less likely to drive or own a vehicle. The next section discusses the influences of the built environment on diet.

2.9.5.2 Influences of the built environment on diet

Environmental influences on diet can be divided into two pathways: access to healthy diets for home consumption from supermarkets and full-service grocery stores, and access to ready-made food for home and out-of-home consumption from fast-food outlets and restaurants (Jones et al., 2007; Shier et al., 2012). Obesity experts and researchers use the term "toxic" to describe the food environment and the term "food desert" to refer to neighbourhoods that lack access to supermarkets or full-service grocery stores. Studies show that living in "food deserts" is associated with lower-quality foods (Black et al., 2012; Morland et al., 2006; Zenk et al., 2009) and with a higher chance of obesity (Giskes et al., 2010; Morland et al., 2006). In contrast, other studies have found that weight status is

associated with the food environment: less access to takeaway outlets and a greater access to retail venues that sell healthy foods (e.g., supermarkets) are associated with lower BMI (Bodor et al., 2010; Giskes et al., 2011).

In addition, a higher exposure to local fast-food restaurants and small food stores, and less access to large supermarkets, is associated with higher BMI (Bodor et al., 2010; Inagami et al., 2009; Sallis & Glanz, 2009). However, the association between access to a variety of foods outlets – whether in close proximity to chain supermarkets or small grocery stores or fast-food restaurants (Morland & Evenson, 2009) – and obesity was inconsistent in other studies (Wang et al., 2007). Such disparities in the associations between supermarkets, local grocery store and fast food restaurants, and body-weight outcomes, make it difficult to draw conclusions about such relationships.Despite numerous epidemiological studies having established associations between neighbourhood characteristics and obesity, Libya lacks data for guiding the design of its interventions in the obesogenic environments. To enhance our understanding of the risk factors for obesity, it is necessary to investigate the potential influence of neighbourhood environments on obesity. To our knowledge, this is the first study not only in Libya but also in the EMR, and the second study in African (the first was in Nigeria conducted by Oyeyemi et al. (2012), to evaluate the role of environmental characteristics in influencing individual-level weight and obesity. Thus, this study may be used to formulate appropriate policy for halting or reducing the obesity epidemic in Libya.

The penultimate section discusses the crucial factors that could be associated with obesity in the Libyan context, are categorised and allocated into the interpersonal level (Culture and religion) or into the public policy level of the SEM (Government food subsidy policy and pricing).

2.9.5.3 Government food subsidy policy and pricing

An 'agricultural subsidy' is a governmental subsidy rewarded to farmers to increase their output of agricultural products (Alston et al., 20010). These subsidies have contributed to the obesity epidemic through making farm commodities significantly more abundant and,

therefore, more affordable. Most staple foods are subsidised, including refined grains and fats. Such foods are energy-dense, taste good and are convenient to use, yet they may be blamed for fuelling the obesity epidemic (Drewnowski & Darmon, 2005; Fields, 2004).

The staple foods that most EMR countries subsidise vary from place to place, but typically they are inexpensive or readily available foods. Because most Arab citizens in these countries rely on such foods, their diets tend to be high in fat and sugar and lacking in fruit and vegetables, to the extent that their intake of micronutrients does not satisfy dietary recommendations (Musaiger, 2011). The Libyan government subsidises numerous goods and services, from housing to water supplies, and power in the form of both gas and electricity, as well as food. Libya imports 75-80% of its food consumption requirements of certain basic items, such as flour, wheat, maize, tomato paste, rice, sugar and cooking oil (World Food Programme (WFP- Middle East), 2011). However, civil instability, fuelled by the presence of militia groups, has effectively destroyed public infrastructure, and is having a deleterious effect on food security in Libya, since the country relies heavily on imports; some 90% of its cereal consumption requirements is imported. Up-to-date information and primary data on food security from Libya remains patchy and unconfirmed due to the absence of officials in the health, nutrition, and censorship sectors (WFP- Middle East, 2011).

2.9.6 Culture and religion

Cross-cultural variation exists regarding preferences for body-weight in many developing countries (Muhihi et al., 2012). In most countries in Middle East and North Africa (MENA), being overweight or obese is widely perceived to be an indicator of affluence (Woodhouse, 2008). A number of Arab nomads in the Arab region, including some Libyans, perceive obesity to be a sign of financial success as well as 'good living' and 'good health', with some holding fatalistic, 'naïve beliefs' about one's body being 'God given' and therefore not amenable to being changed (Badran & Laher, 2011; Mokhtar, 2001). A preference for overweight females is common in Arab communities (Musaiger, 2011), and Libya is no exception. Fatness is culturally associated with beauty, prosperity, health and prestige, whereas thinness is perceived to be a sign of poverty or ill health, with

such individuals being suspected of having HIV/AIDS. Accordingly, fattening rituals are sometimes practised (Khawaja & Afifi-Soweid, 2004; Muhihi et al., 2012; Musaiger, 2011).

Against these culture-related perceptions of weight, Islamic legislation advises people about the dangers of overeating, and Islamic rules obligate Muslims to perform religious rituals to protect themselves against weight-gain and obesity. In the Muslim calendar, Ramadan is an obligatory month of fasting that provides an opportunity to lose weight. However, to achieve lasting weight-loss, people must practice healthy behaviours on a consistent basis. A meta-analysis by Sadeghirad et al. (2012) showed that fasting during Ramadan resulted in significant weight-loss at the end of the period for both genders (-1.51 kg for men and -0.92 kg for women). Muslims are in addition obligated to pray five times a day and do regular exercise to assist in weight-loss. In addition, Muslims are advised to eat within limits; the Prophet said, "Overeating does not go with good health", and Islam forbids the consumption of alcohol which can contribute to gain weight (Sayon-Orea et al., 2011). Despite Libya being an Islamic Arabic country, many Libyans are unwilling to adhere closely to these tenets, and the prevalence of overweight and obesity are high.

Another aspect of Libya culture, derived from Arab culture, is constrictions against women engaging in physical activities (see Section 2.8.3 for further details about cultural barriers regarding physical activities). Traditional dress in Libya is another cultural issue that affects Libyan women more than it does Libyan men. The loose *abayas* that women wear may contribute to increased obesity because they conceal the gradual accumulation of weight-gain which would otherwise go unnoticed if they were wearing close fitting garments such as jeans or shirts (Al-Tawil et al., 2007; Mahboub et al., 2014). Other cultural practices encourage Libyans to gain weight in terms of the frequency social and religious occasions, where large quantities of food are offered, and social influence requires guests to eat as much food as possible – usually traditional meals including rice, meat, and soft drinks – to show their respect for the host (FAO, 2005; Musaiger, 2011; WHO, 2007). Another misconception that a number of Libyan people hold is that consuming olive oil (usually done in the morning) is healthy because it reduces cholesterol and prevents heart

disease (FAO, 2005; Keys et al., 1986). They ignore or are unaware of the fact that olive oil is fattening and could have an adverse effect on their body-weight, thus olive oil might be a risk factor associated with overweight and obesity in Libya (Dontas et al., 2007; FAO, 2005, Musaiger, 2011). Such practices and customs could affect the prevalence of overweight and obesity in Libyans. The next section presents other etiological factors of obesity.

2.9.7 Other factors

Given the prominent role of the aforementioned factors in fuelling the obesity epidemic, over and above any other identified factors, public health researchers and obesity experts recommend that any country in which obesity is being studied for first time, such as Libya, should be investigated initially for as many factors as possible that influence the population as a whole, while the investigation of individual factors should be conducted in advanced studies. In sum, the factors discussed above are salient in the literature, particularly for studying the risk and protective factors of obesity for the first time in the Libyan context. These factors formed the diverse layers of the socio ecological model (SEM), ranging from individual to societal factors. The factors discussed below are no less significant but they are less likely to be variables that affect both men and women.

Additional risk factors for obesity include hormonal problems such as leptin resistance (Myers et al., 2010), an underactive thyroid (hypothyroidism) (Longhi, & Radetti, 2013), Cushing's syndrome (Tiryakioglu et al, 2010), and polycystic ovarian syndrome (PCOS) (Sam, 2007).). Some common medications can also lead to weight-gain, including certain antidepressants, anticonvulsants, oral contraceptives and most corticosteroids (CDC, 2015d; Harvard University ,2016; Rogers& Pies, 2008). Quitting smoking cigarettes can be a strong risk factor in weight-gain (Audrain-McGovern& Benowitz, 2011). In addition, psychological factors may lead to obesity such as 'emotional eating'. Many people eat excessively in response to emotions such as boredom, sadness, stress, or anger (Sominsky & Spencer, 2014). A lack of sleep (Beccuti & Pannain, 2011). and poor body image (Chao, 2015), referring to either body perception or body satisfaction, can also contribute to weight-gain. The next chapter presents the theoretical framework for this study.

Chapter Three Theoretical and conceptual frameworks

3.1 Introduction

The present chapter evaluates the prominent behavioural and social science theories and models for understanding public health in order to determine the most optimal model for understanding and analysing the relationships between the predictor variables that contribute to or slow the increasing rates of obesity in Libya. This chapter then comprehensively describes the theoretical framework of this study in the form of the Socio-Ecological Model (SEM). The SEM theoretical framework enabled the identification key factors that might promote or protect against weight gain and obesity include: (i) socio-economic status (SES); (ii) unhealthy eating habits; (iii) physical activity (PA) and sedentary behaviour (SB) patterns; (iv) and neighbourhood environmental factors. These key factors needed to be measured in order to deepen our knowledge of the obesity epidemic in Libya. From these independent variables, four hypotheses were formulated. Finally, the chapter presents a visual outline of the final conceptual framework for the quantitative study.

3.2 Prominent theories and models in public health research

The following six theories and models were explored for their efficacy in identifying the risk and protective factors that may contribute to or protect against obesity in Libyan adults: social cognitive theory (SCT), the health belief model (HBM), the stages of change or the Trans-Theoretical Model (TTM), the theory of planned behaviour (TPB), ecological systems theory (EST), and the socio-ecological model (SEM). The following section details my evaluation of each.

3.2.1 Social Cognitive Theory (SCT)

Formulated by Albert Bandura in the 1960s, SCT started as Social Learning Theory (SLT). Developed into the SCT in 1986 and construed as the cognitive formulation of SLT, the theory holds that learning is correlated with the observation of role models (Bandura, 1986, 1997; Huitt, 2006). SCT explains human behaviour in terms of a triple-pathway, dynamic, reciprocal model in which environmental, personal, and behavioural factors continually

interact and influence one another in a dynamic process (Bandura, 2002, 2011; Crothers et al., 2008; Burke et al., 2013) see Figure 3.1 (below) for details. The key elements of SCT include: reciprocal determinism (the interaction of the person, behaviour, and the environment), behavioural capability, expectations, self-efficacy, observational learning, and behavioural reinforcements. These components are interrelated, each having an effect on motivation and goal attainment (Bandura, 2002, 2011; Burke et al., 2013).
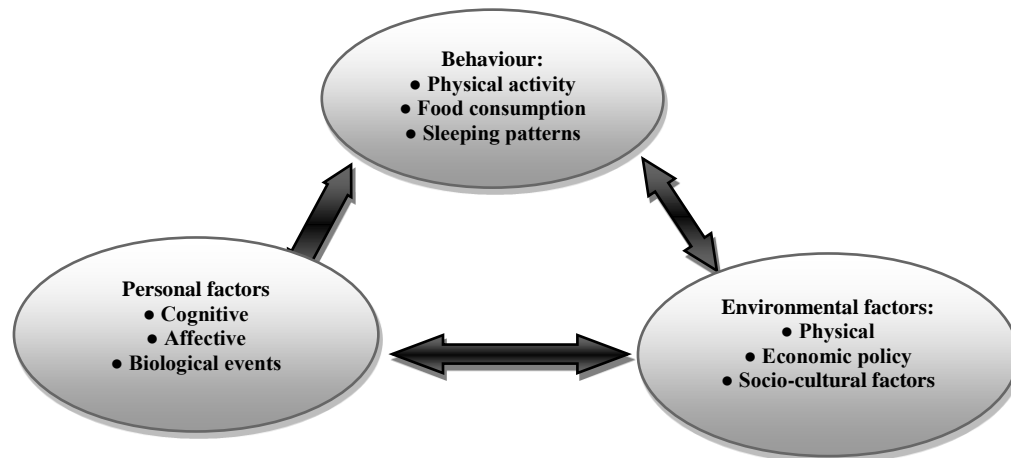
Figure 3.1: Triadic Reciprocal Determinism Model.
(Adapted from Wood & Bandura, 1989).

It has been suggested that the SCT could offer a practically useful framework for designing primary prevention interventions to reduce childhood obesity (Branscum et al., 2013, Sharma et al., 2008). In addition, the SCT is one of the most popular theories used to predict and combat obesity in adolescents (Bagherniya et al., 2014; Taymoori et al., 2010). However, despite recent applications of this model for devising interventions to control obesity among adults (Annesi, & Tennant, 2012), the SCT is arguably more relevant and effective for addressing obesity in younger age groups than in older age groups, and it is more viable for focusing on preventive and management measures of obesity than on the etiological factors of obesity.

One of the main criticisms directed at SCT is that it is a loosely organised theory; it does not specify precisely enough how the three essential elements – the individual, their behaviour, and the environment – interact (Boston University School of Public Health,

2015; Carillo, 2010). Specifically, it does not stipulate the extent to which the person and the environment may influence actual behaviour and whether one component is more influential than another (Boston University School of Public Health, 2015). It is a depersonalised theory in that it does not thoroughly consider personal issues or barriers to learning. It also overlooks the influence of individuals' biology (genetic), brain development, hormonal processes and learning differences, as well as the connection between observational learning and self-efficacy (Boston University School of Public Health, 2015; Harris et al., 2012). A further limitation of SCT is that it suggests that changes in the environment cause changes in a person's behaviour, which is not necessarily the case (Boston University School of Public Health, 2015; Carillo, 2010; Munro et al., 2007). Taking these limitations of SCT into account, it may be concluded that this theory is unsuitable for addressing my research questions. Eliminating the SCT from consideration, I next assess the Health Belief Model.

3.2.2 The Health Belief Model (HBM)

The HBM was considered the first conceptual model of behaviour developed for addressing public health issues (Baghianimoghadam et al., 2013; Orji et al., 2012). This model addresses the association between a person's beliefs and behaviours. It postulates that health-seeking behaviour is influenced by a person's perception of a threat posed by a health problem and the value associated with actions aimed at reducing the threat. The model provides a pathway for understanding and predicting how individuals will behave in relation to their health and the extent to which they might comply with healthcare therapies. The HBM is the most widely-used theory in health behaviour research and is commonly applied to nursing for understanding issues concerning patient compliance and preventive healthcare practices (Marriner & Raile, 2005; Roberts & Marvin, 2010).

The model consists of six key constructs (Hayden, 2013; Orji et al., 2012). Developed as the original tenets of the HBM, the first four constructs are: perceived susceptibility to the problem; perceived seriousness of consequences of the problem; perceived benefits of a specified action; perceived barriers to taking action related to the behaviour including physical, psychological and financial constraints see

Figure 3.2 (below) (Glanzv et al., 2008; Orji et al., 2012). The following mediating factors were later included in the HBM: self-efficacy; cues to action; and modifying variables such as individual characteristics, including demographic, psychosocial (Hayden, 2013).
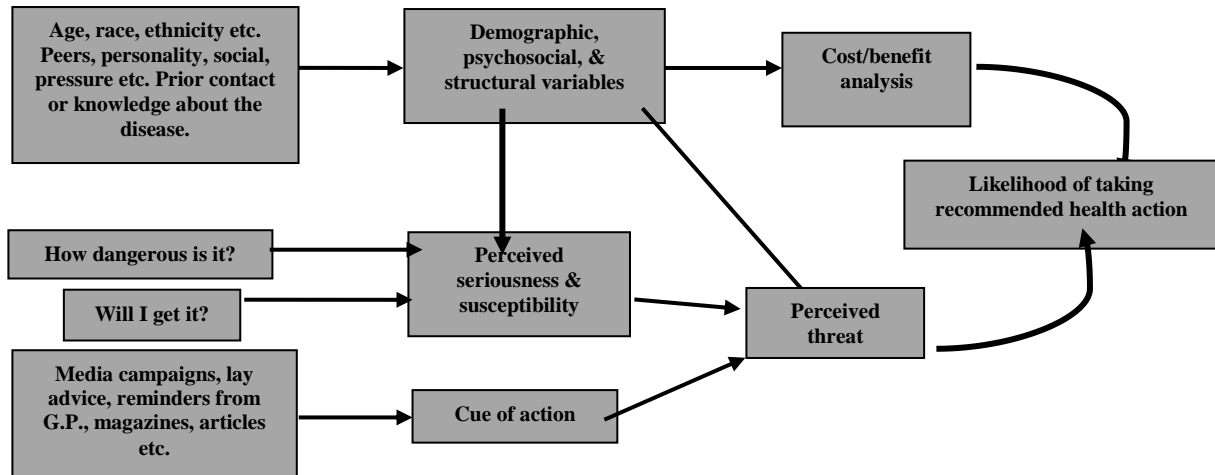
Figure 3.2: The Health Belief Model (HBM)
(Adapted from Banyard, 2002)

Although the HBM has been widely used as a theoretical framework in several epidemiological studies on nutrition promotion, obesity prevention interventions and obesity management (James et al., 2012; Romanoa & Scottb, 2014), this model was not consistent with my research question which addresses the etiological factors of obesity rather than interventions for or management of obesity. This model could however be relevant to the obesity epidemic under study if the study explores interventions for increasing awareness about obesity in the Libyan context, since many Libyans perceive obesity to be a sign of 'good living' and 'good health'. Due to a general absence of health awareness in Libyan healthcare settings, many Libyans are unaware of the health risks of being obese. However, the HBM could be utilised to provide substantial benefit if the research question addressed behavioural interventions for obesity rather than exploring factors which might be contributing to obesity.

Several limitations of the HBM have been identified, which restrict its usefulness whether in my study or the public health sector. First, it tends to treat changes in behaviour as a separate event rather than as a dynamic process of events, which other theories do, for instance, the Stages of Change (SoC) model, discussed below (Boston University School of Public Health, 2013; Jones et al., 2015). Second, the HBM does not explain a person's attitudes, beliefs or other individual determinants that dictate the extent of a person's acceptance of healthy behaviour Boston University School of Public Health, 2013; Glanz et al., 2008). Third, it disregards behaviours that are habitual (e.g., skipping breakfast or eating too quickly) which may inform the decision-making process to accept or reject a recommended course of action (Boston University School of Public Health, 2013; Jones et al., 2015; Carpenter & Christopher , 2010; Glanz et al., 2008).

Further limitation of this model, it neglects behaviours performed for non-health-related reasons, such as social acceptability or social convention, and it overlooks environmental or economic factors that may prevent or promote the recommended action on obesity (Boston University School of Public Health, 2013; Jones et al., 2015) . Finally, it assumes that everyone has equal access to information concerning the problem (e.g., obesity), and it assumes that cues to action are effective in encouraging people to act, and as a consequence that health-related actions are the main goal in the decision-making process (Boston University School of Public Health, 2013; Jones et al., 2015; Carpenter & Christopher , 2010; Glanz et al., 2008).Despite its usefulness in conceptualising the beliefs and misconceptions about health and obesity amongst Libyans, the aforementioned limitations of the HBM make it unrealistic for dealing with my research questions in a pragmatic way. I have therefore eliminated the HBM as a possible theoretical framework for my study, and turn now to evaluate the TTM.

3.2.3 Trans-theoretical stages of change model (TTM SOC)

Developed by Prochaska and Di Clemente in 1984, the core constructs of the TTM SOC model are the processes of change, decisional balance, self-efficacy, and temptation. The TTM involves the following six stages of change (Peterson, 2012; Prochaska &

Velicer,1997): pre-contemplation, contemplation, preparation, action, maintenance and termination see

Figure 3.3 (overleaf). Termination was not part of the original model and it is not commonly used for health-related behaviours in the application of the stages of change. A model of deliberate change, the TTM highlights an individual's decision-making and suggests that behavioural change can be accomplished through encouraging and supporting a person to adjust to a new lifestyle in a regular and cyclical process, rather than in a haphazard or hurried manner. The model has been applied to a wide variety of problem behaviours such as a lack of exercise and high-fat diets (Boston University School of Public Health, 2013; Nigg et al., 2011; Martin, 2012).

Although the TTM SOC model is considered a viable interventional approach in lifestyle modification programmes, its effectiveness as an interventional approach for obesity, such as producing sustainable weight-loss, has not been confirmed as it has been used to provide tailored nursing for lifestyle management such as diet, physical activity, and smoking cessation (Lee et al., 2015 ; Mostafavi et al., 2015), rather than weight-loss directly. Similarly, a recent study suggested that the evidence to support the use of the TTM SOC in weight-loss interventions is limited by the risk of bias and imprecision, and no firm conclusions may be drawn (Mastellos et al., 2014; Tuah et al., 2011).

A limitation of the model is that it disregards personality and demographic variables, as well as the social context in which change occurs, such as SES (Boston University School of Public Health, 2013). In addition, the lines that separate the stages in this model are vague and there are no set criteria for determining a person's stage of change (Boston University School of Public Health, 2013; Levesque et al., 2006). The time that a person spends either struggling within a stage or passing through a stage is ambiguous and unlimited (Boston University School of Public Health, 2013; Brug et al., 2005). The model assumes that individuals have the ability to make rational and logical decisions, although in reality this is not always the case (Boston University School of Public Health, 2013; Brug et al., 2005; Levesque et al., 2006; Nigg et al., 2011). Because it neglects the social context in which change occurs, such as SES, I ruled it out and evaluated whether the next

model, the Theory of Planned Behaviour, could be utilised as the theoretical framework for addressing my research questions.
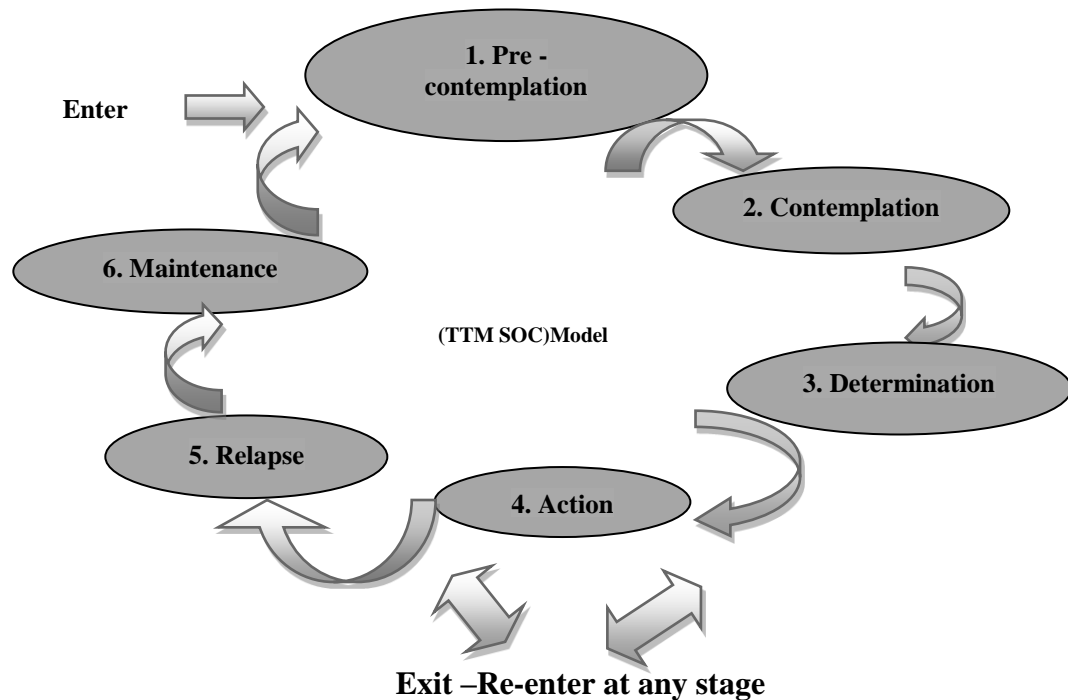
Figure 3.3: Trans-theoretical stages of change model (TTM SOC).
(Adapted from Prochaska and DiClemente,1984).

3.2.4 Theory of Planned Behaviour (TPB)

The TPB was derived from the theory of reasoned action (TRA) (Fishbein & Ajzen, 1975). The TRA was expanded upon through the inclusion of the 'perceived behavioural control' (PBC) construct (Ajzen, 1991; NCI, 2005). The theory postulates that the antecedents of attitude, subjective norms and PBC are corresponding beliefs, which include behavioural beliefs, normative beliefs and control beliefs, reflecting the underlying cognitive structure (Boston University School of Public Health, 2013; Munro et al., 2007). Figure 3.4 (overleaf) depicts the influences on behaviour and their interactions according to the TPB. The theory maintains that the more an individual intends to achieve a behaviour, the better the probability is that they will actually achieve it (Boston University School of Public Health, 2013; Morris et al., 2012).
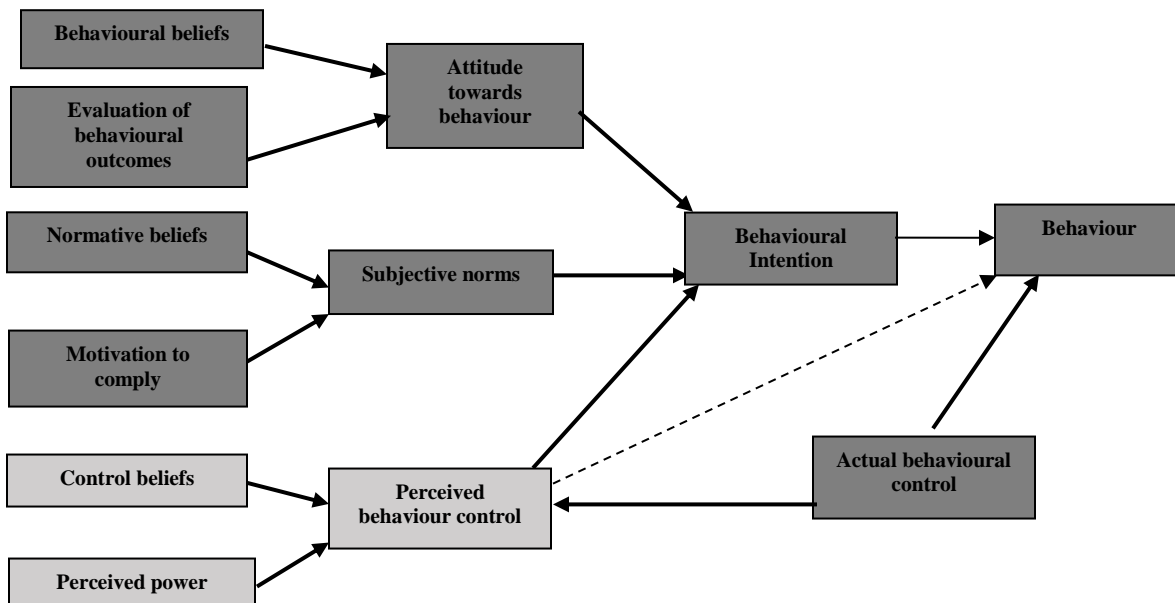
Figure 3.4: Theory of Reasoned Action and Theory of Planned Behaviour.
(Adapted from Ajzen, 1991) (Rimer &Glanz, K. 2005)

.Note: � Sections represent the TRA, while the entire figure shows the TPB.

This theory has been successful in predicting a wide variety of health behaviours including participation in exercise and dieting among different populations (Fila & Smith, 2006 ; Grønhøj, et al., 2013 ; Kumar, 2012). The TPB has also been used as a framework to evaluate and explore numerous interventions for many different behaviours such as interventions to improve diet and prevention interventions in community settings to prevent and control obesity in adolescents (Boudreau & Godin, 2007; Plotnikoff et al., 2013) and in adults (Hackman & Knowlden, 2014; Olander et al., 2013). Although widely adopted to address prevention and management of obesity in every age group, this theory as a framework nevertheless has several drawbacks which prompted me to discount it for my study (Boston University School of Public Health, 2013; Munro et al., 2007).

Firstly, the TPB neglects the environmental and economic factors that may influence a person's intentions to achieve a particular behaviour (Boston University School of Public Health, 2013). Secondly, it does not take into account the person's intention insofar as the

person has acquired the opportunities and resources that enable them to succeed in performing the desired behaviour (Boston University School of Public Health, 2013; Munro et al., 2007). Third, it ignores important variables such as fear, threat, mood and past experiences. Moreover, it neglects the time-frame between 'intent' and 'behavioural action' (Boston University School of Public Health, 2013; Munro et al., 2007; Werner, 2004). For these reasons, it is necessary to search for other theories and models which can address my research questions. I will now look at the EST and the SEM.

3.2.5 Ecological Systems Theory (EST)

Bronfenbrenner (1979) developed his ecological systems theory (EST) in an attempt to define and understand human development within the context of the system of relationships that form the person's environment. 'Bio-ecological systems theory' has been put forward as an alternative name for the EST to emphasise that a child's own biology is a fundamental environment constituting his or her development. Represented in concentric circles, there are five other environmental systems in this model, namely, the microsystem, mesosystem, exosystem, macrosystem, and chronosystem.

The EST is a more popular theoretical framework for addressing obesity in children than are the previously discussed models. Several studies have used the EST as a theoretical framework for developing their conceptual framework as it enables conceptualisation of the complex, multifactorial interactions that place a child at risk of becoming overweight or obese (Boonpleng et al., 2013; Davison & Birch, 2001; Galvez et al., 2010). While this theory could be adopted to explore the etiological factors leading to the disease alongside preventions and interventions, it is similar to those discussed above in terms of addressing obesity in children and their parents rather than focusing specifically on adults (Davison & Birch, 2001; Tudge et al., 2009). Another limitation of Bronfenbrenner's EST is that it does not specify the mechanisms elucidating how individuals develop in interaction with the systems that envelop them (Davison & Birch, 2001). Much of Bronfenbrenner's theory relies on examples rather than being proven by evidence (Tudge et al., 2009). I have therefore discounted this theory and looked to derivative models that can better facilitate our understanding of the etiological factors of obesity in Libyan adults.

It has been suggested that using a model as a theoretical framework rather than a theory has advantages in that a visual representation of a structure or process enables us to construct and/or test inferences and theories through a more accurate representation of key issues than using a theory do so (Cohen et al, 2000; Cole et al, 2011). The EST has been established as a foundation theory in that many models have been derived from it, such as the SEM, discussed next.

3.2.6 The Socio-Ecological Model (SEM)

The Social Ecological Model (SEM), sometimes called the ecological model (Johns Hopkins University, 2016), is derived from Bronfenbrenner's Ecological Systems Theory (Raingruber, 2013). As the word "ecological" denotes, this structural model explores the relationship between human behaviour and the environment (Raingruber, 2014). Ecological models have gained recognition in the field of health promotion and have been usefully applied to the study of a wide range of health issues (Johns Hopkins University, 2016). The applied version of the ecological model, the SEM conceives of health as being affected by the interaction between the individual and the social and political environments, including the local community (CDC, 2015f; Crosby et al., 2013; Reisner et al., 2013;Sallis et al., 2008).

The SEM has been modified and developed into various models by prominent researchers over a two-decade period (Glanz et al., 2008). Despite these different versions of the SEM, the adapted model of Bronfenbrenner remains the theoretical framework most commonly used by researchers to address various health issues (Brown, 2011; Hickey et al., 2012). The SEM provides a visual depiction of the complex interplay between five tiers, which range from the micro- to Macrosystem levels (University of Oregon, 2013; CDC, 2015f). The levels within the SEM are invariably depicted as concentric circles with each successive level inclusive of those that came before (Woolf & Aron, 2013). However, the distinction between levels is not always clear (Brown, 2011). The next section justifies my selection of this model as the theoretical framework for my study of the factors that put people at risk of gaining weight.

3.2.6.1 Rationale for selecting the SEM as my theoretical framework

While most of the aforementioned theories and models have utility in elucidating the lifestyle behaviours and other factors related obesity, they tend to emphasise factors at the individual level (e.g., knowledge, attitudes, and skills), while neglecting community-level factors, which are a substantial theme in the study of the obesity epidemic. In contrast, the SEM is based not on a singular discipline or theory but rather on a broad, overarching paradigm that bridges several different fields of research; it is therefore intrinsically interdisciplinary in its approach to health research, taking into account psychological dispositions, social behaviour and physiological processes in health and illness (Baral et al., 2013; Crosby et al., 2013; Reisner et al., 2013; Stokols, 1996), including community-level factors.

Given the complexity of 'obesity', with its multifactorial aetiology, an approach is needed which focuses on integrating approaches to modify the physical and social environments rather than modifying only individual health behaviours, and these are conditions that the SEM fulfils. The SEM enables us to identify and investigate those factors at the different levels that predispose people to obesity, as well as the prevention strategies that can be used at each level to address these factors. These levels range from biological approaches to human-based approaches. They also include the immediate environment, studied through behavioural theories, and the broader environment, studied through anthropological theories that analyse social conventions and cultural values (Baral et al., 2013; Crosby et al., 2013; Max et al., 2015). Since the factors that contribute to obesity are likely to vary, the factors that can help to manage it are also likely to be multifactorial and may need to be tailored individually to each country.

The SEM has been applied broadly as a comprehensive public-health approach for different purposes (Max et al., 2015; Moore et al., 2015), as well as in several previous evidence-based epidemiologic studies of the etiological factors of obesity. Recently, the CDC (2015) and the WHO (2015) have used the SEM as a theoretical framework to conceptualise epidemics of chronic and infectious diseases, and to identify the risk and protective factors associated with hazardous health-related threats, such as obesity, in different societies

around the globe. Aside from exploring its risk and protective factors, the SEM has been used for conceptualising causal factors and interventions for preventing obesity in children, adolescents, and adults (Amarasinghe & D'Souza, 2012; Brown, 2011; Mullis & Davis, 2013; Williams, 2011; Yin et al., 2012). I have therefore selected the SEM as the theoretical framework for addressing the risk and protective factors associated with the obesity epidemic in Libyan adults. While the strengths of the model are clear, it is also necessary to be aware of it limitations.

3.2.6.2 Limitations of the SEM

Although the model can generally contribute to our understanding of diverse, critical issues in particular contexts, the SEM has been criticised for representing complexity through a two-dimensional model, which oversimplifies the factors involved (Stanger, 2011; Stokols, 1996). The nested circles of Bronfenbrenner's models appear valuable only as a rudimentary theoretical position, but are not practical when discussing the details of an individual's life experiences (Raingruber, 2014; Stivaros, 2007). Still, initial discussions from a re-design of this model might allow for further development of this eco-centring concept (Stanger, 2011). However, this does not obviate the need to evaluate all components of this model empirically, which is no simple task given that the variables of social life are in constant interplay and that small changes in one variable can affect the whole system. The ecological detail investigated would therefore need to be widespread in scope, making it difficult to justify the omission of any particular levels or factors (Boonstra et al., 2016; Fabinyi et al., 2014)

The SEM has been criticised for under-estimating individual's abilities, and overlooking individuals' rights, feelings, and psychological complexity (Davis, 2011; Stanger, 2011). It also neglects biological and cognitive factors in the development stages (McLaren & Hawe, 2005 ; Raingruber, 2013), and it does not explain how all variables influence those behaviours which affect a person's BMI (Body Mass Index), which the Health Belief Model (HBM) can do (Boston University School of Public Health, 2013). The model presents certain variables very broadly, such as 'the media', 'culture' or 'beliefs', without specifying which aspects of the media, for example, interact with which other variables

(Bell, 2005; Fabinyi et al., 2014). An implication of this constraint is that it is difficult to hypothesise relationships between such broad variables, and the dependent outcome variable (obesity) and the hypotheses may need to be formulated in an open-ended way, rather than specifying which subgroup variables fall under the major variables (Bell, 2005; Fabinyi et al., 2014).

Despite these limitations, the SEM is recognised as intrinsically trans-disciplinary and multi-level, and there is consensus that it is the optimal approach for exploring the risk factors that contribute to obesity and the protective factors that can curb obesity (Amarasinghe & D'Souza, 2012; Lytle, 2009; Williams et al., 2011). Accordingly, I adopted it as my theoretical framework during Phase One, so as to identify the predictor variables (the risks and protective factors) that need to be measured in relation to the outcome variable, 'obesity'. Adopting the SEM as my theoretical framework enabled me to construct four hypotheses that are consistent with the Libyan context, and identify the independent variables that needed to be measured in relation to obesity in Libya adults. The following section discusses the use of this model for constructing hypotheses based on the range of relevant variables identified from the literature review.

3.2.7 Differentiating between directional and non-directional hypotheses

Hypotheses are either directional or non-directional. Also known as a one-tailed test, a directional hypothesis is a test of significance to investigate whether there is a relationship between the variables in a particular direction. Directional hypotheses are designed to persuade others that the researcher's hypothesis is correct, instead of letting readers judge for themselves (Bryman, 2012). Directional hypotheses imply that the researcher is "hypothesising" or predicting the direction of the effect of one variable on the other (as 'positive' or 'negative') before they conduct their study (Bryman, 2012). Directional hypotheses are formulated in observational and experimental studies attempting to prove causal inferences when the researcher has enough confidence to specify a direction, based on reviewing the previous evidence-based studies which showed more rigorous and consistent results than other studies that did not use directional hypotheses (Bryman, 2012). Therefore, the more knowledgeable researchers are about the previous evidence-based

studies that used directional hypotheses, the easier it is for them to formulate directional hypotheses for the topic under study.

It has been suggested that obesity is shaped by cultural values and norms which influence body-weight, or perceptions of body-weight, and alter weight through adaptive predispositions to the phenomena of modernisation, migration and acculturation (Sobal, 2001). It follows that the development of obesity is complex and likely varies from country to country (World Obesity Federation (WOF), 2015a). It is likely that the culture and the way in which SES influences obesity differ between the Libyan context and other Arab countries. In addition, the lack of information about obesity in Libyan adults was the key reason that the researcher did not formulate directional hypotheses in the present study.

Another type of hypothesis is the non-directional hypothesis, also known as a two-tailed test. This is the standard test of significance to determine whether there is a relationship between the variables in either direction. Non-directional hypotheses state whether or not a relationship exists between the predictor and outcome variables, implying that readers are unable to predict the direction of effect amongst these variables. Accordingly, non-directional hypotheses can be said to be more hypothetical. Despite the overwhelming evidence that exists in the literature for the obesity epidemic in both developed and developing countries, there is a dearth of information about obesity in the Arab region in general and in Libya in particular. This is partly because most studies conducted in the Arab region have relied on non-directional hypotheses; they generally refrain from predicting the direction of the relationship between variables. The researcher therefore selected and formulated non-directional hypotheses in the present study, as no directional hypotheses exist in the literature to guide this study.

3.3 Four hypotheses derived from the SEM

To address my first research question ('What are the risk and protective factors associated with obesity amongst adults aged 20-65 in Benghazi, Libya?'), a quantitative approach in the form of a cross-sectional study was adopted. Specifically, this study investigated the relationships between four independent variables and the outcome variable (obesity). Each

hypothesis was framed in terms of how certain, measurable factors might contribute to and/or protect against the epidemic of obesity in Libya. These four hypotheses for the quantitative phase of this study are discussed next.

At the centre of the SEM is the **microsystem**, referring to the individual or intrapersonal sphere including biological, demographic and socio-economic, and psycho-social factors. From the literature on obesity, the variable of socio-economic status (SES) was identified to study this level of the SEM. Since the discovery of oil in 1959, Libya has witnessed dramatic social, economic, and political transformations in the past five decades, including workforce shifts from rural and agrarian occupations towards service sector and sedentary activities such as sitting in front of a computer terminal (FAO, 2005; Morris, 2011). SES is mostly measured by education level, income and occupational status (American Psychological Association (APA), 2016), and it has been argued that these factors interact to predict obesity (Dinsa et al., 2012;). It is conceivable that Libya's unique socio-economic history is driving the interaction between socio-economic factors and the prevalence of obesity in unique ways. As the relationship between SES indicators and obesity in Libya has not yet been examined, this concern forms my *first hypothesis*.

H_0: There is no significant association between the BMI of Libyan adults and SES (measured by education level, income and occupational status).
H_1: There is a significant association between the BMI of Libyan adults and SES.

The second level of the SEM is the **mesosystem**, encapsulating the social and institutional environment. Also known as the interpersonal sphere, it includes personal relationships such as family, friends, intimate partners and peers; as well as governmental and non governmental (NG) institutions and organisations. All these variables may influence the risk of obesity. Significantly, obesity has been found to be 'socially contagious' in that it can spread from person to person in a social network and culture can shape eating habits as discussed in the literature review in Chapter 2. Aligned with Arab culture, over-eating is often encouraged in social gatherings in Libya because of the abundance of food. Additionally, some ethnic groups value the fattening of girls before marriage (Rguibi &

Belahsen, 2006). It is clear that certain social and cultural practices in Libya involve unhealthy eating habits.

Arguably, unhealthy eating habits include multiple components. While some can be considered individual-level factors (that is, belonging to the microsystem sphere), others can classified as community- and environment-level factors (belonging to the exosystem sphere). Since not every individual within a community is going to having unhealthy eating habits, I have categorised factors such as skipping breakfast and eating less than 5 FV per day as individual-level factors. However, other components such as consumption of fast foods and sugary beverages, and much food at social functions could be community-level factor e.g, if people are surrounded by fast food outlets and fast food advertising, perhaps then the state needs to take some responsibility, and it's therefore a community factor? Equally not everyone in Libya drinks SSB and eats fast food, which dependence on how widespread these practices are .Therefore, unhealthy eating behaviours could potentially all be categorised as individual-level but perhaps put some 'blame'on the society as well.

Along with other developing countries, Libya has undergone notable shifts in dietary and physical activity patterns (FAO, 2005), collectively known as 'the nutrition transition', coinciding with their economic, demographic and epidemiological transitions. Increasingly, the traditional diet of grains and vegetables is being replaced by what is known as a 'Western diet' (Popkin, 2002). However, no conclusive evidence exists about the association of these factors with obesity in Libyan adults; therefore my *second hypothesis* is as follows.

H₀: The BMI of Libyan adults is not significantly related to unhealthy eating habits, operationalised as: a high consumption of fast foods and sugary beverages; large food portions; a high frequency of skipping breakfast; and eating less than five daily portions of fruit and vegetables and); and engaging in physical activity.

H₁: The BMI of Libyan adults is significantly related to unhealthy eating habits.

Apart from dietary habits, the **exosystem** also comprises sedentary lifestyle activities. The improved economic climate means that Libyans have greater access to technology, both in the workplace and in the home, in the form of private cars, televisions and computers (Centre for Administrative Innovation in the Euro-Mediterranean Region (CAIMED), 2004; Morris, 2011). In addition, many Libyans began employing domestic workers due to the increasing availability of expatriate workers. These factors have reduced physical activity levels and promote a sedentary lifestyle. Accordingly, my *third hypothesis* is as follows.

Ho: The BMI of Libyan adults is not statistically significantly related to physical activity and sedentary behaviour.
H1: The BMI of Libyan adults is statistically significantly related to physical activity and sedentary behaviour.

A third sub-set of factors within the **exosystem** pertains to the 'built environment'. The term 'obesogenic environment' was coined to refer to environments that promote the consumption of energy-dense food and discourage physical activity (Swinburn, et al., 1999). It has been suggested that the built environment can contribute to the obesity epidemic through changes in physical activity levels and diet (Papas et al., 2007; Sallis & Glanz; 2009). Several factors in the built environment are likely to have a significant influence on the average BMI of populations, including residential density zones and street connectivity. Despite the significance of neighbourhood environment factors in obesity research, there is still a dearth of knowledge about the association between built environments and obesity in developing countries (Oyeyemi et al., 2012). Hence it was critical to address the built-environment factors to which Libyans are exposed over the course of their lives as one predictor variable which may contribute to or protect against obesity epidemic.

Apart from the built environment, a component of the exosystem which is not easily modified, another relatively fixed component of this third-level system is the Libyan revolution. Started in 2011, it is ongoing at the time of writing (2015). The current

prevalence of militias is contributing to an unsafe environment which discourages Libyans from exercising or even from simply walking outdoors. It is therefore important to consider the impact of the revolution on lifestyles and environments in the present study. Accordingly, my *fourth hypothesis* is as follows.

H_0: The BMI of Libyan adults is not significantly related to neighbourhood environment factors, including: residential density zones; mixed land use (access to commercial places, public places and walkable destinations); access to public transport; pedestrian infrastructure (presence of pavements and maintenance of pavements); cycling infrastructure (presence and maintenance of cycle lanes); access to recreational facilities; street connectivity; unsafe environment and committing crimes at night (or during the day); traffic safety (for pedestrian and for cyclists); pedestrian safety (perceiving people as being active); neighbourhood aesthetics (the presence of trees and other natural); and household vehicle ownership (vehicles in household).

H_1: The BMI of Libyan adults is significantly related to neighbourhood environment factors.

The final two layers of the SEM are the **macrosystem** and **chronosystem.** The **macrosystem** refers to legislation, regulation, cultural values, customs, laws and policy-making actions that have the potential to affect physical activity and eating habits. In contrast, the **chronosystem** encompasses change or consistency of behaviours over time in the host society through, for example, acculturation to the obesogenic environment. As with the **mesosystem** component, 'socially contagious eating habits', it is necessary to elucidate these **macrosystem** and **chronosystem** key themes through the second phase of this study, namely, the qualitative phase involving semi-structured interviews with healthcare professionals and Libyan community leaders.

3.4 Finalisation and visual representation of my conceptual framework

Adopting the SEM as my theoretical framework enabled me to identify the independent variables that needed to be measured in relation to obesity within the Libyan context. The five types of nested environmental systems are summarised in Figure 3.5 (overleaf), with

the arrows indicating the bi-directional influences within and between the systems. The model is comprised of levels: intrapersonal (microsystem), interpersonal (mesosystem), organisational (exosystem), community (exosystem), and public policy (macrosystem) levels, while the chronosystem is relevant to time and acculturation processes. As can be seen in the conceptual framework depicted in Figure 3.5 (overleaf), the four main predictor variables (risk and protective factors) that needed to be measure to address the first research question are: socio-economic status (SES); unhealthy eating habits; physical activity and sedentary behaviour patterns; and neighbourhood environmental factors. All the variables affiliated with each main variable were placed in the relevant layers of this framework, following my arguments above, resulting in a visual representation of the final conceptual framework of this study. The next chapter discusses the research methodology used in this study.
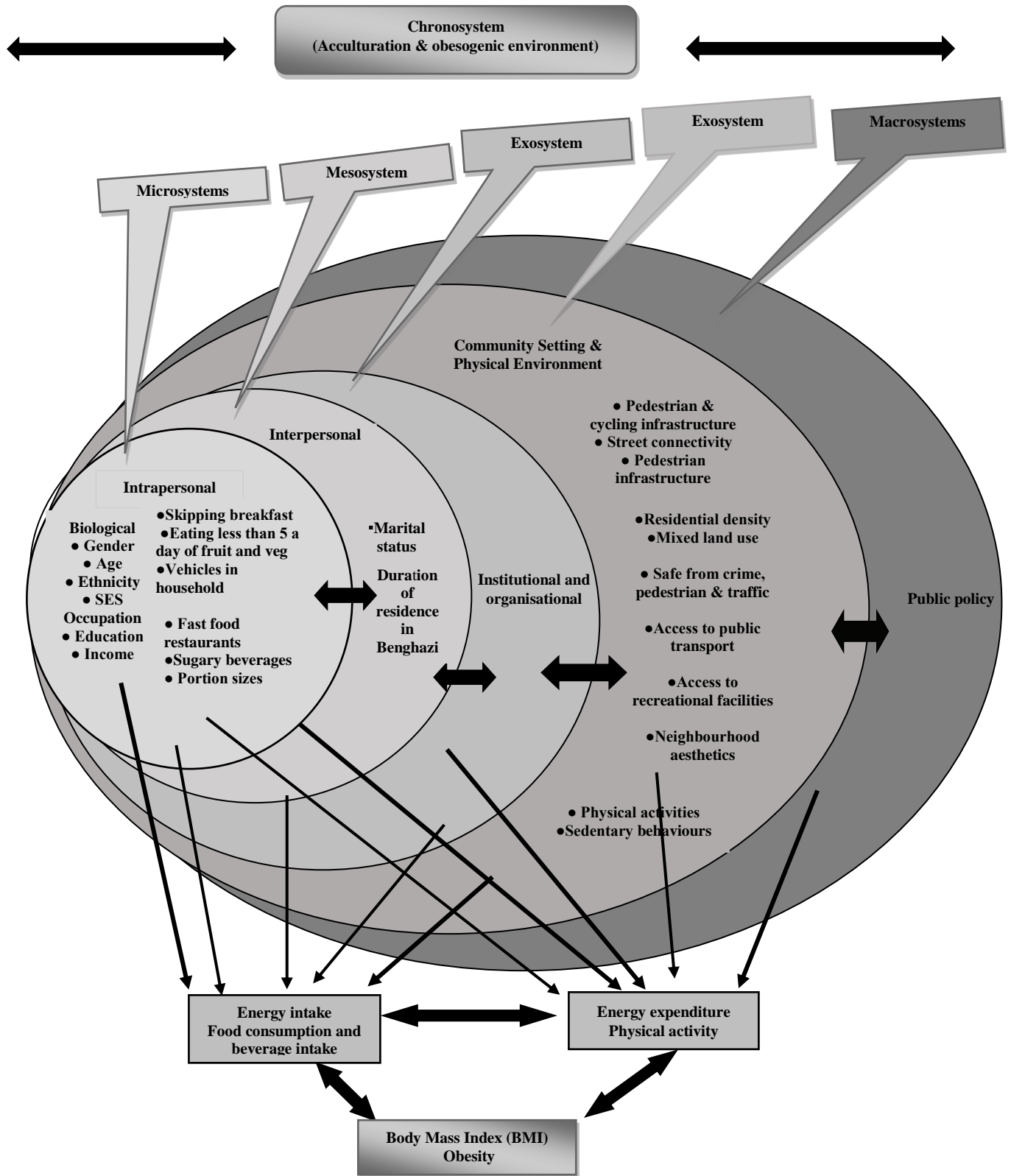
Figure 3.5: A theoretical framework for qualitative research.

Chapter Four : Research methodology

4.1 Introduction

My two main research questions are: "What are the risk and protective factors associated with obesity amongst adults aged 20-65 in Benghazi, Libya?" and "What are the views of Libyan healthcare professionals and community leaders in Benghazi with regard to the risk and protective factors associated with obesity among adults living in Benghazi, within the context of Libyan culture?" To address these questions, I used an adapted mixed-methods sequential explanatory design, consisting of two distinct phases: quantitative followed by qualitative (Creswell et al., 2003). This is in contrast to a convergent parallel design, a sequential exploratory design, and an embedded design (Creswell & Plano Clark, 2011).

The chapter discusses the research design and methodological approach that was employed in this study. First, it provides an overview of the research process 'onion', followed by a rationale for using mixed methods. The use of an adapted mixed-methods sequential explanatory design in this cross-sectional study can be justified from the following four perspectives: the researcher's worldview stance; the nature of the research problem being addressed ; previous evidence-based studies on obesity; and the data collection techniques used. Each of these influences is addressed in turn below, before presenting a visual model of the sequential explanatory design.

4.2 Overview

To ensure the validity of my research strategy, I adopted and modified a model known metaphorically as the research process 'onion', developed by Saunders et al. (2009), consistent with the research methodology of this study. This model contains all necessary components for research, namely: research philosophy, research approaches, research strategies, time horizons and the data collection method. The model depicts them in various layers, hence the 'onion' analogy see Figure 4.1 (overleaf). The framework is implemented by peeling away each layer at a time to reach the centre, which is the actual question of the research. At the broadest level of analysis, the research philosophy was chosen. This represents the outermost layer of the onion. Peeling away this layer, the next layer is

decided: research strategies and time frames, before peeling away the next layer to select the data collection method (Saunders et al., 2009).
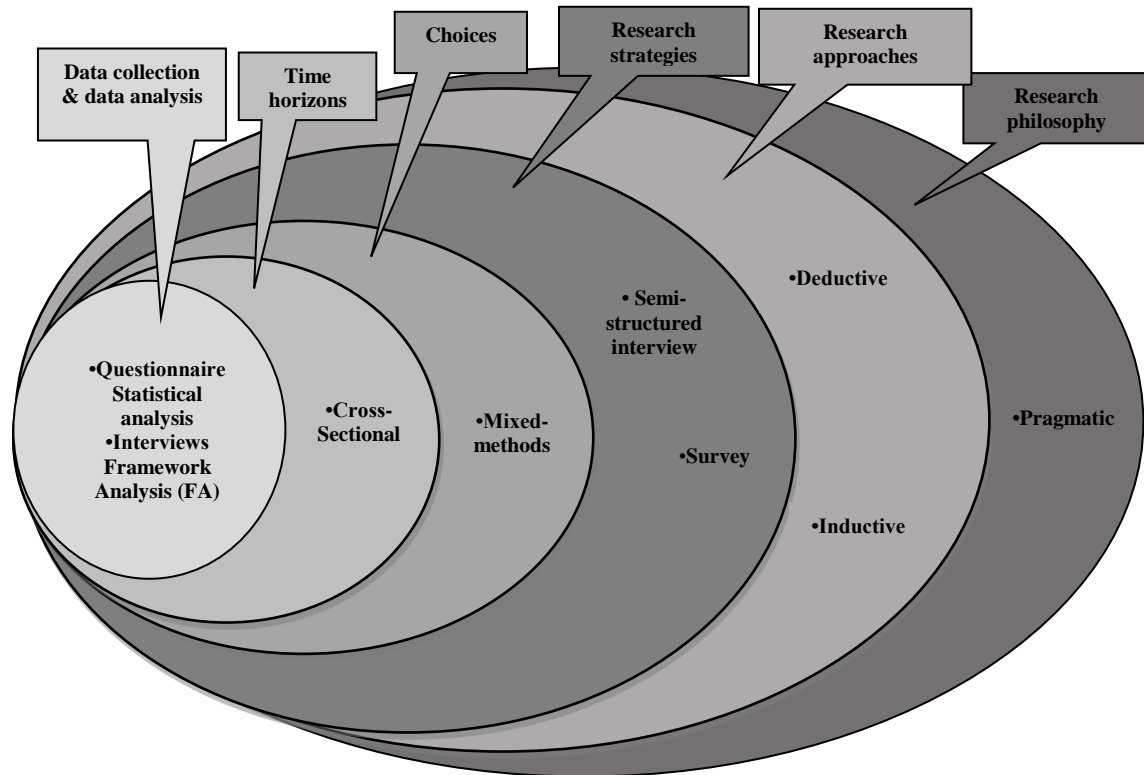
Figure 4.1: Visual model for the research strategy of this study 'Onion model'.
(Adapted from Saunders et al., 2009)

As can be seen in figure 4.1 the research onion ring model adopted in this study has been slightly modified. The research philosophy I have chosen for the present study is pragmatism, along with deductive and inductive approaches. My research strategy is a mixed-methods design, using a survey questionnaire for the quantitative component and semi-structured interviews for the qualitative component. As it is a cross-sectional study, the aim is not to explore changes over a period of time; rather, the time horizon is a single point in time. Finally, my data collection techniques include a structured, numerical survey questionnaire to collect data from a relatively large sample, as well as a semi-structured interview was used to collect qualitative data from a small purposive non-probability

sampling. (Saunders et al., 2012). I analysed the survey questionnaire data by entering it into the software Statistical Packages for Social Sciences (SPSS) version 21.0, while the qualitative data was analysed using Framework Analysis (FA) using NVivo qualitative data analysis software version 10, which simply manage the data and make handling of them easier.

4.3 Rationale for employing a mixed-methods design

The selection of a research design is based on a number of factors, including: the researcher's epistemological stance; the nature of the research problem being addressed (obesity as a complex, bio-psychosocial phenomenon); previous evidence-based studies on obesity; and the data collection techniques used. All these factors are discussed next.

4.3.1 Researcher's worldview assumptions

One major concern of mixed-methods research is the question of which paradigm is most applicable to this type of research. The choice of a suitable paradigm is deemed to be significant for justifying the use of mixed-methods, with pragmatism being the most prominent justification for the use of mixed-methods research (Feilzer, 2010; Morgan, 2007). Aligned with this, O'Cathain et al. (2007) argue that health services research (HSR) in the UK that uses mixed-methods is commonly guided by pragmatism rather than by principle, and is motivated by the perceived deficits of using quantitative methods alone to address the complexity of research in health care, as well as by other more strategic gains. Pragmatism is oriented towards resolving practical problems in the factual world, rather than based on assumptions about the nature of knowledge (Feilzer, 2010). With its principle of 'what works best', pragmatism is considered to be a replacement for the earlier polarised paradigms of post-positivism and interpretivism. Thus, I adhere to 'whatever works' to answer my research questions.

A philosophical perspective which is witnessing a surge in popularity is critical realism. It has various similarities to, and has borrowed key concepts from, the pragmatist tradition. (Lipscomb, 2011). Although important advances based on critical realism have recently been made in the mixed-methods literature (Brown & Brignall, 2007), these do not yet

present a coherent framework for addressing the philosophical criticisms levied at the validation procedures typically invoked in this literature. Although there are many variations of this philosophy, pragmatists consider it to be a worldview arising out of actions, situations, and consequences rather than out of antecedent conditions. Pragmatists are generally not concerned with asking questions about reality and the laws of nature (Creswell, 2003, Creswell & Plano Clark, 2011). Because pragmatism is eclectic in nature – it is not committed to any one system of philosophy and reality, the main concern is with applications of 'what works' and solutions to problems (Creswell & Plano Clark, 2011), hence the researchers emphasise the research problem and use all approaches available to understand the problem, rather than focusing on methods (Creswell & Plano Clark, 2011). This approach is important for paying attention to the research problem in social science research, and then using pluralistic approaches to derive knowledge about the problem (Morgan, 2007).

Given its lack of affiliation to any one system of philosophy or reality, pragmatism has become a logical choice of research philosophy for researchers using mixed-methods research (Johnson & Onwuegbuzie, 2004). The main feature of pragmatism is that researchers are 'free' to choose the methods, techniques, and procedures of research that best meet their needs and purposes. This is because pragmatists do not view the world as an absolute unit; there is no single, superior scientific method that can lead the way to indisputable knowledge. Rather, knowledge is based on practical outcomes and 'what works best'. Pragmatist researchers focus on the 'what' and 'how' and on the intended consequences of the research, that is, 'where the researcher wants to go with it'.

Pragmatism offers a set of assumptions about knowledge and enquiry that firstly upholds the mixed-methods approach and secondly differentiates the approach from purely quantitative approaches that are based on a philosophy of (post-)positivism and from purely qualitative approaches that are based on a philosophy of interpretivism or constructivism (Johnson & Onwuegbuzie, 2004). Thus, pragmatism opens the doors to multiple methods, different worldviews, and different assumptions, as well as to different forms of data collection and analysis within the mixed-methods study. It requires researchers to be

flexible and open to the emergence of unexpected data (Feilzer, 2010). Given these strengths, and the fact that it is the most dominant paradigm associated with mixed-methods research, I have selected pragmatism as my worldview stance to address my research questions.

Adopting pragmatism as my worldview informs all the assumptions underpinning my research. Because this paradigm assumes that the nature of reality can be both objective and subjective, I can use both deductive and inductive reasoning to address my research questions. Epistemologically, the key to pragmatism is practicality. I therefore collected data according to 'what works' in order to address the research problems. Regarding axiology, adopting a mixed-methods approach consonant with pragmatism, I was able to include both biased and unbiased perspectives and accept that both objective and subjective knowledge are valuable to the research. I collected and analysed quantitative data first, before collecting and analysing non-numeric data in the second phase. The patterns detected in the first phase were used to conceptualize and develop the Interview schedule for semi-structured interviews for the second phase to address the second question. Finally, pragmatism allows both formal and informal rhetoric by the researcher.

4.3.2 Nature of the research problem

Contextual features and the nature of the research problem are among the main factors that must be taken into account in deciding upon the most appropriate research design (Bryman , 2012). Given the complexity of 'obesity', with its a multifaceted aetiology, the use of diverse research designs by researchers and experts throughout the world to address this complex phenomenon is justified. Arguably, a quantitative or qualitative approach alone is inadequate for addressing such a complex problem as obesity, which has both biological and psycho-social influences. This is because each type of methodology has its own biases, and integrating them is likely to minimise their respective limitations. Therefore, in order to identify and understand the risk and protective factors associated with obesity in the Libyan adult population, it is necessary to use both quantitative and qualitative methods.

My use of mixed-methods in this study takes the form of a sequential explanatory design comprised of two distinct phases: quantitative followed by qualitative (Creswell et al., 2003; 2007). In this design, quantitative (numeric) data is collected and analysed first. In the second phase, qualitative (text) data collected and analysed in order to help explain, or elaborate on, the quantitative results obtained in the first phase. Conversely, the qualitative phase built on the quantitative phase, with the patterns detected in the first phase conceptualising and developing the interview schedule for semi-structured interviews for the second phase to address the second question. The two phases are connected in the intermediate stage of the study. The rationale for this approach is that quantitative data and results can provide a general picture of the research problem, such as what risk and protective factors contribute to and/or protect individuals from obesity, while qualitative data analysis can refine and explain those statistical results by exploring participants' views in more depth (Creswell, 2003; 2007).

With the potential to harness the advantages and counterbalance the disadvantages of both approaches (quantitative and qualitative), mixed-methods research can be especially powerful when addressing complex phenomena such as the obesity epidemic. Creswell and Plano Clark (2011) argue that a mixed-methods approach provides a better understanding of the research problem than using either method alone. Whereas a quantitative approach can help to detect the risk and protective factors associated with epidemic obesity in Libyan adults, a qualitative approach can give a deeper understanding how Libyan healthcare professionals and community leaders perceive, understand, think and feel about the risk and protective factors associated with obesity among adults, within the context of Libyan culture.

Further reasons for integrating quantitative and qualitative methods in a single study are given by Bryman (2012), who summarised the reasons given by previous studies, resulting in a list of 16 reasons for using a mixed-methods approach include: a) Triangulation or greater validity; (b) Offset; (c) Completeness; (d) Process; (e) Different research questions; (f) Explanation; (g) Unexpected results; (h) Instrument development; (i) Sampling; (j) Credibility; (k) Context; (l) Illustration; (m) Utility or improving the usefulness of findings;

(n) Confirm and discover; (o) Diversity of views; (p) Enhancement; (q) Other/unclear; (r) Not stated.

The most relevant reasons for using mixed methods in the present study are five-fold, based on Bryman's list. Firstly, (e) Different research questions; the fact that my research problem has two different research questions. Whereas the first research question lends itself to more quantitative research methods, the second lends itself to more qualitative research methods. The second reason is (f) Explanation, which refers to using one method to help explain the findings generated by another method. The third rationale is (g) Unexpected results. This is related to elaboration, enhancement, illustration, and clarification, which refers to discussing the extent to which and ways in which the qualitative results help to explain and clarify the unanticipated results from the quantitative phase. Furthermore, two additional reasons can be considered: (h) Instrument development, which refers to development of the interview schedule for the qualitative phase, and (i) Sampling, with reference to the key informants who were selected to be interviewed.

Bryman (2012) recommends that researchers use these justifications as a guide and modify their selection of them based on their particular study, as well as stating at least one clear reason as to why they are planning to combine methods. However, he argues that because mixed-methods derive from different epistemological positions, this type of research design is challenging and should only be undertaken when the researcher has persuasive reasons for carrying out such a study. The most applicable reason for my study is that mixed-methods is necessary 'to offer an explanation' for my research problem about obesity with its a multifaceted aetiology.

Moreover, a sequential explanatory approach using quantitative analysis which is explained through a subsequent, qualitative follow-up is a popular mixed-methods design used in health research (Carr, 2009), and several recent studies have employed an explanatory mixed-methods approach to address obesity amongst young children in Hong Kong (Chan & Wang, 2013), adolescents in the USA (Bastianello et al., 2012), and adults

(Leone & Ward, 2013;Poobalan, 2011). This broadly -used evidence-based design enabled me to employ mixed-methods to exploit the strengths and minimise the weaknesses of the quantitative and qualitative approaches in order to capture inferences that lead to a more comprehensive and nuanced understanding of obesity epidemic in Libya (Plainkas et al., 2011) than using either method alone.

4.3.3 Previous evidence-based studies on obesity

A systematic review conducted by Musaiger (2011) of papers published from 1990 to 2011, to explore the prevalence, risk and protective factors associated with obesity in different age groups in the EMR, concludes that studies on obesity have relied largely on quantitative methodology in the context of cross-sectional studies. It further explains that qualitative research methods to explore the risk and protective factors associated with obesity in the region are scarcely used in a comprehensive and in-depth manner.

Despite Musaiger's (2011) argument that alternative method designs – whether qualitative or mixed-methods – should be undertaken to provide a broader perspective to investigate the risk and protective factors associated with obesity, several recent studies undertaken in the EMR have ignored his claim and continued to use a cross-sectional design to address any topic in connection with the aetiological factors of obesity in adults (Nouhjah et al., 2012; Dalichaouch-Benchaoui & Abadi , 2012). While such studies have made a significant contribution to our knowledge in relation to obesity in the EMR, it appears to be essential to take into account Musaiger's suggestion, which recognises that a cross sectional design is insufficient enough to address a broad complex phenomena, such as *'obesity'* unless it is complemented with other approaches to enhance the rigour of the findings. Thus, using a mixed-methods design in this study, I potentially enhanced our current knowledge with regards to obesity in the EMR region.

Since my second research question naturally lends itself to more qualitative research, I have used semi-structured interviews in order to explore the perceptions, understandings, thoughts and feelings of Libyan healthcare professionals and community leaders about the risk and protective factors associated with obesity in adults from Benghazi, within the

context of Libyan culture. The findings from this qualitative method used in the second phase was used to enhance interpretation and understanding of the findings identified in the initial quantitative phase (Creswell and Plano Clark, 2011).

Bryman (2006) has assessed that cross-sectional designs are commonly used in mixed-methods research, whether as the first phase followed by a quantitative study in the second phase, which was an approach I adopted , to clarify and explain any unanticipated quantitative results (e.g., significant results, non significant results) needed to be further explored with a qualitative strand ; or as the second phase to complete the picture or theme raised by the qualitative study in the first phase. Bryman (2006) recommends that, in using mixed-methods in a cross-sectional survey design, either the quantitative or qualitative phase can be prioritised. In my study, I have prioritised the quantitative approach in the context of a cross sectional survey in the form of personal supervised questionnaire, followed by the qualitative phase in the form of semi-structured interviews. As Mann (2003) points out, surveys are flexible in that they can be combined relatively easily with other methods, such as in-depth interviews, to produce richer data.

The remaining factor on which selection of a research design is based – the data collection techniques used – is discussed below. The following section describes in more depth the cross-sectional design adopted in the first phase of my study.

4.4 Methods of data collection

This section discusses my choice of a cross-sectional design within a sequential explanatory mixed-methods design.

4.4.1 Rationale for adopting the cross-sectional design

To address my first research question ("What are the risk and protective factors associated with obesity amongst adults aged 20-65 in Benghazi, Libya?"), I proposed four hypotheses to examine the relationships between BMI and the following four-predictor variables: (i) SES; (ii) poor diet and unhealthy eating habits; (iii) physical activities and sedentary lifestyle patterns; and (iv) the neighbourhood environment.

Three major types of observational studies may be distinguished, namely, cohort, case-control, and cross-sectional (Carlson & Morrison, 2009; Mann, 2003). While a variety of issues can be answered efficiently by these methods, each has particular strengths and weaknesses. Being flexible and relatively easy to apply, observational studies are commonly used in mixed-method designs because they can be combined with qualitative methods in the form of semi-structured interviews to provide a more complete understanding of the phenomenon under study (Mann, 2003), in this case the risk and protective factors associated with obesity. The next section discusses the reasons for omitting the possibility of using either a case-control or a cohort study and for turning to the third observational design, namely, the cross-sectional study.

Carried out either prospectively or retrospectively, cohort studies are considered the most effective method for determining the incidence and natural history of a condition, as well as causes and prognosis (Bailey et al, 2005 : Hennekens& Buring, 1987; Mann, 2003). Since they measure events in chronological order, cohort studies can be used to distinguish between cause and effect. In addition, these studies permit multiple outcomes to be assessed in the same study. They can provide an indication of the incubation or latency period for communicable or non-communicable diseases, respectively (Bailey et al, 2005 : Carlson & Morrison, 2009; Hennekens& Buring, 1987). Nevertheless, a cohort study is relatively ineffective for exploring diseases with long latency periods, primarily because such studies are susceptible to high attrition rates (participants moving house, falling ill or dying), while some simply refuse to participate (Carlson & Morrison, 2009; Mann, 2003). In addition, this type of study is unsuitable for investigating rare diseases because a large number of subjects is required, which may be expensive. Due to these substantial limitations, a cohort study is inapplicable to the present study, and an alternative observational method was sought.

In contrast to other study designs, case-control studies are most commonly carried out retrospectively (Barratt & Kirwan ,2009). They are relatively quick and inexpensive compared to cohort studies. Individuals with the outcome of interest are compared against a control group known not to have developed the outcome of interest (Barratt & Kirwan

,2009). When conditions are uncommon, case-control studies are usually the only feasible approach for studying rare diseases or outcomes, because they can generate a large amount of information from relatively few subjects. They also enable the study of multiple potential causes of disease (Mann, 2003), as well as diseases with a long latency period between exposure and manifestation, and they are particularly appropriate for investigating outbreaks. They are often used to generate hypotheses that can then be studied by cohort or other studies (Mann, 2003).

However, case-control studies are subject to some methodological concerns. First, data on exposure and antecedents is principally based on interviews and may be subject to recall bias (Carlson & Morrison, 2009; Mann, 2003). Second, it is not possible to validate information about exposure (Barratt & Kirwan ,2009). Third, this method is not applicable for estimating either prevalence or incidence rates of diseases. Fourth, it is potentially subject to the effect of extraneous factors which may distort the findings of these studies. Fifth, the choice of an appropriate control group is difficult, if not impossible. Finally, one needs particular skill and training to conduct this type of study and interpret the results (Carlson & Morrison, 2009; Mann, 2003). For these reasons, I have ruled out the possibility of using a case-control study and turned to the third observational design, namely, the cross-sectional study.

A cross-sectional design is relatively cost-effective since data need be collected only once, and from a single group, while multiple outcomes can be studied (Mann, 2003). Such studies are useful for establishing associations rather than causality, and for determining prevalence rather than incidence (Mann, 2003). They also enable the simultaneous comparison of many different variables (Carlson & Morrison, 2009). In the present study, these include SES; poor diet and unhealthy eating habits; physical activities and sedentary lifestyle; and neighbourhood environmental variables. They are convenient for understanding disease aetiology; and they can be a first step in understanding complex phenomena such as obesity (Carlson & Morrison, 2009). In addition, Levin (2006) points out that a cross-sectional study is appropriate for a large number of participants; many outcomes and risk factors can be assessed; and it can be used for the generation of hypotheses and the formation of pilot or future studies. These strengths suggest that a cross-

sectional design would be the most appropriate for my study. They enable researchers to consider numerous variables at a particular point in time without manipulating variables, which is consistent with my first research question.

However, a cross sectional study may be prone to criticism similar to other observational studies, thus it is important to clarify the limitations of a cross-sectional design. Barratt & Kirwan (2009); Carlson & Morrison (2009); Mann, (2003) mention most of these restrictions, which include: First, it is difficult to infer causality; since it is only a snapshot, the situation may yield differing results if another timeframe had been chosen. Second, rare conditions cannot be studied effectively using cross-sectional designs because even in large samples there may be no one with the disease. A third disadvantage of cross-sectional studies is that they are subject to prevalence-incidence bias or selective survival bias – also termed 'Neyman bias' or 'late-look bias'. This may be explained as a tendency to detect fatal illness preferentially, detect only the late stages of a disease, and detect only those cases of a disease that are asymptomatic (Carlson & Morrison,2009).

4.5 The connection between the quantitative and qualitative phases

Having obtained the results from the quantitative data analysis, it is inevitable that unanticipated results emerged, since this study was undertaken in a context in which obesity among adults is being studied for first time, and the country in question has distinct cultural norms and values that are likely to vary from those in other EMR countries. That is, obesity in the Libyan cultural context may develop differently from that in other Arab countries. Consequently, unanticipated results are to be expected. They necessitate that further, emerging qualitative studies be conducted to clarify the ambiguous results of the quantitative study.

The adapted sequential explanatory mixed-methods research design used to guide this thesis lends itself to emergent approaches, whereby the second phase, the qualitative study, was designed based on the unanticipated results obtained from the quantitative study, which require further explanation through the qualitative approach. Consequently, the integrating step in this mixed-methods design is the use of the quantitative results to inform

the qualitative study regarding the following aspects: refining and formulating the main research question for the inductive approach; selecting the appropriate key informants to provide their experience and expertise regarding the issues in question; developing the interview schedule based on the anomalous quantitative results that require explanation. (For further details about the integrating stage, see Chapter 8, Section 8.2).

4.6 Qualitative phase

To address my second research question ("What are the views of Libyan healthcare professionals and community leaders in Benghazi with regard to the risk and protective factors associated with obesity in Libyan adult population, within the context of Libyan culture?"), I adopted an inductive research approach in the form semi-structured interviews with Libyan healthcare professionals (LHCPs) and Libyan community leaders (LCLs). All details about the rationale for sample for qualitative phase in the context of purposive (expert) sampling see Chapter 8, Section 8.3.3. This method was used to gain a more comprehensive and nuanced understanding about how SES, unhealthy eating habits, physical activity and sedentary lifestyle patterns and neighbourhood environmental factors might contribute to obesity in the Libyan cultural context.

It was difficult to assign a name to the qualitative approach of the present study. Numerous 'pure' qualitative researchers have addressed diverse aspects of the obesity phenomenon, whether aetiological or intervention-related, using five main qualitative approaches, namely: a narrative approach (Karnik & Kanekar, 2014; Seal, 2014), a phenomenological approach (Lindelof et al., 2010; Moore & Bailey, 2013), grounded theory (Southwell & Fox, 2011); ethnography (Warin et al., 2007), and the case study (Bibeau et al., 2008). Others who were unable to determine the specific qualitative approach to address obesity were content to describe their research as "semi-structured interviews" (Lindelof et al., 2010). If qualitative researchers have failed to identify the appropriate approach for their qualitative studies, and they resort to describing their studies as "semi-structured interviews", it does not seem fair to blame mixed-methods researchers for failing to find an accurate name to describe the qualitative phases of their studies. It seems justifiable that they should also refer to their qualitative studies as "semi- structured interviews".

Despite the difficulty of finding an approach peculiar to a mixed-methods designed, aligned with the qualitative phase, a few mixed-methods researchers were able to specify the type of qualitative approach used in their study (Chan & Wang, 2014; Roockley 2014). However, others failed to identify the type of qualitative approach used, and were satisfied with referring to the qualitative phase as "semi-structured interviews" (Heslehurst et al., 2015; Redsell et al., 2011). Since the present study used semi-structured interviews to elicit the perspectives of LHCPs and LCLs about obesity, it did not align neatly with any of the above-mentioned five main approaches to qualitative study. Most of these approaches deal with a limited number of in-depth interviews with people living with obesity. Aligned with my pragmatic stance, I adhered to previous studies in describing my own qualitative approach as "semi-structured interviews".

4.6.1 Historical overview of qualitative research in Libya

Gadour et al. (2003) argues that it is difficult to carry out qualitative research in the Libyan context due to cultural and traditional constraints. Having suffered oppression and injustice under a totalitarian regime, and been subject to regional and tribal traditions and customs, Libyans are generally reluctant to participate in research projects. They have historically lacked free speech, and, above all, are afraid of being misunderstood in political terms due to the strict former Libyan regime. Similarly, Bubaker and Rathakirshnan (2009) note that qualitative research studies did not exist in Libya until the early 1990s, and they concur with Gadour et al. (2003) in acknowledging the reticence of Libyan citizens under the strict cultural and political regime as the main obstacle to conducting this type of research. They observe that researchers found it difficult to convince potential participants to have their responses recorded.

However, since the Libyan revolution in 2011, such strictures have been destabilised, suggesting that it is now easier to conduct either qualitative or mixed-method research among Libyan communities (Doherty, 2012; Foss, 2012). Accordingly, despite the totalitarian legacy, some qualitative research is beginning to emerge in Libya in various sectors, such as the health sector when Abrika et al. (2012) conducted semi- structured

interviews with ten Libyan pharmacists, using a purposive sampling technique to explore their views about the importance of social-pharmacy education in Libyan pharmacy schools. Another study in the political sector was by Doherty (2012) who used focus group to elicit Libyan citizens' views on the country's electoral and political processes. Both studies concluded that Libyans are gradually becoming less fearful of participating in qualitative research. Recently, mixed-methods studies have been conducted in Libya due to PhD students studying abroad and using a mixed-method approach for their empirical investigations in such diverse fields as education (Asker, 2012; Shihiba, 2011), and economics and finance (Bayoud, 2012). Generating valuable findings, such studies are helping to relieve Libyans' concerns about participating in qualitative research studies. These developments have encouraged me to adopt a mixed-methods approach in my study in a way that seems to be, however, sensitive to cultural values in Libya.

4.7 Visual model for mixed-methods study design

A visual model of the study design is presented in Figure 4.2 (overleaf). It depicts an overview of the procedural steps used to implement this mixed-methods sequential approach. It consists of two sequence phases: a quantitative phase followed by a qualitative phase (Creswell et al., 2003). The data collection method for the first phase involved a personally supervised questionnaire; data analysis was numerical, and the findings pertained to the four main research hypotheses regarding SES, eating habits, sedentary lifestyles, and the neighbourhood environment. The second phase consisted of semi-structured interviews with Libyan 'healthcare professionals and community leaders' to explore their perceptions, understanding, thoughts and feeling about the risk and protective factors associated with obesity among adults from Benghazi, within the context of Libyan culture. The next chapter discusses methodology for the quantitative study (Phase I).

Phase I:
Quantitative approach

Pilot study conducted (January- February 2014)

Aim:
To investigate the risks and protective factors associated with obesity amongst adults aged 20-65 in Benghazi, Libya.

Data collection
• Cross-sectional survey.   • Personally supervised questionnaire.   •
Multi-stage cluster sampling.   • Sample size calculated =512.

Outcomes:
• Descriptive statistics
• Estimated prevalence of obesity
• Association between BMI & the following predictor variables:
• (SES; unhealthy eating habits ;physical activities & sedentary behaviour; and neighbourhood environment)

Data analysis & interpretation
• Using SPSS software version 21.   • Univariate descriptive statistics.
• Multivariate inferential statistics.

Connection
Quantitative & qualitative phases

Outcome of integration:
• Developing interviews schedule
• Purposive sampling technique. "Expert sampling" (n =21).

Phase II:
Qualitative approach

Aim:
To explore the views of Libyan key informants about the risk and protective factors associated with obesity among Libyan men and women, within the context of Libyan culture.

Outcomes:
Similar and different themes about the informants' views about obesity.

Qualitative data collection
• Semi structured interviews were conducted with (9) LHCPs & (12) LCLs.

Qualitative data analysis
• Using NVivo qualitative data analysis software version 10.
• Using Framework Analysis (FA) to explore the concepts and themes.

• Summarize and interpret the quantitative & the qualitative results.
• Discuss to what extent and in what ways the qualitative results help to explain the quantitative results.

Interpret all findings from an integration of the two methods.

Pilot study conducted (September - November 2014)

Phase I: Quantitative Approach

Phase II: Qualitative Approach

Figure 4.2: Visual model for an adapted mixed-methods sequential explanatory design.

Chapter Five : Phase I: Methodology for the quantitative study

5.1 Introduction

The present chapter outlines all components relevant to this cross-sectional design, including: a comprehensive picture of the research population; the eligibility criteria for the participants; the sampling frame (the Benghazi Electoral Register), the sample-size calculation and the rationale for selecting a multi-stage cluster sampling technique. In addition, it discusses data gathering methods in terms of the following: designing the survey questionnaire; the translation process; pre-testing; administering the questionnaire; recruitment process of the participants; and response rate. Furthermore, it discusses ethical considerations, before giving a more detailed description of the pilot study and main fieldwork procedure for this phase. Ultimately, the chapter provides all details on fieldwork challenges for this study.

5.2 Population and sampling technique

This section identifies the target population and eligibility criteria for the quantitative study. It also discusses my sample selection method and sample size calculation, followed by the concept of response rate.

5.2.1 Population

The target (theoretical) population of this study was Libyan adults to which the results of the study would be generalized, while the study (accessible) population was Libyan adults living in Benghazi aged 20-65 years. The Benghazi electoral register was used as the sampling frame for this study for access to the potential participants in this study.

5.2.2 Eligibility criteria for participant

Identifying the inclusion and exclusion criteria for participants prior to conducting the study enhances the chance of producing reliable results, as well as minimising the risk of causing distress to the participants, including the risk of abuse of susceptible persons (Yale University, 2006). However, no group or individual participant should be excluded without

a scientifically sound or legitimate reason (Emmanuel et al., 2011). Accordingly, my inclusion and exclusion criteria were as follows.

5.2.2.1 Inclusion criteria

- Aged 20-65 years.
- Resident in Benghazi for over ten years.
- Eligible to register to vote.

5.2.2.2 **Exclusion criteria**

- Less than 20 years of age or more than 65 years of age.
- Pregnant.
- Unsteady on their feet.
- Chair-bound.
- Amputee; a person who has had a limb amputated.
- Too frail or unable to stand upright.
- Is subject to any legal incapacity to vote.

The rationales for specifying these particular inclusion and exclusion criteria (see Appendix 5.1)

5.2.3 The sampling frame

The sampling 'survey' frame is the tool used to achieve access to and provide information regarding the study population (Bryman, 2012; Denscombe, 2010), in this study, namely Libyan adults in Benghazi. The Benghazi electoral register was used as the sampling frame for this study, in order to identify my target sample from an accessible population. To reach an ultimate sampling frame, a sample for my study was chosen from the district electoral register for Benghazi. The sampling procedures subsequently navigated through sampling parliamentary constituencies, polling districts, and finally, individuals.

5.2.4 Access to the electoral register (roll) in Benghazi

Although the electoral register of the Municipal Council of Benghazi is available, the public is prohibited from accessing it unless they wish to confirm and update their personal

details under the supervision member of the Libyan High National Election Commission (LHNEC, 2013).

However, the Libyan National Agency for Scientific Research (LNASR) has an agreement with the HNEC to allow certain people access to the electoral roll, including any researchers belonging to the LNASR or any researcher affiliated to a Libyan university (LNASR, 2014). They may access the register for research purposes, such as obtaining reliable and up-to date demographic information, provided that they present an official letter of verification from their institutions. Given that I am affiliated to the Omar Al-Mukhtar University, I was eligible to access the electoral roll. My eligibility was proven by obtaining a letter of permission from the Libyan Embassy in London and another from the Omar Al-Mukhtar University in Libya (see Appendices 5.2 & 5.3). It should be noted that in order to comply with legislation for the protection of data, the HNEC prohibits researchers from copying, recording or photographing any information from the electoral roll using electronic devices (LHNEC, 2013).

In comparison with other western countries like the UK, the electoral register is a public document which is on display in most libraries. However, in Libya, there is an absence of reference documentation regarding the rules of access to the electoral register and prohibiting users from copying any information relevant to register. Therefore, it was necessary for the head of the Benghazi Election Commission to issue a letter addressed to Omar University, Benghazi, and Bedfordshire University, UK, giving approval for me to access the electoral registers. The letter provided information about the working rules of the HNEC in terms of accessibility of the electoral registry and confidentiality (see Appendix 5.4).

5.2.5 Sample size calculation

Determining the sample size, subject to the available resources, is a critical issue in any survey as it impacts on the accuracy of the results (Data Analysis Australia, 2015). Approaches to determining sample size include statistical, cumulative and pragmatic methods (Bryman, 2012; Data Analysis Australia, 2015; Denscombe, 2010). The

cumulative approach is typically used on a small scale and is associated with qualitative methods. The pragmatic approach for calculating sample size is based on 'what works' effectively given the available resources, and is frequently used by market researchers. Both these approaches pose constraints for determining an accurate sample size in quantitative studies. Most applicable for my purposes is the statistical approach, which is recommended for large-scale surveys and probability sampling techniques (Bryman, 2012).

Since every survey is different, there are no fixed rules for determining sample size (Data Analysis Australia, 2013). However, the 'correct' sample size for a particular application depends on several factors that include the following: the population size and variability within the population; resources (time, money and personnel); the level of accuracy and detail required for the results; the likely level of non-response; the sampling methods used; and the relative importance of the variables of interest (Denscombe, 2010).

Within a statistical strategy, several approaches exist for determining sample size (Data Analysis Australia, 2015; Denscombe, 2010). These include using a census for small populations; replicating the sample size used in a similar previous study; applying formulas to calculate a sample size; using a web-based sample size calculator; or using sample size guidance published tables (Israel, 2013). The actual sample size calculated for this study was 384. Using the assumption of a 75% response rate, as justified in Section 5.6 below, the final sample size calculated was 512 Libyan adults (see Appendix 5.5, 5.6a &5.6b).

Once the study population was defined and a list of the research participants obtained, I then chose a technique for selecting a sample that represents the Libyan adult population from which it was drawn.

5.2.6 Rationale for selected multi-stage cluster sampling

Sampling schemes may be divided into two main types: random sampling schemes (probability sampling) which are traditionally associated with the quantitative paradigm, and non-random sampling schemes (non-probability sampling) which are typically

associated with the qualitative paradigm (Onwuegbuzie & Leech, 2007). The choice of either random or non-random sampling should be based on the level of generalisation required. In quantitative research, generalisability is statistical, that is, the study sample is matched to the study population to ensure comparability of demographic characteristics and it is assumed that the findings are generalisable (Horsburgh, 2003). In qualitative studies, participants are selected by means of theoretical sampling, that is, for their ability to provide information or assist theory development about the phenomenon under investigation. Situational, rather than demographic, representativeness is what is sought (Horsburgh, 2003). For further information on the critical evaluation about ruling out the following three probability sample to be employed in this study: simple random sampling (SRS) stratified random sampling systematic sampling.

Conceptually, simple random sampling (SRS) is the most common probability sampling procedure (Bryman, 2012; Trochim, 2006). It is generally easier to implement than other probability sampling procedures. Each element has an equal and independent chance of being selected, and, unlike stratified sampling, discussed below, it does not depend on any descriptive information about the target population (Bryman, 2012; Trochim, 2006). However, a limitation is that it can be difficult to apply because it requires a complete sampling frame, which may not be available or feasible to construct for large populations (Bryman, 2012; Trochim, 2006). It is also a tedious, time-consuming process, and it may be very costly, particularly when populations are geographically dispersed. It is therefore not recommended for large populations (Bryman, 2012; Daniel, 2012). In addition, it tends to have larger sampling errors and less precision than stratified samples of the same sample size (Bryman, 2012; Daniel, 2012; Trochim, 2006).

Another type of probability sampling is stratified random sampling. This is a technique whereby the researcher divides the entire target population or sampling frame into different subgroup 'strata', according to a particular characteristic that reflects the variables of interest (Bryman, 2012; Daniel, 2012). Unlike simple random sampling, a strength of stratified sampling is that it obtains a more representative sample coverage of the relevant population because it ensures that elements from each stratum are represented. This can be

the best technique with which to gain accurate and unbiased results that reflect the diversity of the population in question (Bryman, 2012; Daniel, 2012). For large and diverse populations, this renders it more effective than simple sampling. However, there are some limitations to this technique (Bryman, 2012; Daniel, 2012). In contrast to simple random sampling, stratified sampling requires information on the proportion of the entire population belonging to each stratum (Bryman, 2012; Daniel, 2012). Obtaining this information can be more time-consuming, expensive and complicated than simple random sampling (Bryman, 2012; Daniel, 2012). Not only can samples take longer to prepare and develop, due to difficulties in identifying appropriate strata, the analysis of the collected data can also be complex. In light of these limitations, stratified random sampling is deemed inappropriate for use in this study.

A third category of probability sampling is systematic sampling, whereby sample members from a target population are selected based on a random starting point and a fixed, periodic interval (Bryman, 2012;Daniel, 2012; Trochim, 2006). This interval, known as the sampling interval (SI), is calculated by dividing the population size by the desired sample size. With similar strengths and weaknesses to those associated with probability sampling, systematic sampling can ensure that the sample is spread across the population (Bryman, 2012; Daniel, 2012; Hague, 1993). In contrast to simple random sampling, where the selection process is done manually, systematic sampling is easier, simpler, less time-consuming and more economical (Bryman, 2012; Daniel, 2012). However, there is a risk of bias since the sampling interval may co-occur with a systematic variation in the sampling frame. (Bryman, 2012; Daniel, 2012). Although the most significant disadvantage of systematic sampling is that the process of selecting the sample can interact with a hidden intermittent feature within the population, however, I used this technique within multi-stage cluster sampling, which used a conceptual sampling technique to address my first research question.

Cluster sampling involves dividing the entire population into groups, or clusters, from which a random sample is selected (Bryman, 2012; Daniel, 2012; Hague, 1993). All observations in the selected clusters are included in the sample. This technique is utilised

when it is impossible or impractical to create a sampling frame of a target population, and/or the target population is dispersed widely geographically, thereby increasing data collection costs (Bryman, 2012; Daniel, 2012; Hague, 1993). The main reason for selecting cluster sampling is its cost-effectiveness in terms of 'economy and feasibility'. Cluster sampling enables the use of a larger sample for a similar fixed cost to other methods (Daniel, 2012). Moreover, greater precision may be achieved with cluster sampling, than is possible with other methods. It requires less time for listing primary sampling units afterwards implementation, and is often used for survey of institutions and organisations, such as hospitals or schools (Bryman, 2012; Daniel, 2012; Hague, 1993).

However, cluster sampling, when compared with simple random sampling, has the following weaknesses: it may not reflect the diversity of the community; other elements in the same cluster may share similar characteristics; higher sampling errors may occur, which can be expressed in the so-called 'design effect'; and there may be less information per observation than for a SRS of the same size, in the form of redundant information or similar information from the others in the cluster (Bryman, 2012; Daniel, 2012; Hague, 1993).

A multi-stage sampling procedure is a more complicated form of cluster sampling. It involves randomly-selected clusters and, subsequently, randomly-selected subjects from each chosen cluster, rather than including all units in the cluster (Bryman, 2012; Daniel, 2012; Hague, 1993). Moreover, it involves selecting a sample in at least two stages, with the precise number of stages often determined by the availability of sampling frames at different stages. Generally, it involves the recurrence of two basic steps: listing and sampling. Typically, at each stage, the clusters become gradually smaller in size; and elements-sampling is used in the final stage. Some researchers have suggested that in multi-stage cluster sampling, it is inadvisable to employ the same kind of sampling technique in each stage, hence, it is feasible to use different methods of sampling in each stage by navigating between SRS, stratified sampling, or systematic sampling (Bryman, 2012; Daniel, 2012; Hague, 1993).

Bryman (2012) & Daniel, (2012) argue that multi-stage sampling is used generally when it is costly or impracticable to compile a list of all the units within the target population. Typically, a multi-stage cluster sample design is utilised in conducting large-scale survey investigations. This is because surveys over large geographical areas generally require a more complicated sample design than those described up to this point. For studies conducted in large cities, use of a multi-stage cluster random sampling technique is highly recommended as it is relatively convenient, economical and efficient. Rather than obtaining a list of all members in the target population all that is required is a list of all participants for each selected cluster (Australian Bureau of Statistics, 2006; Levy & Lemeshow, 1999). Bryman (2012) and Neuman (2006) argue that this technique is easier to apply and can generate a more representative sample of the population than single-stage sampling. In addition, it minimises the sampling complexity for very large populations.

As with cluster sampling, the main weakness of multi-stage sampling is the possibility of lower accuracy than other probability sampling techniques. This is due to higher sampling errors than in simple random sampling, since sampling errors can occur at any stage of multi-stage sampling (Daniel, 2012; Shackman, 2001). However, sampling errors increase when there is a low number of the selected clusters, despite the differences between clusters, and it decreases when the homogeneity of cases per cluster is high (Daniel, 2012; Shackman, 2001). In order to minimise sampling errors and enhance the heterogeneity of the participants, I selected as many clusters as possible. Since my target population is dispersed widely across Benghazi, simple random sampling is unviable. Thus, on balance, multi-stages cluster sampling acquired the most relevance for my particular target population. It was arguable that increasing the number of selected clusters in this study made this technique very similar to random sampling in terms of cost. However, cluster sampling remains more feasible and requires less effort to implement than simple random sampling (Daniel, 2012; Shackman, 2001). Therefore, a multistage sampling technique was employed to select the research participants in the quantitative study.

5.2.7 Application of the multi-stage cluster sampling method

I conducted multi-stage cluster sampling in three stages to draw a total sample of 512 citizens, using Benghazi's 11 parliamentary constituencies (HNEC, 2013) as my clusters. Listed alphabetically they are: Al-Break, Al-Keisha, Al-Sabre, Al-Salami-El-Garb, Al-Salmani-ElSharki, Al-Uruba, Benghazi al-Jadida, Bu Atni, Benina, Garyounis, and Madinat Benghazi. Stage One comprised the sampling of parliamentary constituencies; Stage Two involved sampling the polling districts, whilst Stage Three entailed the sampling of individuals.

In the first stage, Primary Sampling Units (PSUs) were obtained by the systematic random selection of 5 of the 11 constituencies that were listed alphabetically, and were assigned serial numbers. These five were: Al-Keisha; Al-Sabre; Al-Salmani-ElSharki; Bu Atni and Madinat Benghazi. Each of the eleven constituencies has three polling districts (Benghazi Municipal Election, 2012). In the second stage, Secondary Sampling Units (SSUs) were derived by simple random sampling of one polling district from each of the five constituencies (PSUs), specifically: Al-Fuwayhat; Al-Kwayfiya; Raas Abayda; Laithi and Al-Hadaa'iq pertaining to Al-Keisha; Al-Sabre; Al-Salmani-ElSharki; Bu Atni and Madinat Benghazi respectively. Finally, in the third stage, ultimate or Tertiary Sampling Units (TSUs) were obtained by the systematic random sampling of potential participants (see Appendices 5.7).For further information with regards to building the sampling frame and calculating the number of potential participants in each of the five districts, (See Appendix 5.8).

5.3 Response rate

Although a high response rate minimises the risk of misleading or biased findings, some biases cannot be minimised even if a high response rate is achieved (Data Analysis Australia, 2013). Conversely, a low response rate does not necessarily mean that the results are biased – provided the non-respondents are not significantly different in their perspectives from the respondents (Bryman, 2012). However, this is difficult to ascertain because the researchers cannot predict what kinds of responses the non-respondents might have given, which in turn might introduce some bias into the findings (Data Analysis

Australia, 2015). According to Data Analysis Australia, 2013, the response rate can be calculated as follows:

$$\text{Response Rate} = \frac{\text{The number of completed questionnaires}}{\text{The number of people in the original sample}}$$

The response rate of a study is critical because a low response rate could compromise the representativeness of a sample derived from random sampling (Bryman, 2012). In contrast, in studies based on non-probability or convenience sampling schemes, the response rate is less critical because the selected samples are not representative of the target population to begin with (Bryman, 2012). As non-response can affect the validity of epidemiological studies, an important aspect of critically appraising health research is to assess the response rate (Data Analysis Australia, 2013).

Although the key challenge in survey research is to maximise the study's response rate, in practice response rates have been found to vary significantly, both across diverse professions and occupational groups, and across countries. Bryman (2012) endorses the classification of response-rate bands by Mangione (1995) with respect to postal questionnaires as follows: a response rate of over of 85% is an excellent rate of return; 70-85% is very good; 60-69% is acceptable; 50-59% is barely acceptable; and below 50% is not acceptable. In contrast, making reference to the claims of Babbie (1973) and Kidder (1981) cited by Richardson (2005), argued that 50% is considered as an acceptable response rate for social research postal surveys. Relatedly, a comprehensive review by Baruch (1999) of 141 published studies and 175 surveys concluded that the overall average response rate was 55.6%, which is slightly higher than the previously suggested 50%. Furthermore, the Australian Vice-Chancellors' Committee (AVCC) and the Graduate Careers Council of Australia (GCCA) (2001) declared that an overall institutional response rate for the Course Experience Questionnaire (CEQ) of at least 70% is both desirable and achievable.

In developing countries, which include Arab countries, response rates are typically disappointing (Al-Subaihi, 2008). Researchers in health and social sciences in these regions tend to use conventional survey research methodologies, namely postal questionnaires and telephone interviews, which have higher levels of coverage than electronic-mail surveys, due to unreliable internet access, but lower response rates and sometimes coverage bias. Recently, however, the response rate has been improving from less than 50% to around 73% to 83% in diverse parts of the Arab region (Al-Subaihi, 2008). Increasingly, research on patients recruited from clinics and hospitals, or based on existing data, has found that Libyans generally have a positive attitude towards an invitation to complete a survey questionnaire about health-related issues (Tashani, 2009). Moreover, positive response rates of between 60% and 86% have been achieved (LNASR, 2013).

The present study is distinctive in that no one has attempted to visit Benghazi citizens at their homes, in order to conduct a survey. The fact that I was administering the questionnaire under the personal supervision maximised the chances of obtaining a high response rate. It has been suggested that personal and telephone surveys generally achieve a higher response rate than postal and internet surveys. Hox and de Leeuw (1994) and de Leeuww and Collins (1997) reviewed the response rates to 45 studies which employed face-to-face (personal), telephone and postal administration methods cited by de Vaus (2013). They concluded that surveys conducted face-to-face have the highest average response rate (70%), followed by telephone surveys (67%) and postal surveys (61%). Similarly, Shosteck and Fairweather (1979) cited in (McFarlane & Garland (1994), found that studies conducted by post had a response rates ranging from 41% to 80%, whereas personally administered surveys achieved higher response rates, of between 65% and 80%.

Accordingly, I assumed that a predictable response rate (RR) for this study could be 75%. Since the minimum sample size of my study was computed and estimated to be 384 people and the likely response rate proposed was 75%, thus, the final estimated sample size for this study was 512 individuals (384/0.75 = 512). This increase in sample size is based on the assumption of a 75% RR, which tends to play a crucial role in enhancing the response rate for this study (see Section 5.14.4.2.5 for more details).

5.4 Data collection techniques

5.4.1 Survey questionnaire design

In Chapter 3, I reviewed this study's four main variables of interest, namely socio-economic status (SES),unhealthy eating habits, lifestyle activities (sedentary and physical), and neighbourhood environment, in order to describe how the four hypotheses on the risk and protective factors associated with obesity in Libya ,were deduced from the social-ecological model (SEM). To compile my questionnaire, I adapted four pre-existing instruments which measure the variables that I identified as critical to my study. There are sufficient evidence in a literature acknowledge a number of questionnaires on the etiological factors of obesity exist, whether self-completion or interviewer-administered (Gillum and Sempos, 2005; Jacqueline et al.,2014). The four pre-existing instruments were identified through a review of the literature.

The four pre-existing instruments (see Appendix 5.9) were adopted and used to address the first research question,which are listed as follow:

1. The WHO STEPS Instrument for Noncommunicable Disease Risk Factor Surveillance, of which the sociodemographic and socioeconomic information questionnaire was employed, (Available at: http://www.who.int/chp/steps/ instrument/Q-by-Q_STEPS_Instrument_V3.0.pdf) (WHO, 2013c).
2. A questionnaire for eating behaviours associated with obesity and being overweight (Available at:http://www.jabfm.org/content/21/6/539.full.pdf+html (Greenwood et al., 2008).
3. The Global Physical Activity Questionnaire (GPAQ) (Available at: http://www.Who .int/chp/steps/resources/GPAQ_Analysis_Guide.pdf (WH0, 2015).
4. The Physical Activity Neighbourhoods Environment Survey (PANES) (also known as: IPS/IPAQ Environmental Survey Module). (Available at: http://sallis.ucsd.edu/Documents/Measures_documents/PANES_survey.pdf (Sallis et al., 2010).

The fowling section for justification my choice the four pre-existing instruments over others:

5.4.1.1 The WHO STEPS Instrument for NCDs Risk Factor Surveillance

It has been recognised that gathering SES data can be difficult, particularly in developing countries (Pascoe et al., 2013). It has been argued that the collection of SES data frequently relies on interviewer-administered questionnaires Mbada et al. (2009), as this tactic can allow interviewers to clarify any ambiguous questions, probe for more information, and moreover, to persuade and reassure respondents to answer the questions completely. Reporting on personal income and socio-economic position (SEP) is as sensitive as reporting on mental health variables according to Tourangeau and Yan (2007). Consequently, they contend that the questionnaire delivery mode (QDM) plays a significant role in how different socio-economic indicators are reported and recommend that researchers consider the method of data collection when identifying indicators to determine SES data.

The SES questionnaire devised by Balogun et al., (1990) was used in a cross-sectional study by Mbada et al., (2009) to investigate the relationship between SES and BMI among Nigerian adults. Mbada et al., (2009) established that individuals of lower SES had a greater BMI and a higher prevalence of being overweight and obese. Recently, the WHO Stepwise questionnaire was used by Chukwuonye et al., (2013) to determinate associations between SES and obesity amongst adults in the state of Abia, Nigeria. The WHO STEPwise approach to the surveillance (STEPS) instrument covers several 'steps' in risk factor assessment and has been developed for use in low- and middle-income countries.

Chukwuonye et al., (2013) argue that face-to-face interviews were used to administer the questionnaire, despite the fact that SES data is not separate from demographic data, making it difficult to solicit information with regards to SES in one section of the questionnaire alone. Formulating the range of income in the survey to tick and administering this questionnaire under personal supervision reassured respondents in relation to their anonymity, and collected as much SES-related data as possible without causing any harm

to those contributing. Furthermore, it may enable me to minimise any obstacles relevant to this issue. Therefore, I adopted and used the WHO STEPS instrument to measure SES using three different sets of questions dealing with educational level, employment status, and income respectively.

There are obvious advantages to using existing questionnaires. First, the four instruments have been well validated and tested for reliability. Second, using pre-developed instruments links my study to the body of research utilising the same instruments, making my findings potentially comparable with those of other studies. Finally, in adapting the instruments developed by other researchers, the present study has a better chance of contributing to the worldwide knowledge-base on obesity and its associated risk and protective factors. Conversely, a drawback of applying a newly developed instrument is that it can be unclear how the research findings relate to those of other researchers (Mathers et al., 2009). My questionnaire opens conventionally by soliciting sociodemographic factors (e.g., age, gender, ethnicity and religion) and socioeconomic characteristics. I have made the instructions as clear and simple as possible to ensure that each item was suitably phrased and that the formatting was sufficiently clear and straightforward for all the the research participants .

5.4.1.2 Unhealthy eating behaviours questionnaire

Several questionnaires have been used to assess eating behaviour features in children ,adolescents and adults, in order to predict the risk of eating disorders and body weight-related problems, for instance, the Restraint Scale (RS)3, the Dutch Eating Behavior Questionnaire (DEBQ), and the Three-Factor Eating Questionnaire (TFEQ) have all been used in a study of eating behaviour (De Lauzon et al.,2004). However, these questionnaires include a number of items (items 10 to 51) that restrict their application in epidemiological studies of multi-factorial disease, especially in the present study on the risk and protective factors of obesity, where a number of other questionnaires are required, namely (unhealthy eating habits, SES, physical activity, neighbourhood environment). As a result, Karlsson et al. (2000) developed a reduced TFEQ, the TFEQ-R18 which consists of 18 items. This

instrument is easier to use in epidemiological studies where subjects have to complete a considerable number of questionnaires.

An unhealthy diet is a major risk factor for a number of the chronic non-communicable diseases. Nonetheless, it is difficult to assess the dietary habits of free-living individuals because of the variability in food preference and availability, socio-economic factors, cultural concerns and educational level. Food Frequency Questionnaires (FFQs) are the most frequently dietary assessment tool used in large-scale epidemiological studies and in other nutritional and health research (Fred Hutchinson Cancer Research Centre, 2011). However, due to differences in food supply and dietary habits from one population to another, there is no universally accepted FFQ that can be used in all populations.

Greenwood et al. (2008) carried out the first study to generate the "Questionnaire for eating behaviours associated with overweight and obesity". This questionnaire has been validated and used as an effective screening tool in the US to identify key eating behaviours that may assist public health providers in managing or controlling obesity. The Greenwood et al.'s questionnaire contains statements describing six items addressing both a one-day and a one-week recall of the respondent's recent and typical behaviours, over a day or a week. The six items address eating behaviour in terms of (1) restaurant food and fast food consumption; (2) beverage consumption in terms of with sugar added; (3) consumption of fruits and vegetables; (4) consumption of breakfast; (5) portion sizes; and (6) amount and type of physical activity. Therefore, I adopted and used the "Questionnaire for eating behaviours associated with overweight and obesity" for measuring unhealthy eating habits.

5.4.1.3 The Global Physical Activity Questionnaire (GPAQ)

There are a number of ways to measure physical activity. Accelerometry-based monitors in particular are more accurate in assessing activity than self-report methods (Hoos et al., 2012). Nevertheless, accelerometers are not always feasible because they are expensive and participants have to remember to wear them during waking hours for up to seven days. Self-report methods are the most convenient and economical way to collect physical activity data from a large number of people in a short period of time (Mackay et al., 2007).

In their study entitled 'A systematic review of reliability and objective criterion-related validity of PAQs,' Helmerhorst et al. (2012) argue that there is a diversity of PAQs , which were undergone to test their reliability and validity. These PAQs include: the Seven-Day Physical Activity Recall (PAR); the Flemish Physical Activity Computerized Questionnaire (FPACQ); the Occupational Physical Activity Questionnaire (OPAQ); IPAQ; and GPAQ. Helmerhorst et al., (2012) conclude that although the outcome of testing the reliability and validity of the majority of existing PAQs are fairly acceptable, the results of testing the newly developed PAQs is not as effective as the existing PAQs, in terms of reliability and validity.

The GPAQ and IPAQ are the most widely used self-report questionnaires for measuring physical activity and have been used extensively in research to assess frequency, duration type and intensity of activity (either vigorous or moderate) (Cleland et al., 2014 ; Van Poppel et al., 2010). The IPAQ is available in a short form for surveillance and in a longer form for when more detailed information is required about physical activity. Both forms are available in a number of languages. The questionnaire was rigorously tested for reliability and validity (Craig et al., 2003) and it has been replicated in a number of countries. This questionnaire is not designed to provide a detailed assessment of physical activity in all domains.

A recent study conducted by Singh and Purohit (2011), to assess physical activity using the GPAQ amongst healthy and obese health professionals in Central India, found a significant correlation between the physical activity categorical indicator and BMI. A significant correlation was noted between BMI and sedentary behaviour. The Global Physical Activity Questionnaire (GPAQ) was developed to assess physical activity (PA) by the World Health Organisation (WHO, 2013a). As a consequence, the GPAQ has been demonstrated to be valid and reliable, and adaptable enough to incorporate cultural and other differences (Herrmann et al., 2013; Hoos et al., 2012). The IPAQ and the GPAQ were developed for surveillance studies; however, the GPAQ is more specifically for surveillance studies in developing countries. These research tools are not recommended for

other purposes. It has been used in more than 100 countries globally, mainly through the WHO STEPwise approach to a non-communicable disease (NCD) risk factor surveillance (STEPS). The GPAQ assesses three areas of PA and sedentary behaviour: occupational (PA at work, including household activity); active commuting (PA for travel); and recreational activities (leisure time PA).Therefore, I adopted and used the GPAQ for measuring physical activity and sedentary behaviour.

5.4.1.4 Physical Activity Neighbourhood Environment Scale (PANES)

Brownson et al. (2009) distinguished 20 environmental self-report instruments with evidence of reliability and validity, and ranging from 7 to 68 items. Several of these scales possess fewer than 15 items; however, because they lack key variables such as transportation and recreation activities, they are considered. In this context, Brownson et al. (2009) classify three types of data that are utilised to measure built environment attributes associated with physical activity, namely: (1) perceived (subjective) measures obtained by personal interview with a questionnaire; (2) observational (objective) measures obtained using systematic scans or audits; and (3) archival data-sets that are often layered and analysed with Geographic Information Sciences (GIS).

The built environment has been divided into six dimensions: residential density, street connectivity, accessibility to services and destinations, walking and cycling facilities, aesthetic quality, and safety (Brownson et al., 2009) The International Physical Activity Prevalence Study (IPS) developed an optional environmental module used to assess the environmental factors for walking and cycling in built neighbourhoods. PANES is a short-form environment tool using single items instead of multi-item scales. Revised in 2002, it is used in the IPS study in addition to the International Physical Activity Questionnaires (IPAQ) (short form). The PANES is a brief scale developed specifically for The International Physical Activity Prevalence Study (IPS) comprised of a 17-item questionnaire that measures attributes of the built neighbourhood and social environments, hypothesised or known, which are related to physical activity. The environmental module has three sets of carefully chosen items that reflect current thinking in this field (core items (1-7); recommended items (8-11); and optional items (12-17) (see Appendix 5.9).

The PANES questionnaire was tested for validity and reliability and used extensively among adults in developed countries such as the US (Sallis et al., 2010) and in Sweden (Alexander et al., 2006) and in developing countries such as Nigeria (Oyeyemi et al., 2012). I therefore adopted and used the PANES questionnaire within my devised questionnaire to measure the built environment.

5.4.1.5 Validity and reliability

It is critical that the questionnaire is valid and reliable for the population that the researcher seeks to measure. An instrument that was validated in one culture for use in another is not sufficient; it needs to be adapted for the target population or culture, hence it is crucial to ensure that careful cross-cultural adaptation has been conducted (Bryman, 2012; Borsa et al., 2012). In order to ensure that a questionnaire measures what it is supposed to measure, the researcher should test it with the target population, age group, ethnic group and language. Unless the researcher is prepared to develop a new measuring instrument, it is advisable to use those tools that are already widely accepted. There are several steps that the researchers should follow in order to achieve a reliable and valid measuring instrument, prior to embarking on the main study (Bryman, 2012; Borsa et al., 2012). Three pre-existing instruments mentioned in (Section 5.4.1) used in the present study were tested for validity and reliability (the WHO STEPS Instrument; the unhealthy eating habits questionnaire; the Physical Activity Neighbourhood Environment Scale (PANES). The fourth questionnaire, the Global Physical Activity Questionnaire (GPAQ), has been found to be valid and reliable in Arab countries (Herrmann et al., 2013; Hoos et al., 2012). The researcher conducted further procedures, discussed below, to confirm the validity and reliability of the four questionnaires in terms of Libyan culture.

First, the face validity of the four pre-existing questionnaires was evaluated by the supervisory team, and an expert committee was appointed for the back-translation of the instruments. This committee evaluated the contents of the four questionnaires, concluding that all versions of the questionnaires, including the final Arabic edited version, were relevant to the study of obesity in Libyans adults and incorporated the following

characteristics: straightforward; understandable; all the questions are in a regular sequence; easy for the respondents to answer; meaningful, that is, relevant to Libyans' daily lives. Hence, a layperson would be able to understand clearly all the words in the Arabic translated version.

Another technique to confirm the validity of questionnaires used in this study was the pre-testing of the four questionnaires with ten Libyan adults living in the UK. Pre-testing is a crucial step in this study as it ensured that any errors associated with the wording of the questionnaire were corrected and that the contents of the questionnaire were clear from the perspective of the respondents. The pre-test interviews indicated that most questions in the questionnaires were clearly understood by the Libyan adults. There were no difficulties with understanding the words, terms, or concepts used in the questionnaires. The respondents interpreted most of questions as the researcher intended and used all the response categories or choices offered. The respondents were willing and able to perform the tasks required and to provide acceptable answers.

5.4.1.5.1 Test validity

The validity of each questionnaire was tested using Pearson's correlation coefficient. Run on SPSS, this test correlates scores for each item of the questionnaire with the total score. Items that correlate significantly with the total indicate that the items are valid. For the pilot study, a significant correlation was found between the score for each item of questionnaire and the total score of the same questionnaire as follows for each questionnaire: the WHO STEPS Instrument ($r=0.521$, $p<.001$); the unhealthy eating habits questionnaire ($r=0.279$, $p=.005$), the Global Physical Activity Questionnaire (GPAQ) ($r=0.352$, $p<.001$); and the Physical Activity Neighbourhood Environment Scale (PANES) ($r=0.337$, $p<.001$).

5.4.1.5.2 Test reliability

The pilot study tested the reliability (internal consistency) of all four instruments using Cronbach's alpha. Generally the coefficient should be >0.7 to be considered "acceptable" in most social science research situations (Bryman, 2012).

- A questionnaire was used to measure construct, "the WHO STEPS Instrument", which consisted of nine questions. A Cronbach's alpha (α) score of 0.763 was obtained, suggesting that the items have a relatively high level of internal consistency.

- A questionnaire was used to measure construct, "unhealthy eating habits", which consisted of 14 questions. A Cronbach's alpha (α) score of 0.732 was obtained, suggesting that the items have a relatively high level of internal consistency.

- A questionnaire was used to measure the construct, "the Global Physical Activity Questionnaire (GPAQ)", which consisted of 16 questions. A Cronbach's alpha (α) score of 0.812 was obtained, suggesting that the items have a relatively high level of internal consistency.

- A questionnaire was used f to measure the construct, "the Physical Activity Neighbourhood Environment Scale (PANES)", which consisted of 17 questions. . A Cronbach's alpha (α) score of 0.742 was obtained, suggesting that the items have a relatively high level of internal consistency.

5.5 Anthropometric measurements section

The fifth and final section of my questionnaire pertained to anthropometric measurements, including Height (cm), Body Mass Index (BMI) (Kg/M²), Percent Body Fat (%) and Visceral Fat Level ranging from 1 to 59. All these objective measurements were taken by the appointed qualified nurses. (See Section 5.10.4.3.1. for details about the rationale for appointing qualified nurses to take these measurements and see Appendix 5.15 & 5.16 for all details about the protocol for taking these anthropometric measurements). Participants were requested to give their permission to allow qualified nurses allocated by the Regional Health Sector in Benghazi to take their anthropometric measurements, whether at their own home, at specific clinics or any other mutually agreed place and to have the information recorded in the designated sections of their questionnaire (See Section 5.11.4 for details). To minimise the limitations in BMI were argued and discussed in Section 2.3.1 in Chapter

Two, the literature review chapter, this study used the Tanita BC-601 Segmental Body Composition Monitor to ascertain the measurements of Percent Body Fat (%) and Visceral Fat Level (See Section 5.10.4.3.1. for details about the rationale for allocating qualified nurses and see Appendix 5.15 & 5.16 for all details about the protocol for taking all these anthropometric measurements by qualified nurses). As a result, adopting measurement of the Visceral Fat Level in conjunction with BMI for each single participant can minimise the BMI restrictions.

5.6 The translation process in the quantitative protocol

It has been acknowledged that a well-translated survey instrument should have semantic equivalence across languages, conceptual equivalence across cultures, and normative equivalence to the source survey (Oude Voshaar et al., 2012; WHO, 2015c). To assert the validity of the meaning of all items, conceptual equivalence should be prioritised over linguistic equivalence. There is consensus in the literature (WHO, 2015c) that the main elements in the procedure should include: initial forward translation into the target language; back-translation into the source language by certified translators; holding meetings between the expert panel members in order to reconcile and agree on the final version of questionnaire; and pre-testing the final translated version on target-language participants. Accordingly, I have applied the forward–backward–forward translation technique (see **Figure 5.1** (overleaf) and Appendix 5.10 for details).
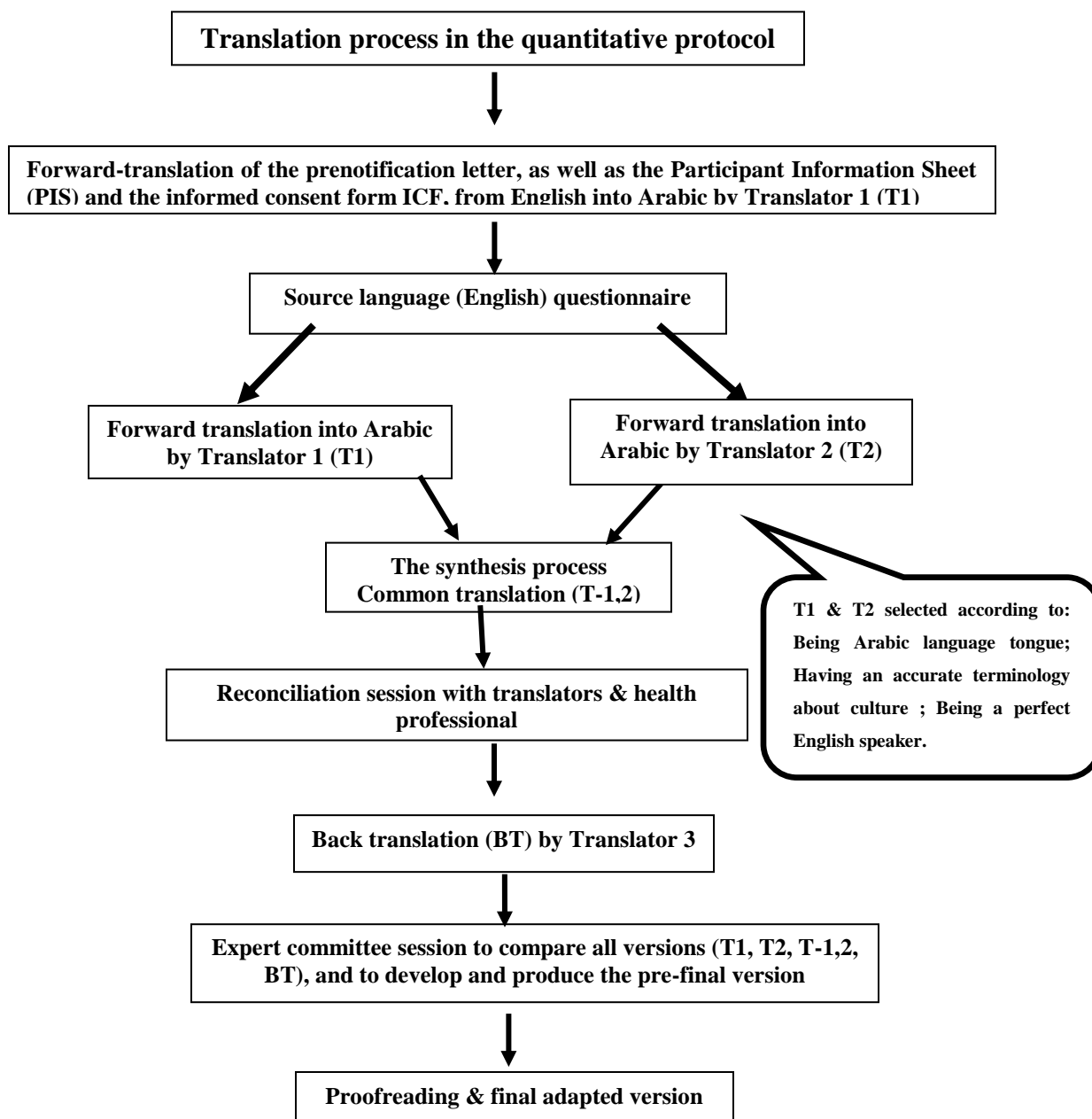
Figure 5.1 All stages involved in the translation process in the quantitative protocol.

Source: Adapted from Davison (2004)

5.7 Administration of the questionnaire

Self-completion or self-administered questionnaires may be categorised either as telephoned, administered in person, postal or mailed, web-based or e-mailed, internet-mediated only, or a combination of these techniques (Bryman, 2012; Fincham, 2008).Postal questionnaires are commonly applied to collect data in health research and are a suitable approach when collecting information from large, geographically dispersed populations (Bryman, 2012). Although a postal survey questionnaire can be less expensive and quicker if the sample is large and widely dispersed, this method is unviable for the present study due to Libya's ineffective postal service, which is consistent with many other developing countries (Sawan & Alzeban, 2015; Kennard, 2001).

It should be noted that e-mail and website surveys have become one of the most widely utilised assessment methods in recent years, due to convenience and rapid results, whilst having the potential to reach many more respondents than a postal method, without incurring any extra costs (Phellas et al., 2011). However, this method was also unworkable for this study due to unreliable internet services in many parts of Benghazi (Elzawi et al., 2013; Kennard, 2001; Sawan & Alzeban, 2015;).

Therefore, a more practicable method of distributing my questionnaires was to administer them under the personal supervision to the potential respondents. This method can achieve a much higher response rate from respondents than methods which are not face-to-face, such as postal, e-mails or on-line surveys (de Vaus ,2013). However, the main drawback of this approach is that *'captive'* subjects may distort their responses according to social desirability effects, and this may bias the study's findings. To minimise this limitation, once the potential participants signed the informed consent form (ICF) and had their anthropometric measurements taken, I gave the respondents time to complete their questionnaires individually, and hand them back to me.

5.8 Recruitment procedures

5.8.1 Access to and recruitment of potential participants

Once a sampling technique had been allocated and a final draft of a questionnaire had been constructed, designed, reviewed by experts and subsequently, pretested, and furthermore, once a list of potential participants had been devised, I made preliminary contact by phone or via

correspondence to inform participants of the forthcoming study. Thus, I notified them of when they could expect a home visit from the researcher to complete the survey (Fowler, 2002; Salant & Dillman, 1994).This strategy complies with Arabic culture and Islamic etiquette in terms of obtaining permission in advance prior to visiting people at home (Abu Ghuddah, 1992). Within a Libyan context, a telephone call is usually more appropriate than other methods for recruiting participants. Relevantly, Elzahaf et al. (2013) studied chronic pain in Libyan adults in the city of Derna using the Arabic Structured Telephone Interview Questionnaire. They established that the telephone is an efficient and reliable method when recruiting participants, and that the recruitment and interview of participants over the phone is viable in a Libyan context. However, due to unavailable or obsolete phone numbers, the use of the telephone was only partially viable in my research to inform prospective participants of my impending study.

Although Heberlein and Baumgartner (1978) argue that there is no significant association between response rates and pre-notification letters, Fox et al., (1988) refute this claim, asserting instead that giving notice to prospective participants enhances potential response rates. Other researchers concur with Fox et al., (1988) and claim that using pre-notification letters addressed to potential participants is associated with increased response rates. In the present study, I pre-notified all the research participants concerning the pending survey and to arrange a home visit using two particular methods: a phone call and a postal letter. Daytime telephone numbers, either landline or mobile, were obtained either from electoral registration forms from the Libyan High National Election Commission (LHNEC) (2012), or from an updated phone directory when there was no telephone number listed on the electoral registration form. Despite using these two sources, it was difficult to contact some participants by phone, as some people do not have telephones numbers, and others dislike the intrusion of a call to their home.

According to regulations provided by the 'Ministry of Higher Education and Scientific Research in Libya' (MOHESR), all students must be reimbursed for any expenditure incurred over the course of their fieldwork. Consequently, I was eligible for recompense for those I enlisted to help minimise the obstacles I encountered during my fieldwork. Aligned with my pragmatic approach, I used the services of a reliable communication agency to notify the participants of a forthcoming survey by phone. The company has an up-to-date phone book, with phone numbers for both fixed lines and mobile phone lines. In addition, I provided them with the list of phone numbers of participants which I obtained from the electoral register. Using a private phone agency is a method that has been used to recruit participants successfully

by recent studies in Libya conducted in Arabic language (e.g., 201; El Zahaf et al., 2013; Rhema, 2013). Based on recommendation of the director of the central post-office in Benghazi, I used the services of the 'Alfwehat Telecom and Technology Agency' which is affiliated to the Libyan general postal services.

Once I had contacted the agency, I was requested to provide all documents relevant to my research including the list of participants, and we agreed on how the plan was to be carried out and on the cost of the services provided. The agency allocated two males and two females to achieve this task. As these employees are affiliated with the official post-office body, they are experienced in dealing with the public. In addition, their usual work is undertaken confidentially, which complies with the ethical requirements of this study. This approach was therefore a viable method to notify the participants of a forthcoming survey.

This agency already has a list of updated phone numbers for the public, whether landlines or mobiles because customers in Libya must have an official contract to buy a SIM card. It is arguable as to whether the database for the phone numbers is reliable; therefore, this is why the researcher assigned those particular employees. This helped to minimize time delays due to invalid phone numbers collected from the electoral registers, or as some people had changed their phone numbers.

Participants who could not be contacted by phone were contacted by post instead. I supplemented the telephone method by contacting the postal services and enlisting their help to deliver an introductory letter to prospective participants. As the postal infrastructure in Libya is relatively ineffective, I obtained a letter from Omar Al-Mukhtar University addressed to the postal office headquarters based in Benghazi to facilitate and expedite delivery of the pre-notification letters (Appendix 5.13).

The introductory letter explained that the researcher would visit the research participants at their homes to ask whether or not they wished to participate in the forthcoming study. The visit was a one-off, taking place at some point in (February 2014 for the pilot study and in December 2014 for the main study) that took approximately 17 minutes and included having several anthropometric measurements taken from the participants by a qualified nurse, who accompanied the researcher on the visits. The letter assured them that cultural norms would be taken into account (see standard letter in Appendix 5.14).

5.8.2 Recruitment of nurses

My experience of working in the Libyan health sector enabled me to build firm relationships with professionals who supported my fieldwork and assisted in overcoming any problems that arose. One concern I had with my pilot study was how to obtain the anthropometric measurements from female, Muslim participants. To overcome cultural inhibitions and to search for an effective way to minimise this issue within this conservative society, I piloted my study after discussions with the health authority in Benghazi, with the aim of providing assurance to the research participants. (For involving, nurses in this fieldwork see, Section 5.14.4. 3.1).

5.8.3 Instrumentation for taking anthropometric measurements

Participants were asked to give their permission for the assigned nurses from the local health authority in Benghazi to take their anthropometric measurements and record them in the designated section at the end of the questionnaire. The nurses used two pieces of transportable equipment to obtain the anthropometric measurements from the research participants. The first was a portable stadiometer, which was used to measure height (cm) to the nearest 0.1 centimetre. The second was the Tanita BC-601 Segmental Body Composition Monitor, which was used to identify the following measurements: Weight to the nearest 0.1 kilogram, BMI (Kg/M^2), Percent Body Fat nearest to 0.1% and Visceral Fat Level. The nurses followed and performed all measurement procedures precisely, as shown in (Appendix 5.15 & 5.16). Adopting these procedures helped to minimise the limitations of BMI , which mentioned in Chapter Two, Section 2.3.1, and also ensure the accuracy of the measurements obtained, which contributes to the validity and reliability of the study's findings.

5.8.4 The validity and reliability of Tanita's Body Fat Monitor/Scales

Independent research at a number of universities, including Columbia University in New York City, has emphasised that in clinical settings, the Tanita Body Fat Monitor is accurate to within +/- 5 percentage points of the institutional standard of body composition analysis, Dual Energy X-ray Absorptiometry (DEXA) (Abolhasani et al., 2013). Tanita's Body Fat Monitor Series results are repeatable to within +/- 1 percent variation when used under consistent conditions. Another study conducted at the University of Hong Kong concluded that these three BIA (Bioelectrical Impedance) devices are reliable and are valid field measures of mass and percentage Body Fat (BF) in this population, provided the device allows a correction for athletic status (Macfarlane, 2007). Recently Kelly and Metcalfe (2012) in the UK ascertained

that using a Tanita body composition analyser and stadiometer are convenient and accessible for assessment body weight, while the reading of anthropometric measurements produced from the Tanita can be considered accurate, valid and reliable.

5.9 Ethical considerations

In order to ensure that the first phase of this mixed-methods design, in the context of cross sectional design, was conducted ethically, I considered the following four ethical principles: informed consent; beneficence or 'do not harm'; respect for anonymity and confidentiality; and protection of privacy (Beauchamp & Childress 2001; Long & Johnson, 2007). The following sections discussed these fundamental factors in greater detail.

5.9.1 Ethics approval

Ethical approval for the quantitative study was obtained from the following relevant bodies:
- The Institute of Health Research Ethics Committee (IHREC) at the University of Bedfordshire, UK (Appendix 5.17).
- The Libyan Cultural Affairs at the Libyan Embassy, affiliated to the Ministry of Higher Education and Scientific Research, Libya (Appendix 5.18 & 5.19).
- The Omar Al-Mukhtar University in Bayda, Libya (Appendix 5.20 & 5.21).
- The Regional Health Ministry in Benghazi, Libya (Appendix 5.22).

5.9.2 Informed consent

In obtaining voluntary informed consent from participants, I reassured the potential participants about the following five points of ethical concern: disclosure; understanding; volunteering; competence; and consent (Adams, 2013). I discuss these in turn below.

5.9.3 Disclosure

During the course of the fieldwork, all the research participants were provided with a Participant Information Sheet (PIS) (see Appendix 5.23) and an Informed Consent Form (ICF) (see Appendix 5.24). These provided participants with the opportunity to learn more with regards to the study and what their participation entails. The research participants were fully informed about the nature and purpose of the study, such as the procedures to be undertaken, participants' responsibilities, the benefits to society from participating in this study, potential risks, distress, and reassurances concerning safety, and moreover, the anonymity and confidentiality of their data.

5.9.4 Understanding

The research participants were given the opportunity to ask me any questions they had about the study prior to providing their final consent to participate (National Health and Medical Research Council (NHMRC), 2015). The ICF was written in layman's language and technical jargon was avoided in order to convey the purpose of the study in the clearest possible way.

5.9.5 Volunteering

Another ethical consideration was autonomy, which required that the participant's consent to participate had to be voluntary and free of any coercion (Adams & Callahan, 2014; NHMRC, 2015). The potential participants were informed that they were not obliged to participate. Their personal details were kept confidential and they had the right to omit or refuse to answer any question asked, or even to withdraw from the study at any time without explanation. (For further details about the Ethical considerations see Appendix 5.25)

5.10 Pilot study

Conducting a pilot study alerted the researcher to the drawbacks and feasibility of the proposed study (De Vaus, 1993). Having adopted a sequential mixed-methods design, data collection for the pilot study of the quantitative phase was conducted during (January-February 2014).

5.10.1 Reasons for conducting the quantitative pilot study

1. To evaluate the feasibility of environmental fieldwork during the politically unstable conditions in Benghazi, current at the time of undertaking a pilot study (2014).
2. To assess whether the research protocol was realistic and workable in terms of:
   - establishing the effectiveness of the sampling frame and sampling technique;
   - identifying potential practical problems concerning the proposed recruitment process;
   - establishing questionnaire-completion times;
   - estimating the response rate.
   - determining the most effective method for taking the anthropometric measurements from participants, which also comply with the conservative Libyan culture.

3. To collect as many data as possible and conduct preliminary analyses of the data.

5.10.2 Initial stage

In the middle 2013, due to the deteriorating security environment in Libya, particularly the current situation in Benghazi, attributable to a proliferation of radical militia, conducting

fieldwork in this area is relatively hazardous for the researcher. Due to news concerned with the deteriorating social-political situation in Benghazi, my supervisory team requested that I provide an official letter ensuring my safety in order to comply with the requirements of the Institutional Health Research Ethics Committee (IHREC). Consequently, I sought and obtained an official letter from the Libyan Embassy in London which promised to ensure my wellbeing when travelling in and around Benghazi during the current unstable circumstances (see Appendix 5.26) and I submitted to the research ethics committee. Likewise, I asked for my supervisory team to provide me with official letters addressed to the three Libyan institutions, which played the role of hosts for my study, specifically; the Omar Al-Mukhtar University, the Regional Health Ministry in Benghazi and the Libyan Cultural Affairs,London , seeking their cooperation in minimising any obstacles that I might encounter as a researcher (see Appendix 5.27, 5.28 & 5.29).

5.10.3 Conducting the pilot study

The researcher diarised all the tasks that needed to be achieved and made observations every single day in relation to the fieldwork, in order to reflect on the various incidents and minimise as many obstacles as possible. Once the diary had been written and finalised, the researcher elicited the visiting logs (roster) for the participants in the five selected polling districts (see Appendix 5.30). These logs contained: the names of each polling district used in the survey; the case numbers for each participant; the dates and the allocated visiting times; the participants' contact numbers and addresses (these were deleted from the final logs to protect confidentiality and anonymity, in compliance with ethical consideration and Libyan electoral commission regulations); gender; the meeting locations; and finally, remarks with regards to the visits, which included either complete, ineligible or refusal to contribute from the participants.

As mentioned in Section 5.2.5, the actual sample size calculated for this study was 384. Using the assumption of a 75% response rate, as justified in Section 5.6, the final sample size calculated was 512 Libyan adults. Actually taking part in this study were 401 of 512 Libyan adults, divided as follows: 156 of 200 Libyan adults took part in the pilot study, while 245 of 312 Libyan adults took part in the main study. The majority of the researcher participants were visited in their homes, which represented exactly 227 of 401 participants (57%), while 174 of 401 participants (43%) requested to meet at other locations. Precisely 166 of these 174 participants (95%) were visited in a variety health facilities including: a walk-in clinic, primary

health care trust, polyclinic, and general hospital. Four of these 174 participants were visited in a community centre, two were visited in their grocery stores, and two were visited in a football club. I gave each participant a package consisting of the PIS and the ICF.

The next step was to conduct a quick test to establish whether the respondent met the eligibility criteria (listed in Section 5.2.2). If the participant met the eligibility criteria, I asked him or her to sign the two copies of the ICF that I had already signed in compliance with the research ethics (Section 5.12.7). A copy of the signed ICF was given to the participant, while I retained the other signed copy. I then asked the participant to allow the allocated professional nurse (male or female) to take some physical measurements from him or her (see Section 5.12.2 for details). The respondent's anthropometric measurements were taken and the results recorded on his or her questionnaire by the allocated nurse. In the last stage of the visit, I handed the participant the questionnaire to fill in individually, while the nurse and I waited for him or her to complete it. Once this was completed, we thanked the participant and left. However, some participants asked us to leave the questionnaire with them to complete and for us to collect it from them later on the same day at a mutually agreed time. I complied with such requests.

5.10.3.1 Sensitive weighing procedures

Getting weighed and finding out one's weight can be distressing and anxiety-provoking for research participants and patients alike (Kodya, 2002; Matson et al., 2009). Stepping onto the scale can cause distress or anxiety, which in turn may discourage participants from taking part in the study (Kodya, 2002; Matson et al., 2009), thereby perpetuating the lack of research on this topic. This issue was one of fieldwork challenges of the present study, the possibility that some potential participants were reluctant to confront any health concerns which my study might uncover for them (see Section 5.12 concerning fieldwork challenges).

Although all research participants had the capacity to give fully informed consent regarding their anthropometric measurements, further sensitivities were noted during the weighing procedures by the appointed nurses. The appointed nurses were qualified for dealing with sensitive issues practically and effectively, including helping to reduce any signs of distress or anxiety shown by the participants, using the following strategies.

1. The participants were weighed in a private location where their confidentiality was ensured.

2. The qualified nurses used empathic, sensitive communication to initiate the procedure of weighing the participants. Common phrases used by the nurses included: "Would you like to be weighed today?" or "Do I have your permission to weigh you today?"; "Would you prefer if I weighed you facing away from the scale?"

3. The nurses recorded each research participant's weight without judgment or comment. They also offered to the participants the choice of seeing or not seeing the results, and they asked, "Would you like to discuss any weight concerns you might have with your doctor?"

Apart from a concern with the well-being of the participants, a reason for minimising any anxiety that participants experienced in the course of their anthropocentric measurements is that it may negatively affect their answers to the questions of the survey, thereby affecting the validity of the findings of this study . Another consideration is that anxiety among the participants in this study is not necessarily problematic because Libyans perceive obesity to be a sign of 'good living' and 'good health', and they perceive it to be unamenable to change (Mokhtar, 2001). Furthermore, it is likely that some potential participants refused to take part at the outset study once they were informed by phone about the impending survey, as argued in Section 5.13 on 'fieldwork challenges'. Therefore, the weighing issue in the Libyans context is not necessarily problematic in terms of provoking anxiety, and is not considered to have deterred participants. It therefore does not significantly impact on the validity of the findings.

5.10.4 Lessons learned from the pilot study

The pilot study confirmed that I was using a viable protocol for gathering data to address my research questions. The value of conducting the pilot study is discussed below in terms of the following three areas: the environment (evaluating the feasibility of the research environment; taking precautions to minimise hazards in the fieldwork environment); sampling, data collection methods and recruitment (establishing the effectiveness of the sampling frame and technique; identifying the questionnaire-completion rates; identifying potential practical problems concerning the recruitment process; estimating the response rate); and, finally, the home visits and physical measurements (exploring an effective method for taking anthropometric measurements; estimating the physical distances between two consecutive visits; scheduling home visits).

5.10.4.1 Environment

5.10.4.1.1 Evaluating the feasibility of the research environment

Since the end of the Libyan civil war in October 2011, Benghazi has become a prominent destination for various radical militias, a multitude of armed men and hard-line Islamist groups, which have emerged from the conflict. The fight in Libya continues to be an immense struggle for power due to the Muslim brotherhood, as well as Islamic hard-line militias allied to them, who have refused to integrate themselves into the Libyan military services. There is an ongoing attempt to establish an Islamic state in the east, which currently threatens Libyan security and stability. On a daily basis, unknown assailants attack checkpoints and assassinate military personnel using booby-trapped cars. There are bombings in public places, nightly gunfire and kidnappings, and other appalling crimes such as robbery, arson and embezzlement, amongst the appalling chaos.

Unsurprisingly, people's lives have been profoundly affected by these developments with governmental institutions, such as the courts and the military, companies and workforces being severely disabled. Moreover, the violence and physical insecurity is causing people in Benghazi to remain in their homes for long periods of time. From my perspective, a positive outcome of this unfortunate situation was that it enabled me to visit a considerable number of the research participants in their homes during the study. Overall, my pilot study was conducted safely, except for one explosion from which I escaped unharmed (see Appendix 5.31).

5.10.4.1.2 Taking precautions to minimise hazards in the fieldwork environment

As the Omar Al-Muktar University and Local Health Authority in Benghazi played a significant part in this study, and were considered as the host institutions for this research, they postulated to have a responsibility to take into account any hazards that the researcher might face and attempt to minimise them. However, in reality, since absence of documentation in Libya makes it difficult to find the scope of details of any applicable legislations for ensuring that adequate fieldwork planning is undertaken (Bristol University ,2014)., including assessments of the risks that need to be managed during the fieldwork, and for ensuring that safe working procedures have been established for research students, especially in the current precarious circumstances in Libya.

Although the supervisory team obtained official documents from the Libyan authorities to guarantee researcher safety during fieldwork, and despite the fact that the Libyan authorities provided letter vouching for acceptable levels of stability and safety for me to conduct fieldwork (see Appendix 5.26), I was risk-prone during the course of my fieldwork due to continuous conflict between militias, and experienced an explosion while I was collecting data in a pilot study , which left me shocked but unhurt.

On average, 2-3 days was spent in each of the five districts included in my study. Conducting the pilot study in such a politically unstable environment, I recognised that two of the five districts were considerably riskier than the others. Due to the presence of radical militias, they were classified as unsafe. As a precaution when entering these unsafe districts, I heeded the precautionary measures suggested by community leaders for encountering perilous situations. In addition, I solicited the protection of the dominant tribe in each region while I visited participants in their homes. The authority of the Libyan tribes in these areas is not totally effective under Libyan law; however, they have the power to protect their communities and citizens based on public interest.

The dominant tribes work in a similar manner to the police and have trained selected people in special duties such as patrolling designated areas of the district on foot, or by motorcycle or car, to protect and observe people in the district and report to the leaders of the tribes any untoward events that are occurring. Because tribal protection of districts is unlegislated, they can be said to be performing their duties as volunteers. As such, their role is not without controversy. However, relying on such tribal advice and protection is aligned with the pragmatist approach ('whatever works'), argued above to underpin this study. As two of the five identified districts were particularly dangerous, the dominant tribe in each of these two districts assigned a chaperone to accompany me until my tasks were achieved. As a further precaution, I obtained a chaperone from the dominant tribes in each of five districts during the course of main study. Adopting this method was effective in helping me to achieve my aims in the current (2014) climate of unrest across Libya.

Based on my pilot-study report, I was invited to a meeting held at the Research Graduate School (RGS) upon my return from fieldwork. The meeting included the supervisory team, and the RGS director and administrator, with the purpose of discussing and re-assessing the risks that need to be managed in the main fieldwork. The committee reviewed the explosion incident that occurred during data-collection in January-February 2014, as well as the outcomes of the pilot

study, and concluded that I should confirm my protection by the governing tribe in the two most hazardous districts while conducting fieldwork. I was strongly advised to follow the same conduct for the main study that I had deployed in the pilot study, taking into account all necessary precautions including an assigned chaperone to accompany me until my tasks were achieved. Finally, to comply with the university's regulations, I was required to report to the supervisory team daily, assuring them by text of my well-being. Failure on my part to do so would necessitate that legal action be taken immediately.

On the other hand, with respect to the main fieldwork, due to the deteriorating situation in Benghazi, at a time when the researcher was about to embark on the main fieldwork in Benghazi, the supervisory team requested an official meeting with the cultural attaché at the Libyan Embassy, in order to discuss this critical issue and place the safety of the researcher at the top of the agenda.

The meeting took place on Tuesday 10th October 2014 at 9:00 am at the Libyan Embassy. A number of topics were discussed during the meeting. The meeting concluded with the proposal, which hereby the Libyan Embassy had to issue an official response to the Director of IHR at Bedfordshire University. This would be undertaken by issuing an updated letter, which emphasised that the Libyan Embassy would confirm its responsibility for the safety of the researcher by coordinating with the Libyan government from the time he left the UK, until he returned from his fieldwork. Consequently, the Libyan Embassy issued the appropriate correspondence to the Director of IHR (see Appendix 5.32 & 5, 33).

5.10.4.2 Sampling, data collection methods and recruitment process

5.10.4.2.1 Establishing the effectiveness of the sampling frame and technique

The electoral register (sampling frame) and Multi-stage Cluster Sampling were discussed in detail in Section 5.2.2 (and see Appendices 5.6-5.8). In line with the pragmatic approach adopted in this study, I decided to collect as much data as possible in the pilot phase, as opposed to in the main study, for two main reasons: to test the proposed protocol from a range of angles; and to minimise any obstacles that might emerge due to ongoing political conflict in Libya which could impede my ability to conduct the main fieldwork. The second reason was that to develop the semi-structured interview schedule for the qualitative study. Therefore, I distributed 200 of the 512 questionnaires to the research participants across all five selected polling districts for the pilot study (156 of 200 Libyan adults, took part in the pilot study). This

suited the timeframe for my research, as stipulated by the Research School Graduate's Regulations (RGS).

Table 5.1 (below) shows how the researcher computed the number of research participants in each polling district for my pilot study. The table shows the percentage of the calculated sample size for each polling district, the total research participants for whole sample, and the numbers of participants in each polling district for both the pilot and main study.

Table 5.1 The % of the calculated sample size for each polling district and number of participants for the whole study (pilot and main).

SN	Polling district name	Number of registered voters in each polling district	% of the calculated sample size for each polling district for the 512 participants	Number of the participants for each polling district (For total sample size n = 512)	Number of the participants of each polling district (Sample size of the pilot study n = 200)	Number of the participants of each polling district (Main study sample) = 312
1.	Al-Fuwayhat	8,012	13.8 %	71	28	43
2.	Al-Kwayfiya	10,433	18 %	92	36	56
3.	Raas Abayda	8,480	14.7 %	75	29	46
4.	Laithi	11,858	20.5 %	105	41	64
5.	Al-Hadaa'iq	19,102	33 %	169	66	103
	Total	57,885	100 %	512	200	312

5.10.4.2.2 Questionnaire-completion rates

I collected questionnaire data from five adults at Benghazi Diabetes Centre (BDC), on Monday 3 February 2014 at 15h00 to gauge the questionnaire-completion rates. Administering the questionnaire and taking anthropometric measurements took on average 15-17 minutes for each participant. Therefore, I set 17 minutes as the maximum time required for each.

5.10.4.2.3 Practical problems concerning the recruitment process

Obstacles encountered in recruiting participants, included religious and cultural barriers, participants who weighed more than 150 kilograms, and in addition, temporary reasons, for instance inebriated people. Nevertheless, the researcher was able to negotiate and persuade some of the participants to take part in this study by offering a variety of options, so as to

minimise the obstacles, such as offering a rescheduling of their appointment (see Section 5.16 Field Work Challenges)

5.10.4.2.4 Outcome of the recruitment process

Either pre-notification letters or phone calls were used to notify 200 out of 512 Libyan adults whose names had been drawn from the Benghazi electoral registry for the pilot study. Calculating the percentage of the research participants who were informed by post or phone calls about the pilot study, the researcher found that 153 (76.5%) of the participants were informed about forthcoming research via phone, while 47 (23.5%) were informed via pre-notification letters mailed to them by the post office (see Table 2.1 below for details).

Table 5.2 The percentages of participants informed whether by the phone calls or the post office in each polling district for the pilot study.

S.N.	Polling district name	Number of the participants for each polling district (Sample size of the pilot study n = 200)	Number of participants informed by a phone call in each polling district	Number of participants informed by post in each of in each polling district
1	Al-Fuwayhat	28	21	7
2	Al-Kwayfiya	36	28	8
3	RaasAbayda	29	20	9
4	Laithi	41	32	9
5	Al-Hadaa'iq	66	52	14
Total		200	153 (76.5 %)	47 (23.5%)

The outcome of the recruitment of the research participants in each of the polling districts for the pilot study. It depicts the total numbers of ineligible participants (15); refused participants (outright refusal) (14); participants who were not approached (12); and those who did not complete questionnaires (3). The total number of participants who took part in this pilot study was 156 (60 males; 96 females or 61.5%) (see Table 5.3 (below) for details).

Table 5.3 Outcome of the recruitment of the participants in each of the five polling districts for the pilot study (n=156).

Name of Polling districts	Number of ineligible participants	Number of the participants who refused	Number of the participants who not approached	Number of the Incomplete questionnaires	Completed questionnaires			Total of the participants
					Male	Female	Total	
Al-Fuwayhat	2	3	1	1	9	12	21	28
Al-Kwayfiya	1	2	3	1	11	18	29	36
Raas Abayda:	3	2	3	1	12	8	20	29
Laithi	4	1	2	Nil	15	19	34	41
Al-Hadaa'iq	5	6	3	Nil	13	39	52	66
Total	15	14	12	3	60	96	156	200

5.10.4.2.5 Estimating the response rate for pilot study

I hypothesised that the response rate for this study would be approximately 75% (see Section 5.3). The actual response rate achieved in the pilot study was 78%: slightly higher than estimated. The response rate obtained in each polling district which ranges from 69%, in RaasAbayda, to 81%, in Al-Kwayfiya (see Table 5.4 (below) for details).

Table 5.4 Clarifies the response rate in each polling district and the overall response rate for the pilot study.

Polling district	Response rate achieved for each polling district
Al-Fuwayhat	$\frac{21}{28}$ x10= 75 %
Al-Kwayfiya	$\frac{29}{36}$ x100= 81 %
RaasAbayda:	$\frac{20}{29}$ x100 = 69%
Laithi	$\frac{34}{41}$ x100 = 83%
Al-Hadaa'iq	$\frac{52}{66}$ x100 = 79 %
The overall response rate in the pilot study	$\frac{156}{200}$ x100 = 78 %.

5.10.4.3 The home visits and physical measurements

5.10.4.3.1 An effective method for taking anthropometric measurements

Given that Libyans have a conservative culture and religious rules (Falola et al., 2012), it was challenging for the male researcher to conduct this survey, as a number of anthropometric measurements were required from females that might belong to several religious or conservative tribal families. For this particular reason, the researcher piloted this study, in order to investigate how to solve this issue if and when confronted by it. Therefore, the researcher sought and obtained an official letter from the regional health sector in Benghazi to allocate male and female nurses to each of the polling districts (see Appendix 5.34). The recruitment of two nurses (one male and one female) in each district facilitated the researcher in obtaining anthropometric measurements on home visits, and helped to ensure the validity of the anthropometric measurements. Female nurses were allocated to take the anthropometric measurements of female participants, aligned with cultural norms (see protocol for taking anthropometric measurements in Appendix 5.15& 5.16). This helped to minimise religious and cultural obstacles, thereby helping to maximise recruitment rates. This method was viable, enabling us to obtain anthropometric measurements from all the female participants, including from religiously devout women.

5.10.4.3.2 Estimating the distances between two consecutive visits

The estimated distance between the participants' homes or clinics in each of the districts ranged from 2-4 miles (3.2-6.4 kilometres) and took around 7-15 minutes to travel (see map in Appendix 5.31). I learned to leave early for initial visits to allow time for unexpected events and to call prior to embarking on the next journey to ensure that the participants were available as planned. However, communication using mobile phones was not viable with some of the participants, due to unavailable or out-dated phone numbers since the commencement of this study. Hence, I had made contact with those research recruits by post, and scheduled my visits to them in those slots on my timetable that had not been booked by the participants whom had I already contacted (see Appendix 5.30).

5.10.4.3.3 Scheduling home visits

The appointment time had to comply with the protocols of Islamic and Libyan culture, thus, early mornings and late evenings were avoided. Moreover, I needed to ensure the protection of the two nurses who accompanied me on the home visits and therefore visiting times were

between 9h00 and 18h00, except at the weekends, when they varied. On Friday afternoons, appointments were from 14h00 due to prayer times, and some participants requested meeting at 11h00 on Saturday morning. The timing of visits for evening meant that I often drove back home in an unsafe environment and was therefore susceptible to assault by militias.I computed that the maximum number of questionnaires that could be collected per day was 14 from when I started the actual fieldwork for the pilot study (which ran for two weeks from 4-18 February 2014) (Appendix 5.30). No data was collected on 17 February, as this was the third-year anniversary of the 2011 Libyan revolution and an official holiday.

5.11 Details of the main fieldwork procedure

The data collection for this main study occurred from the 3rd-27th December 2014 between 9:00am and 18:00pm.Howeverat the weekend, it started at 14:00pm on the Friday afternoon and at 11:00am on the Saturday morning, similar to the method conducted in the pilot study . One consideration the researcher had to take into account was that December 24th was an official holiday to celebrate the anniversary of Libya's independence; therefore, the researcher avoided collecting data on that specific day. The same steps of the pilot study was applied in the main study, in other words, once finished documented all tasks and remarks in the diary, the researcher formulated the visiting logs for the participants in the five selected polling districts and then integrated them with the home visiting logs of the pilot study (see appendix 5.30). Additionally, a fieldwork diary, which has been documented and enclosed at the end of my thesis (see Appendix 10).

I distributed 200 of 512 questionnaires in the pilot study and attained a response rate of 78%. The outstanding questionnaires that were required to be distributed in the main fieldwork were 312. I followed the same calculation method used for the total sample and the pilot study to determine the number of the participants in each polling district.

Having calculated the number of outstanding participants who were recruited in the main study in each of the five polling districts, the next step was to notify each individual, either by phone (via the allocated workers belonging to the communication agency)or by post based on the mean viability. The summary findings of the main fieldwork comprising outcome of the recruitment process of the study participants (see Appendix 5.36), while estimating the response rate for the whole study is shown in the findings (Chapter 6).

5.12 Fieldwork challenges

The task of data collection for this study has been both challenging and rewarding. The study involved approximately 401visits to Libyan adults, aged 20-65 years, in various districts in Benghazi. The meeting locations were varied, ranging from the participants' homes to a clinic, other public places or, a meeting at a mutually agreeable place, if requested by the participants. It was revealed that most females preferred to meet at the clinics in the regions where they live, as they appeared to feel more comfortable with this. Despite the tremendous challenges encountered during the fieldwork, varying from simple logistic obstacles to daunting safety situations, the researcher attempted to minimize some of them through support from the supervisory team and the official host bodies of the study. The next section discusses in details all obstacles that the researcher encountered while conducting the fieldwork

5.1 Despite notifying the study participants in advance, either over the phone or by post to inform them of the forthcoming survey, in order to minimise the non-response rate, several of them were unavailable at home during the scheduled time for the home visit. However, a number of people were not approached for a variety of reasons. The main reason was that the crime rates are currently extremely high in Libya, due to a proliferation of weapons and chaos related to the civil unrest. Consequently, several homes are guarded by fierce dogs and locked gates, with a number of the large blocks of flats often guarded by security guards who control access. My fieldwork was at times hindered by these factors, and therefore, it was not possible to contact some of the research participants who had been sent information by post, especially very wealthy people who have a tendency to have security guards at their gates.

5.2 Although respondents' phones worked and the allocated workers belonging to the communication agency (see Section 5.12.1 'recruitment procedures' for details) texted them, some of the potential participants were reluctant to answer phone calls and moreover, never texted back. In such cases, I sent them a pre-notification letter by post. In most districts, it was revealed that females were less willing than males to respond to phone calls. A possible reason is that females in Libyan culture are averse to taking unknown calls or, their unwillingness is because most 'unknown' calls are from bill collectors, scammers, wrong numbers or individuals causing harassment. Two male and two female employees from the reliable communication agency were allocated in this study to contact the research participants via phone (see Section 5.12.1 for details). However, they were unable to persuade all of the participants to participate in this study; some simply refused (i.e., an outright refusal). Several

of them simply terminated the phone call, possibly out of disinterest, from fear or embarrassment at having to talk to a stranger, tiredness or because they did not feel like talking. For example, five people said, *'I appreciate your study, but I have an urgent matter to attend to, so if you don't mind can you call me later.'* Despite calling them several times later, they refused to respond.

Nevertheless, to reduce the non- response rate, the researcher decided to post pre-notification letters to their homes. Some potential participants gave plausible reasons for their refusal, for example, they did not have enough time to contribute to the study because they were too busy, they had business to take care of or manage or, they were fully engaged with work. Other participants avoided talking to the commissioned workers over the phone, which inferred that they appeared reluctant to take part in this study without providing any explicit reasons, or even presenting the commissioned workers with an opportunity to talk with them. Thus, such kind of behaviour undertaken by some of the participants discouraged the commissioned employees from calling them back and minimised achieving this task.

5.3 Furthermore, in order to persuade these individuals to participate, the researcher gave the research participants the opportunity to choose slots on the visiting schedules sheet and also offered the chance to reschedule visits if the respondents wanted to defer to a more suitable time .While some agreed to postpone their participation until they had returned from work, others remained unwilling to participate; possibly due to the fact that they did not want to confront any health concerns which my study might evoke for them. Despite structuring the visits in this way, it was necessary to schedule some 'free-time' slots into the programme for when appointments ran over time or, there were other unexpected developments, such as a wind or sandstorm, which happened during the fieldwork days or, time-wasting by some potential participants when they considered our visits to be social visits and offered us hot or cold drinks in keeping with Libyan customs and traditions. In addition, taking advantage of the free time to visit participants who were informed by post, the researcher was unable to determine the time of the visits exactly.

5.4 A different obstacle that I encountered during my fieldwork was religious or cultural barriers. Some of the Libyans that the researcher approached are very religious and conservative Muslims. The Bedouin, for example, live in extended family groups, and it is the responsibility of the males, who are the head of the household, and who are often illiterate, to conduct all dealings with strangers. This made it difficult for me to visit Muslim women in

these groups, despite the fact that the female participants had agreed to take apart in the study over the phone and a female nurse accompanied the researcher during the home visits, so as to conduct the visit out of respect and in keeping with their cultural manner. However, this obstacle occurred infrequently over the course of this fieldwork, comprising a negligible percentage of the sample for this study and therefore, having only a modest affect on the overall results of the study. In contrast, I was fortunate to encounter many more educated heads of Bedouin households who allowed us to contact the relevant Muslim women, provided that they were accompanied by their husbands or male relatives (Mahram or unmarriageable kin) during the time of the home visits, as is consistent with Islamic rules. This served to compensate for some of the refusals and may contribute valuable information to this survey.

5.5 Four participants, all in different districts, weighed more than 150 kilograms. After they had agreed to participate and had completed their questionnaire, I invited them to come to the nearest clinic at their own convenience, so that nurses could take their anthropometric measurements. We agreed that the measurements obtained from these participants would be retained by the designated nurses, who worked at the clinic in the same district and who had accompanied me during the fieldwork, as this would enable me to obtain the required measurements directly from the nurses over the phone. Despite three of these participants reaching the clinic late, we eventually obtained all four required measurements. It was not necessary to weigh one of the participants; as he was recently discharged from hospital, he had copy of the discharge report and we were able to obtain his relevant measurements from the discharger report.

5.5 Another challenge was some participants could not complete the survey at the appointed time, for various temporary reasons. One reason was alcohol intoxication. A physical assessment by the qualified nurses to assess potential participants' capacities indicated that three participants were inebriated. Indicators included: alcohol smell on breath; glazed eyes; mood extremes; and slower-than-usual reactions. A second reason was illness. The family members of five potential participants informed us that the participant in question was ill and confined to bed. To minimise this matters the researcher offered each of them a rescheduled visit a few days later. However, I could only manage to complete one visit with a an individual who was under the influence after rescheduling the visits; whilst I was unable to complete the visits with the two other intoxicated people despite rescheduling the visits, because one of them was drunk again and the other was not approached. Moreover, time constraints with the

fieldwork and difficulty in estimating how long it would take those who were ill to recover were the main reasons that discouraged me from visiting them again.

5.6 Libya is presently witnessing its worst violence since the start of the revolution. Four years after the regime was overthrown by rebel forces, the country has been taken hostage by militants, whose loyalties are either to their local area or to Islamic extremist ideology. Given that the two out of the five districts were more hazardous than the others, I decided to visit both of them to assess the situation before conducting the main study, in order to identify if any precautions needed to be undertaken. As a consequence, I was informed that I should bring an updated letter from the Libyan institution, which the researcher is affiliated to, in order to be allowed to access these two particular districts. Therefore, I sought and obtained the approval letter from Omar Al-Mukhtar University and thus, submitted it to the officials in both districts, who granted me permission to enter into these places to conduct my research (see Appendix 5.37).

5.7 As a considerable number of people have fled Libya due to the deteriorating situation, several streets remain empty, and some properties which were destroyed have not yet been rebuilt. Furthermore, with regards to Benghazi, having defeated all the radical militias in the city, the army destroyed some militant leaders' houses, as they were being used as shelters for snipers and mercenaries, where Libyan government confirmed and announced that presence of foreign mercenaries within these radical militias. However, in certain areas residents are beginning to gain more trust with regards to the situation as it has become more settled than before, hence, they have returned to their homes and are sharing in the reconstruction. I noted that the official army and police have also resumed their normal day-to-day activities after liberating Benghazi from various militias. Thus, the residents are gradually returning to the streets to resume their work and daily routines (see Appendix 5.38).

5.8 It was very difficult for the researcher to obtain some photographs in the devastated districts of Benghazi. This was due to the fact that the army was deployed in these areas and the soldiers would probably have prevented me from taking any pictures, as this might have demonstrated their loyalty to the state despite, no negotiations having occurred about this matter. Deploying the army on the streets is probably related to protecting people and keeping places more secure than before, and until most of the residents return to their homes. Despite this obvious challenge, I was able to take several photos describe how residents in Benghazi are suffering and struggling with their living due to the deteriorating current situation in Benghazi.

Consequently, I obtained a number of photographs even though I did not expect to do so (see Appendix 5.38).

5.9 Although some people have returned to their homes after a long period of fighting between the official army and pro-government forces against Islamist militias, the general environment has deteriorated. For instance of struggling with their lives is that the residents have to stand in long queues for many hours, in order to refill gas cylinders and there are frequent power outages, which impacts on phone signals and the internet connection. In fact, most of the internet infrastructure has been destroyed. In addition to this, there are interruptions to the electricity supply every day in the majority of districts in Benghazi due to a power grid that is prone to blackouts, as a result of damage to the main electricity supply (see Appendix 5.38). The next chapter presents the quantitative data analysis and findings.

Chapter Six : Quantitative data analysis and findings

6.1 Introduction

This chapter presents the data analysis and findings of the first research question: 'What are the risk and protective factors associated with obesity amongst adults aged 20-65 in Benghazi, Libya?' Four hypotheses were formulated to address this research question. This chapter starts by estimating the response rate for the whole study. It then presents the findings of the main study including the statistical methods used in this study to analyse the data, after cleaning, grouping and regrouping (recording) it, namely, a descriptive analysis of demographic characteristics, bi- and multivariate analysis and inferential statistical analysis to examine the statistical relationships between BMI and the aforementioned four predictor variables.

6.2 Estimating the response rate for the whole study

The actual response rate achieved in the whole study was identical to that achieved in the pilot study: 78%, which was slightly higher than the estimated response rate (75%) (see Chapter 5, Section 5.12, lessons learned from the pilot study). This increases the likelihood that the sample is representative of the population. Table 6.1 (below) shows that the response rate obtained in each polling district ranged from 72%, in Al-Fuwayhat and RaasAbayda, to 82%, in Laithi.

Table 6.1 The response rate in each polling district and the total response rate for the whole study.

Polling district	Response rate achieved in each polling district
Al-Fuwayhat	$\frac{51}{71}$ x100= 72 %
Al-Kwayfiya	$=\frac{75}{92}$ x10= 81.5= 82 %
Raas Abayda:	$=\frac{54}{75}$ x100= 72 %.
Laithi	$=\frac{86}{105}$ x100= 82 %.
Al-Hadaa'iq	$\frac{135}{169}$ X100= 80 %.
The total response rate of this study	$\frac{401}{512}$ x100= 78 %

6.3 Statistical analysis methods

The software used to perform data entry and analysis was Statistical Package for Social Sciences (SPSS, version 21.0; SPSS Inc. Chicago, IL, USA). All data was cleaned, and

subsequently data entry was undertaken concurrently with data collection until gathering of the data was complete. Moreover, all the entered data was cross-checked against the original questionnaires to ensure its accuracy.

6.3.1 Normality assumption test

The primary outcome variable (BMI) was tested for normality numerically, while normality was also verified visually with reference to the frequency distribution (histogram), boxplot, P-P plot (probability-probability plot), and quantile-quantile plot (Q-Q plot). The two main normality tests supplementary to the graphical tools for the assessment of normality are the Kolmogorov-Smirnov statistic (K-S test) and the Shapiro-Wilk statistic test ($p > .05$). The K-S test is a common non-parametric goodness-of-fit test that compares the measured data distribution function with the normal distribution function. In addition, the Shapiro-Wilk test was recommended as the best choice for testing the normality of data (Field , 2003; Ghasemi, A., & Zahediasl, 2012; Oztuna et al., 2006). Thus, both the K-S test and the Shapiro-Wilk were calculated for BMI to assess normality.

An assessment of the normality of data is necessary for identifying the appropriate statistical tests utilised to analyse these data. If the data are well-modelled by a normal distribution, then parametric tests can be used, but if the data follow no specific distribution then distribution-free or nonparametric tests should be used. As mentioned above, two main approaches to assessing normality can be distinguished: numerical (relying on statistical tests) and graphical (relying on visual inspection). To determine whether the data follows a normal distribution or not, the distribution of the outcome variable (BMI) was checked whether or not it fits a normal distribution.

Table 6.2 (overleaf) presents the results from the two well-known numerical tests of normality: the K-S test and the Shapiro-Wilk test. The values of the K-S test and the Shapiro-Wilk test were $p = .000$ ($p < .05$).In addition, a visual inspection of the distribution of the histogram, boxplot, probability-probability plot (P-P plot), and quantile-quantile plot (Q-Q plot) demonstrated that the BMI did not follow a normal distribution, with a skewness of 0.818 (0.122) and kurtosis of 0.725 (0.234).

Table 6.2 Results of the tests of normality: The K-S test and the Shapiro-Wilk test

Outcome variable	Kolmogorov-Smirnov[a] (K-S test)			Shapiro-Wilk		
BMI Values	**Statistic**	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
	.074	**401**	**.000**	**.958**	**401**	**.000**

a. Lilliefors Significance Correction

Given that the *p*-values for both the K-S test and the Shapiro-Wilk test were less than .05, the distribution of data did not meet the assumption of normality. Thus, the distribution of the outcome variable (BMI) did not fit a normal distribution, namely, that the data significantly deviated from a normal distribution then it is not normally distributed data. Consequently, non-parametric tests were employed in this study, rather than parametric tests.

6.3.2 Summary of variables used in the study

This study has measured three outcome variables, namely: Body Mass Index (BMI) (kg/m²), Visceral Fat Rating (1-12) and body fat percentage (BF%). However, BMI was the primary dependent variable (DV), and its association with the four main independent variables (IVs) was investigated. This section clarifies the nature of these variables, which are categorical and were classified into two major types:

6.3.2.1 Dependent variable (DV) (outcome variable): BMI ≥30kg/m²

BMI (kg/m²) was classified into three main patterns based on the kind of test used. Having used a variety of tests (Chi-Square (X^2) test; Spearman's rho test ;and logistic regression analysis), the BMI was recoded to align with the assumptions of the chosen tests. Three models of BMI categories were employed to assess the statistical strength of the association between the four main, selected contributing or determining factors and the dependent variable (BMI):

- First pattern: BMI was used as a continuous variable in order to perform Spearman's rank correlation coefficient (Spearman's rho) test, which was used to test the relationship between the outcome variable (BMI) and each of the following predictor variables: the anthropometric measurement (Gierach et al., 2014); duration of residence in Benghazi (Shah et al., 2015); unhealthy eating behaviour (Greenwood et al., 2008); and PA and sedentary behaviour (Singh & Purohit, 2011)

- Second pattern: BMI was recoded into three categories as follows: underweight (BMI < 18.5), normal weight (18.50 - 24.99), overweight (25.00 ≤ BMI < 30.00), and obese (I, II, III: ≥30.00), in order to perform Chi-Square (X^2) test, which was was used to test the relationship between the outcome variable (BMI) and each of the following predictor variables: socio-demographic factors (age, gender and ethnicity, religion) and SES (Chamieh et al., 2015; Chukwuonye et al., 2013; Oyeyemi et al., 2012).

- Third pattern: BMI was coded into two categories as follows: not obese (< 25.00) and obese (≥25.00), in order to perform a binary logistic regression analysis, which was performed to examine the relationship between the outcome variable (BMI) and each of the following predictor variables: SES components (education level, income, or occupational status) (Chamieh et al., 2015; Chukwuonye et al., 2013); PA and sedentary behaviour (Singh & Purohit, 2011) ; and unhealthy eating behaviour (Adole & Ware, 2014; Anderson et al.,2011), and neighbourhood environment attributes (Oyeyemi et al., 2012).

6.3.2.2 Four independent variables (IVs)

The four independent variables (IVs) are discussed in turn.

6.3.2.2.1 Socio-economic status (SES)

Numerous studies in developing countries, including the EMR (Chamieh et al., 2015; Chukwuonye et al., 2013; Fouad et al., 2006; Navadeh et al., 2011), used the WHO Stepwise questionnaire to investigate the association between SEM and obesity. They also used the standardised analytical technique, which relied on converting the variables as follows.

Educational level was coded into three categories for descriptive analysis and regression analysis:
- Low level: No formal schooling, or primary school completed.
- Moderate level: Secondary school and high school completed.
- High level: College/university completed; post -graduate degree.

Occupation was coded into two categories for descriptive analysis and regression analysis:
- Employed: Government employee, non-government employee, self-employed, non-paid, student.

- Unemployed: retired, housework, unemployed (able to work) and unemployed (unable to work).

The logical reasons behind converting occupation as mentioned in the adopted questionnaire (the WHO Stepwise questionnaire), into two codes (employed and unemployed) is because priority should be given to investigating the association between obesity and employment in terms whether the participants are employed or unemployed, especially in a country in which the obesity epidemic has not previously been studied. However, other aspects of occupation can be tested in terms of their relationship with obesity in the future research. Another reason is that it is difficult to convert the list of occupations in the WHO Stepwise questionnaire into other codes such as skilled or unskilled occupations, because the formulated questionnaire determines the type of occupation and ignores other measures of obesity in advanced research which distinguishes between skilled and unskilled occupations. Therefore this study has followed the procedures used by previous evidence-based studies (Chamieh et al., 2015; Chukwuonye et al., 2013). Such studies converted a list of occupations into the sub-categories of 'unemployed' and 'employed'. This is aligned with the pragmatic stance which guided this study. In addition, as obesity has not previously been studied in Libya before, it made sense to use the binary-coded employment status.

Finally, income level was coded into three categories for descriptive analysis and logistic regression analysis:
- Low income: <500 & 500-999 Libyan Dinar (LYD).
- Moderate income: 1,000-1,999 & 2,000-2,999 LYD.
- High income: 3,000-3,999 & 4,000-5,000 LYD.

6.3.2.2.2 Unhealthy eating habits

- First pattern: Unhealthy eating habits were used as a continuous variable in order to perform the Spearman's rank correlation coefficient (Spearman's rho) test.

- Second pattern: Multivariate linear regression analysis was inapplicable for this study because it failed to find an association between any of the unhealthy eating habits and BMI, and all results diverged from those obtained by performing the Spearman's rho test. Therefore, it was logical to use the alternative option, namely, a binary logistic

regression analysis which provides similar results those obtained from using Spearman's rho test. Hence, each unhealthy eating habit was coded two categories, in order to perform the logistic regression analysis.

The variables of various aspects of unhealthy eating habits investigated in this study will now be discussed.

6.3.2.2.2.1 Fast-food consumption

Aligned with Anderson et al. (2011) and Li et al. (2009), I coded fast food consumption per week as a binary variable in order to conduct binary logistic regression analysis:

- Low fast food consumption: ≤ 3 times per week,
- High fast food consumption: >3 times per week.

6.3.2.2.2.2 Consumption of sugar-sweetened beverages (SSBs)

Aligned with Kristal et al. (2015) and Mathias et al. (2012), I coded consumption of SSBs as a binary variable in order to conduct binary logistic regression analysis:

- Low & moderate beverages consumption: ≤ 3 times per week,
- High beverages consumption: >3 times per week.

6.3.2.2.2.3 Fruit and vegetable (FV) consumption

It has been suggested that the individuals who eat more than five servings of fruits and vegetables per week have a lower risk of chronic diseases, compared with individuals who eat less than three servings per day (He et al., 2007). Aligned with Greenwood et al. (2008), this study combined the responses for the questions about fruit and vegetable and coded consumption of FV into two categories for performing the logistic regression test:

- fruit and vegetable consumption >3 times a day,
- fruit and vegetable consumption ≤3 times daily.

6.3.2.2.2.4 Breakfast consumption

In this study, the responses were summed to give a total number of times breakfast was consumed within a 7-day period. Aligned with previous studies (Adole & Ware, 2014; Corder et al., 2014; Liu et al., 2013), this study coded breakfast consumption as a binary variable:

- Irregular breakfast consumption: ≤ 3 times a week,
- Regular breakfast consumption: >3 times a week.

6.3.2.2.2.5 Large portions of food consumption

Aligned with Ledikwe et al. (2005) and Livingstoneand and Pourshahidi (2014), fast-food consumption per week was coded into a binary variable in order to conduct binary logistic regression analysis:

- Low fast-food consumption: Uncommon intake all food served: Never, and rarely
- Common intake of all the food served: Occasionally, sometimes, often, usually and always.

6.3.2.2.2.6 Engaging in physical activity (PA)

The WHO recommendation stipulates that people should engage in physical activity three times per week or more. Aligned with previous studies (Gómez, 2005; Zlot et al. 2011), PA was coded into a binary variable in order to conduct binary logistic regression analysis:

- Irregular physical activity: ≤ 3 times per week
- Regular physical activity: >3 per week.

6.3.2.2.3 Physical activity (PA) and sedentary behaviour (SB) patterns

This study complied with the Global Physical Activity Questionnaire (GPAQ) Analysis Guide (WHO, 2015a). Previous studies on obesity (Singh & Purohit, 2011) have adhered to the analytical techniques as specified by the Global Physical Activity Questionnaire (GPAQ) Analysis Guide (WH0, 2015). Accordingly, the present study adhered to these analysis techniques, which were applied to address the third hypothesis of this study.The GPAQ collects information on three domains: activity at work, travel to and from places, and recreational activities. For analytical purposes, these domains can be further broken down into six sub-domains:

• Vigorous work (codes P1-P3)

• Moderate work (codes P4-P6)

• Travel (codes P7-P9)

• Vigorous recreation (codes P10-P12)

• Moderate recreation (codes P13-P15)

• Sitting (code P16)

Total physical activity or metabolic-equivalent-of-task (MET) minutes per week equals the sum of the total MET minutes of activity computed for each setting. The equation is as follows:

Total Physical Activity MET-minutes/week = [(P2 * P3 * 8) + (P5 * P6 * 4) + (P8 * P9 * 4) + (P11 * P12 * 8) + (P14 * P15* 4)]

The WHO recommends that the normal recommended range of PA is: Total Physical Activity MET minutes per week ≥600. Accordingly, the Total Physical Activity MET minutes per week was converted into two categories for regression analysis as follows:

- Irregular physical activity: MET minutes per week is ≤ 600,
- Regular physical activity: MET minutes per week is >600).

This was done to perform binary logistic regression analysis in which the dependent variable is binary or dichotomous.

6.3.2.2.4 Neighbourhood environment attributes

Although Sallis et al. (2010) suggested how the items of PANES questionnaires can be categorized into different constructs as follows: (Residential Density: item 1; Land Use Mix: items 2 and 17; Transit Access: item 3; Pedestrian Infrastructure: items 4 and 13; Bicycling Infrastructure: items 5 and 14; Recreation Facilities: item 6; Street Connectivity: item 12; Crime Safety: items 7 and 16; Traffic Safety: items 8 and 15; Pedestrian Safety: item 9; Aesthetics: item 10; vehicles in household: Item 11), however, other researchers argue that it is workable to maintain all items and coded them into binary codes when analyse the data collected using the PANES questionnaires (Ishii et al.,2010; Liao et al, 2011). Therfore , aligned with previous studies in Japan by Inoue et al. (2009), Ishii et al. (2010) and Liao et al. (2011), and another study conducted in Najera by Oyeyemi et al. (2012), these studies used the following procedure to code and analyse the PANES instrument. The 17 environmental variables were converted into binary items in order to perform binary logistic regression analysis.

- Low residential density was coded as detached single-family housing.
- High residential density was coded as the other four housing types.

A four-level Likert scale was used: (Agree: Strongly agree and agree & Disagree: Strongly disagree, disagree). This study used the same strategy used by Oyeyemi et al. (2012), and Japanese researchers to analyse the collected data using the PANES tool, as well as it used the categorising items of the PANES tool , which suggested by Sallis et al. (2010), in the discussion of the obtained results similar to perious study (Liao et al, 2011Oyeyemi et al. 2012).

A further detailed list of these variables and how the four pre-existing questionnaire were coded / recoded is outlined in Appendix 6.1.

6.3.3 Nonparametric Statistical Methods

6.3.3.1 Data analysis technique 1: Univariate analysis

6.3.3.2 Descriptive statistics

A single variable has three major characteristics that tend to be presented and considered according to the aims and objectives of research studies: distribution, central tendency, and dispersion. Descriptive statistics were computed to show the characteristics of the sample in relation to socio demographic data, SES, Unhealthy eating habits, PA and sedentary behaviour and neighbourhood environment attributes,while frequency statistics showed percentage distributions, percentiles, means, standard deviations, and medians.

6.3.3.2.1 Metabolic Equivalents (METs)

Metabolic Equivalents (METs) are a physiological measure used to analyse GPAQ (Global Physical Activity Questionnaire) data (WHO, 2015a). According to the WHO, a MET is commonly used to assess physical activity. It is defined as the ratio of the work metabolic rate to the resting metabolic rate. One MET is defined as 1 kcal/kg/hour and is roughly equivalent to the energy cost of sitting quietly. For the analysis of GPAQ data, existing guidelines have been adopted. That is, it is estimated that, compared to sitting quietly, a person's caloric consumption is four times as high when being moderately active, and eight times as high when being vigorously active. Therefore, when calculating a person's overall energy expenditure using GPAQ data, four METs are assigned to the time spent in moderate activities, and eight METs to the time spent in vigorous activities.

For the analysis of GPAQ data (WH0, 2015), existing guidelines were adopted. It is estimated that, compared to sitting quietly, a person's caloric consumption is four times higher when being moderately active, and eight times higher when being vigorously active. Therefore, for the calculation of a person's overall energy expenditure using GPAQ data, the following MET values were used across three domains (work, travel and leisure):

- 4 METs assigned for time spent in moderate activities,
- 8 METs to the time spent in vigorous activities.

To assess physical activity, MET scores were calculated separately for individual domains and sub-domains. For the calculation of a categorical indicator, the total time spent in physical activity during a typical week and the intensity of the physical activity were taken into account. Within the course of a week, adults should engage in the following PA for work, during transport and leisure time:

• 150 minutes of moderate-intensity physical activity OR

• 75 minutes of vigorous-intensity physical activity OR

• An equivalent combination of moderate- and vigorous-intensity physical activity, achieving at least 600 MET-minutes.

6.3.4 Data Analysis Technique 2: Comparing Means – Statistical Testing

Among different types of multiple comparisons available to determine which means differ are the post-hoc testing of one-way analysis of variance (ANOVA). This is a statistical test to determine whether the test statistic has an F-distribution under the null hypothesis. A post-hoc, multiple comparison test that does not assume equal variances is Tamhane's T2. This post-hoc test is generally the preferred test for conducting post-hoc tests in a one-way ANOVA, although there are a number of other tests that are available. Tamhane's T2 was used to determine where the differences occurred between groups. The Mann-Whitney U test was used for comparisons of subgroups within the following variables: gender, marital status, and occupation. In contrast, a rank-based nonparametric investigation called the Kruskal-Wallis H test was used to determine if there are statistically significant differences between the means of the subgroups of the following predictor variables: education and income levels.

6.3.5 Data Analysis Technique 3: Bi- and multivariate analysis

Following the univariate analyses, bi- and multivariate inferential statistical tests were conducted by computing cross-tabulations of selected variables to develop the contingency tables. A *p*-value less than or equal to 0.05 was considered statistically significant.

6.3.5.1 Inferential statistics

6.3.5.1.1 Cross-tabulation analysis

Cross-tabulation analysis, also referred to as contingency table analysis, is a powerful technique that helps to describe the relationships between categorical (nominal or ordinal)

variables. The cross-tabulation can produce the following statistics: observed counts and percentages, expected counts and percentages, and a Chi-square statistic.

6.3.5.1.2 Associations

A Chi-square (X^2) statistic is used to investigate whether distributions of categorical variables differ from one another. It is used to test an association between two categorical variables according to the following assumptions: the two variables should be measured at an ordinal or nominal level (i.e., categorical data), and the variable should consist of two or more categorical, independent groups. Chi-Square tests (X^2) were performed to test for any association between the predictor variables (for example socio-demographic factors (age, gender and ethnicity, religion) and SES) and the outcome variable (BMI).

6.3.5.1.3 Correlations

Correlation is a bivariate analysis that tests the strength of association between two variables. The correlation coefficient ranges from -1 to +1. Spearman's rank correlation coefficient (Spearman's rho) test was used to determine the correlation between BMI and the anthropometric measurement variables as well as the relationship between BMI and the length of residence in Benghazi. In addition, it was used to test the relationship between the independent variables, namely, physical activity and sedentary behaviour and unhealthy eating behaviour, and the outcome variable (BMI). Furthermore, Spearman's rho test was used to compute the correlation between two continuous random variables, namely, the physical activity categorical indicator (CI), sedentary behaviour, and BMI.

6.3.5.1.4 Logistic regression analyses

Logistic regression analyses were carried out to investigate the association between the four main selected, contributing or determining factors, and the dependent variable (BMI). Logistic regression is a powerful statistical technique for modelling a binomial outcome with one or more predictor variables. The logistic regression can include more than one dependent variable, and these can be dichotomous, ordinal, or continuous. In addition, logistic regression provides a quantified value for the strength of the association, adjusting for other variables (removing confounding effects). The exponential of the beta coefficient corresponds to the odds ratio for the given factor. In addition, logistic regression analysis can identify which explanatory variables independently predict an outcome from all the others. Despite both Peng et al. (2002) and Spicer (2004) recommending caution when dealing with log likelihood statistics in logistic

regressions, the model summary table presents the results of the logistic regression using Nagelkerke's R^2 as a modification of Cox and Snell's pseudo R^2, with the latter unable to achieve a value of 1. Considering that Nagelkerke's R^2 value is normally a higher value than the Cox and Snell value, statisticians prefer to report Nagelkerke's R^2 than the Cox and Snell value.

The Chi-square test and logistic regression are not entirely different analyses. Both techniques test the association between two variables, although logistic regression entails fewer assumptions. For instance, logistic regression enables one to test the associations between two or more explanatory variables instantaneously. Moreover, explanatory variables for the Chi-square test must be categorical. However, in the case of two or more independent variables, the Chi-square test is not able to look at the association between independent variables. In such cases, logistic regression should be used to remove any confounding effects. Adjusted odds ratios (ORs) together with confidence intervals (CI) of 95% were calculated for each variable.

6.3.5.1.5 Statistical analysis to eliminate confounding effects

In contrast to selection or information bias, confounding is a category of bias that can be adjusted after collecting data, using statistical models (Bryman, 2012; Pourhoseingholi et al., 2012). To control for confounding in the analyses, researchers should compute the confounders in the study. Researchers usually achieve this by collecting data on all recognised, previously identified confounders (McNamee, 2005; Pourhoseingholi et al., 2012). There are two main possibilities for dealing with confounders in the analysis stage: stratification and multivariate methods (Pourhoseingholi et al., 2012). Multivariate models are arguably the best technique for managing numerous of covariates or confounders simultaneously (Pourhoseingholi et al., 2012). Three main multivariate models can be utilised to eliminate the confounders: logistic regression, linear regression and analysis of covariance. To adjust for potentially confounding variables, the researcher relied on statistical models, especially binary logistic regression model, which are flexible enough to eliminate the effects of confounders (Pourhoseingholi et al., 2012). Logistic regression is a mathematical model that is capable of yielding results that can be interpreted as an odds ratio. This odds ratio is termed the 'adjusted odds ratio' when its value is adjusted for the other covariates including confounders (Pourhoseingholi et al., 2012). Logistic regression is straightforward to practise using any statistical package. The distinctive feature of logistic regression is that it can control for a large number of confounders provided that a large enough sample size is used.

6.4 Findings of phase I

6.4.1 Descriptive and demographic characteristics

Table 6.3 (overleaf) depicts demographic information in relation to the participants in this study. Four-hundred and one Libyan adults, who have lived in Benghazi for over ten years and who were within the required age range of 20-65 years, participated; 253 were female (63.1%) and 148 were male (36.9%). Of the 401 participants, the highest proportion of participants were aged from 30–39 years (35.7%), whilst the lowest proportion of participants were aged from 60–65 years (3.7%). In addition, females had a higher participation rate than males in every age group.

The majority of respondents were married (67.1%), while those who have never married were (32.9%). With regards to ethnic groups; of the 401 participants (84.6%) were Arabic, Berbers 'Imazighen', (10.7%) and Toubou (4.7%). Regarding religion, all the participants in this study were Muslims (100%).Concerning level of educational attainment, 51.4% of the participants had acquired higher educational qualifications, 29.4% of the participants had attained moderate educational qualifications, while nearly 19.2% of the participants were illiterate or had only managed primary education. Of the 401 participants, 77.6% were working , while 22.4% were non-working. Nearly half of the participants (48.4%) earned a high income, 20.0% reported that they earned a moderate income, while 24.2% reported that they earned a low income.

Table 6.3 Summary of the demographic and SES characteristics of participants.

Demographic and Socio-Economic Characteristics	Frequency (Number)	Percentage (%)
Gender :		
Male (M)	**148**	**36.9%**
Female (F)	**253**	**63.1%**
Age:	**N (M& F)**	
20 – 29	**78 (27 & 51)**	**19.5%**
31 – 39	**143 (60 & 83)**	**35.7 %**
41 – 49	**115 (37 & 48)**	**28.7 %**
51 – 59	**50 (18 & 32)**	**12.5 %**
60 – 65	**15 (6 & 9)**	**3.7 %**
Marital Status:		
Single (Unmarried)	**132**	**32.9 %**
Married♦	**269**	**67.1 %**
Racial group:		
Arabic	**339**	**84.6 %**
Berbers 'Imazighen'	**43**	**10.7 %**
Toubou	**19**	**4.7 %**
Religion:		
Muslim	**339**	**100 %**
Level of education:		
Low educational level✱	**77**	**19.2 %**
Moderate educational level✱✱	**118**	**29.4 %**
High educational level✱✱✱	**206**	**51.4 %**
Occupation:		
Employed groups✦	**311**	**77.6 %**
Unemployed groups✦✦	**90**	**22.4 %**
Income: "Libyan Dinar (LYD)" ✱		
Low income: 0-999 LYD	**97**	**24.2 %**
Moderate income :1000 -2999 LYD	**80**	**20.0 %**
High income : 3000– 5000 LYD	**194**	**48.4%**
Missing	**30**	**7.5%**

Married♦: "Being married, divorced separated & widowed."
Low educational level✱: "No formal schooling; Less than primary school; Primary school completed."
Moderate educational level✱✱: "Secondary school completed; High school completed."
High educational level✱✱✱: "College/university completed; Post graduate degree."
Employed groups✦: "Government employee; non-government employee; Self-employed; non-paid & student."
Unemployed groups✦✦: "Housework; retired ; unemployed (able to work); and unemployed (unable to work). (**Libyan Dinar**

(**LYD) ✱** = 1/2 Pound under current exchange rate).

6.4.2 The prevalence of normal weight, overweight, and obesity

Table 6.4 (below) demonstrates that the prevalence of obesity amongst adults was 42.4%, whereas the prevalence of being overweight and being of normal weight was 32.9% and 24.7% respectively. In addition, the table 6.4 indicates that the prevalence of being overweight and obese was 75.3%, which is threefold higher than the prevalence of participants who were of normal weight. The table further depicts that the prevalence of obesity amongst men was 33.8%, while amongst women it was 47.4%; in addition, the rate for being overweight was 32.4% in men and 33.2% in women. However, what also interesting was that there were no underweight participants.

Table 6.4 The prevalence of normal weight, overweight, and obesity.

Three weight status categories (BMI categories)		Gender		Prevalence of normal weight, overweight and obesity in Libyan adults
		Male	Female	
Normal weight (BMI=18.5–24.9 kg/m^2)	(N)	50	49	99
	%	33.8%	19.4%	24.7 %
Overweight (BMI= 25–29.9 kg/m^2)	(N)	48	84	132
	%	32.4%	33.2%	32.9 %
Obese (BMI ≥ 30 kg/m^2)	(N)	50	120	170
	%	33.8%	47.4%	42.4 %
Total	(N)	148	253	401
	%	100%	100%	100%
Overweight & obese (BMI ≥ 25 kg/m2)	(N)	98	204	302
	%	24.4%	50.9%	75.3%

6.4.3 Mean and SD of anthropometric measurements

Table 6.5 (overleaf) demonstrates the means of participants' anthropometric measurements for all participants as follows: The mean weight was 82.21 (+/-17.47) kg; the mean height was 166.81 (+/- 9.15) cm; the mean BMI was 29.52 (+/- 6.19) kg/m², the participants' mean visceral fat was 10.42 (+/-4.1) and the mean Body Fat Percentage was 31.57 (+/-9.42%). Additionally, Table 6.4 reveals that males had a higher physical measurements values than females in terms of the mean weight which was 84.66 (+/-17.50) kg and the mean height which was 172.06 (+/- 7.68) cm for males. In contrast, females had a higher anthropometric measurement values than males in relation to other physical measurements where the mean BMI was 30.12 (+/- 6.54) kg/m², mean visceral fat was 10.65 (+/- 4.2) and mean Body Fat Percentage was 34.24 (+/-

9.42%) for females. Another category presented in Table 6.2 was the mean period of residence amongst males in Benghazi, which was 33.32 (+/-14.08) years. This was slightly lower than the mean period of residence amongst females, which was 34.81 (+/-13.82) years. The total period of residence amongst all the respondents was 34.25 (+/-13.92) years.

Table 6.5 Mean and SD of anthropometric measurements in Libyan adult population.

Physical Anthropometric characteristics	Male (N= 148) "Mean (+/- SD)"	Female (N= 253) "Mean (+/- SD)"	All participants (N= 401) "Mean (+/- SD)"
Weight values (kg)	**84.66 (+/- 17.50)**	**80.78 (+/- 17.33)**	**82.21 (+/- 17.47)**
Height values (cm)	**172.07 (+/- 7.69)**	**163.75 (+/- 8.54)**	**166.81 (+/- 9.15)**
BMI values (kg/m²)	**28.50 (+/- 5.40)**	**30.12 (+/-6.54)**	**29.52 (+/- 6.19)**
Visceral Fat Rating (1-12)	**10.04 (+/- 3.9)**	**10.65 (+/-4.2)**	**10.42 (+/- 4.1)**
Body fat %	**27.01 (+/- 7.31)**	**34.24 (+/-9.51)**	**31.57 (+/- 9.42)**
Period of residence in Benghazi (Years)	**33.32 (+/-4.08)**	**34.81 (+/-13.82)**	**34.25 (+/- 13.92)**

6.4.4 Bi- and multivariate analyses results

This section presents the association between BMI and anthropometric measurements including (weight, height, visceral fat rating and body fat). In addition, it outlines the relationship between BMI and socio-demographic factors consisting of (gender, age, marital status, racial group, religion and length of residence in Benghazi).

6.4.4.1 Association between anthropometric measurements and BMI

Table 6.6 (overleaf) shows the relationship between BMI and several anthropometric measurements variables including: weight, height, visceral fat, body fat percentage, and period of residence in Benghazi. Table 6.6 shows statistically significant rho =.854, p=.000); between BMI and visceral fat, which was statistically significant (rho =.448, p=.000); and between BMI and body fat percentage, which was statistically significant (rho = .658, p=.000). In addition, another moderate positive correlation was found between BMI and period of residence in Benghazi, which was statistically significant (rho =.130, p=.009). In contrast, a strong negative association was found between BMI and height values, which was statistically significant (rho =-.176, p=.000).

Table 6.6 The associations between BMI and anthropometric measurements and length of residence in Benghazi.

Physical Anthropometric characteristics	BMI values (kg/m²)	
	Spearman's rank test value (rho)	Sig P-Value
Weight values (kg)	.854	.000**
Height values (cm)	-.176	000**
Visceral Fat Rating (1-12)	.448	000**
Body fat %	.658	000**
Period of residence in Benghazi (Years)	.130	.009*

* p value of <.05 is statistically significant.

**p value of<.001 is highly significant.

6.4.4.2 Association between socio-demographic factors and BMI

Table 6.7 (below) shows that obese females constituted the highest percentage of the whole sample, that is, 29.9%. The second highest percentage was the overweight female, which constituted 20.9%, whilst the other BMI groups had approximately the same percentage in both genders. A statistically significant positive correlation was found between BMI and gender (p=.003).

Table 6.7 The associations between gender and BMI by subgroups.

Variable Category			Body Mass Index (BMI)				Chi-square (X^2)	Sig P-Value
			Normal weight 18.5–24.9	Overweight 25.0–29.9	Obesity 30.0 or greater	Total		
Gender	Male	(N)	50	48	50	148	11.98	.003*
		%	33.8%	32.4%	33.8%	100.0%		
		Total	12.5%	12.0%	12.5%	36.9%		
	Female	(N)	49	84	120	253		
		%	19.4%	33.2%	47.4%	100.0%		
		Total	12.2%	20.9%	29.9%	63.1%		
	Total	(N)	99	132	170	401		
		Total	24.7%	32.9%	42.4%	100.0%		

{Chi-squared statistic :(χ2); degree of freedom: (df); p=the p-value is (p≤ .05)}.
* p value of <.05 is statistically significant.

- Results with respect to association between other socio-demographic , age .marital status and racial group) and BMI (see Appendix 6.2).

- Results regarding variances of BMI means against demographic data (see Appendix 6.3).

- Results with respect to variances of BMI means against SES (see Appendix 6.4).

6.4.5 Statistical analyses to test the first hypothesis

H_0: There is no significant association between the BMI of Libyan adults and SES (measured by education level, income and occupational status).

H_1: There is a significant association between the BMI of Libyan adults and SES.

Firstly, descriptive statistics were used to explore percentage distributions of the three SES components amongst participants: education level, income, and occupational status. Secondly, were performed to test for association between BMI and SES. Logistic regression analysis was performed to examine the relationship between SES and obesity in Libyan adults, analysed according to gender. In addition, logistic regression analysis was used to identify the association between the three SES components themselves. Thirdly, logistic regression analysis was performed to examine the relationship between SES and obesity in Libyan adults and analysed according to gender after adjusting for socio-demographic factors. In addition, logistic regression analysis was used to identify which one of the three SES components (education level, income, or occupational status) independently predicts an outcome (BMI) from all the others.

6.4.5.1 Association between level of education and BMI

Table 6.8 (oveleaf) shows that the highest percentage of obese and overweight participants was amongst participants who had attained high educational qualifications, at 18.0% and 27.4% respectively. In contrast, the highest percentage of normal weight participants was amongst people who had attained low educational qualifications, at 12.2%. The Pearson Chi-Square test was used to test the relationship between the level of education and BMI. The table shows that there was a positive and statistically significant association between BMI and level of education (p=.000).

Table 6.8 Association between level of education and BMI

Variable Category			Body Mass Index (BMI)				Chi-square (X²)	Sig P-Value
			Normal weight 18.5–24.9	Overweight 25.0–29.9	Obesity 30.0 or greater	Total		
Levels of Education	Low	(N)	49	14	14	77	85.35	.00**
		%	63.6%	18.2%	18.2%	100.0%		
		Total	12.2%	3.5%	3.5%	19.2%		
	Moderate	(N)	26	46	46	118		
		%	22.0%	39.0%	39.0%	100.0%		
		Total	6.5%	11.5%	11.5%	29.4%		
	High	(N)	24	72	110	206		
		%	11.7%	35.0%	53.4%	100.0%		
		Total	6.0%	18.0%	27.4%	51.4%		

**P value of<.001 is highly significant

6.4.5.2 Association between level of income and BMI

Table 6.9 (overleaf) shows that the highest percentage of obese and overweight participants was amongst participants who earned a high income, at 31.8% and 11.3% respectively. The highest percentage of normal weight participants was amongst people who earned a low income, at 9.7%. The Pearson Chi-Square test was used to exam the relationship between level of income and BMI. This test revealed a positive and statistically significant association between BMI and level of income (*p*=.000).

Table 6.9 Association between level of income and BMI.

Variable Category			Body Mass Index (BMI)				Chi-square (X²)	Sig P-Value
			Normal weight 18.5–24.9	Overweight 25.0–29.9	Obesity 30.0 or greater	Total		
Income (Libyan Dinar (LYD)= 1/2 Pound)	Low 0-999	(N)	36	43	18	97	59.20	.000**
		%	37.1%	44.3%	18.6%	100.0%		
		Total	9.7%	11.6%	4.9%	26.1%		
	Moderate 1000 - 2999	(N)	20	38	22	80		
		%	25.0%	47.5%	27.5%	100.0%		
		Total	5.4%	10.2%	5.9%	21.6%		
	High 3000– 5000	(N)	34	42	118	194		
		%	17.5%	21.6%	60.8%	100.0%		
		Total	9.2%	11.3%	31.8%	52.3%		

**p value of <.001 is highly significant.

6.4.5.3 Association between occupation and BMI

Table 6.10 (**Error! Reference source not found.**) explains that the highest percentage of obese and overweight participants was found amongst who were employed, at 34.7% and 26.2% respectively. The Pearson Chi-Square test was used to test the relationship between level of BMI and occupation. The table shows that there was a statistically significant association between BMI and occupation (p=.023).

Table 6.10 Association between occupational status and BMI.

Variable Category			Body Mass Index (BMI)				Chi-square (X²)	Sig P-Value
			Normal weight 18.5–24.9	Overweight 25.0–29.9	Obesity 30.0 or greater	Total		
Occupation	Employed	(N)	67	105	139	311	7.58	.023*
		%	21.5%	33.8%	44.7%	100.0%		
		Total	16.7%	26.2%	34.7%	77.6%		
	Unemployed	(N)	32	27	31	90		
		%	35.6%	30.0%	34.4%	100.0%		
		Total	8.0%	6.7%	7.7%	22.4%		

* p value of <.05 is statistically significant.

6.4.5.4 Binary logistic regression for socio-economic status and BMI

The model summary table indicates that the model explains roughly 36.4% of the variation in the outcome for males. Additionally, the value of the Cox & Snell R^2 is 0.364, indicating a weak relationship of 36.4% between the predictors and the prediction. The Hosmer & Lemeshow goodness-of-fit test indicates that the model is a good fit to the data as $p=.49$ ($>.05$) for males and $p=.67$ ($>.05$) for females.

Table 6.11 (below) presents the results of the logistic regression analysis, which was performed to determine the independent predictive power of SES as an independent variable to obesity when sociodemographic factors were adjusted. The results of the logistic regression of education level, occupation and income show that all these variables were significantly related to obesity. A significant positive correlation was observed between BMI and education level (Exp (B) = 4.29; CI: 2.88–6.39), BMI and occupation (Exp (B) = .38; CI: .19–.72), and BMI and income (Exp (B) = 1.40; CI: 1.01–1.94). Notably, level of education was the strongest predictor of outcomes has the highest (Exp (B) = 4.29) compared to other predictor factors in this model, associated to increased risk of obesity.

Table 6.11 Association between SES and BMI using binary logistic regression.

socio demographic & Socioeconomic factors	Sig.	Exp (B)	95% CI for Exp(B)	
			Lower	Upper
Gender	.005	.44	.25	.78
Age	.494	.85	.54	1.34
Resident in Benghazi	.007	2.58	1.30	5.11
Marital status	.046	.53	.28	.99
Racial	.109	1.65	.89	3.05
level of education	.000	4.29	2.88	6.39
Occupation	.003	.38	.19	.72
Income	.044	1.40	1.01	1.94

OR: odds ratio; CI: confidence interval. The OR was calculated for all variables with 95% confidence intervals.

Adjusted for, gender, age, marital status, ethnicity, and being a resident in Benghazi. , education, occupation & income.

* P < 0.05

6.4.5.5 Gender-related differences in the association between SES and BMI

The model summary table indicates that the model explains roughly 47% of the variation in the outcome for males and roughly 32% of the variation in the outcome for females. Additionally, the Cox & Snell $R^2 = 0.47$, indicating a weak relationship of 47% between the predictors and the prediction. Likewise, the Cox & Snell $R^2 = 0.32$ indicating a weak relationship of 32% between the predictors and the prediction. The Hosmer & Lemeshow goodness-of-fit test indicates that the model is a good fit to the data as $p=.82$ ($>.05$) for males and $p=.67$ ($>.05$) for females.

Table 6.12 (below) shows the results of the logistic regression between SES and obesity in male and female adults. For males, a significant positive association was observed between BMI and education level (Exp(B) = .000; CI: 6.45–13.08), and between BMI and occupation (Exp(B) = .001; CI: .04–.47), but there was no association between BMI and income (Exp(B) = 1.19; CI: .70–2.01). For females, a significant positive association was observed between BMI and education level (Exp(B) = 3.69; CI: 2.20–6.19), and BMI and income (Exp(B) = 1.62; CI: 1.04–2.54), but there was no association between BMI and occupation (Exp(B) = .59; CI: .25–1.41). Notably, level of education in men was the strongest predictor of outcomes has the highest (Exp (B) = 6.45) compared to other predictor factors in this model, associated to increased risk of obesity.

Table 6.12 Gender-related differences in the association between SES and BMI

Socioeconomic factors	Male				Female			
	Sig P-Value	odds ratio (OR)	95% C.I. for EXP(B)		Sig P-Value	odds ratio (OR)	95% C.I. for EXP(B)	
			Lower	Upper			Lower	Upper
level of education	.000	6.45	3.18	13.08	.000	3.69	2.20	6.19
Income	.001	.14	.04	.47	.004	.38	.15	.96
Occupation	.525	1.19	.70	2.01	.035	1.62	1.04	2.54

OR: odds ratio; CI: confidence interval. The OR was calculated for all variables with 95% confidence intervals.

ªAdjusted for, gender, age, marital status, ethnicity, and being a resident in Benghazi. , level of education, occupation and income.

* P < 0.05.

6.4.6 Statistical analyses to test the second hypothesis

H₀: The BMI of Libyan adults is not significantly related to unhealthy eating habits, which involve a high consumption of fast foods and sugary beverages, large food portions, a high frequency of skipping breakfast, eating less than five daily portions of fruit and vegetables, and engaging in physical activity.

H₁: The BMI of Libyan adults is significantly related to unhealthy eating habits.

Firstly, descriptive statistics were used to explore percentage distributions of participants' unhealthy eating habits were identified. Secondly, the association between BMI and the variable 'unhealthy eating habits' was examined using Spearman's rank-order correlation. Thirdly, logistic regression analysis was performed to examine the relationship between 'unhealthy eating habits' and obesity in Libyan adults and analysed according to gender after adjusting for socio-demographic factors and SES.. In addition, logistic regression analysis was used to identify which one of the three SES components unhealthy eating habits' patterns independently predicts an outcome (BMI) from all the others.

6.4.6.1 Descriptive data analysis of unhealthy eating habits of participants.

Table 6.13 (overleaf) demonstrates a summary of the averages of the variables denoting unhealthy eating habits and physical activity at a yesterday /last week and a typical day/week in Libyan adults. The average frequency of consuming a meal or snack from a restaurant, or fast food intake for a Libyan adult was 1.37 (+/- 0.8) times for a typical day and 5.54 (+/- 3.1) times for a typical week. The mean intake of sugar-sweetened beverages (SSBs) for a Libyan adult was 3.15 (+/- 1.2) cans or times yesterday and 3.68 (+/- 1.23) cans or times for a typical day . The average number of portions of fruit and vegetables consumed by a Libyan adult was 2. 53(+/-1 .24) portions yesterday and 3.13(+/- 1.42) portions for a typical day. The average frequency of regular breakfast consumption per week amongst Libya adults was 3.18 (+/- 1.83) times for a typical week. The average frequency of consuming large portion sizes at one sitting by Libyan adults was 3.19 (+/- 1.84) at one meal sitting. The table also demonstrates that average number of times Libyan adults performed physical activity was 2.03 (+/- 1.49) times last week and 2.70 (+/- 1.56) times for a typical week.

Table 6.13 Summary of the mean and SD of 'unhealthy eating habit patterns'.

Unhealthy eating habits	Yesterday /last week "Mean (+/- SD)"	A typical day/week "Mean (+/- SD)"
The amount of fast food intake	NA	1.37 (+/-0.8) times/ typical day 5.54 (+/-3.1) times/ typical week
The amount of sugar sweetened beverages intake	3.15 (+/-1.2) times/ yesterday	3.68 (+/-1.23) times/ typical day
The amount of vegetable and fruit intake	2. 53(+/-1. 24) Times/ yesterday	3. 13(+/-1.42) times/ typical day
The number of times breakfast intake	NA	3.18 (+/-1.83) times/ typical week
Consumption of a full large portion size meal, served at one sitting	NA	3.19 (+/-1.84*)
The number of times an exercise or activity is performed.	2.0 3(+/-1.49) times/ last week	2.70 (+/- 1.56) times/ typical week

*For the consumption of large food portion sizes, 0 denotes 'never' while 7 denotes 'always.' Otherwise, all numeric values correspond to the frequency of behaviour for the given time period

6.4.6.2 Association between unhealthy eating habits and BMI

The relationship between BMI and unhealthy eating habits and gender related differences in 'unhealthy eating habits' using Spearman's rank test value (rho) .

Table 6.14 (overleaf) shows that there was no visible variance in the average frequency of unhealthy eating habits and physical activity between males or females, with the exception of large portion sizes consumed at one sitting for a typical day recall. The frequency of consuming large portion sizes at one sitting was slightly higher for females 3.31 (+/- 1.81) than it was for males 2.99 (+/- 1.90). Spearman's rank-order correlation was used to determine the relationship between BMI and unhealthy eating habits. The table also shows that a significant positive correlation was observed between BMI and four unhealthy eating habits, namely: fast food intake 'yesterday' (rho =.440, p = .000); fast food intake 'in a week' (rho =.460, p = .000); intake of SSBs 'in a typical day' (rho =.467, p = .000); consumption of large portion sizes at one sitting (rho =, p = .000). In contrast, a strong and significant negative association was noted between BMI the following two variables: the number of times breakfast is consumed 'in a week' (rho =, p = .000); and physical activity undertaken 'in a typical week' (rho = - .348, p =. 000).

Table 6.14 The relationship between BMI and unhealthy eating habits and gender related differences in 'unhealthy eating habits'.

Unhealthy eating habits	Male "Mean (+/- SD)"	Female "Mean (+/- SD)"	Spearman's rank test value (rho)	Sig P-Value
Fast food intake yesterday.	1.23 (+/- 0.72)	1.46 (+/- 0.83)	.440**	.000
Fast food intake in a week.	5.41 (+/- 2.30)	5.62 (+/- 3.13)	.460**	.000
Sugar and sweetened beverages consumed yesterday.	3.15 (+/- 1.16)	3.15 (+/- 1.22)	.037	.465
Sugar and sweetened beverages consumed in a day.	3.66 (+/-1.21)	3.69 (+/- 1.24)	.467**	.000
Portions of vegetable and fruit consumed yesterday.	2.47 (+/- 1.32)	2.57 (+/- 1.19)	081	.107
Portions of vegetable and fruit consumed in a typical day.	3.10 (+/- 1.46)	3.15 (+/- 1.40)	-.042	.401
Number of times breakfast is consumed in a week.	3.33 (+/- 1.97)	3.09 (+/-1.74)	-.506**	.000
Full portion size of served food consumed at one sitting.	2.99 (+/- 1.90)	3.31 (+/- 1.81)	.429**	.000
Physical activity performed in the last week.	2.05 (+/- 1.48)	2.02 (+/-1.50)	-.080	.108
The number of times an exercise or activity is performed in a typical week.	2.85 (+/- 1. 60)	2.60 (+/- 1.520)	-.348**	.000

* p value of <.05 is statistically significant. **p value of<.001 is highly significant.

6.4.6.3 Binary logistic regression for unhealthy eating habits and BMI:

Table 6.15 (overleaf) shows the results of the adjusted logistic regression analysis, which was used to determine the independent predictive power of 'unhealthy eating habits' as an independent variable to obesity. After adjusting for socio-demographic and SES factors, statistical associations were found between BMI and 6 of the 10 unhealthy eating habits. Positive associations were found between BMI and the following explanatory factors: fast food intake yesterday (Exp (B) = 3.12; CI: 1.04–9.39); fast food intake in a week (Exp (B)= 6.65; CI: 2.55–17.35); intake of SSBs in a typical day (Exp (B) = 2.71; CI: 1.02–7.23); and large portion sizes consumed at one sitting (Exp (B) = 4.72; CI: 1.82–12.27). In contrast, negative relationships were found between these BMI and the following predictor variables: regular breakfast consumption per week (Exp (B) =.08; CI: .02–.23); and physical activity undertaken in a typical week (Exp(B) =.13; CI: .05–.36). Notably, 'fast food intake in a week' was the

strongest predictor of outcomes compared to other factors in this model, linked to increased risk of obesity.

Table 6.15 Association between unhealthy eating habits and BMI using binary logistic regression.

Variables for unhealthy eating habits	Sig.	Exp(B)	95% CI for EXP(B)	
			Lower	Upper
1. Fast food intake yesterday.	.042	3.14	1.04	9.46
2. Fast food intake in a week.	.000	6.83	2.59	18.01
3. Sugar and sweetened beverages intake yesterday.	.316	.61	.23	1.61
4. Sugar and sweetened beverages intake in a typical day.	.051	2.66	.99	7.10
5. Portions of vegetable and fruit intake yesterday.	.510	1.42	.50	4.05
6. Portions of vegetable and fruit intake in a typical day.	.339	.63	.240	1.63
7. Number of times breakfast intake in a week.	.000	.08	.03	.25
8. Full portion size of served food intake at one sitting.	.001	4.78	1.84	12.46
9. Physical activity performed in the last week.	.324	1.73	.58	5.18
10. Physical activity is performed n in a typical week.	.000	.13	.05	.35

OR: odds ratio; CI: confidence interval. The OR was calculated for all variables with 95% confidence intervals.
[a]Adjusted for, gender, age, , marital status, level of education, occupation and income
* $P < 0.05$

6.4.6.4 Gender-related variances in the association between unhealthy eating habits and BMI using binary logistic   regression.

Table 6.16 (overleaf) shows the results of the adjusted logistic regression analysis, which was used to determine the independent predictive power of 'unhealthy eating habits' as an independent variable to obesity when other factors were adjusted. After adjusting for socio-demographic and SES factors, the results revealed the presence of a significant positive correlation between BMI and three unhealthy eating habits for males and four unhealthy eating habits for females. For males, a positive association was found between BMI and the following three explanatory factors: fast food intake in a day (Exp (B)= 2.52 ; CI: 4.04–12.32); : fast food intake in a week (Exp (B)= 4.65 ; CI: 1.04 – 9.46); large portion sizes consumed at one sitting (Exp(B) = 19.54; CI: 1.41–270.74). For females, a positive association was found between BMI and the following four explanatory factors: fast food intake in a day (Exp (B)= 2.14 ; CI:

3.32–11.12); fast food intake in a week (Exp (B)= 5.5; CI: 1.88–16.11); intake of sugar-sweetened beverages (SSBs) in a typical day (Exp (B) = 4.02; CI: 1.35–11.99); and large portion sizes consumed at one sitting (Exp (B) = 3.40; CI: 1.18–9.84).

In contrast, a negative relationship was found between BMI and the following   two unhealthy eating habits for males and females alike. A negative association was found between BMI and regular breakfast consumption per week, which were (Exp (B) =.00; CI: .00–.77) and (Exp (B) =.11; CI: .03–.43) for male and females respectively. In addition an inverse association was found between BMI and engaging in physical activity per week for males (Exp (B) =.00; CI: .00–.24) and females (Exp (B) =.21; CI: .08–.63) respectively. Notably, 'large portion sizes consumed at one' in males was the strongest predictor of outcomes compared to other factors in this model, linked to increased risk of obesity.

Table 6.16 Gender-related variances in the association between unhealthy eating habits and BMI

Variables for unhealthy eating habits	Male				Female			
	Sig P-Value	odds ratio (OR)	95% C.I. for Exp(B)		Sig P-Value	odds ratio (OR)	95% C.I. for Exp(B)	
			Lower	Upper			Lower	Upper
1. Fast food intake yesterday.	.047	2.52	4.04	12.32	.043	2.14	3.32	11.12
2. Fast food intake in a week.	.014	4.65	1.04	9.46	.002	5.50	1.88	16.11
3. Sugar and sweetened beverages consumed yesterday.	.094	.089	.01	1.52	.810	.87	.298	2.61
4. Sugar and sweetened beverages consumed in a typical recall day.	.452	2.53	.22	28.61	.013	4.02	1.35	11.99
5. Portions of vegetable and fruit consumed yesterday.	.408	2.86	.24	34.50	.580	.72	.23	2.30
6. Portions of vegetable and fruit consumed in a typical day.	.379	.34	.03	3.83	.538	.72	.25	2.08
7. Number of times breakfast intake in a week.	.042	.00	.00	.77	.001	.11	.03	.43
8. Full portion size of served food consumed at one sitting	.027	19.54	1.41	270.74	.024	3.40	1.18	9.84
9. Physical activity performed in the last week.	.067	25.33	.80	801.25	.910	.93	.29	3.03
10. Physical activity performed in a typical week.	.011	.00	.00	.24	.005	.21	.08	.63

OR: odds ratio; CI: confidence interval. The OR was calculated for all variables with 95% confidence intervals.
[a]Adjusted for, gender, age, , marital status, level of education, occupation and income
* P < 0.05

6.4.7 Statistical analyses to test the third hypothesis

Ho: The BMI of Libyan adults is not statistically significantly related to physical activity and sedentary behaviour.

H1: The BMI of Libyan adults is statistically significantly related to physical activity and sedentary behaviour.

Firstly, descriptive Statistics were used to explore percentage distributions of participants with respect to engaging in physical activity and sedentary behaviour. Secondly, Spearman's rho test was used to compute the correlation between physical activity (category indicator, as explained below) and sedentary behaviour, and obesity. Thirdly, logistic regression analysis was performed to examine the relationship between physical activity and sedentary behaviour and obesity in Libyan adults and analysed according to gender after adjusting for socio-demographic factors. In addition, logistic regression analysis was used to identify which one of physical activity and sedentary behaviour independently predicts an outcome (BMI) from all the others.

6.4.7.1 Descriptive data of physical activity & sedentary behaviour

Table 6.17 (overleaf) shows that the majority of participants reported that they engaged in a variety of physical activity during their daily lives in all domains mentioned in the questionnaire, namely: work, transport and recreation. They also reported that their actions ranged from 'vigorous' and 'moderate' activities to sedentary lifestyle. The number of respondents who reported that they engaged in any activities, whether physical or sedentary, in all domains.The number of Libyan men who reported that they engaged in recreational activities whether vigorous or moderate were 135 (91.2 %),137 (92.6 %) respectively., which were slightly higher than the number of Libyan women that they engaged in recreational activities whether vigorous or moderate were 337 (84 %)and 365 (91 %) respectively.

Table 6.17 The numbers and percentages of Libyan men and women about engaging in any activities, whether physical or sedentary.

Physical activity & Sedentary behaviour variables		The number of Libyan men who reported that they engaged in (PA or SB) (N=148) (%)	The number of Libyan women who reported that they engaged in in (PA or SB)(N=253)(%)	The number of Libyan adults who reported that they engaged in (PA or SB)(N=401) (%)
Physical activity 3 domains	Sub-domains			
1.Activity at work	Vigorous	133 (89.9 %)	200 (79.1 %)	333 (83 %)
	Moderate	140 (94.6 %)	226 (89.3 %)	366 (91.3 %)
2. Travel to and from places		140 (94.6 %)	226 (89.3 %)	366 (91.3 %)
3. Recreational activities	Vigorous	135 (91.2 %)	202 (79.8 %)	337 (84 %)
	Moderate	137 (92.6 %)	228 (90.1 %)	365 (91 %)
Sedentary behaviour		148 (100 %)	248 (98 %)	396 (98.8 %)

6.4.7.2 Average time spent on physical activity and sedentary behaviour per week

Table 6.18 (overleaf) presents the mean number of minutes spent per week on physical activity in three separate settings (at work, travel to and from places, and recreational activities) and sedentary behaviour per day or week among males and females as well as all participants. The average time spent on physical activity at work was 56.46 ($\pm$ 20.48), 34.12 ($\pm$ 4.59) and 34.26 ($\pm$ 15.91) minutes for males, females and all participants respectively. The average time spent on physical activity while travelling to and from places was 34.50 ($\pm$ 17.88), 34.12 ($\pm$ 14.59) and 34.26 ($\pm$15.91) minutes per week for males, females and all participants groups respectively. The average time spent in leisure and sports activities per day was 72.67 ($\pm$ 26.94), 72.84 ($\pm$ 25.09) and 72.77 ($\pm$25.81) minutes per week for males, females and all participants groups respectively. The average time spent on physical activity in the three settings (work; transport; and recreational activities) was 166.16 ($\pm$ 50.71), 163.97($\pm$39.06) and 164.89 ($\pm$44.26) minutes per week for males, females, and all participant groups respectively, while the average time spent in sedentary behaviours per week was 1170.6 ($\pm$ 528.8), 1141.2 ($\pm$ 486.2) and 1152.2 ($\pm$ 502.4) minutes per week for males, females, and all participant groups respectively.

Table 6.18 Average time spent on physical activity and sedentary behaviour per week for males and females and all participants.

Physical activity & Sedentary behaviour variables		Male (N=148) "Mean (± SD)"	Female (N=253) "Mean (± SD)"	All participants (N=401) "Mean (± SD)"
Physical activity 3 domains	Sub-domains			
1. Activity at work	Vigorous	21.43 (± 7.68)	21.08 (± 9.04)	21.22 (± 8.51)
	Moderate	34.50 (± 17.88)	34.12 (± 14.59)	34.26 (± 15.91)
Total Activity at work		56.46 (± 20.48)	56.02 (± 17.00)	56.19 (± 18.44)
2. Travel to and from places		34.50 (± 17.88)	34.12 (± 14.59)	34.26 (± 15.91)
3. Recreational activities	Vigorous	24.67 (± 12.36)	24.50 (± 9.748)	24.57 (± 10.85)
	Moderate	47.52 (± 23.05)	47.43(± 23.20)	47.47(± 23.11)
Total recreational activities		72.67 (± 26.94)	72.84 ± 25.09)	72.77 (± 25.81)
Total physical activity		166.16 (± 50.71)	163.97(± 39.06)	164.89 (± 44.26)
Time spent in sedentary behaviours per day		167.23 (± 75.54)	163.02 (± 69.53)	164.6 (± 71.77)
Time spent in sedentary behaviours per week		1170.6 (± 528.8)	1141.2(± 486.2)	1152.2(± 502.4)

6.4.7.3 Mean metabolic Equivalents (MET) minutes per week in three different PA settings (work, transport, and recreational activity)

Table 6.19 (overleaf) shows the Mean Metabolic Equivalents (MET) minutes per week in three different PA settings (work, transport and recreational activity) among males, females and all participants. Activity at work was further classified into two sub-domains: vigorous and moderate. Mean MET minutes per week for total activity at work was 352.3 (±91.5), 357.8 (± 112.2) and 355.7 (± 104.4) for males, females and all participants respectively. The Mann-Whitney U test indicated that there was no statistically significant difference for activity at work between the genders (Z=-.140 p=.889). In addition, mean MET minutes per week for travel to and from places was 138 (±71.5), 136.5 (± 58.4) and 137.1 (± 63.6) for males, females and all participant groups respectively.The Mann-Whitney U test indicated that there was no statistically significant difference in the travel to and from places between the genders (Z = -.600, p = .549). Recreational activities were further classified into two sub-domains: vigorous and moderate. Total mean recreational activity was 390.7(± 139.9), 390.3 (± 122.2) and 390.5 (± 129.4) MET minutes per week for males, females and all participants respectively. The

Mann-Whitney U test indicated that there was no statistically significant difference in energy expenditure in recreational activities between the genders (Z = -.401, *p* = .688). Total physical activity was calculated by summing the energy expenditure across the three domains (work, transport and recreation). Total physical activity measured in mean MET minutes per week was 892.5 (± 197.8), 888.9 (± 181.9) and 890.4 (± 188.3) for males, females and all participant groups respectively. The Mann-Whitney U test indicated that there was no statistically significant difference for total physical activity between the genders (Z = -.097, *p* = .923).

Table 6.19 Mean metabolic Equivalents (MET) minutes per week in three different PA settings (work, transport and recreational activity) among males, females and all participants.

Physical activity in three different domains		Metabolic Equivalents (MET) minutes per week "Mean (± SD)"		
Physical activity 3 domains	**Sub-domains**	**Male (N=148)**	**Female (N=253)**	**All participants (N=401)**
1. Activity at work	**Vigorous**	**171.4 (± 61.4)**	**168.6 (± 72.3)**	**169.7 (± 68.1)**
	Moderate	**184 (± 67.7)**	**189.6 (± 78.6)**	**187.4 (±74.6)**
Total activity at work		**352.3 (±91.5)**	**357.8 (± 112.2)**	**355.7 (± 104.4)**
2. Travel to and from places		**138 (±71.5)**	**136.5 (± 58.4)**	**137.1 (± 63.6)**
3. Recreational activities	**Vigorous**	**197.3 (± 98.9)**	**196.0 (± 77.9)**	**196.6 (± 86.8)**
	Moderate	**190.1 (± 92.2)**	**189.7 (± 92.8)**	**189.9 (± 92.53)**
Total recreational activities		**390.7(± 139.9)**	**390.3 (± 122.2)**	**390.5 (± 129.4)**
Total physical activity		**892.5 (± 197.8)**	**888.9 (± 181.9)**	**890.4 (± 188.3)**

6.4.7.4 Physical activity converted into a category indicator

Table 6.20 (overleaf) presents a summary of the total physical activity scores computed from the GPAQ, which were used to categorise the participants into three levels of physical activity: low physical activity or inactivity, moderate and high levels of physical activity. For all Libyan adults who were categorised as having a low level of physical activity, of these, 95 (72.5 %) were female and 36 (27.5 %) were male. While those who were categorised as having a moderate level of physical activity, of these, 157 (59 %) were female and 109 (41 %) were male. In addition, those who were categorised as having a high level of physical activity, of these, 1 (25 %) were female and 3 (75 %) was male.

Table 6.20 Three levels of physical activity: low, moderate and high.

Participants	Category Indicator		
	Low level of activity no activity is reported or (<600 MET* min/week)	Moderate level of activity (600 to < 1500 MET min/week)	High level of activity (1500-3000 MET min/week)
Males	36 (27.5 %)	109 (41 %)	3 (75%)
Females	95 (72.5 %)	157 (59 %)	1 (25%)
Total	131(100 %)	266 (100 %)	4 (100 %)

*The intensity of physical activity was calculated in mean metabolic equivalents (MET) minutes per week

6.4.7.5 Correlation between physical activities and sedentary behaviour, and BMI.

Table 6.21 (below) shows the correlation between Total Physical Activity MET-minutes/week = [(P2 * P3 * 8) + (P5 * P6 * 4) + (P8 * P9 * 4) + (P11 * P12 * 8) + (P14 * P15* 4)]and sedentary behaviour, and obesity using Spearman's rho test. A significant inverse correlation was observed between the physical activity category indicator and BMI (rho = -.125; p = .041). A significant positive correlation was also noted between BMI and sedentary behaviour (rho = .251; p = .000). However, no statistically significant correlation was found between the physical activity category indicator and sedentary behaviour (rho = .040; p = .509).

Table 6.21 Correlation between physical activities and sedentary behaviour, and BMI.

Outcome variables	Predictor variables	Spearman's rank test value (rho)	Sig P-Value
BMI	Total physical activity MET-minutes/week	-.125*	.041
BMI	Sedentary activities	.251**	.000
Physical activity in three different domains	Sedentary behaviour activities	.040	.509

* p value of <.05 is statistically significant.

**p value of<.001 is highly significant.

6.4.7.6 Association between physical activity and the sedentary behaviour, and BMI using binary logistic regression.

Table 6.22 (overleaf) shows the results of the adjusted logistic regression analysis, which was used to determine the independent predictive power of 'physical activity and sedentary behaviour' as an independent variable to obesity, after adjusting for socio-demographic and

SES factors. The results of the logistic regression showed that all independent variables were significantly related to obesity, with the exception of age and income. Physically inactive subjects had an odds ratio (Exp (B) of 1.00 (p = .001) of developing obesity compared to those who are physically active. There was no association between BMI and physical activity (Exp (B) = .99; CI: .99–1.01). A significant positive correlation was observed between BMI and sedentary behaviour (Exp (B) = 1.00; CI: 1.001–1.002). Notably, sedentary behaviour activities was the strongest predictor of outcomes compared to other factors in this model linked to increased risk of obesity.

Table 6.22 Association between physical activity and the sedentary behaviour, and BMI using binary logistic regression.

Explanatory variables	Sig.	Exp(B)	95% CI for EXP(B)	
			Lower	Upper
Physical activity in three different domains	.505	.99	.99	1.01
Sedentary behaviour	.000	1.001	1.001	1.002

OR: odds ratio; CI: confidence interval. The OR was calculated for all variables with 95% confidence intervals.
[a]Adjusted for, gender, age, duration of residence, marital status, level of education, occupation and income
* P < 0.05

6.4.7.7 Association between physical activity and the sedentary behaviour, and BMI using binary logistic regression across Gender-related variances

Table 6.23 (overleaf) presents the results of the logistic regression analysis to determine to what extent physical activity and sedentary behaviour contribute to the development of obesity in male and female adults. For males, it is evident that there was no association between physical activity and sedentary behaviour and developing obesity. However, for females, there was a significant negative correlation between BMI and physical activity (Exp (B) = .99; CI: .98–1.00), but a significant positive correlation between BMI and sedentary behaviour (Exp (B) = 1.00; CI: 1.001–1.004). Noticeably, sedentary behaviour activities among females was the strongest predictor of outcomes compared to other factors in this model linked to increased risk of obesity.

Table 6.23 Gender-related variances in the association between physical activity and the sedentary behaviour and BMI.

Neighbourhood environment variables	Male				Female			
	Sig P-Value	odds ratio (OR)	95% C.I. for Exp(B)		Sig P-Value	odds ratio (OR)	95% C.I. for Exp (B)	
			Lower	Upper			Lower	Upper
Physical activity in three different domains	.464	1.01	.99	1.02	.050	.99	.98	1.000
Sedentary behaviour	.193	1.00	1.000	1.002	.000	1.00	1.001	1.004

6.4.8 Statistical analyses to test the fourth hypothesis

H_o: The BMI of Libyan adults is not significantly related to neighbourhood environment factors, including: residential density zones; mixed land use (access to commercial places, public places and walkable destinations); access to public transport; pedestrian infrastructure (presence of pavements and maintenance of pavements); cycling infrastructure (presence and maintenance of cycle lanes); access to recreational facilities; street connectivity; unsafe environment and committing crimes at night (or during the day); traffic safety (for pedestrian and for cyclists); pedestrian safety (perceiving people as being active); neighbourhood aesthetics (the presence of beautiful things); and household vehicle ownership (vehicles in household).

H_1: The BMI of Libyan adults is significantly related to neighbourhood environment factors.

Firstly, the descriptive characteristics of participants with respect to the perception of environmental factors of the environmental neighbourhood (see Appendix 6.5, Table 6.5.1). Sedentary, the logistic regression analysis which was used to the association between BMI and the features of the neighbourhood environment and to determine the independent predictive power of 'environmental neighbourhood' as an independent variable to obesity when other factors were adjusted. Thirdly, logistic regression analysis was performed to examine the relationship between the neighbourhood environment attributes and obesity in Libyan adults and analysed according to gender after adjusting for socio-demographic factors. In addition, logistic regression analysis was used to identify which one of the neighbourhood environment attributes independently predicts an outcome (BMI) from all the others.

6.4.8.1 Association between neighbourhood environment factors and BMI using binary logistic regression.

Table 6.24 (overleaf) shows the results of the adjusted logistic regression analysis, which was used to determine the independent predictive power of 'the neighbourhood environment as an independent variable to obesity after adjustment socio-demographic and SES factors. Results revealed a significant positive association between BMI and 6 of the 17 neighbourhood environment factors. A significant positive association was established between BMI and the following neighbourhood environment factors: residential density zones (Exp(B)=3.33; CI: 1.41–7.87), street connectivity (Exp(B)=5.13; CI=2.25–11.70), unsafe environment and committing crimes at night (Exp(B)=3.90; CI: 1.56–9.78), unsafe environment and committing crimes during the day (Exp(B)=3.88; CI: 1.52–9.89); (OR=.38; CI: .15–.96) and 'aesthetics' or the presence of beautiful things (Exp(B)=.08; CI: .02–.28). Notably, both street connectivity was the strongest predictors of outcomes compared to other factors in this model, linked to increased risk of obesity.

Table 6.24 Association between neighbourhood environment factors and BMI using binary logistic regression.

Neighbourhood environment variables	Sig.	Exp(B)	95% CI for Exp (B)	
			Lower	Upper
1. Residential density.	.006	3.33	1.41	7.87
2. Access to commercial places.	.269	.55	.19	1.60
3. Access to public transport.	.040	.38	.15	.96
4. Presence of pavements.	.599	1.37	.42	4.45
5. Presence of cycle lanes.	.118	.40	.13	1.26
6. Access to recreational facilities.	.453	.69	.26	1.81
7.Crime / safety at night.	.004	3.90	1.56	9.78
8. Traffic safety.	.211	1.71	.74	3.93
9. See people as being active.	.894	.95	.42	2.15
10. Presence of beautiful things 'Aesthetics'.	.000	.08	.02	.28
11. Household vehicle ownership.	.869	.93	.40	2.19
12. Connectivity of streets.	.000	5.13	2.25	11.70
13. Maintenance of pavements.	.576	1.43	.41	4.98
14. Maintenance of cycle lanes.	.742	.82	.25	2.66
15. Traffic safety for cyclists.	.658	.82	.34	1.98
16. Crime / safety during the day.	.004	3.88	1.52	9.89
17. Public places and walkable destinations.	.856	.91	.32	2.61

OR: odds ratio; CI: confidence interval. The OR was calculated for all variables with 95% confidence intervals.

[a]Adjusted for, gender, age, duration of residence in Benghazi, marital status, level of education, occupation and income

* $P < 0.05$.

6.4.8.2 Association between neighbourhood environment factors and BMI using binary logistic regression across gender-related variances

Table 6.25 (overleaf) shows the results of the adjusted logistic regression analysis, which was used to determine the independent predictive power of 'Neighbourhood environment variables' as an independent variable to obesity after adjustment socio-demographic and SES factors. Based on the perceptions of male Libyan adults regarding neighbourhood environment factors, there were positive associations between 6 of the 17 explanatory factors and developing BMI, including: access to public transport (Exp (B)= .02; CI: .001–.56); access to recreational

facilities (Exp (B)= .03; CI: .001–.913); unsafe environment and committing crimes at night (OR = 27.76; CI: 1.37–562.20); 'aesthetics' or the presence of beautiful things (Exp (B)= .001; CI: .000–.15); street connectivity (Exp (B) = 44.29; CI: 2.69–729.63); and unsafe environment and committing crimes during the day (Exp (B) = 204.94; CI: 3.15–13336.90). In contrast, based on the perceptions of female Libyan adults regarding neighbourhood environment factors, there were associations between 4 out of the 17 explanatory factors and developing BMI, including: residential density zones (Exp (B) = 4.77; CI: 1.44–15.82); unsafe environment and committing crimes at night (Exp (B) = 5.90; CI: 1.54–22.51); 'aesthetics' or the presence of beautiful things (Exp (B) = .01; CI: .00–.24); and street connectivity (Exp (B) = 5.75; CI: 1.73–19.08). Notably, both Street connectivity and the presence of beautiful places in females were the strongest predictors of outcomes compared to other factors in this model linked to increased risk of obesity.

Table 6.25 Association between neighbourhood environment factors and BMI of male (n=148) and female (n=253) participants, using binary logistic regression.

Neighbourhood environment variables	Male				Female			
	Sig P-Value	odds ratio (OR)	95% C.I. for EXP(B)		Sig P-Value	odds ratio (OR)	95% C.I. for Exp (B	
			Lower	Upper			Lower	Upper
1. Residential density.	.092	9.13	.70	120.02	.011	4.77	1.44	15.82
2. Access to commercial places.	.295	5.62	.22	141.87	.110	.28	.06	1.34
3. Access to public transport.	.022	.02	.001	.56	.317	.54	.16	1.80
4. Presence of pavements.	.118	43.76	.38	4997.11	.869	.86	.15	5.01
5. Presence of cycle lanes.	.139	.04	.00	2.82	.445	.54	.11	2.62
6. Access to recreational facilities.	.044	.03	.001	.913	.935	.95	.25	3.66
7. Crime / safety at night.	.030	27.76	1.37	562.20	.009	5.90	1.54	22.51
8. Traffic safety.	.948	.93	.09	9.33	.494	1.57	.43	5.77
9. See people as being active.	.521	2.28	.184	28.29	.151	.40	.11	1.40
10. Presence of beautiful things 'Aesthetics'.	.007	.001	.000	.12	.003	.01	.00	.24
11. Household vehicle ownership.	.538	.47	.042	5.21	.580	.72	.22	2.34
12. Connectivity of streets.	.008	44.29	2.69	729.63	.004	5.75	1.73	19.08
13. Maintenance of pavements.	.383	5.249	.127	216.23	.677	.68	.12	4.24
14. Maintenance of cycle lanes.	.304	.13	.003	6.48	.455	.54	.10	2.75
15. Traffic safety for cyclists.	.056	.02	.001	1.10	.585	1.43	.40	5.20
16. Crime / safety during the day.	.012	204.94	3.15	13336.90	.095	2.97	.83	10.64
17. Public places and walkable destinations.	.985	.97	.048	19.86	.513	.61	.14	2.72

OR: odds ratio; CI: confidence interval. The OR was calculated for all variables with 95% confidence intervals.

[a]Adjusted for, gender, age, duration of residence in Benghazi, marital status, level of education, occupation and income

* $P < 0.05$.

The next chapter discusses the results of the quantitative study.

Chapter Seven : Discussion of the results of the quantitative study

7.1 Introduction

This chapter discusses and interprets the findings presented in Chapter 6 with respect to the four hypotheses, which were devised to test the following four major predictor variables in association with BMI in Libyan adults: socio-economic status (SES); unhealthy eating habits; physical activity and sedentary behaviour patterns; and neighbourhood environmental factors. The present chapter also discusses and interprets the results of the analysis of the prevalence of overweight and obesity in Libya. In addition, the most prominent and notable factors are discussed in this chapter, including demographic data (age, gender, marital status, religion, ethnicity, and residence in Benghazi), since these factors may have a significant influence on the obesity epidemic or play a role as confounding variables. The subsequent section of the present chapter discusses and interprets the findings of each hypothesis separately.

The section below was addressed *the first hypothesis* of this study was to examine if there was a significant association between the BMI of Libyan adults and SES, measured by three factors: education level, income, and occupational status.

7.2 Socio-economic status (SES)

My study established a strong significant positive association between SES and obesity in both genders. Furthermore, after adjusting for all possible confounding factors, including demographic factors, a significant positive association was also observed between two SES components (education level and income) and obesity for both genders. In contrast, occupational status alone was significantly associated with obesity in women but not in men. Such findings indicate that there is sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

Several possible explanations can be postulated for the positive association between high-SES and BMI in Libyan adults. One is that unhealthy eating habits and a reduction in physical-activity levels emerged dramatically in the Libyan population as a result of the country's growing wealth (Centre for Administrative Innovation in the Euro-Mediterranean Region (CAIMED),2004; FAO, 2005,WHO, 2007). With higher incomes, Libyans may indulge in a more sedentary lifestyle and in more leisure activities in order to satisfy their desire for

entertainment and pleasure (CAIMED, 2004; FAO, 2005, WHO,2007). Typically, Libyans enjoy buying luxury cars and engaging in indoor leisure activities, such as watching TV, sitting in front of the computer or playing video games, which could lead to a technology addiction. Health wise, such a lifestyle can be a curse rather than a blessing (CAIMED, 2004; FAO, 2005,WHO.2007).

A second possible explanation is that the Libyan government provided to nationals a great deal of staple food commodities at highly subsidised prices, with the implication that energy-dense diets high in fat and sugar are readily available, affordable and accessible (Drewnosky & Specter, 2004; FAO, 2005, World Food Programme (WFP),2011). The relatively high total monthly income of Libyans, coupled with a lack of awareness about healthy eating choices, predisposes Libyans to eating unhealthy, high calorie foods and developing unconscious cravings for such food, which gradually contributes to the increased risk of obesity in Libyan adults (FAO, 2005;World Food Programme (WFP- Middle East), 2011). A further possible factor that exacerbates the issue is a huge increase in the number of fast food restaurants throughout Benghazi in particular and Libya as a whole. Apart from constructing fast food outlets, another Libyan policy is the large-scale, year-round importing of commodities such as agricultural, manufactured and processed food products from many industrial countries, with no seasonal restrictions (FAO, 2005; WFP- Middle East, 2011). Cumulatively, these factors raise the frequency of junk food consumption among Libyan adults, thereby increasing the risk of obesity.

Whereas the above factors can be categorised as political-economic, there are also cultural factors which could explain the positive association between high-SES and BMI in Libyan adults. In Arab culture, fattening rituals exist for women before marriage as plumpness is considered a cultural symbol of beauty, fertility and prosperity (Mokhtar et al., 2001). Many Arab societies prefer a larger body size because it suggests affluence or a higher socio-economic status (Fernald, 2009), whereas being thin is seen as a sign of ailment or extreme poverty (Rguibi & Belahsen, 2006), and Libya is no exception: plumpness tends to be more socially acceptable than is thinness due to its association with healthy and wealthy living. In contrast, thinness is more valued by individuals in countries with a higher Human Development Index (HDI).

A final possible explanation is the existence of urban sprawl as an economic development indicator, and the resulting traffic jams within the big cities (Seliske et al., 2012; Trowbridge & McDonald, 2008), along with Libyans' strong preference for cars over all other means transport, such as walking or using public transport to get to work (Elbendak et al., 2008; FAO, 2005). Spending excessive time in the car may be harmful to health, hence Libyans who commute longer distances to their work spend a prolonged time in their vehicles and are therefore more at risk of becoming obese (Elbendak et al., 2008; Russo, 2004). In addition, an increasing proportion of the occupations offered to Libyans are predominantly desk-bound in nature, with widespread use of air-conditioning in work places (Elbendak et al., 2008; Russo, 2004), which could have adverse implications for health. Therefore, there is a significant positive association between obesity and two SES components (education level and income) in both genders, while occupational status was associated significantly with obesity in women only.

The results of my study are inconsistent with those of previous epidemiological studies which showed a consistent inverse association between SES and obesity in women, and an inconsistent and contentious association in men. These established findings are the result of sequential comprehensive reviews by Monteiro et al. (2004) and Dinsa et al. (2012) in developing countries, while McLaren (2007) and Pampel et al. (2012) reviewed studies of adult populations in both developed and developing countries, which confirmed this pattern. My findings is aligned with the first comprehensive review carried out by Sobal and Stunkard (1989) which found that, in developing countries, a consistent positive correlation was established between SES and obesity in both genders, that is, the higher the SES, the higher the rate of obesity.

 My findings are also aligned with studies undertaken in developing countries with a lower HDI, such as Bangladesh (Khan & Kraemer, 2009) ;India (Subramanian & Smith, 2006) and Cameroon (Fezeu et al. 2005), where positive associations between SES and obesity were observed.Although Libya was ranked as having the highest Human Development Index (HDI) in Africa, according to the classification of the United Nations Development Programme (UNDP, 2015), my findings may be considered unanticipated because they resemble those for developing countries with a lower HDI rather than those for countries with a higher HDI. This therefore requires further explanation through interviews with Libyan healthcare professionals (LHCPs)and Libyan community leaders (LCLs).

The following section discusses and interprets my results concerning the association between BMI and each of the three SES components: education level, income, and occupational status.

7.2.1 Educational attainment

My study found a strong, significant positive association between education level and obesity in the adult Libyan population for both genders. Furthermore, after adjusting for possible confounding factors, including demographic and socioeconomic factors, the same a strong, significant positive association between education level in Libyan adults and obesity was found in both genders. My findings indicate that there was sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

Several possible explanations can be posited for the positive association between high-education and BMI in Libyan adults. One could be the general lack of public awareness of this disease in Libya, as well as a paucity of health services providing preventive, curative, promotional or rehabilitative healthcare (Eldarrat . 2011; Elfituri et al., 2006; Solliman et al., 2012; WHO, 2007). Hence, most Libyans – both those with lower educational attainment and those with higher educational attainment – are probably lacking the appropriate health information and are therefore ignorant about obesity and its risks, as well as about the importance of eating healthy food and engaging in physical activity (Eldarrat . 2011; Elfituri et al., 2006; Solliman et al., 2012). Such lack of knowledge may predispose Libyans to gaining weight and becoming obese, with the overall lack of health awareness in the country liable to contribute to the obesity epidemic in Libya.

Another explanation for the positive association between obesity and education level in Libyan adults pertains to cultural values and tradition. For both genders in Libya, obesity is considered to be a symbol of affluence; a larger body size is also valued as a sign of physical dominance and courage; thus, social culture is relatively tolerant of both genders being obese (Uthman, 2009; Sibai et al., 2003). While Libyan adults with higher education levels probably have some knowledge of issues related to calorie intake and obesity, but the social and culture pressures to comply with body-weight norms ('fatness') are probably a more intense influence on educated people than on uneducated people. This might be because it is the educated, rather than uneducated, who are responsible for upholding Libyan cultural norms and defending against lawlessness or neglect of cultural practices in the next generation. Therefore, there is a

significant positive association exists between education level in Libyan adults and obesity in both genders; that is, the higher the educational attainment, the higher the BMI in Libyan adults in both genders.

My findings are in line with the results of previous studies undertaken in developing countries, where a positive association between educational status and obesity was established a (Al-Mahroos & Al-Roomi, 2001; Al-Nuaim et al., 1996; Al-Nuaim et al., 1997). However, my findings are contrary to a substantial body of literature that emphasises a significant inverse correlation between education level and obesity, particularly among women in developed societies, while in men this association is less consistent (Ball & Crawford, 2005; Hermann et al., 2011; Tzotzas et al., 2010). Although this inverse association is a pattern commonly found in Western societies, the same association has been found by studies undertakrn recently in developing countries (Janghorbani et al., 2007; Xiao et al., 2013) and in Arab countries, such as Lebanon (Chamieh et al., 2015), Syria (Fouad et al., 2006) and Jordan (Khader et al., 2008).

In contrast, some studies claim that an inverse association exists between education and BMI in both genders (Groth et al., 2009; Soriguer et al., 2004). Two recent comprehensive reviews on overweight and obesity in Arabic-speaking countries, and another in the EMR, concluded that the association between education level and obesity is contentious and requires further research (Badran &Laher, 2011; Musaiger, 2011). It is clear that more research and debate is required amongst researchers in the EMR before consensus can be reached. The next section discusses and interprets the association between BMI and income.

7.2.2 Income

My study found a strong, significant positive asscoaition between level of income and obesity in the adult Libyan population for both genders. Furthermore, after adjusting for possible confounding factors, the same a strong, significant positive association between level of income in Libyan adults and obesity was found in both genders. My findings indicate that there was sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

One obvious factor that could explain the positive association between high income and obesity in Libyan adults is that Libyans with higher incomes often spend their money on luxury items which increase their sedentary behaviour such as watching TV and playing video games (Elbendak et al., 2008; CAIMED, 2004) (see section 7.2 for details). Libyan households with

higher incomes also tend to have more hired help in the form of female domestic workers who carry out a wide range of household chores instead of the women in the household, which further enables a sedentary for lifestyle for those women, thereby raising the risk of obesity (Elbendak et al., 2008; CAIMED, 2004).

Another likely explanation is the Libyan government's importing of branded fast food at a low price and subsidising of staple food commodities, coupled with negligence or failure to comply with the requirements Imported Food Control Act (FAO, 2005; World Food Programme (WFP),2011). The wide availability and accessibility of such foods may contribute to an exacerbation of the obesity epidemic in Libya (Darmon et al., 2003; FAO, 2005; Sehib et al., 2013).An additional possible explanation is the catastrophic absence of health education in Libya, coupled with the lack of primary healthcare services (El-Fallah, 2014), which translates into little knowledge about obesity and its consequences and little guidance disseminated on how people can administer and invest their money in buying proper, healthy food and avoiding unhealthy choices, as well as utilising their free time to engage in physical exercise (CAIMED, 2004; El-Fallah, 2014;WHO, 2007). Therefore, there is a significant positive assiocation exists between the level of income in Libyan adults and obesity in both genders; that is, the higher the level of income, the higher the BMI in Libyan adults of both genders.

My findings are consistent with those of epidemiological studies conducted in developing countries, where those with a higher income tend to have a higher rate of obesity. (Nguyen et al., 2007; Badran & Laher,2011; Al-Nuaim et al., 1996; Al-Mahroos & Al-Roomi, 2001;; Atek et al., 2013; Xiao et al., 2013). However, my findings differ from the results of epidemiological studies undertaken in developed societies, where an inverse association has been found between obesity and income level for women, with higher-income women being less likely to be obese than low-income women, while there was an inconsistent and contentious association in men (Drewnowski et al., 2007; National Obesity Observatory, UK, 2010; Paeratakul et al., 2002). Hence, the association between income and obesity requires further explanation, which may be achieved by undertaking interviews with LHCPs and LCLs about obesity. The next section discusses and interprets the association between BMI and occupation.

7.2.3 Occupation

My study found a significant positive association between occupation status and obesity in the adult Libyan population for both genders. In contrast, after adjusting for possible confounding

factors, occupation was significantly associated with obesity in women but not in men. Such findings indicate that there is sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

One possible explanation for the positive association that exists between the BMI of Libyan adults and employed women but not employed men nor unemployed adults of either gender is that. Typically, overweight or obese women are less likely to be selected for jobs than their slimmer rivals because of the requirement that they undergo pre-employment medical screening to determine their physical and psychological fitness for the job. In addition, there is often a perception that overweight or obese women are less productive than their slimmer counterparts. However, in the Libyan context, such requirements and norms are not strictly applied, and qualified Libyan applicants who are overweight or obese may be readily employed (Elbendak et al., 2008; Musaiger & Al-Ansari, 1992; Musaiger, 2011).

Despite these terms and conditions such as having a medical exam before being employed as stipulated by the Civil Service Act in Libya (Al-Hadad , 2015), many officials overlook them in order to employ female applicants in certain sectors, based on their qualifications, so as to rectify historical inequities and encourage women to engage more actively in the workforce and contribute to the country's economic development (Al-Hadad, 2015). Consequently, many Libyan women are exempted from undergoing the pre-employment medical exam, unlike Libyan men who are required to undergo the exam. In addition, employed Libyan women are not censured by their employers regarding their physical health or weight to the same extent as their counterparts in the Arab countries of the Gulf Region, who do in fact face censure in the workplace regarding their weight. Whereas other Arab women have this incentive to keep their weight down (Musaiger, 2011), working Libyan women face no such incentive, possibly explaining why they are more overweight than their unemployed Libyan counterparts.

Another possible explanation is that in the Libyan context, the nature of occupations offered by the Ministry of Labour and Rehabilitation, to Libyan adults for both men and women are predominantly desk-bound. Libyans generally prefer sedentary or office jobs , and avoid manual jobs even, if they do not have the qualifications for office jobs (Elbendak et al., 2008, FAO, 2005, WHO, 2007). It is common for employed adults to spend a quarter of their working lives sitting for several hours at a time per day in paperless offices, because all their tasks can be performed on computer using emails. In addition, office jobs are actually more stressful,

demanding and unpleasant than manual labour, and these pressures may affect employees' eating habits, such as consuming more fast foods that enable them to be away from home for long periods during the day; the failure to prepare home-made meals and to engage in any physical activity may also contribute to the occurrence of obesity (Schulte et al., 2007). Therefore, there is a significant positive association exists between the BMI of Libyan adults and employed women but not in employed men nor unemployed in both genders; that is, the higher the employment rate , the higher the BMI in Libyan women but not in men.

Several studies conducted in the EMR countries have shown the same finding as in my study, that is, the occupational status of women (but not men) is significantly associated with increasing BMI (Ahmad et al., 2006; Chamieh et al., 2015; Nozha et al., 2005). My finding, however, is inconsistent with those of other studies carried out in the same region of the EMR, which revealed a significant negative association between obesity and employment status in women, with employed women being less likely to be obese than their non-working counterparts; while the association was ambiguous in men (Ainy & Azizi, 2007; Fouad et al., 2006; Musaiger & Al-Ahdal, 2010), which was similar to my findings about Libyan men. The findings of my study differ in that occupational status did affect obesity rates, with high occupational status linked to higher obesity rates in women but not in men. Therefore, further inquiries are necessary to better understand the reason behind this anomalous correlation in Libyan adults.

The section below addresses *the second hypothesis* of this study: to investigate whether there is a significant association between the BMI of Libyan adults and unhealthy eating habits.

7.3 Unhealthy eating habits

This section discusses and interprets the association between BMI and each of these components of unhealthy eating habits, operationalised as follows: an excessive consumption of fast foods; an excessive consumption of sugar-sweetened beverages (SSBs); eating less than five daily portions of fruit and vegetables; a high frequency of skipping breakfast; consumption of large food portion sizes (FPS); and engaging in physical activity.

7.3.1 Fast-food consumption

My study established a strong, significant positive association between obesity and the frequency of consuming restaurant and fast food, whether in a typical day or in a week, in the

adult Libyan population of both genders. Furthermore, after adjusting for all probable confounding factors, obesity was also significantly associated with the frequency of restaurant and fast-food consumption per week, in Libyan adults of both genders. My findings indicate that there was sufficient evidence to reject the null hypothesis and accept the alternative hypothesis

One possible explanation for the positive association between obesity and the frequency of consuming restaurant and fast food is that most fast foods have an extremely high energy density, and palatable, energy-dense foods are associated with reduced satiation and satiety (Drewnowski, 1998; Drewnowski & Specter, 2004; Rolls & Barnett, 2000). Being affordable, convenient and accessible, fast food encourages a large number of Libyans to purchase it as an alternative to expensive, healthier food (FAO, 2005; Sehib et al., 2013) . Another possible factor that contributes to the high rate of fast-food consumption is the availability of relatively homogeneous fast food outlets across Benghazi. In addition, some fast food restaurants advertise more aggressively and extensively than others, which may encourage vast numbers of Libyans to eat out at these particular restaurants. Therefore, the BMI of Libyan adults is significantly positively associated with the consumption of Fast-food in both gender; that is, the higher the frequency of consuming restaurant and fast food per week, the higher the BMI in Libyan adults in both men and women.

My study found a relatively high frequency of fast-food consumption in Libyan adults: I computed the average frequency of fast-food consumption in Libyans adults to be 5.54 (+/- 3.1) times per week. In contrast, a cohort study in the USA conducted by Pereira et al. (2005) established that adults who consumed fast food more than twice a week had an increased BMI. Thus, the frequency of fast-food consumption identified in my study was nearly double the recommended daily amount of fast food restaurants by Pereira et al.'s (2005) study. My findings were more similar to those of two studies conducted by (Amin et al., 2008; Abou-Gamel et al., 2013) in Saudi Arabia by (which found that the average frequency of fast-food consumption was more than 5 times per week. It is plausible that an increase in the frequency of fast-food consumption in Libyan adults is one of the risk factors contributing to increased obesity in Libyan society.

My findings are aligned with those of several cross-sectional studies conducted in developed countries which determined that fast-food consumption was positively associated with

increased BMI (Cummins et al., 2005; Marlatt et al., 2016; Rouhani et al., 2012; Shah et al., 2014). My findings are similar to other cross-sectional studies conducted in some Arab countries which indicated similar associations between fast-food intake and increased BMI (Amin et al., 2008; Ghazali et al., 2010; Musaiger et al., 2014). However, my findings differed from a prospective longitudinal study in the USA, which found that fast-food consumption was positively associated with energy-intake and BMI in women, but not in men (Jeffery & French, 1998). Moreover, many studies, both in developing and developed countries, have shown contradictory findings or revealed no significant relationship between the frequency of consuming fast foods and BMI (Alfawaz, 2012; Anderson & Matsa, 2011; Simmons et al., 2005).

7.3.2 Consumption of sugar-sweetened beverages (SSBs)

My study established a strong, significant positive association between obesity and the frequency of consuming sugar-sweetened beverages in a typical day, in Libyan adults of both genders. In contrast, after adjusting for all probable confounding factors, consumption of SSBs was significantly associated with obesity in females but not in males. My findings indicate that there was sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

One possible explanation for the excessive consumption of SSBs amongst Libyans is the fact that SSBs are inexpensive, palatable, energy-dense foods (Drewnowski et al., 2009; Mobley et al.,2009 ; Swinburn et al., 2004). Apart from being readily available and heavily promoted through media advertising, sugary drinks provide energy but do not seem to induce satiety (Harvard School of Public Health, 2016f; Hector, 2009; Van Dam & Seidell, 2007). Another explanation for high levels of SSBs consumption among Libyan adults is that the inclination for unhealthy food increases in social situations, which are key triggers for food and beverage consumption (FAO,2005; Sachithananthan et al., 2012). Traditional Arab hospitality dictates that a variety of SSBs are served as refreshments to guests on social occasions. A further explanation is that, during the summer months, the hot and arid climate in Libya leads to dehydration which affects Libyans' health.

Consequently, Libyans seek out cold SSBs from grocery stores and vending machines so as to rehydrate (Sachithananthan et al., 2012; Sehib et al., 2013). In addition, SSBs are considered to be a staple commodity and a priority for all Libyan families; hence, they are offered at each meal (FAO,2005; Sachithananthan et al., 2012). Therefore, the BMI of Libyan adults is

significantly positively correlated with the consumption of SSBs in women but not in men; that is, the higher the frequency of consuming sugar-sweetened beverages in a typical day, the higher the BMI in Libyan women but not in men (see Appendix 7.1 for more details).

My findings were consistent with numerous cross-sectional studies in both developed and developing countries, which revealed a positive association between the consumption of SSBs and obesity in women but not in men (Liebman et al., 2003; Nikpartow et al., 2012). However, the most common pattern in the literature is the finding of no gender differences in obesity rates related to the consumption of SSBs. For example, large prospective cohort studies among adults conducted in developed societies found that higher SSB consumption was associated with significant weight-gain for both gender (Dhingra al., 2007; Odegaard et al., 2010). In addition, three recent comprehensive reviews concluded that a positive association exists between intake of SSBs and obesity (Malik et al., 2006; Woodward-Lopez et al., 2010).

Furthermore, several observational studies (including cross-sectional, longitudinal, and nationally representative studies), conducted in developed and developing countries, found that SSB intake among adults is significantly associated with greater adiposity (Babey et al., 2008; Payab et al., 2015; Trumbo & Rivers, 2014; Woodward-Lopez et al., 2010). Likewise, my findings differed from the results of several cross-sectional studies which revealed no association between intake of SSBs and weight-gain in either gender (Odegaard et al., 2012; Sun & Empie, 2007).

7.3.3 Eating less than five daily portions of fruit and vegetables

According to the WHO, a high consumption of fruit and vegetables (FV) per day (defined as at least five portions) is associated with a reduced risk for obesity. However, my study found no association between consuming five daily portions of fruit and vegetables and obesity in the adult Libyan population of either gender. Furthermore, after adjusting for all probable confounding factors, consuming five daily portions of fruit and vegetables was not associated with obesity of either gender. Such explanations indicate that there is insufficient evidence to reject the null hypothesis.

Numerous explanations can be posited for the lack of association revealed in my study between a high daily intake of FV and a reduced risk of obesity in Libyan adults. One is that five portions is insufficient to have an effect; recently obesity experts and public health activists have

advised that doubling the FV intake of five- or seven-a-day to ten-a-day would be a more optimum intake level (NHS, 2015). Hence, it may be argued that more than five portions a day is required for a higher protective effect against obesity (NHS, 2015). It is somewhat surprising that the average daily FV intake among Libyan adults is 3.13(+/-1.42) portions a day, which is relative low – particularly with respect to the new recommended level proposed by the NHS (2015) and considering that fruit and vegetables are accessible, affordable and available to low-income minority families and wealthy communities alike in Libya (Centre for Administrative Innovation in the Euro-Mediterranean Region (CAIMED), 2004; Elbendak et al., 2008; FAO, 2005). (For mor details about Eating less than five daily portions of fruit and vegetables see appendix 7.1)

7.3.4 A high frequency of skipping breakfast

My study found a significant negative association between breakfast consumption per week and obesity in the adult Libyan population of both genders. Furthermore, after adjusting for all probable confounding factors, the same inverse association between breakfast consumption per week and obesity was found in both genders. My findings indicate that there is sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

There are two possible explanations for an inverse association between breakfast consumption per week and the lower the BMI in Libyan adults in both genders. First, it has been suggested that eating breakfast helps to reduce the tendency towards unplanned, impulsive snacking and hence there is less consumption of the calories and fats associated with spontaneous snacking (Farshchi et al., 2005; Watanabe, et al., 2014). Thus, eating a regular breakfast is a significant factor in re-setting the body's biological clock and generally results in people feeling nourished and satisfied. In sum, those who eat breakfast are less likely to overeat throughout the rest of the day (Watanabe, et al., 2014).

Second, skipping breakfast may affect people's physiological functioning in that fasting results in stress and disruption to the metabolic process, leading people to attempt to compensate later in the day through excessive consumption of foods high in either saturated fats or refined carbohydrates, which may contribute to an increase of obesity (Farshchi et al., 2005; Watanabe, et al., 2014). Therefore, there is a significant inverse association exists between breakfast consumption per week and BMI in both genders; that is, the higher the frequency of breakfast consumption per week, the lower the BMI in Libyan adults in both genders.

The finding of a significant negative association in my study between the frequency of eating breakfast and obesity is unexpected due to a high prevalence of overweight and obesity in Libyan adults .Although the average frequency of eating breakfast per week amongst Libya adults was 3.18 (+/- 1.83) days per week, this figure is close to the recommended level of regular breakfast eating (RBE) of at least five days a week (≥5 days/week) (Liu et al., 2011).

This finding aligns with the literature in that several epidemiological studies conducted in developed and developing countries, including Arab countries, revealed compelling evidence for an inverse association between regular breakfast consumption and obesity (Kerkadi, 2003; Musaiger & Al-Ahdal, 2010; Song et al., 2005; Mesas et al., 2011). Similarly, the findings of my study align with epidemiological studies performed on other groups that investigated the association between irregular breakfast consumption (that is, skipping breakfast as opposed to regularly eating breakfast) and BMI, and determined a positive association between skipping breakfast and an increased risk of obesity in adults of both genders (Horikawa et al., 2014; Keski-Rahkonen et al., 2014; Watanabe et al., 2014).

7.3.5 The consumption of large food portion sizes (FPS)

This study revealed a strong significant positive association between the consumption of large food portion sizes (FPS) and obesity in the adult Libyan population of both genders. Furthermore, after adjusting for all possible confounding factors, the same positive association between consuming of FPS sizes and obesity was established in both genders. Such findings indicate that there is sufficient evidence to reject the null hypothesis and accept the alternative hypothesis. See Appendix 7.1 for further discussion about the consumption of large food portion sizes (FPS).

7.3.6 Engaging in physical activity

My study found that a strong, significant negative association exists between the frequency of engaging in physical activity per week and obesity in Libyan adults of both genders. Furthermore, after adjusting for all probable confounding factors, the same negative association was found between the frequency of engaging in physical activity per week and obesity in both genders. Such findings indicate that there is sufficient evidence to reject the null hypothesis and accept the alternative hypothesis concerning.

A possible explanation of this finding is that physical activity (PA) enhances total energy expenditure, which can help individuals to sustain their energy balance and even lose weight, as long as they do not eat more to compensate for the extra calories they burn (Harvard School of Public Health, 2016e). In addition, PA may inhibit depression and anxiety (Ströhle,, 2009), which in turn may motivate people to adhere to their exercise regimens over time. Another possible explanation of an increase in physical activity among Libyan women may be attributed to Islamic religious tenets which encourage Muslims to engage in physical activity provided it does not violate certain principles such as the Islamic dress code – Libyan women wear the traditional black female over-garment (jilbabs or abayas), and other loose garments, which predisposes Muslim women to being unaware of any increase in their weight (Musaiger, 2011; Musaiger et al., 2013; Musaiger & Qashqari, 2005; Benjamin & Donnelly, 2013).

Furthermore, the Islamic religion advises people to have slimmer bodies, and religious leaders convey health promotion messages intended to encourage Muslims to adopt a physically active lifestyle (Benjamin & Donnelly, 2013). However, despite these encouragements, various barriers prevent adult Libyan women from engaging more extensively in physical activities. These include family obligations such as caring for their children and husband, and the Islamic law that, when going outdoors, women must be accompanied by their *Maharim* (unmarriageable kin) (Benjamin & Donnelly, 2013). A woman's male *Mahrams* fall into four categories: permanent or blood *Mahrams*, in-law *Mahrams*, milk-suckling *Mahrams* and the ascendants and descendents of the husband *Mahrams*) (Kariapper, 2008). Therefore, there is a significant inverse association exists between the frequency of engaging in physical activity per week and obesity in both genders: the higher the frequency of engaging in physical activity, the lower the BMI in Libyan adults in both genders.

The results of the present study are aligned with those of previous epidemiological studies, indicating an inverse association between physical activity and increasing BMI (Besson et al., 2009; Rupps et al., 2012; Tiruneh, 2009). My findings are also similar to the results of most prospective cohort studies which found that people who engage in physical activities on a regular basis are less likely to be overweight or obese (Drøyvold et al., 2004; Schmitz et al., 2000). However, my findings were dissimilar to a prospective longitudinal study conducted in Denmark which found no relationship between long-term physical activity participation and the development of obesity (Petersen et al., 2004). In addition, my findings were contradictory

to a prospective study of adults in China (Paeratakul et al., 1998) and to a cross-sectional study in Lebanon (Chamieh et al., 2015), both of which found that the level of physical activity was inversely associated with changes in BMI in women but not in men.

According to my findings, the average number of times that Libyan adults perform some form of physical activity is 2.70 (+/- 1.56) times per week. These figures are similar to the range recommended by the Physical Activity Guidelines (PAG) for Americans (2008) and by the WHO (2015), which stipulates that people should engage in physical activity at least three times per week (equal to 150 minutes) spread over at least three days of the week. A paradox occurred in my findings in that the average frequency of engaging in physical activities falls within the normal range recommended by the PAG for Americans and recommended by the WHO, yet the prevalence of overweight and obesity was high. In order to further understand this finding, a separate hypothesis concerning physical activity and sedentary behaviour was devised and the topic raised in interviews with health professionals and community leaders.

The section below was addressed the third hypothesis of this study was to investigate whether or not there was a statistical association between obesity and physical activities under three domains: work, transport and recreational activities, as well as the association between obesity and sedentary behaviour.

7.4 Physical activity and sedentary behaviour

7.4.1 Physical activity

This study found a strong, significant inverse association between total physical activity (PA) under the three domains (work, transport and recreational activities) and obesity for both genders in Libyan adults. However, after adjusting for all possible confounding factors, a negative association was established between total PA and obesity in women but not in men, Such findings indicate that there is sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

In addition to those explanations mentioned in Section 7.3.6 about engaging in physical activity, another possible explanation may promote an increase in physical activities among Libyan adults is the existence of separate recreation facilities for men and women (Musaiger et al., 2013; Benjamin & Donnelly, 2013). This enables women to engage in physical exercise

with less socio-cultural inhibition than they have experienced over the past few decades, when socio-cultural constraints largely prevented women from exercising (Musaiger et al., 2013; Benjamin & Donnelly, 2013). Consequently, this change may encourage both genders to participate in more PA. In addition, Arabic culture associates a heavier weight in women with beauty and wealth, however, due to the integration of Arabic and Western cultures, Libya's modern feminists are more likely to imitate the ideal embedded in the media in relation to the appearance of Western women, which states that 'thin is beautiful' (through engaging in PA and/or eating less) as opposed to 'fat being beautiful' (Musaiger et al., 2013; Benjamin & Donnelly, 2013). Furthermore, in adherence to Islamic principles, Libyans are being persuaded to change their sedentary lifestyles by engaging in PA and sustaining an active life in all aspects of everyday life, for instance at work, home, transport and during leisure time (Musaiger et al., 2013; Benjamin & Donnelly, 2013). Therefore , the BMI of Libyan adults is significantly negatively associated with total PA under the three domains (work, transport and recreational activities) in women but not in men.

The finding that Libyan adults meet the criteria for a 'moderate' level of PA in my study is surprising, particularly given the latest obstacle constraining Libyan adults from engaging in PA, namely, the current deteriorating political-economic situation in Benghazi, due to the conflict between militias and the Libyan military, which has led to an unsafe environment and many people preferring to stay indoors (Chivvis & Martini,2014). Turning to the three domains of PA (work, transport, and recreational activities), the following barriers might explain why many Libyans fail to engage in PA: a lack of time; a lack of local exercise facilities; and the distance between homes and exercise facilities in deprived areas (Benjamin & Donnelly, 2013; Musaiger et al., 2013). Another environment-related barrier that may hinder Libyans from engaging in PA is the hot weather (30-40 degrees Celsius in summer). Other reasons include: health impairments, such as co-existing diseases; fear of injury; feelings of tiredness; and indulging in an affluent lifestyle such as a tendency to use cars excessively and being distracted by TV or video games (Caperchione et al., 2009; Serour et al., 2007; Thomas et al., 2004). See Appendix 7.2 for further discussion about engaging in physical activity.

7.4.2 Sedentary behaviours

This study found a significant positive association between sedentary behaviour and obesity for both genders in Libyan adults. However, after adjusting for all possible confounding factors, a significant positive association was observed between sedentary behaviour and

obesity in women but not in men. Such findings indicate that there is sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

There are several possible reasons why sitting or lying contributes to the obesity epidemic in women. One is the role of TV viewing, as a key sedentary behaviour is screen-time. However, it is common in many Libyan families to hire maids to perform typical domestic chores rather than the Libyan women. Consequently, Libyan women are likely to be more prone than men to gaining weight. A possible likely explanation is that food marketing is highly influential for people who lives a sedentary lifestyle through overexposure to television advertising which stimulates them to purchase and consume unhealthy food, and sedentary behaviours influence body metabolism by reducing metabolic rate, which in turns decreases energy expenditure, ultimately increasing body weight (Heinonen et al., 2013; Scully et al., 2007; Shields & Tremblay, 2008).

Another reason is that eating while watching television poses a distraction, prompting dietary habits during TV viewing to deviate from those during regular meals. It may disrupt the ability of individuals to respond adequately to normal internal hunger and satiety cues, and people tend to unknowingly overindulge, which results in obesity (Liang et al., 2009; Wansink, 2010). Another explanation is the employment of at least one domestic worker by many Libyan households to perform typical domestic chores and to look after the children. In addition, there is widespread use of household appliances to make life easier, and a heavy reliance on cars that promote a sedentary lifestyle. Consequently, Libyan women are likely to tendency towards sedentary lifestyle to a greater extent than are men, thereby predisposing women to gaining weight.

A further explanation is that prolonged sitting or lying down may displace time spent in higher-intensity physical activities, thereby resulting in reduced energy expenditure and ultimately increased body weight, which develops into obesity (Boulos et al., 2012; Heinonen et al., 2013; Hu et al., 2003). In the Libyan context, it is possible for Libyan adult men engage in both sedentary and physically active behaviours simultaneously, and that these two behaviours co-exist within the same day, for example, through participating in sport and exercise and engaging in computer games and TV-viewing. Thus, one type of behaviour does not necessarily displace the other. Although Libyan men reported being sedentary (sitting) for slightly more extended periods of time more than did women, the lack of association between sedentary

behaviour and obesity in men was unexpected. Therefore, the BMI of Libyan adults is significantly, positively associated with sedentary behaviour in women but not in men. See Appendix 7.2 for further discussion about the association between sedentary behaviour and obesity.

The section below addresses the *fourth hypothesis* of this study: to investigate whether there was a statistical association between obesity and neighbourhood environmental factors.

7.5 Neighbourhood environmental factors

After adjusting for all possible confounding factors, my study reveals a significant association between obesity in Libyan adults and 6 of the 12 neighbourhood environment factors. A significant association was found between obesity and 3 of the 12 neighbourhood environment factors, for both genders. These were: street connectivity; unsafe environment and committing crimes at night; and neighbourhood aesthetics. However, an association was found between obesity in men but not in women for 3 of the 12 neighbourhood environment factors. These were: access to public transport; access to recreational facilities; 'unsafe environment and committing crimes during the day'. Furthermore, an association was established between only one neighbourhood environment factor and obesity for women but not in men. This was 'residential density zones'. These findings indicate that there is sufficient evidence to reject the null hypothesis and accept the alternative hypothesis, that is, there is a significant association between the BMI of Libyan adults in 6 of the 12 neighbourhood environment factors: street connectivity, 'unsafe environment and committing crimes at night', and neighbourhood aesthetics, for both genders combined; while access to public transport, access to recreational facilities, and 'unsafe environment and committing crimes during the day' were significant for men but not for women; and finally 'residential density zones' was significant for women but not for men.

Conversely, my study found no association between the BMI of Libyan adults for the remaining 6 of the 12 neighbourhood environment factors: land use mix (access to commercial places, access to public places, and walkable destinations); pedestrian infrastructure (presence of pavements and maintenance of pavements); cycling infrastructure (presence and maintenance of cycle lanes); traffic safety (for pedestrians and for cyclists); pedestrian safety (being active in their neighbourhood); and household vehicle ownership (vehicles in household). It follows that there is insufficient evidence to reject the null hypothesis, that is, there is no association

between BMI and the 6 aforementioned neighbourhood environment factors. The following sections discuss these associations (or lack of associations) in more detail.

7.5.1 Residential density

My study found a strong, significant positive association between residential density zones and obesity, in Libyan adults, for both genders. In contrast, after adjusting for all probable confounding factors, 'residential density zones' was significantly associated with obesity in women but not in men. My findings indicate that there was sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

Numerous factors could explain the significant positive correlation between 'residential density zones' and obesity in women but not in men, that is, the higher the density of the residential zone, the higher the BMI in women. One possibility is that people who living in low-density areas, such as in sprawling suburbs, tend to be car-dependent communities whereas those living in high-density areas such as central urban areas may have less reliance on cars (Frank et al., 2007; Pendola & Gen, 2007). Since driving a car is a relatively sedentary activity, those who rely on cars are more likely to have a higher BMI (Frank et al., 2004). Another possibility is that the increasing residential density in Benghazi is leading to an overcrowding of open spaces, parks, public spaces, and pedestrian amenities, leaving little space for the residents to walk or perform outdoor physical activity.

Additionally, high-density areas may generate traffic jams along with safety and pollution concerns, which could further discourage walking and other outdoor physical activity (Alfonzo et al., 2014). The inconsistent findings in previous studies are likely due to differences in the way in which residential density is measured, for example, site, net, gross, urban or metropolitan. Determining which of these measures of density to use depends on two factors: the scale of the precinct and its purpose, whether residential or non-residential land uses. Site and net residential densities are used at the smaller scale of lots, blocks and precincts. Gross and urban residential densities are used at the neighbourhood or district level, and metropolitan density at the city scale. Because site and net densities omit the non-residential land uses, they are theoretical measures. Gross and urban densities, however, are considered to be better indexes of what occurs on the ground (Cheng2010; Forsyth,, 2003).

In the literature, an increase of sprawling suburbs tends to have detrimental outcomes due to the reliance on driving and the reduced engagement in meaningful exercise that it encourages, which likely lead to rising obesity rates (Ewing et al., 2008; Kelly-Schwartz et al., 2004). Further discouraging the use of neighbourhood facilities for outdoor physical activity is the unstable political environment in Benghazi, due to conflicts between the armed groups creating an unsafe environment, which may contribute to increase obesity epidemic. The lack of an association, whether positive or negative, between 'residential density zones' and obesity in the case of men, is an ambiguous finding which differs from those of previous studies. Therefore, the BMI of Libyan adults is significantly positively correlated with 'residential density zones' in women but not in men. In other words, the higher the residential density, the higher the BMI in Libyan women but not in Libyan men.

In finding that a higher population density is associated with a higher risk of obesity among women, but not among men, my results are consistent with those of a US study by Smith et al. (2008) and a Massachusetts study by Troped et al. (2010). However, numerous epidemiological studies have shown the opposite result: that people living in high-density neighbourhoods have lower BMIs (Hirsch et al., 2014; Lopez, 2007; Rundle et al., 2007). Other studies have however found inconsistent results concerning the association between residential density and BMI figures. It is unsurprising that my findings are dissimilar not only to some epidemiological studies that found no association between residential density and obesity for both genders (Feng et al., 2010; Frank et al., 2004; Pendola & Gen, 2007; Ross et al., 2007; Rutt & Coleman, 2005), but also to those of studies reporting a positive association between urban sprawl (low-density residential areas) and the risk of being obese for both genders (Ewing et al., 2006; Lopez, 2004; Plantinga & Bernell, 2007). This is because many of these studies were conducted in Western cities, and the association between built environment features, in the form of residential density, and obesity cannot be assumed to apply to the Libya context, particularly considering its unique situation of political instability. It is necessary to seek further explanation and clarification through discussion with Libyan HCPs and LCLs.

7.5.2 Unsafe environment and committing crimes at night or during the day

My study found a strong, significant positive association between 'an unsafe environment and committing crimes at night (or during the day)' and obesity in the adult Libyan population, for both genders. In contrast, after adjusting for all possible confounding factors, 'an unsafe environment and committing crimes at night' was significantly associated with obesity in the adult Libyan population for both genders. However, 'an unsafe environment and committing

crimes during the day' was significantly associated with obesity in men but not in women. My findings indicate that there was sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

Most of the respondents in this study reported that they perceived the environment to be unsafe and perceived crime safety to be poor at night (71.6%) and during the day (75.5%). It may be inferred that they perceive the current situation in Benghazi to be very dangerous in all aspects, with some districts in Benghazi being evacuated by residents due to the fighting between the Libyan army and the Islamic radical militias. Another explanation for the positive association found between 'an unsafe environment and committing crimes at night' and BMI of Libyan adults is the government's ineffective role in crime-prevention and the absence of laws for arresting criminals. These factors may impede Libyans from practising PA in their daily lives. Further compounding the lack of PA may be Libyans' limited resources and lack of access to healthy, affordable foods; even if healthy and fresh foods are available, it may be of poor quality so as to lower costs, which reduces the appeal of these agricultural products for shoppers (Andreyeva et al., 2008; Black et al., 2012; Zenk et al., 2006).

Furthermore, perceived neighbourhood safety may influence residents' levels of stress, affecting their health behaviours and outcomes, such as increasing weight-gain through stress-induced hormonal and metabolic changes as well as unhealthy eating behaviours, which have been associated with an increased risk for central obesity (Adam & Epel, 2007; Tomiyama, et al., 2011; Torres & Nowson, 2007). Therefore, the BMI of Libyan adults is significantly correlated with 'an unsafe environment and committing crimes at night' in Libyan adults in both genders, while 'an unsafe environment and committing crimes during the day' was found to have an association with BMI in men but not in women. In other words, the lower the level of safety in the environment and committing crimes at night, the higher the BMI in Libyan adults for both genders. In addition, the lower the level of safety in the environment and committing crimes during the day, the higher the BMI in Libyan men but not in women.

My findings reveal that the BMI of Libyan adults is significantly associated with 'an unsafe environment and low perceived crime safety at night' in Libyan adults in both genders, while with 'an unsafe environment and low perceived crime safety during the day' was positively associated with BMI in men only. These findings are consistent with the body of literature which showed that the higher the level of danger in the environment and the higher the crime-rate, the lower the levels of PA reported, which is related to higher risks of obesity and higher

levels of BMI (Brown et al., 2014; Burdette & Hill, 2008; Christian et al., 2011; Li et al., 2005; Mota et al., 2007; Roman et al., 2009). In contrast, other studies found no significant relationship between 'perceived unsafe environment and committing crimes' and PA (Ball et al., 2007; Duncan & Mummery, 2005; Hoehner et al., 2005). This is consistent with one aspect of my findings, namely the lack of association found between 'an unsafe environment and committing crimes during the day' and BMI in Libyan women. It is necessary to seek further explanation from HCPs and LCLs for the lack of association between 'perceived unsafe environment during the day' and BMI in women. See Appendix 7.3 for further discussion about the association between other neighbourhood environment factors and obesity.

7.6 The prevalence of overweight and obesity

My study revealed that the prevalence of obesity among Libyan adults was 42.4%, whereas the prevalence of being overweight was 32.9%. In addition, the prevalence of obesity among women was significantly higher than that among men (47.4% vs. 33.8%). Although an increase in the prevalence of obesity has been reported in many countries around the world, the rate of increase in Libya has been observed to be particularly high. The prevalence of obesity in Libya has more than doubled in the last three decades, from 12.6% in 1984 to 30.5% in 2009 (MoH, 2010; WHO, 2009; World Obesity Federation, 2014). Consequently, it may be concluded that the prevalence of obesity in Libya has increased by more than a third over the past six years from 2009 when it was 30.5% until this year 2015 when it was estimated to be 42.4% in this study. Since the present study adopted the Segmental Body Composition Analyser to identify anthropometric measurement readings, which were conducted by highly trained and experienced nurses, the results of this study are arguably more accurate and reliable than those of other studies in the Arab region, which adopted self-administered questionnaires that included self-reported anthropometric measures (Dijkshoorn et al., 2011; Musaiger , 2011).

One possible explanation for the high prevalence of obesity amongst Libyans adults is the deterioration in the current political situation in Libya, including an unsafe physical environment due to battles amongst militias coupled with weak Libyan government performance in upholding the rule of law. This has resulted in their inability to protect civilians from rights abuses in Benghazi (Chivvis & Martini, 2014; Tabib, 2014). Hence, Libyans tend to stay at home most of the day, eating unhealthy foods, which are the 'staple food commodities' of the country, subsidised by the Libyan government who makes them widely available to the general public. Other possible explanations are the absence of physical

activities due to a curfew enforced by the government (Chivvis & Martini, 2014 ;Tabib, 2014); deteriorating Libyan health system performance, resulting in Libya's healthcare facilities become completely ineffectiveness in preventing and controlling obesity among Libyans and in spreading health awareness amongst Libyan population about obesity (WHO,2015), whether by the old or the new regime. Collectively, these factors may contribute to an exacerbation of the obesity epidemic; therefore, the high prevalence rate of obesity revealed by my study is unsurprising.

The Global Burden of Disease Study (GBD), coordinated by the Institute for Health Metrics and Evaluation (IHME), estimated the prevalence of obesity and overweight in Libyan adults at 73.9% in 2013 (43.9% for obesity and 30.0 % for being overweight)., whereas my study found that the prevalence of obesity and overweight is at 75.3% in 2015 (42.4% for obesity and 32.9% for being overweight). Thus, the prevalence of obesity and overweight in Libya estimated by the GBD study (71.9%) is slightly lower than the prevalence of obesity and overweight in Libyan adults estimated by my study in 2015 (75.3%).

While my study found that Libya has a prevalence rate of 42.4% for obesity, 32.9% for being overweight, and 75.3% for both, it found BMI figures of 28.50 (+/- 5.40) for men and 30.12 (+/- 6.54) kg/m² for women. In comparison with, Nauru is the world's fattest country, with an average BMI of 34 to 35 kg/m², while Bangladesh is the world's thinnest nation, with an average BMI of 20.5 kg/m² for women and 20.4 kg/m² for men (Ng et al., 2014).Libya was ranked ninth in the list of the world's fattest countries, based on the classification presented by a comprehensive review titled 'Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: A systematic analysis for the Global Burden of Disease Study 2013' (Ng et al., 2014). However, the more up-to-date calculations and findings from my study may necessitate a re-classification of the fattest countries in the world. With these latest figures of the prevalence of obesity for Libya (33.8% of men; 47.4% of women) pushing this country further up the list, to occupy a place between Qatar (44% of men; 54.7% of women) and Saudi Arabia (30% of men; 44.4% of women), Libya should in fact occupy sixth place, which would be a rise of three places on the list according to the estimation of the Global Burden of Disease Study (Ng et al., 2014).

7.7 Sociodemographic data

7.7.1 Gender

My study found that a significant association between obesity and genders. My results revealed that approximately 75.3% of Libyan adults were overweight or obese, and that the prevalence of obesity in women was significantly higher than that in men (47.4% of women compared to 33.8% of men).

Several possible reasons for the higher obesity rates among Libyan women can be posited. As discussed in Chapter 2, Literature review (Section 2.10.6), cultural values and traditional restrictions in lifestyle choices available to women in Libya probably contribute to their gaining weight. Libyan culture continues to treat women in a strict manner, and assumes that women were created only to serve 'man', and that they are only child-bearers and carers; therefore, in the context of societal traditions women are compelled to stay at home in order to perform household tasks (Abul Hajj, 2013), which gives them less time to exercise. In addition, women in Libya probably have little opportunity to engage in physical activity due to cultural or religious barriers similar to other Arab women (Al-Lawati & Jousilahti, 2004; Galal, 2002; Musiager, 2011); physical exercise by women is generally frowned upon in Libya.

Another gender-related contributor to obesity is the fact that most Libyan women wear the traditional black female over-garment (jilbabs or abayas), and other loose garments, which predisposes them to being unaware of any increase in their weight (Musaiger, 2011; Musaiger & Qashqari, 2005; Mokhtar et al., 2001). With the abaya serving to hide the extent of the obesity, women are more likely than men to become overweight or obese. Furthermore, many Libyan communities and tribes persist with fattening rituals for women before marriage, as a sign of fertility, good health and prosperity (Musaiger, 2011; Rguibi & Belahsen, 2006). All of these factors could explain why women are more obese in Libya than are men. Therefore, the prevalence of obesity in women was significantly higher than that in men is predictable. As the obesity epidemic in Libya continues to escalate, with a complete absence of any preventive measures being performed by the health authorities, more research on gender disparities in obesity will improve our understanding of this damaging epidemic.

My findings were consistent with those of previous studies which found a significant association between obesity and gender (Albert & Peng, 2009; Chamieh et al., 2015;

Mungreiphy et al., 2011; Pei et al., 2015).In comparison, the last survey in Libya in 2009 estimated the prevalence of obesity to be 40.1% of women compared to 21.0% of men (MoH, 2010; WHO, 2009; World Obesity Federation, 2015). Both the findings of the present study and the 2009 survey were consistent with recent studies in the EMR that have proved consistently that obesity rates are higher among women in the region than men (ALNohair, 2014; Ng et al., 2011), despite other studies appearing to have a consensus in their findings that obesity rates have been inclined to increase more rapidly in men than in women, in the EMR (ALNohair, 2014; Ng et al., 2011).

7.7.2 Age

My study found that a significant association between obesity and age in Libyan adults of both genders. My findings revealed that for females, the highest obesity rate was in middle-aged adults, aged 40-49 years, while the lowest rate was in younger adults, aged 20-29 years. In contrast, the highest obesity rate for males was in older adults aged 60-65 years, while the lowest rate was in younger adults, aged 20-29 years, as for females. This suggests that the prevalence of obesity in both men and women in Libya increases with age.

One possible explanation for middle-aged (aged 40-49 years) women having higher rates of obesity than women from other age groups is multiparity. In contrast, it was older men (aged 60-65 years) who have higher rates of obesity than men from other age groups. One explanation could be retirement, which is usually accompanied by behavioural changes including: unhealthy food intake; less structured meal times or a change in eating patterns; and becoming less physically active, for example, due to no longer getting up early to travel to work on a daily basis (Chung et al., 2009). It is generally agreed that the slowing metabolism that occurs at this age also promotes changes in body composition, favouring increased body weight (St-Onge & Gallagher, 2010). Furthermore, since the second highest obesity rate was in women aged 60-65 years, it is likely that biological changes such as menopause are responsible for weight gain in this age group due to a decline in women's oestrogen levels, which probably affects fat distribution and may increase the risk of obesity (Kanter & Caballero, 2012; Morita et al., 2006).

My findings were consistent with those of previous studies which found a significant association between obesity and age (Albert & Peng, 2009; Chamieh et al., 2015; Mungreiphy et al., 2011; Pei et al., 2015).In addition, my findings are similar to those of a comprehensive

review study conducted by Musaiger (2011), which concluded that, in most EMR countries, obesity increases with age up to 60 years of age, when obesity starts to decline in both men and women. Likewisw, my findings were similar to data reported by Employment and Social Development Canada (ESDC), Canada, where both men and women aged 45-64 were reported to have the highest rates of obesity (ESDC, 2016). Also in support of my results, numerous studies reported the findings of several prospective cohort studies which revealed that men and women gain weight consistently until age 65 (The Hastings Centre Organization ,2016; Chumlea et al., 1999; Guo & Chumlea, 1999). In addition, my findings corroborated the suggestion of Flegal et al. (1998) that the association between age and weight-gain is an inverted U- or J-shaped pattern. Therefore, all findings concerning age associated with obesity revealed by my study are unsurprising.In contrast to my study, a study in Lebanon (Chamieh et al., 2015) and another in Syria (Fouad et al., 2006) reported the higher rates of obesity in men in early adulthood, while higher rates of obesity were found in women of an advanced age.

7.7.3 Marital status

My study found a strong significant association between obesity and marital status in Libyan adults of both genders. However, after adjusting for all possible confounding factors, a significant association was established between obesity and being married in women, but no such association was established between obesity and being married in men, even though married men had a higher prevalence of obesity (39.6%) than men who had never married (21.3%). Therefore, the association between increased BMI and being married exists for Libyan women but not for Libyan men.

Several possible explanations can be postulated for the association observed in the present study between marital status and obesity. The lack of health awareness among the public about obesity is probably the biggest barrier that impedes Libyan adults, whether married or unmarried, from engaging in physical activity, which may lead to an increased risk of obesity. A second possible explanation is the decline in the levels of physical activity in newly married couples, which may occur in conjunction with increased social responsibilities (Hull et al., 2010; Kahn & Williamson 1990), particularly amongst married women who often busy themselves with household chores, laundry, cooking and raising children. All these commitments are likely predispose married Libyans to gain weight. Another possible explanation is that, although married people are more likely to engage in physical activities

than individuals' who have never married (CDC, 2004), this assumption may apply more to Libyan men than Libyan women because, as my study found, Libyan women Likely are discouraged from engaging in physical exercise due to religious and cultural barriers, as discussed earlier in Chapter 7, Section 7.3.6.

A final possible explanation is that, although Libyan culture discourages -married spouses from engaging in physical activities, current circumstances may also be discouraging them from engaging in PA, such as the political conflicts and curfew enforced by the Libyan government (see Chapter 7, Section 7.5.8). Under these unstable circumstances in Benghazi, it may be more possible for Libyan men, in contrast to women, to engage in outdoor physical activities, given that in Libyan culture men have a greater responsibility compared to women, regarding their sincere commitment to take care of and feed their households according to Islamic law. These factors could help to explain the association between increased BMI and married Libyan women, and the unexpected results in terms of married Libyan men. This finding is inconsistent with the pattern identified in the literature.

The association found in my study is however dissimilar to the findings of previous epidemiological studies (both cross-sectional and longitudinal) conducted in developed and developing countries, which revealed a significant association between obesity and being married, that is, married men and women tend to have a higher risk of being overweight and obese than never-married individuals (Aryee et al., 2013; Fouad et al., 2006; Janghorbani, 2008; Leahy et al., 2014; Tzotzos et al., 2010; Veghari et al., 2010). In addition, my findings were contrary to the results of a study in Lebanon which found an association between obesity and being married in men, but not in married women (Chamieh et al., 2015). However, interestingly, the findings of my study showed significantly different with the findings of existing literature; hence to my knowledge no existing study has revealed the same results as my study. Consequently, further exploration is required to understand this pressing issue by interviewing Libyan HCPs and LCLs.

The section, which addressed other prominent factors, including: other sociodemographic data (religion and ethnic groups and residence in Benghazi) (see Appendix 7.4 for more details). The next chapter discusses methodology for the qualitative study (Phase II).

Chapter Eight : Phase II: Methodology for the qualitative study

8.1 Introduction

The first three chapters of this thesis outlined the need to explore the risk and protective factors associated with obesity in Libyan adults, and discussed the theoretical framework (SEM) used to address the phenomenon understudy, obesity. The next four chapters constituted the research design employed, namely, a sequential explanatory mixed-methods design, in Chapter Four, while the methodology for the quantitative study was discussed in Chapter Five and quantitative data analysis and discussion in Chapter Six and Seven respectively.To address my second research question ("What are the views of Libyan healthcare professionals and community leaders in Benghazi with regard to the risk and protective factors associated with obesity in Libyan men and women, within the context of Libyan culture?"), an inductive research approach was adopted in the form of a semi-structured interview.

The present chapter presents the intermediate stage of the adapted sequential explanatory mixed-method design, which integrates the qualitative and quantitative phases.It then discusses the research design and methodological approach of the qualitative study (Phase II). It outlines all components relevant to the semi-structured interview including: an overview of the target population; the rationale for selecting eligibility criteria for the participants. It also discusses sample-size considerations; and the rationale for selecting a purposive sampling technique. In addition, the chapter presents data collection methods in terms of semi-structured interviews, the recruitment of the participants, and the translation process in the qualitative protocol. Furthermore, it presents ethical considerations, before discussing in detail the pilot study for the qualitative approach. Last but not least, it outlines a method of qualitative data analysis commonly used in health-related research known as Framework Analysis (FA). It also applies all five key stages of the Framework Analysis method to the analysis of the qualitative data. Finally, the chapter provides how the verification (validation) of the qualitative research data was performed in this thesis.

8.2 Integrating the qualitative and quantitative phases

This section presents the intermediate stage of the adapted sequential explanatory mixed-methods design. During this stage, the quantitative and qualitative phases of the study were connected through identifying the unanticipated results of the quantitative data analysis that

required further explanation. The emerging qualitative approach was used to explain and explore the ambiguous and unexpected findings – both significant and non-significant – of the first phase, the quantitative study. This section outlines all the steps that were taken to integrate the adapted sequential explanatory mixed-methods design. These included identifying the key informants to provide their perspectives on the under-researched topic of obesity in Libya. In addition, this section outlines all the steps taken to develop the interview schedule, based logically on those results requiring further explanation. Finally, this section outlines the steps taken to formulate the main research question for the inductive approach.

The adapted sequential explanatory mixed-methods research design that guided this thesis lends itself to emergent approaches, whereby the second phase, the qualitative study, was developed based on the unanticipated quantitative results that needed further clarification through conducting the qualitative study. Consequently, the integrating step in this mixed-methods design included the following aspects. First, the potential key interviewees in the community were identified. This study required a diverse mix of experts in order to elicit a variety of perspectives about the obesity epidemic in Libyan context. Aligned with a pragmatic approach guiding this study, the researcher selected those who are most likely to be knowledgeable about current issues pertaining to obesity in Libya, from diverse perspectives, whether health-related, social, political, or economic. Because of their understanding and experience of these issues, the researcher chose Libyan healthcare professionals (HCPs) and Libyan community leaders (LCLs) as key informants for the individual interviews. For more detail about the justification for selecting these two groups, see Section 8.3.

The second integrating step involved developing the semi-structured interview schedule, and formulating the open-ended questions. This was done with the aim of understanding or gaining further insight into the unanticipated quantitative results, regarding the nature of the significant or non-significant relationships found between obesity and the following four-predictor variables: (i) socio-economic status (SES); (ii) unhealthy eating behaviour patterns; (iii) physical activity and sedentary behaviour patterns; and (iv) neighbourhood environment factors. This is followed by the series of questions that were devised for the design of the semi-structured interview schedule (for more details about developing the semi-structured interview schedule see Section 9.12).

Finally, formulating the research question for the inductive approach. The key informants for the inductive study were identified and the individual interview schedule was developed, guided by the unanticipated findings from the deductive approach. Based on the significant and non-significant relationships found between obesity and the four-predictor variables, the research question formulated is as follows:

"What are the views of Libyan healthcare professionals and community leaders in Benghazi with regards to the risk and protective factors associated with obesity among Libyan men and women from Benghazi, within the context of Libyan culture?"

8.3 Population and sampling technique

Population and sampling technique
This section identifies the target population and eligibility criteria for the qualitative study. It also discusses sample-size considerations and the rationale for selecting a purposive sampling technique, specifically expert sampling.

8.3.1 Population

As mentioned in Chapter Five on 'qualitative methodology', Section 5.2.1, the target (theoretical) population of this study was Libyan adults, while the study (accessible) population was Libyan adults living in Benghazi aged (20-65 years). The two key groups were Libyan healthcare professionals (LHCPs) and Libyan community leaders (LCLs) were selected to formulate the sampling frame for the inductive study.

8.3.2 Eligibility criteria for participants

This section discusses the eligibility criteria requirements for the two groups selected to be interviewed: LHCPs and LCLs.

8.3.2.1 Inclusion criteria

Interviewees selected for participating in the interviews met all of the following criteria:
- Currently works as a healthcare professional, community leader or both.
- Speaks an Arabic language.
- Has been resident in Benghazi for over ten years.
- Has at least five years' work experience.

- Must meet the eligibility criteria for appointments as set out in the internal regulations of the Social People's Leadership Institution, that is, 35 years of age or older and has achieved an educational qualification(s).

8.3.2.2 Exclusion criteria

Any potential participant was excluded if they met one or more of the following criteria:

- Speaks only the Berber language as opposed to Arabic.
- Healthcare professional who is not affiliated to the Benghazi Diabetes Centre (BDC).
- Has been recently appointed in any of the institutions from which the respondents were recruited.
- Fails to meet the requirements for appointments as set out in the internal regulations of the Social People's Leadership Institution.

For further information on the rationale for selecting the above inclusion and exclusion, criteria for participating in the interviews see Appendix 8.1.

8.4 Rationale for selecting the interviewees

Although there were no restrictions against accessing and recruiting the ordinary Libyan people in Benghazi to interview, I excluded them from my study because they were viewed as likely to have less knowledge, in general, than the healthcare professionals and community leaders; accordingly, the dialogue is likely to be inadequate for interview purposes. In addition, the information they provide might be misleading and fail to elucidate the actual findings. Furthermore, they may be hesitant about speaking freely, given the strictures historically imposed by Libya's strict cultural and political regime, for further details, see Chapter 4, Section 4.6.1 . All these factors pose an obstacle to conducting interviews with ordinary Libyans.

A more appropriate person to interview, following the recommendations of CDC (2013), WHO and University of Amsterdam (2004) and Sliwa (2011), are those whose occupation necessitates frequent contact with the public and entails providing a continuous service. Such people can be a valuable source of information about their communities, providing meaningful information about any under-researched topic due to their being one of the three primary types of interviewees: informants, subjects or respondents (Bryman, 2012). Those employees who are in constant contact with the public include schoolteachers, healthcare professionals (HCPs) and community leaders (CLs) (Burnet et al., 2008; Nicol et al., 2014; WHO and University of

Amsterdam,2004). The opinions of such experts have more credibility than those of lay people – to professionals, to others in the same field, to researchers and to other end-users of research (Corden & Sainsbury , 2006; Trochim, 2006). This regard for experts' views is due to society or the community unquestioningly accepting these people as being experts in their respective fields (Creswell, 2013; Trochim, 2006).

In identifying potential key interviewees in the community with whom to conduct interviews, I sought a diverse mix of experts in order to elicit a variety of perspectives (Carroll et al., 2004). Aligned with a pragmatic approach, I selected those who are most likely to be knowledgeable about current issues pertaining to obesity in Libya from diverse perspectives, whether health-related, social, political or economic. Because of their understanding of such issues, I chose healthcare professionals and community leaders as my interviewees. The following section provides an overview of each group and the rationale for selecting these two groups.

8.4.1 Libyan healthcare professionals (HCPs)

There is consensus in the literature that healthcare professionals should not only advise on and provide curative, preventive, promotional or rehabilitative healthcare services to individuals, families or communities, but they can also be invaluable resources for community education, policy advocacy and counselling, bringing influential and respected voices to communities, especially when they are recruited for any academic research (CDC, 2016a; WHO, 2016c). In the Libyan context, the vast majority of Libyan healthcare professionals are foreign. Due to the absence of scientific research and lack of documentation in the healthcare field in Libya, the roles of Libyan healthcare professionals tend to be ineffective in terms of providing advocacy and counselling. Since healthcare professionals can be considered to be public healthcare experts working for the common good of the society (CDC, 2016a; WHO, 2016c), their role in Libya is arguably similar to their counterparties in other parts of the world. Consistent with my pragmatic approach, I selected Libyan HCPs as one of my target groups for interviewing, given their knowledgeability about obesity in Libya.

8.4.2 Libyan community leaders (LCLs)

In Libyan society, the role of community leaders is to take responsibility for the well-being and improvement of their communities, as well as interacting and communicating with the media and the police as a representative of that particular community (Tempelhof & Omar, 2012).

They determine the general feeling within a particular community and liaise between the community and the authorities (Axner, 2014). In many countries, community leaders are not officially elected or appointed by their communities, nor are they enabled by legal powers to achieve their tasks within or outside their districts (Axner, 2014; Sharqieh, 2013). Frequently self-appointed, the majority conduct their activities as volunteers (Sharqieh, 2013; Tempelhof & Omar, 2012). However, in the Libyan context, community leaders have traditionally been appointed by the old Libyan regime, which gave them a salary and upheld their position (Sharqieh, 2013; Tempelhof & Omar, 2012).

According to the Harwood Institute for Public Innovation (HIPI) in the USA, community leaders within any country around the world can be categorised into five distinguishable clusters based on the responsibilities and roles performed, namely: (1) Official leaders, who hold elected positions, including mayors, state legislators and city council members; (2) Civic leaders, such as religious leaders (Imam or Sheikh), and heads of civic organisations; (3) Connectors, who convey and spread ideas and social norms from place to place, such as tribal leaders; (4) Catalysts, who are perceived to have wisdom, such as tribal leaders or religious leaders; and (5) Experts, including planners in diverse fields such as college or university professors (HIPI, 2015). The community leaders in Libya conform to this classification in that (1) the municipal council members are the official leaders; (2) the Imams or Sheikhs are the civic leaders; and the tribal leaders are both (3) connectors and (4) catalysts. Finally, (5) lecturers in Benghazi are the experts.

In Benghazi, these five distinguishable types of community leaders are affiliated with or employed by the following organisations respectively: (1) official leaders at Benghazi Municipal Council, (2) civic leaders at the General Authority of Islamic Affairs and Endowments of Benghazi; (3) connectors and (4) catalysts at a council of wise men and tribal elders in Benghazi; (5) experts at Benghazi universities. All 5 are selected according to eligibility criteria see (Section 8.2.2) to be appointed as members of the Social People's Leadership Institution (SPLI), which pays them an extra salary, separate from their salary from their institution of origin. Hence, consistent with my pragmatic approach, I selected all aforementioned subcategories of the LCLs as my second target group. The next section discusses my decision to use a purposive sampling technique.

8.4.3 Rationale for using purposive (expert) sampling

Non-probability sampling techniques are typically associated with the qualitative paradigm (Onwuegbuzie & Collins, 2007) and may be categorised into three broad methods: convenience sampling, also called 'accidental or haphazard sampling'; theoretical sampling; and purposive sampling, also called 'judgmental or authoritative sampling' (Bryman, 2012; Creswell 20013). Numerous overlaps exist between purposive and theoretical sampling, which are often regarded as interchangeable in the literature (Oppong, 2013; Trochim, 2006). These three types of 'qualitative' sampling are discussed below in more detail, with a view to justifying my selection of purposive sampling.

8.4.3.1 Convenience sampling

Convenience sampling is easy and quick to implement, as well as resource-efficient since the selected participants are accessible or in close proximity to the researcher (Brayman, 2012; Oppong, 2013; Trochim, 2006). It is usually suitable for pilot surveys in which questions are pre-tested to assess the preliminary findings before finalising the sample design (Tuckett, 2004; Brayman, 2012). However, a drawback of convenience sampling is that the interviewees selected by this technique may not be representative of the entire population, given that the sampling frame is unidentified (Brayman, 2012; Creswell 20013; Tuckett, 2004). This in turn impedes generalisation and inference making about the population under study (Brayman, 2012; Creswell 2013; Tuckett, 2004). To avoid the risk of obtaining results that lack external validity, I eliminated the use of this technique in my study, and examined theoretical sampling.

8.4.3.2 Theoretical sampling

Commonly used in the grounded theory approach to collect rich data from informants for theory-generation (Thomson, 2011), theoretical sampling involves selecting additional participants based on previously analysed data (Brayman, 2012; Creswell, 2013; Strauss & Corbin, 1998). Typically, the first participants recruited in theoretical sampling are purposively chosen or conveniently available, while the second group will be selected based on the preliminary analysis of the data (Brayman, 2012; Creswell, 2013; Schneider et al., 2013). The main drawback of this sampling method is the lack of guidelines for identifying how the theoretical saturation point is reached (Brayman, 2012; Creswell, 2013). In addition, this highly systematic method is more time-consuming and expensive than other sampling methods (Oppong, 2013). I therefore investigated a purposive sampling technique instead.

8.4.3.3 Purposive sampling

Also called selective or subjective sampling, this is a common sampling technique in qualitative research, referring to the selection of participants based on the researcher's personal judgment rather than on randomisation (Brayman, 2012). Subjective sampling is tentatively 'representative' of the population of interest, despite that fact that the sampling is not random (Babbie, 2010; Brayman, 2012). It is considered an effective technique for obtaining information about participants who possess traits which include experiences or knowledge of the issues being researched (Brayman, 2012; Mack et al., 2005; Onwuegbuzie & Leech, 2007). A drawback is that it can be prone to researcher bias, with the implication that the findings cannot be generalised to the population as a whole (Bryman, 2012; Creswell, 2012).

One type of purposive sampling is expert sampling. This is commonly used to glean knowledge from individuals whose qualifications and experience in their fields make them a source of information for researchers who seek to explore new areas of potential interest (Brayman, 2012; Mack et al., 2005; Onwuegbuzie & Leech, 2007). Expert sampling is particularly useful when there is a lack of empirical evidence or documentation in an area and/or high levels of uncertainty (Brayman, 2012; Creswell, 2013; Oppong, 2013; Morgan & Henrion, 1990; Tuckett, 2004). Because numerous questions arose from the results of my quantitative study which required further interpretation, I selected expert sampling as the sampling technique for my qualitative study.

The two participants groups, Libyan healthcare professionals and Libyan community leaders, were selected because they possess relevant knowledge and information about the diverse issues encountered in present-day Libyan society, in particular, health, social, economic, environmental, public policy and political matters within and outside the various Libyan communities. Having recognised obesity as a biopsychosocial phenomenon, with cultural values and norms about body weight differing substantially between cultures (Sobal, 2001), these two distinct groups have a good chance of providing valuable insights that would expand our understanding of the risk and protective factors associated with obesity in Libya. Whereas ordinary Libyans are generally reluctant to participate in research projects, due to having suffered oppression and injustice under the old totalitarian regime and being subjected to regional customs and tribal traditions and constraints (Bubaker & Rathakirshnan,2009; Gadour

et al., 2003), Libyan *experts* are more likely to be comfortable with providing information and discussing the issues.

8.4.4 Sample size considerations

Unlike the calculation method used to compute sample size in quantitative research, there is no agreed approach to estimate the number of participants to be recruited for a qualitative study (Baker & Edwards, 2012; Brayman, 2012; Creswell, 2013). However, researchers have identified a number of factors that can affect the number of interviews required and which can serve as a rule of thumb to achieve saturation, namely: the nature and scope of the study; the quality of the interviews; the number of interviews per participant; sampling procedures; and a researcher's experience (Bryman, 2012; Marshall et al., 2013; Mason, 1010; Morse, 2000). Although a saturation point technique can be used to determine "how many interviews are enough?" (Baker & Edwards, 2012; Bryman, 2012; Creswell, 2008; Sargeant, 2012), determining "saturation point" is a tedious task that requires highly skilled researchers to implement it.

Despite the lack of consensus on how to determine the sample size in qualitative studies, some qualitative researchers favour a numerical technique. It has been suggested that a minimum of 20 to 30 interviews needs to be conducted for the following purposes: for an interview-based qualitative study to be published (Warren, 2002); to develop a well-saturated theory for grounded theory design (Charmaz, 2006; Creswell, 2013); for a successful post-graduate study (Bryman, 2012). Although it is not possible to define the number of participants in advance, a range of 20 to 30 interviews may achieve saturation (Baker & Edwards, 2012; Bryman, 2012).

Furthermore, researchers suggest that three individuals be interviewed in each sub-group or from a particular setting (Baker & Edwards, 2012; Onwuegbuzie & Leech, 2007). This is because any subsequent data generated tends to be repetitive. Onwuegbuzie and Collins (2007) and Hancock et al. (2009), concur with this suggestion and recommend that interviews with three to four people across each sub-group is viable, enabling the researcher to reach a point of data saturation at the earliest possible stage.The theoretical saturation point technique in my study is relatively time-consuming as it entails verbatim transcriptions of the recorded interviews, followed by constant comparison analysis. Pragmatically, it was difficult to employ this method in my study due to time frame restriction for conducting my main fieldwork, resulting from the deteriorating social-political circumstances in Benghazi. Aligned with the

pragmatic approach, I adopted the above-mentioned numerical approach for determining sample size, which is estimated to be withn the range from 20 to 30 participants (exactly 21 interviwewes).

8.4.5 Determining sample size

Healthcare professionals may be divided into three subgroups, while community leaders have five subgroups, although two of these are similar enough to be collapsed into one (see Section 8. 3. 2). This results in a total of seven subgroups. Three participants were selected from each, according to the above recommendations (Baker & Edwards, 2012; Fox, 2009, NHS, 2009) WHO, 2012) resulting in a total sample size of 21 for the deductive phase of my study.

Table 8.1 (below) shows the names of five institutions from which the interviewees were selected, as well as the occupational category for each of the seven subgroups and th number of participants selected from each subgroup.

Table 8.1 Classifying the 21 interviewees, were recruited from 5 Libyan institutions.

SN	Institution name	Sub-categories of the interviewees	Number of interviewees
1.	Benghazi Diabetes Centre	Physicians	3
		Nurses	3
		Clinical nutritionists	3
2.	Al-Arab Medical University	Lecturers in public health	3
3.	General Authority of Islamic Affairs and Endowments of Benghazi	Imams (Sheikhs)	3
4.	Benghazi Municipal Council	Municipal council members	3
5.	A council of wise men and tribal elders institution in Benghazi	Tribal leaders	3
The total sample size			21

8.5 Recruitment of the participants

8.5.1 Overview

Between 2000 and 2010, the Libyan government started nominating and sponsoring large numbers of Libyan students to study abroad in order to enable the country to develop and progress in various employment sectors and improve Libyan quality of life. Some PhD students

conducted their studies in Libya (Dabia , 2012; Rhema & Miliszewska, 2010). However, they failed to establish even basic principles of scientific research methodology, whether quantitative or qualitative. This may be due in part to the absence of effective and reliable infrastructures, such as postal and internet services, as well as the instability of the administrative systems in both governmental and non-governmental organisations. Abrika et al. (2012), and Bubakar and Rathakrishnan (2009), who all collected qualitative data from Libya, contend that accessing their interviewees in institutions was arduous in terms of obtaining the requisite approval to reach their potential participants.

Although the above-mentioned researchers did not precisely detail the procedures that they undertook, they concurred on one procedure, namely, contacting their cultural attachés at the Libyan embassies in the countries in which they were conducting their research to obtain letters of approval for commencing their study in Libya. This letter plays an effective role in minimising obstacles. Some of the researchers mentioned other letters that they obtained from their affiliated institutions in Libya, which facilitated the recruitment of potential participants, but they failed to provide any details about these letters. It may be concluded that the basics of the scientific method have been poorly attended to in Libya. The lack of documentation in Libyan research has impeded novice researchers from replicating their methods.

8.5.2 Recruitment process

Aligned with my pragmatic approach, I implemented the first step recommended by Libyan researchers for conducting a study in Libya: I obtained a letter from the Libyan cultural attaché at the Libyan Embassy in London (Appendix 8.2). From the same four institutions that granted me ethical approval for the quantitative phase, I re-obtained ethical approval for the qualitative phase (see Section 8.9.2 for details). I also obtained five letters of permission from the Omar Al-Mukhtar University, with whom I am affiliated. These letters were addressed to the five institutions with which the participants were affiliated (see Section 8.3.5 for details). Using standardised wording, the five letters sought the cooperation of the relevant bodies of research to facilitate access to the target participants in each institution (see Appendix 8.3- 8.7).

Having worked in both the health and higher education sectors, I used my experience and professional relationships in these two sectors to facilitate the recruitment of the participants. Listed in the Table 8.1 (above), Section 8.3.5, the Benghazi Diabetes Centre (BDC), belonging to the health sector, is where I met some participants whilst conducting my pilot study; whereas

Al-Arab Medical University, belonging to the higher education sector, is where some of my work colleagues are located. My task was also facilitated by a relative who works at the Social People's Leadership headquarters as a mediator between myself and his director. Despite having no prior communication with the other two institutions – the headquarters of the Civic Leaders and the Benghazi Municipal Council – the letters issued from Omar Al-Mukhtar University were vital for persuading the heads of each institution to cooperate.

Because the postal service in Libya is largely ineffective, I personally handed each of the five letters to each head of the five selected institutions, so that I could establish a relationship of mutual confidence and cooperation with each institution. The heads of the three institutions with which I am familiar were willing and cooperative from the outset, accompanying me to meet their employees and encouraging their employees to participate in my study. Similarly, the heads of the two institutions with which I was not familiar were receptive to my explanations of the procedures followed in the other institutions to facilitate recruitment of research participants, and were happy to cooperate, for example, accompanying me to meet their employees.

That all the directors accompanied me to meet their employees indicates their support for my study. Once I obtained initial consent from a large number of potential participants from each institution, I returned to the director of the institution to evaluate who met the eligibility criteria in Section 8.2.2. Accordingly, I selected three eligible participants in each sub-group. Those selected participants were invited to the head office of each institution to take a Participant Information Sheet (PIS) and an Informed Consent Form (ICF) and to schedule their interview at a mutually agreed time and place. Finally, I finalised the interview schedule for the 21 participants (see Appendix 8.9). Those employees who were excluded from the study were notified by their directors that they did not meet the eligibility criteria.

8.5.2.1 Language , setting, cultural and religious considerations

All interviews were conducted in Arabic language because it is a first language for both the interviewees and the researcher. Seventeen of the 21 interviews were conducted at institutional locations during normal business hours when the prospective respondents were at their premises, while four were conducted at the interviewee's home. This follows the principle of allowing participants to select an optimal interview venue or a 'natural' setting such as their workplace, hotel lobby, library or home, in the hope that this will encourage them to share their

knowledge and speak freely on the topic of obesity in Libya. Although a choice of venue was offered to participants, they were restricted in their choice due to the curfew enforced by the Libyan government in response to the political instability in Libya, particularly if the interview is conducted late in the day.

Another constraint on the interviews was Libyan cultural restrictions against a male researcher interviewing women. To minimise this issue, I gave female participants the option of holding the interview in presence of their husbands or a Mahram (an unmarriageable kin) at their own home, consistent with conservative cultural norms and Islamic rules. However, in the main fieldwork, all families of the nine women interviewed were forward-thinking enough to allow the women to talk to me without their husbands or Mahrams being present.I conducted all interviews as early as possible in the day to avoid the curfew and the militias deployed in the streets. The subsequent section justifies the data collection method used in this study.

8.6 Methods of data collection

In the field of health research, individual interviews and focus groups are the most common qualitative research methods employed (Gill et al., 2008; Legard et al., 2003). The following section justifies my use of individual interviews as opposed to focus group interviews and other methods. See Appendix 8.8 for more details about focus group and the most common types of interview are: structured, unstructured and white semi-structured Interview discusses below.

8.6.1 Semi-structured interviews

The semi-structured interview is a qualitative method of inquiry that combines a pre-determined set of open-ended questions with ad hoc questions that enable the interviewer to explore the topic that is being studied. While the pre-determined questions provide uniformity and enable the interviewer to retain control, respondents also have the freedom to express their views in their own terms (Brayman, 2012; Gill et al., 2008). However, semi-structured interviews can be resource-intensive and time-consuming. They require interviewing skills, and extensive training and preparation on the part of the interviewer (Brayman, 2012; Gill et al., 2008).

Despite these limitations, this method is the most common form of interview used in exploratory studies, particularly in the health and social fields (Bryman, 2012; Hancocket al., 2009). It enables a deep exploration of participants' experiences and can provide reliable,

comparable qualitative data (Bryman, 2012; Gill et al., 2008). These factors make this method ideal for exploring the topic of obesity in Libya from different angles. Despite the absence of proper justifications, all previous qualitative studies conducted in Libya have used semi-structured interviews. Furthermore, previous evidence-based studies on obesity in developed and developing countries have used primarily semi-structured interviews (Brown et al., 2006; Phillips. et al., 2013). Since Libyans are usually happy to share their experiences in one-to-one situations, rather than in a group, semi-structured interviews were the optimal method for my study.

8.6.2 Semi-structured interview schedule

I collected the qualitative data using semi-structured interviews. Twenty-one semi-structured interviews were conducted between November and December 2014. These were conducted with the aid of an interview schedule (see the next Section 8.5.3 for an explanation of how the semi-structured interview schedule was developed, and how the open-ended questions were formulated). The interview schedule was compiled following the literature review, which included a review of interview schedules used in previous studies addressing the obesity epidemic (Epstein & Ogden, 2005; Phillips et al., 2013; Sterno, 2014). These previous interview schedules embodied broader questions about obesity in general, therefore I developed and designed an interview schedule specifically for this qualitative study.To elicit the interviewees' perceptions and insights about obesity in Libya, this schedule incorporated both open-ended questions and probes, which were tested and developed in a series of pilot interviews prior to the main data collection phase (see Appendix 8.10 for the Interview Schedule). The next section describes the interview process.

8.6.3 Development of the semi-structured interview schedule

8.6.3.1 Socio-economic status (SES)

The relationship between the prevalence of obesity and SES can be examined in different ways. It has been acknowledged that assessing SES data, including education, income and occupational status, can be complicated, particularly in developing countries (Pasco et al., 2012). The ways in which SES influences dietary and physical activity patterns are complex and require clarification. Income affects primarily the resources available to buy food and participate in leisure-time physical activities. My finding that the higher the SES, the higher the rate of obesity in Libyan adults, may be considered surprising because Libya is considered

to have one of the highest Human Development Indices in Africa and its HDI is ranked 55th in the world, which signifies that Libya is listed with high-income countries in terms of measures such as life expectancy, education, and per capita income (Human Development Reports, United Nations (HDRUN) , 2014); we might therefore expect Libyans to have lower rates of obesity if they are of high SES.

However, my findings contradict this substantial body of literature that emphasises a significant inverse association between BMI and SES in women but an ambiguous association in men in both developing and developed countries. Instead, my results find a positive association between SES and obesity in both genders. Prima facie, this finding is counter-intuitive. Since people with a high SES have more flexibility to choose their dietary and physical activity patterns, whilst those with a low SES are more constrained in their choice of food and physical activity, it may expected that low-SES individuals are more predisposed to obesity. Why then does Libya have a BMI-SES pattern that resembles that of lower HDI countries? This association warranted further exploration through interviews with Libyan healthcare professionals and community leaders who might be able to provide further insight into the association.

A first measure of SES is education. Generally, education is associated with the acquisition of beliefs and knowledge which could affect dietary and lifestyle patterns. People who have received a better education are likely to be more informed than poorly educated individuals about the health consequences of their lifestyle, possibly leading to a healthier diet and taking more regular exercise. However, Libyan adults may not have such knowledge, hence explaining why a statistical association emerged between obesity and higher-SES qualifications, rather than those with lower qualifications. Alternatively, they may have the knowledge but simply not act on it in a rational, logical way. Perhaps higher-SES individuals have more disposable income to eat out and consume more fast foods, and/or perhaps they do less manual labour, which would predispose them to obesity.

Such speculation needs to be explored through posing these topics to Libyan HCPs and LCLs. From the quantitative study, it is unclear why a significant positive correlation should exist between education level and obesity in Libyan adults, in a country with relatively high HDI, since the more usual pattern in countries with a medium HDI is an inverse correlation. The findings of this study revealed that obesity is associated with Libyans who have achieved

higher educational qualifications. Therefore, raising this issue among Libyan HCPs and LCLs could provide a greater understanding of the reasons behind this association, namely, those with higher educational attainment tending to be obese, in contrast to their counterparts in other countries.

My findings for Libya are unexpected in terms of the significant positive association between income and obesity, which goes against the findings in some middle-income countries, for instance, neighbouring Arab countries (Egypt and Lebanon), that share some of their culture, values and economic conditions. Therefore, further inquiries are necessary to better understand the reason behind this anomalous association in Libyan adults.

Occupational status is the most likely SES indicator to show sex differences in association with obesity, because the requirements of occupations vary considerably for men and women. It has been suggested that occupational status affects the risk of obesity in that low-status jobs are more likely to be associated with an unhealthy lifestyle, although they are also more likely to involve physical activity than high-status occupations, particularly in the case of the typical 'male' jobs, such as manual work, which could protect against obesity. However, the findings of this study showed a significant association between obesity and occupational status in women only and not in men, despite the majority of Libyan adults of both genders having sedentary occupations, requiring many hours a day sitting at a desk. It was therefore expected that a greater employment status among both genders in Libya would be associated with a higher BMI in both genders, yet this was only the case for employed women and not the case for employed men. These speculations require further exploration through conducting interviews with LHCPs and LCLs.

Having found that the SES-obesity association in this study diverged from those of previous epidemiological studies, it was necessary to formulate questions to explore and understand the perspectives of LHCPs and LCLs on a topic of obesity. Their responses could explain the associations more explicitly and remove any ambiguity in the findings about the nature of the relationship between BMI and the SES in the Libyan context. (See the Interview Schedule in Appendix 8.10). The following broad questions on obesity were formulated:

- Can you tell me what you know about obesity?
- What do you think causes obesity?

- Is obesity an issue in Libya? Why?

- Is obesity an issue in Benghazi? Why?

- How do you think obesity can be prevented?

If the informants provided sufficient responses to each main question, it was not necessary to pose the probe questions, and the next question was asked. However, if they failed to express their views, the probes were asked to elicit more information on the topic. Additional examples of probe questions include:

- Could you tell me a little more about obesity?

- Could you tell me more about other factors you think lead to obesity?

If the interviewees failed to share their views on obesity or were unable to provide enough information about the topics raised and the etiological factors concerning SES, I then presented them with the following probe questions:

Pilot study question:

- How do you think socio-economic status impacts upon a person's weight?

Pilot study probes:

- Could you tell me how income impacts upon a person's weight?

- Could you tell me how education impacts upon a person's weight?

- Could you tell me how occupation impacts upon a person's weight?

Since the question on the SES-obesity relationship and its probes in the pilot study were considered a very theoretical question and leading questions, I re-phrased them through piloting the interview schedule (see Chapter 8, Section 8.10.2 about lessons learned from the pilot study qualitative phase) as follows:

Probes:

- Do you think well-educated people are more or less likely to be obese than relatively uneducated people? If so, why?

- Do you think wealthier or poorer people are more likely to be obese? If so, why?

- Do you think employed people are more or less likely to be obese than relatively unemployed people? If so, why?

8.6.3.2 Unhealthy eating habits

Unhealthy eating habits were operationalised in this study as follows: an excessive consumption of fast foods; an excessive consumption of sugar-sweetened beverages (SSBs); eating less than five daily portions of fruit and vegetables; a high frequency of skipping breakfast; consumption of large food portion sizes (FPS).

My results reveal that the higher the frequency of consuming restaurant and fast food per week, the higher the BMI in both male and female Libyan adults. According to my results, some obese Libyans reported that their consumption of fast food is lower than that of their non-obese counterparts. One possible explanation is that those classified in my study as obese might be on diet whilst participating in this study. Another possibility is that they are consuming traditional foods which they think are healthy but which are in fact rich in fat, salt and calories and are therefore unhealthy and contributing to weight-gain (FAO, 2005; Sehib et al., 2013). Musaiger and D'Souza (2007) suggest that many (local) traditional foods provided by self-catering food outlets, common in most Arab countries, including Libya (FAO, 2005; Sehib et al., 2013), have a high-energy density – even higher in saturated fat, sugar and salt than many Western fast foods. These assumptions about fast food or (local) traditional food among Libyans need further exploration in order to better understand their role as a risk factor in obesity within the Libyan context. Consequently, further exploration is required to understand this pressing issue by interviewing LHCPs and LCLs.

My results reveal that the higher the frequency of consuming sugar-sweetened beverages in a typical day, the higher the BMI in Libyan women but not in men. Despite the rising consumption of SSBs reported by Libyans adults for both genders, it is surprising that my study found no association between intake of SSBs and obesity in Libyan men. Raising this issue in the interviews with LHCPs and LCLs could help to explain these ambiguous results.

Concerning the consumption of five daily portions of FV, my results revealed a lack of association between the consumption of five daily portions of FV and a reduced risk of obesity in Libyan adults of either gender. These unexpected findings about FV intake make it difficult to draw firm conclusions regarding the role of FV intake in curbing obesity. Consequently, further exploration is required to understand this pressing issue by interviewing LHCPs and LCLs.

Despite this, my results indicate that the higher the frequency of breakfast consumption per week, the lower the BMI in Libyan adults in both genders. Given that the prevalence of overweight and obesity is so high in Libya, one would expect the frequency of skipping breakfast by Libyans to be higher. It is necessary to raise the topic of skipping breakfast with LHCPs and LCLs in order to better understand Libyans' assumptions and motivations.

As expected, my findings indicate a positive association between the consumption of large food portion sizes (FPS) sizes and obesity in both genders. While Islamic etiquette for eating stipulates taking food in small portions, social norms concerning hospitality to guests at social gatherings interfere with this etiquette, encouraging them to eat excessively as a way of showing their appreciation to the host. These conflicting requirements about FPS need to be raised with Libyan LHCPs and LCLs so that their views could help to explain the varied results further.

To explore and understand unhealthy eating habits in Libya and their relationship with BMI from the perspective of the LHCPs and LCLs, the following questions were formulated:

- How do you think diet and eating habits impacts upon obesity?
- In your view, how do you think unhealthy eating habits impacts upon obesity?
- In your view, how do you think healthy eating habits impacts upon obesity?
- How can this be dealt with?

8.6.3.3 Physical activity and sedentary behaviours

My findings reveal that there is a significant inverse association between total physical activity (PA) under the three domains (work, transport and recreational activities) and obesity in women but not in men. In addition, my study finds that the BMI of Libyan adults is significantly, positively associated with sedentary behaviour in women but not in men. These findings are dissimilar to those of numerous epidemiological studies which found compelling evidence that regular physical activity is a protective factor against obesity, while a sedentary lifestyle promotes it.

Concerning BMI and physical activity (PA) in men, additional exploration is required to understand the role of PA as a protective factor against obesity and why a lack of association between obesity and PA was observed in men but not in women. Further exploration is needed to understand why a lack of association between BMI and sedentary behaviour emerged in men but not in women. Raising these issues with LHCPs and LCLs may elicit views which can enhance our understanding about these unexpected findings. The following questions were formulated to gain a deeper understanding of this topic.

- How do you think physical activity impacts upon obesity?
- How can this be dealt with?
- How do you think physical inactivity impacts upon obesity?
- How can this be dealt with?
- How do you think sedentary behaviours impacts upon obesity?
- How can this be dealt with?

8.6.3.4 Neighbourhood environment

The final predictor variable explored in this study is the neighbourhood environment. Although my study reveals a significant association between BMI of Libyan adults and 6 of the 12 neighbourhood environment factors, some of these results are inexplicit and need further clarification. Firstly, there is a consensus in the literature about street connectivity being negatively related to obesity; however, my finding revealed instead a positive association between street connectivity and obesity. Secondly, distance to transit is usually negatively associated with obesity; however, my findings differed and varied between genders, with a positive association found between obesity and access to public transport for men but not for women. Thirdly, my findings reveal a positive association between an unsafe environment and committing crimes during the day for men, but not for women; this differs from previous studies which indicated an association between BMI and an unsafe environment for both genders.

Another aspect of neighbourhood environment is population density. Previous studies found that living in high-density areas is negatively associated with obesity. However, my findings revealed a positive association between high-density areas and obesity women but only in men. In addition, most previous studies found that greater access to recreational facilities is

associated with lower obesity rates. However, my findings revealed a positive association between access to recreational facilities and obesity in women but only in men.

Finally, my study reveals a lack of association between the BMI of Libyan adults for the following neighbourhood environment factors: land use mix; pedestrian infrastructure; cycling infrastructure; traffic safety; pedestrian safety; and household vehicle ownership. In contrast, previous epidemiological studies found that these factors were associated with lower obesity rates, with the exception of the last one, household vehicle ownership, which is positively associated with obesity.

It is important to consider the impact of the 2011 Libyan revolution on lifestyle and environments in the present study. While some factors that affect obesity rates are malleable, for example, diet and physical activity levels, other factors are not as easily modified, such as the Libyan revolution and factors related to the politically unstable environment. At the time of writing (2015), Libya is in the throes of troubling challenges and the struggle for democracy, following the revolution of 2011. The current proliferation of weapons and the emergence of radical militias that are resisting government control are contributing to an unsafe environment across the country. It is conceivable that these conditions might discourage Libyans from exercising or even from simply walking outdoors, thereby preventing people from accessing large and small supermarkets that provide healthier, fresher foods; they rely instead on their local grocery stores during the evening. It is therefore critical to discuss the environmental variables in terms of how amenable they are to modification.

Another consideration is the 'obesogenic' environment. Consensus exists among obesity experts that changing the 'obesogenic' environment is a critical step towards minimising obesity. Thus, understanding the environmental factors associated with obesity amongst Libyan adults can be critical to establishing the environmental approach as a viable national strategy for controlling the obesity epidemic in Libya. To explore and understand in more depth neighbourhood environments factors in Libya and their relationship with BMI from the perspective of the LHCPs and LCLs, the following questions were formulated:

- How do you think access to healthy food could be improved in your neighbourhood built environment?

- How do you think your neighbourhood built environment impact upon accessing unhealthy food, which in turn may impact on your weight?

- How can this be dealt with?

- How do you think access to physical exercise could be improved in your neighbourhood built environment?

- How do you think your neighbourhood built environment impact upon hindering Libyans to engage in physical activities, which in turn may impact on your weight ?

- How can this be dealt with?

How do you think the current political situation in Benghazi impacts upon obesity?

8.6.3.5 Formulating questions about the variances between Libyan men and women

The adapted sequential explanatory mixed-methods research design used to guide this thesis lends itself to emergent approaches, whereby the second phase, the qualitative study, was developed based on the quantitative study. A key aspect of the merging stage was developing the interview schedule based on the unanticipated quantitative results which required explanation from the key informants' perspectives. By interviewing both female and male experts, both feminine and masculine perspectives are likely to have been obtained. The final interview schedule highlighted the exploration the gender differences, based on the unanticipated quantitative results. The researcher formulated the questions in the interview schedule in the form of broad, open-ended questions that gave the key informants an opportunity to voice their thoughts and feelings about obesity. Additional questions and probes, not included in the interview schedule, were raised by the researcher during the interviews depending on what the interviewees said. Although the questions in the interview schedule did not address the issue of gender differences in obesity because formulating questions about gender difference might be considered leading questions that are highly recommended by experts to be avoided in interviews due to such questions are more bias than opened questions (Bryman 2012; Creswell 2012), the researcher addressed these issues by raising verbal probes when he perceived that the interviewees needed prompting to talk about gender issues more explicitly. Below are some examples of the probes applied whenever key informants failed to raise the topic of gender differences within the obesity-related topic under discussion.

- What do men and women think about physical activity? Why do you think that is the case?

- Do you think men engage in more physical activity than do women? Why do you think that is the case?

- Do you think women eat more unhealthy or healthy food than do men? Why?

- What do men and women think about sedentary behaviour? Why?

8.6.4 Interview process

At the start of the interview, I explained to the interviewee the purpose of the study and presented an outline of the questions to be covered. I also explained the consent form and obtained written consent from each participant (see Section8.9.2). A short questionnaire was given to each respondent prior to the interview to obtain basic demographic information and contact information for participant validation purposes (see Appendix 8.11). Finally, the interviewee was given an opportunity to ask any questions. Each interview lasted between 35 and 50 minutes and was digitally recorded with the consent of the interviewee as indicated on the ICF (see Section 8.9.2.1).

Although all interviewees were offered a reimbursement for their travel expenses, none of the participants accepted any payment and none were reluctant to talk about it when I raised this issue. However, 8 of the 21 of the participants did accept a voucher for a free three-day pass to a gym, which was offered as a token of appreciation for their time (see Section 8.9.2.8). Benghazi Diabetes centre issued letter, addressed to my supervisory team, confirmed that all facilities has been provided to the researcher and his tasks were entirely accomplished (See Appendix 8.12).

8.6.5 Documenting the interviews

Documenting the interviewsTwo methods were used to record all interviews: I supplemented the audio-recording using a digital voice recorder by making notes. The audio-recording enabled me to engage freely in the conversation, without undue interference from note-taking. All interviews were conducted in the original source language, Arabic. Once all interviews were recorded, I transcribed them verbatim in Arabic, including the notes that were taken during the course of the interviews. The next section discusses the back-translation process.

8.7 Translation process in the qualitative protocol

Figure 8.1 (overleaf) depicts the steps involved in translation process in qualitative protocol. See Appendix 8.13, which discusses in details the following themes: methods of translation,

allocation of translators, and the back-translation process employed prior to and following the 21 semi-structured interviews.

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┌─────────────────────────────────────────────────────────┐
│     Translation process in the qualitative protocol       │
└─────────────────────────────────────────────────────────┘
                            │
                            ▼
┌─────────────────────────────────────────────────────────┐
│     The researcher developed the interview schedule in the source │
│                    language (English)                     │
└─────────────────────────────────────────────────────────┘
                            │
                            ▼
┌─────────────────────────────────────────────────────────┐
│  Forward-translation of the interview schedule, PIS & ICF into target │
│            language (Arabic) by Translator 1 (T1)         │
└─────────────────────────────────────────────────────────┘
                            │
                            ▼
┌─────────────────────────────────────────────────────────┐
│    Back-translation (BT) of the interview schedule into English by │
│                                                           │
│            another independent Translator (T3)            │
└─────────────────────────────────────────────────────────┘
                            │
                            ▼
┌─────────────────────────────────────────────────────────┐
│     The researcher conducted 9 interviews with healthcare professionals │
│     (HCPs) and 12 with Libyan community leaders of (LCLs) in Arabic │
└─────────────────────────────────────────────────────────┘
                            │
                            ▼
┌─────────────────────────────────────────────────────────┐
│   The researcher transcribes all recorded interviews in the source language (Arabic) │
└─────────────────────────────────────────────────────────┘
                            │
                            ▼
┌─────────────────────────────────────────────────────────┐
│  Forward-translation of all Arabic interview transcripts into English by two translators │
│  (T1= translated 9 interviews of HCPs & T2 translated 12 interviews of LCLs) │
└─────────────────────────────────────────────────────────┘
                            │
                            ▼
┌─────────────────────────────────────────────────────────┐
│   The T3 translated four random translated interview transcripts (conducted by │
│            T1& T2) into back-translation for the validation │
└─────────────────────────────────────────────────────────┘
                            │
                            ▼
┌─────────────────────────────────────────────────────────┐
│              Final version transcript in English          │
└─────────────────────────────────────────────────────────┘
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Step One (brackets the first three boxes)

Step Two (brackets the last four boxes)

Figure 8.1 All steps involved in translation process in the qualitative protocol

8.8 Ethical considerations

There were four ethical main issues associated with the interview process that needed to be considered: reducing the risk of unanticipated harm; ensuring privacy and confidentiality by protecting the interviewee's personal information; effectively informing interviewees about the

nature of the study prior to obtaining their consent; and reducing the risk of exploitation of participants (Bryman, 2012; Creswell, 2008).

8.8.1 Ethics approval

Ethics approval was obtained for the qualitative phase of this study from the same following four relevant bodies that granted ethics approval for the quantitative phase:

- The Institute of Health Research Ethics Committee (IHREC) at the University of Bedfordshire, UK. (see Appendix 8.14).
- The Libyan Cultural Attaché at the Libyan Embassy, affiliated to the Ministry of Higher Education and Scientific Research, Libya. (see Appendix 8.15).
- The Omar Al-Mukhtar University in Bayda, Libya. (see Appendix 8.16& 8.17).
- The Regional Health Ministry in Benghazi, Libya. (see Appendix 8.18).

8.8.2 Consent form

To comply with ethics regulations, I reassured all interviewees about the following five issues of ethical concern: disclosure; understanding; volunteering; competence; and consent. The following section addressed each issue individually.

8.8.2.1 Disclosure

All interviewees were provided with the Participant Information Sheet (PIS) and an Informed Consent Form (ICF). They were given an opportunity to read about what the study entailed, and then decide whether or not they wanted to participate. All participants were thoroughly informed about my study on obesity through reading the PIS which detailed: the nature and purpose of the study; what the interview process entailed; what the data will be used for; details of the research team who accessed to the data; how long the data will be retained and the assurance that it will be disposed of securely (see Appendix 8.19). For further ethical considerations were taken into account in this qualitative study see Appendix 8.21 .

8.9 A pilot study for the qualitative protocol

In order to ensure the feasibility of a study, it is important to conduct a pilot study prior to embarking on the main study. In order to prepare for the main study of the second phase of this research, I employed the back-translation process for the interview schedule. This process deploys the equivalence principle between the source language (English) and the target language (Arabic) (see Appendix 8.13). However, back-translation alone was insufficient to

validate the questions, which were devised from the unanticipated results of the quantitative phase; in order to identify any ambiguities in the interview questions and to start identifying the range of possible responses for each question, it was necessary to pilot the interview schedule on some prospective participants prior to conducting the main fieldwork. Apart from ensuring that the wording in each of the questions is unambiguous, the pilot study should also verify that the questions are appropriate and acceptable to the respondents, and that the respondents can respond straightforward to all questions. Although a time-consuming process, pilot of the interview schedule is vital to ensure that the data gathered in the main data collection phase is rigorous and robust.

Conducting the pilot study in Benghazi proved difficult due to time constraints. Due to the current unstable political-economic situation (see Chapter 5, Section 5.14), numerous time-consuming security measures would have had to be put in place for me to travel there. It was impossible to travel to Libya and return to the UK in time to refine and finalise the interview schedule before submitting the amended version to the University Ethics Committee. Aligned with the pragmatic approach that underpins this study, I conducted the pilot study for the qualitative phase in the UK between September and November 2014. This entailed interviewing five Libyans (two males and three females): all five have lived in the UK for more than five years (see Appendix 8.23, Demographic data for interviewees in the pilot study).While, (Appendix 8.24 demonstrates a summary characteristics of the interviewees in the main study).

It should be noted that none of these five met the inclusion criterion of having been "resident in Benghazi for over the past ten years", as specified in Chapter 5 (Section 5.2.2). Due to the fact that they did not have enough experience of the recent political-economic changes in the lives of resident Libyans, these five were included in the pilot study only and were excluded from the main study. Each interview lasted for 35-50 minutes, and all five interviews took place at a mutually agreed date, time and place in the UK.

8.9.1 Reasons for conducting the qualitative pilot study

The aims of the pilot study were two-fold:

1. To examine the feasibility of the planned procedures for fulfilling the following aims:

- To acquire and hone the practical skills of the researcher, required to administer semi-structured interviews.

- To assess how successfully the interview schedule was translated, by verifying that the item wording is clear, unambiguous and enables respondents to answer the questions accurately.

- To obtain the opinions of and feedback from interviewees regarding any ambiguities and difficult questions, and to remove or modify any unnecessary, difficult or ambiguous questions accordingly.

- To assess whether each question provided an opportunity for the potential respondents to give broad rather than restricted answers.

- To establish the time taken to complete the interview.

2. To practice transcribing the audio-recordings of the interviews and all the various steps in the interview process, prior to the final stage (thematic analysis).

- To transcribe the interview dialogue to the origin language (Arabic).

- To translate the interview transcripts from the original language (Arabic) into the target language (English).

8.9.2 Lessons learned from the pilot study

The lessons learned through conducting a pilot study of the qualitative protocol the interviews can be categorized into two parts that are: lessons learned relevant to conducting semi structured interviews and other relevant in the translation process.

8.9.2.1 The interviews

The pilot study provided a number of positive outcomes for the qualitative protocol. All four interviews undertaken in the pilot study were conducted in Arabic. In addition each participant signed an informed consent form (ICF) before participating in the interview. According to participants' feedback on their interviews, the questions on the interview schedule and asked during the interview session were well-formulated, that is, explicitly stated, straightforward and understandable. This meant that all the participants could absorb and respond to each of the questions. None of the four respondents requested clarification of any of the questions, which confirmed that all the questions were in a regular sequence, easy for the respondents to answer, and meaningful. Not only could respondents answer the questions, they were also able

to elaborate on their answers. One exception was one question when one participant failed to mention any component of socioeconomic status as a cause of obesity, I had proposed this question 'How do you think socioeconomic status impacts upon obesity?' however, one of four particpants understood the question properly and they thought socioeconomic status was restricted only to income and social factors and they neglected to consider the two main factors which are education and occupation. Consequently, I rephrased the probe as follows:

Probes:

- *"In your opinion, what impact does level of education have on a person's weight?"*
- *"Do you think wealthier or poorer people are more likely to be obese?"*
- *"In your opinion, what impact does occupation have on a person's weight?"*

In terms of Libyan culture and Islamic laws for gender relations, as a male researcher, it was necessary to conduct my interviews with the two female participants in the presence of their husband or a relative; the latter is termed 'Mahram' or 'unmarriageable kin'. Due to my concern that this third party to the interview might interrupt our dialogue, making it difficult for the interviewee to resume her train of thought, I briefed the third person before the interview about respecting the interview protocol. Given that the interview with this woman was successful, I followed the same method for the main study. Although interviews with females accompanied by their relatives could be few due to other female participants might belong to open minded very cultured and helpful families and they accept to interview individually without involving any relative. I have nevertheless learned some skills from this pilot study to minimise the impact of any external circumstances.

One of the five audio-recorded interviews from the pilot study was deleted on the request of the participant. This was because I neglected to bring with me the document proving that this study had obtained ethics approval, and this particular participant requested to see it. Refusing my offer to send her the letter of ethics approval via email, she unfortunately insisted that I delete her recorded interview immediately and I duly complied. Thereafter I took the precaution of always bringing the original document of ethical approval with me.

Ethical considerations required that I ask all four respondents whether any of the questions asked during the interview made them feel distressed, offended or upset. All confirmed that all the questions were formulated in an appropriate manner and maintained that the participants in the principal study would be able to respond to the questions without feeling apprehensive or

uncomfortable. As one of interviewees was in fact obese when he admitted that "his weight was affecting his work, health, and mobility," these positive responses to the interview were encouraging in relation to interviewing any obese people in the main study.

8.9.2.2 Translation of the interview transcripts

The pilot study enabled me rectify some problems that arose during the translation process for the interview transcripts. During the translation of the audio-recordings, it came to my attention that occasionally the translator had misunderstood some words or sentences stated by the interviewee, either in the form of idioms, proverbs or metaphors in the Arabic language. Such mistakes could have led to a misinterpretation of the results. To minimise this obstacle, I ensured that there was frequent communication between the translator and myself during the translation process, in order to obtain accurate and meaningful transcripts and to achieve conceptual equivalence. In addition, I sometimes needed to add explanations in brackets about aspects of the translated transcripts. For example, the initial translation of these Arabic sentences was:

"Libyan old regime launched and raised many slogans, for instance, 'Sport for All' and also 'Exercise is general activities you should do and avoid to watch it' but the Libyan citizen ignored all these catchwords, I mean Libyans did not believe and care what did the old Libyan regime want to market for such slogans?"

(HB, Female, 57, Social worker, MA Sociology)

After reviewing the transcript, the translator and I agreed on the meaning as follows:

"Libyan old regime launched and raised many, many slogans, for instance, 'Sport for All' and also 'Sport is a public activity which must be practised rather than watched.' However, Libyan citizens 'Throw everything at the wall.' I mean Libyans did not believe and care about why the old Libyan regime wanted to market such slogans."

Maintaining communication with the translator by email enabled me to clarify and explain some of the mistranslated words. In this particular case, I requested that the translator consider amending some sentences according to my own understanding of what had been said in the interview. In most instances, we came to a sensible agreement regarding the selected equivalence words that made sense within the context. Ultimately, the translator realised and understood the importance of continual communication with me, so as to identify the most appropriate words, phrases and sentences that most accurately reflected Libyan culture and the meaning intended by the interviewees.

The following excerpt demonstrates some ambiguous words that were translated based on the translator's view; however, due to the frequent communication with the translator, the appropriate translation was achieved. The translator had initially translated this statement by one of the interviewees as follows:

"Having said that healthy fresh food is cheap and exercise is free, so no one will of now blame on availability rather than blame on their willing and compliance."

(SM, Male, 57, Administrator, BSc Business Management)

After reviewing the transcript, the translator and I agreed on the meaning as follows:

"Having said that healthy fresh food is cheap and exercise is free, people should blame their willingness and compliance and not the availability of food and the ability to exercise."

The translator occasionally misunderstood the difference between idioms, proverbs and metaphors due to translating them literally. For example, the translator translated one phrase as "*reduce your concerns by increase you're eating.*" This translation was not technically wrong, but it was cumbersome and too literal; it was in fact a word-for-word translation rather than a meaning-based translation. In clarifying the meaning of this phrase with the translator to better reflect what the interviewee had said, the translator and I construed the phrase as: "*Put your worry in your morsels.*" Another two excerpts rephrased, as follows : "*'what you are is what you put in your mouth.*" And *"culture is the current in which we swim."*

Finally, to ensure accuracy, all the transcripts were audited by myself, the researcher who was also the interviewer and the transcriber. I listened to each audio-recorded interview three times, comparing it each time to the typed transcript to ensure the faithfulness of transcripts. Once the transcriptions were finalised, I sent all respondents by e-mail a transcription of their interview for checking, hence all the participants had an opportunity to check the accuracy of their interview. A positive outcome of this process was that three of the interviewees agreed entirely with the transcript, whilst one participant deleted a few sentences that he did not agree with. Once each transcript was approved by each interviewee, I submitted all transcripts to the certified translator to translate into the target language (English).

Once the pilot study had been completed and some of the probes for the interview schedule had been refined, I submitted the final amended copy of the interview schedule, to the University Ethics Committee to further review in compliance with the Guidelines on Research Ethics.

8.10 Data analysis

Prior to the qualitative data collection and analysis, the following technical issues was considered in order to maximise the quality of the data, data analysis and the credibility of findings: the processes for recording the interviews; transcribing the interviews, and using computer-assisted qualitative data analysis software (CAQDAS) (Bryman 2012; Creswell 2012).

1. For recording the interviews, I used a high-quality digital voice recorder (DVR) to record the 21 interviews for transcription purposes.

2. I transcribed the 21 recorded interviews verbatim and checked each transcript against the original recording for accuracy. Each transcript was then anonymised to protect the identity of the interviewee by converting their name into their initials (APA, 2015).

3. The computer-assisted qualitative data analysis software package NVivo 10.0 software (QSR International, Melbourne, Victoria, Australia) was used to organise, manage, code, analyse and report the interview data.

8.10.1 Critique of qualitative data analysis

See Appendix 8.25 for all details about this section.

8.10.2 Framework Analysis (FA)

Developed in the 1980s by social policy researchers at the National Centre for Social Research in the UK, the Framework Analysis method is a pragmatic approach for real-world investigations (Ritchie & Spencer, 1994; Ritchie & Lewis, 2003). A type of thematic methodology, it is flexible and systematic, and can provide clarity and transparent results in terms of generating an audit trail. It offers either theme-based or case-based analysis, through the development of charts that may be read across (cases) or downwards (themes), as well as readily retrievable data to show others how decisions were derived (Bridgelal et al., 2008; Dixon-Woods, 2011; Swallow et al. 2011; Ward et al., 2013). The strengths of FA make it an increasingly popular approach for analysing primary qualitative data, particularly in health-related research (Murtagh et al., 2006; Tierney et al., 2011). See Appendix 8.26 for all details about the rationale for adopting Framework Analysis method to analysis the qualiativt data for this study and all details of how these stages were applied in my study.

8.11 Verification of the qualitative research data

Three key approaches were employed in this study to validate the quantitative data in accordance with the suggestions of Burnard et al. (2008). First, all the transcripts were audited by the main researcher, who was also the interviewer and the transcriber, in order to verify the accuracy of the qualitative data. I listened to each audio-recorded interview three times, comparing it each time to the typed transcript to ensure the faithfulness of the transcript. The second approach used to validate my data was participant validation: once the transcriptions were finalised, I sent 13 transcripts by email to 13 of the 21 the interviewees who had provided me with their email address (9 HCPs and 3 academic staff, and the deputy of the Benghazi Council who had a MSc in primary healthcare). Eight of the 21 refused to give their contact details for me to e-mail them their interview transcription for checking. Therefore, the 13 interviewees were asked to return any comments or feedback on their transcripts within one week. Nine of the 13 replied while 4 did not reply despite being sent reminder emails two or three times. A positive outcome of this process was that 5 of the interviewees admitted that their transcript accurately represented their views, while 4 participants deleted a few sentences that they did not agree with; they felt that their original comments were not 'socially desirable'. Therefore, all edits, additions and omissions made to the four interview transcripts were accomplished and I duly complied.

The third approach used to validate the date was back-translation. Once each transcript had been approved by each of the 9 interviewees, I submitted all transcripts to the two certified translators to translate into the target language (English). Once I had received all the English-translated transcripts back from both translators (T1 & T2), I sent two random translated interview transcripts from each of the translators (T1& T2) to the third independent translator (T3) for back-translation. Once I had received the four back-translated versions of the four interview transcripts, I reviewed and compared them to the original Arabic transcripts to ensure accuracy and validation.

Chapter Nine : Qualitative data analysis and findings

9.1 Introduction

The present chapter presents the findings from 21 interviews conducted with 9 Libyan healthcare professionals (LHCPs) and 12 Libyan community leaders (LCLs) to address the second research question: "What are the views of Libyans with regards to the risk and protective factors associated with obesity among adults in Benghazi, within the context of Libyan culture?" In this chapter, the findings of the qualitative analysis of the 21 interviews are presented as a series of themes in the form of risk and protective factors influencing body-weight.

The chapter prioritises the themes relevant to the four main hypotheses, addressing SES, unhealthy eating habits, physical activities and sedentary lifestyle, and neighbourhood environment, respectively. The chapter then presents the other themes that emerged, relevant to the risk and protective factors associated with obesity. In total, the chapter presents 11 themes, which were categorised according to the different levels or spheres of the SEM. These findings were presented in the form of comparisons and contrasts between the two distinguishable groups of interviewees: healthcare professionals and community leaders. Finally, the chapter presents a theoretical model derived from the qualitative research findings.

9.2 Findings of the qualitative research

Having applied the Framework Analysis approach to analyse the qualitative data of this study, the findings from the 21 interviews are presented in the next sections as a series of 11 themes. These findings were comprised of comparisons and contrasts between the views expressed by the two groups of interviewees: healthcare professionals (LHCPs) and community leaders (LCLs). The perceptions of the LHCPs were closely linked to their knowledge of the risk and protective factors associated with obesity in Libya. While, the LCLs possessed relevant knowledge and information about the diverse issues affecting present-day Libyan society, in particular, health, social, economic, environmental, public-policy and political matters within the various Libyan communities, which might be identified as risk and protective factors associated with the obesity epidemic in Libya. The next sections demonstrates all 11 themes, categorised according to the different levels or spheres of the SEM.

9.3 Factors influencing body-weight at the individual level

The four main themes in this section are socio-demographic and biological factors; socioeconomic status; unhealthy eating behaviours; and knowledge about obesity. Elicited from the 21 interviews, these themes were allocated to the individual level of the SEM.

9.3.1 Socio-demographic and biological factors

Presented below, socio-demographic factors are divided into three sub-themes (age, gender, and ethnicity) while biological factors refer to (genetic influences and hormone leptin), medical causes refer to (other health problems and taking certain medications). The details of this theme shown in Figure 9.1 (below).
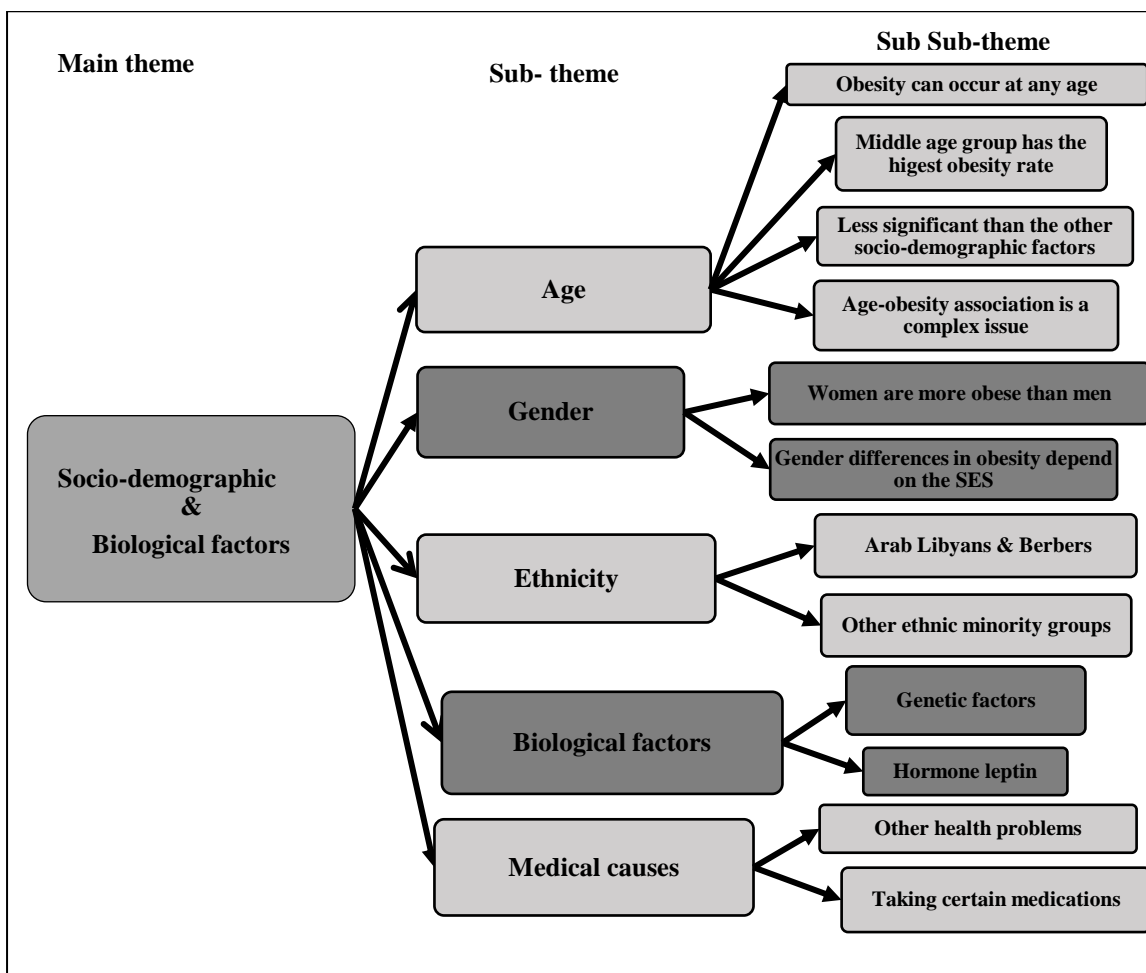
Figure 9.1 Thematic map of 'socio-demographic and biological factors'.

9.3.1.1 Gender

Analysis of the interviews revealed two distinguishable views concerning gender. Held by the interviewees, belonging to LHCP groups, one view was that women are more likely than men to be overweight and obese. Their attributions included physiological factors and cultural norms.

"Libyan women are more likely than men to be overweight and obese, but this does not mean Libyan men are excluded from being overweight and obese."
(SG, Female, 37, Diabetes Specialist Nurse, BSc Nursing Studies)

"Despite the fact that obesity in Libya affects men and women evenly, women are much more likely than men to become obese in order to attract men as is consistent with our culture."
(PV, Female, 38, Diabetes Specialist Nurse, BSc Nursing Studies)

"Typically, women all over the world are more likely than men to be obese due to physiological causes such as hormones, so I do not think the scenario is any different in Libya, and this what I always see in my work."
(WQ, Female, 36, Dietician, BSc Dietetics)

While, the second view held by the academic staff (LCLs), the second view took into account SES as a crucial indicator before inferences could be drawn about the relationship between gender and obesity.

"I think poor and uneducated women are more likely to be obese than rich and educated women, while in men obesity occurs in married men more than in singles. Overall, females are more overweight and obese than males."
(HZ, Male, 46, Lecturer, Doctor of Public Health (DrPH))

For further results related to 'socio-demographic and biological factors', see Appendix 9.1.

9.3.2 Socio-economic status

Presented below, SES factor are divided into three sub-themes (education, Income, and occupation). The details of this theme shown in Figure 9.2 (below).
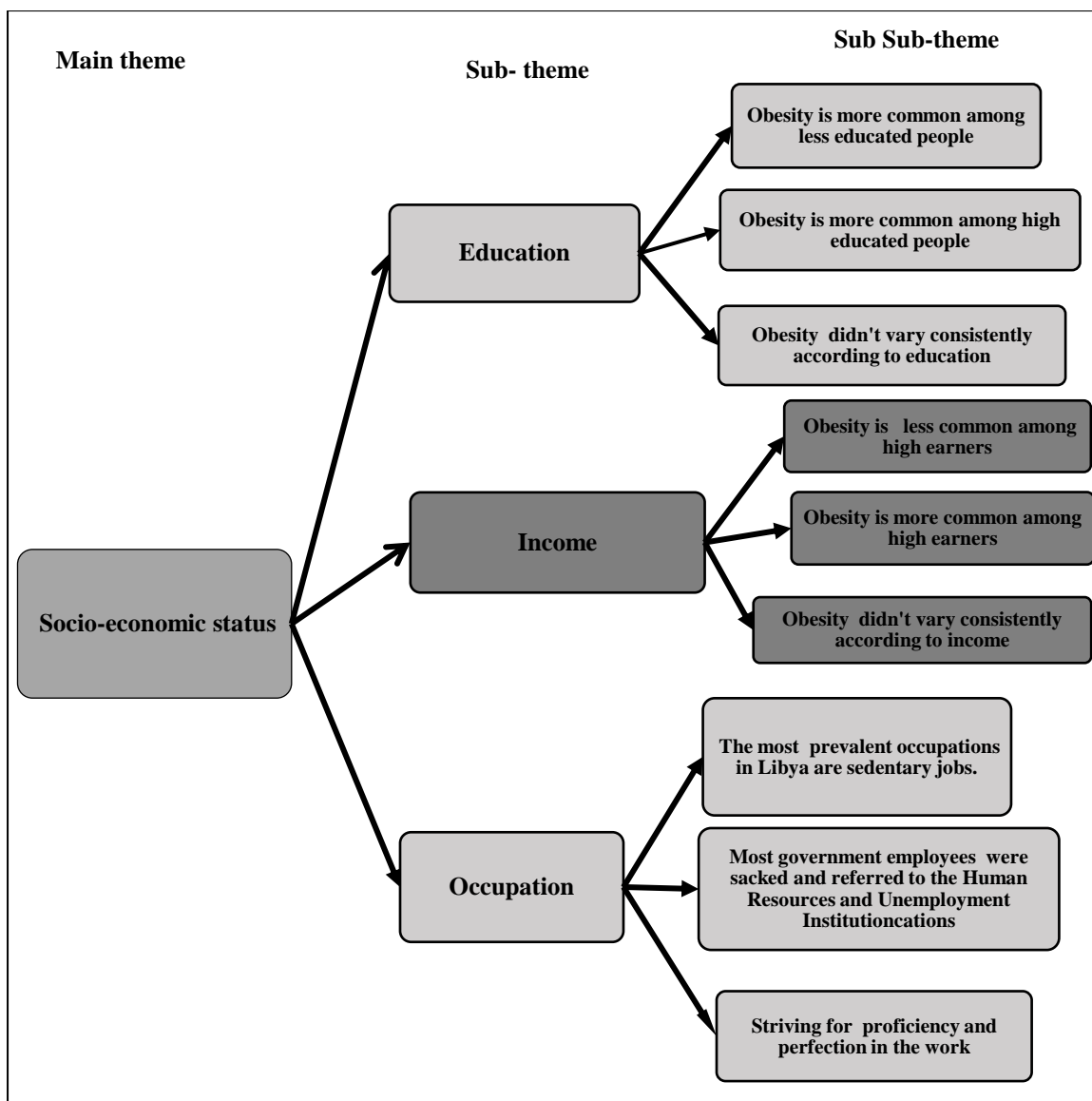
Figure 9.2 Thematic map of 'Socio-economic status'.

9.3.2.1 Education

The most interviews, belonging to the two groups, revealed three distinguishable views concerning education and obesity, the first attributable to the interviewees, belonging to LHCP groups, and the other two attributable to the interviewees, belonging to LCLs. On the one hand, LHCPs stated that people with a higher educational attainment could be assumed to have knowledge about obesity and its risks, including awareness of how they can avoid gaining weight.

"Highly educated people in Libya are more likely to be employed and well-paid than those less educated, so they can spend their money on healthy foods and engage in physical activity to a greater extent than can poorer people."

(NK, Female, 48, Diabetologist, Doctor of Medicine)

"... highly educated people are usually aware of healthy foods and the benefits of exercise, unlike uneducated people, who sometimes ignore even simple information about the causes of obesity."

(AE, Male, 64, Imam of a mosque, BA Principles of Islamic jurisprudence)

However, the majority of interviewees, belonging to LCL groups, held the opposite perspective, that is, that highly educated people in Libya are more prone to gaining weight than are uneducated people.

"It is well known and agreed that people in developed countries with a higher education level and socio-economic position are rarely overweight or obese. But in Libya it is the converse case as people who have a higher education level and socio-economic position are more often overweight or obese."

(AB, Male, 46, Deputy of Medical Department, Doctor of Medicine)

"We expect people with higher levels of education groups to be less susceptible to gaining weight. [Umm], but the disaster here in Libya is that even the more highly educated suffer from obesity. Ironically, my colleagues, who work in the health sector, I mean health professionals, are overweight or obese."

(GX, Female, 47, Municipal Council Member, Benghazi, Master of Science in Economics)

However, the three tribal leaders, belonging to LCL groups, suggested that education is less significant than are other components of socio-economic status in terms of its influence on weight-gain.

"From my point view, education is not a strong factor related to obesity because, actually, in Libya you can observe both educated and uneducated people being overweight and obese, which is an obvious fact you can see."

(AA, Male, 65, Tribal leader, MA in Social Sciences)

"I personally believe that education is not as important as other factors such as income because many Libyans hold qualifications due to the free education system offered by the Libyan government. But even though they are educated people, they are probably unaware of obesity and its implications, so what's the benefit of education then?"

(AL, Male, 56, Tribal leader, Diploma of Higher Education)

9.3.2.2 Income

Views diverged widely on the topic of obesity and income. Of the interviewees, belonging to LCL groups, the academic staff suggested that high earners are more likely than lower earners to choose a healthy lifestyle that would maintain their body-weight.

"Wealthy people can afford to buy healthy food, personal dieticians, the best exercise equipment, gyms, fitness trainers, cosmetic surgery, etc. Some of them even have their own

private chef! But poor people can't afford such luxury lifestyles and they eat mass carbs because it is cheaper and affordable."

(RE, Female, 44, Dean of Public Health Department, PhD Epidemiology)

However, interviewees, belonging to LHCP groups, had a different view about how income is linked to obesity in the Libyan context, stating that the higher earners in Libya are more inclined to purchase fast food and indulge in overeating and sedentary lifestyles than are low earners.

"I presume that the Libyans who earn a high income go shopping frequently to buy all types of fast, frozen food or eat out often, compared to those who earn a low income. Therefore higher income Libyans are more prone to gaining weight than others, hence they will suffer from obesity."

(NM, Female, 56, Diabetologist, Doctor of Medicine)

"Do not be surprised here in Libya if I say, some Libyans who earn a high income behave in a different way so they buy unhealthy food, such as junk food, and they don't engage in any outdoor activities."

(YS, Female, 37, Dietician, BSc Dietetics)

Other interviewees, belonging to LCL groups, particularly tribal leaders, stated that income might not influence weight-gain in Libyans due to the widespread availability of affordable foods and the role of the Libyan government in subsidising staple food commodities.

"I don't know if income impacts on gaining weight or not because many Libyan people earn high incomes and grocery stores sell cheap food, so even people who earn a low income can purchase food. In addition, our government subsidises the staple food commodities, which are available at a low price. You know, you can buy 10 loaves of bread for only 100 Libyan dirham [5 pennies]."

(KM, Male, 61, Tribal leader, Diploma of Higher Education in Social Sciences)

9.3.2.3 Occupation

The majority of interviewees, belonging to LHCP and LCL groups, agreed about the link between occupation and obesity. However, the interviewees, belonging to LCL groups, broached the topic more deeply and from different angles. Firstly, both groups viewed the nature of employment offered to Libyans by the Ministry of Labour and Rehabilitation as largely comprised of sedentary jobs, and stated that most Libyans are reluctant to engage in manual-labour jobs.

"Most occupations offered to Libyans are desk-bound; even if they do not have the qualifications for these jobs. What I want to say is that Libyan people prefer sedentary jobs, so Libyans have become prone to inactivity even in their occupations and I think this is why Libyans have become fat people."
(PV, Female, 38, Diabetes Specialist Nurse, BSc Nursing Studies)

"The Libyan government usually offers people sedentary jobs because it knows Libyans will not accept any [err] job that requires effort, namely manual labour. In general, most Libyans hate to work in any job that needs effort. Even uneducated people, who do not have any qualifications, are eligible for office jobs."
(AL, Male, 56, Tribal leader, Diploma of Higher Education)

Secondly, the Benghazi Municipal Council members, belonging to LCL groups, went further in explaining the occupations. The council members mentioned that many Libyans were dismissed from their jobs under the old regime and were referred to the Human Resources and Unemployment Institution. Despite not working, all Libyans still receive their salaries from the government treasury. At the time of writing [January 2016], the Libyan provisional government has been unable to permit people to return to their previous jobs.

"The old regime sacked many official workers from various vital sectors, such as education, health, economic etc. and the regime transferred them to the Human Resources and Unemployment Institution, despite the government continuing to pay their salaries without anybody carrying out any type of work or service."
(GX, Male, 57, Deputy of Municipal Council, Benghazi, Masters in Primary Health Care)

"Most Libyans get their monthly salary from the government, even though they have accomplished no actual work, since the old regime refers most employees to an innovative organisation, the so called the Human Resources and Unemployment Institution, which in fact embraces all those dismissed from their institutions as, [it is] unemployment that places a burden on the Libyan state."
(EL, Male, 53, Municipal Council Member, Benghazi, Master's in Business Management)

Finally, the Imams (Sheikhs), belonging to LCL groups, stated that Islam commands Muslims to practice and apply proficiency, striving for perfection in their work. However, many Libyans are disloyal employees, leaving work after only a few hours due to the lack of management supervision.

"Libyans like to cheat in everything because corruption is everywhere in all ministries and bodies in Libya, and I know most of Libya failed to achieve perfection in their work even in the office jobs. They stay as short a time as possible at their workplaces and then leave their work, because of the absence the management of employee absenteeism."
(AE, Male, 64, Imam of a mosque, BA Principles of Islamic jurisprudence)

9.3.3 Unhealthy eating behaviours

Presented below, unhealthy eating behaviours patterns are divided into five sub-themes (skipping meals and eating at irregular times, fruit and vegetable intake, consumption of large food portion sizes, beverage consumption, consumption of fast food and traditional food). The details of this theme shown in Figure 9.3 (below).
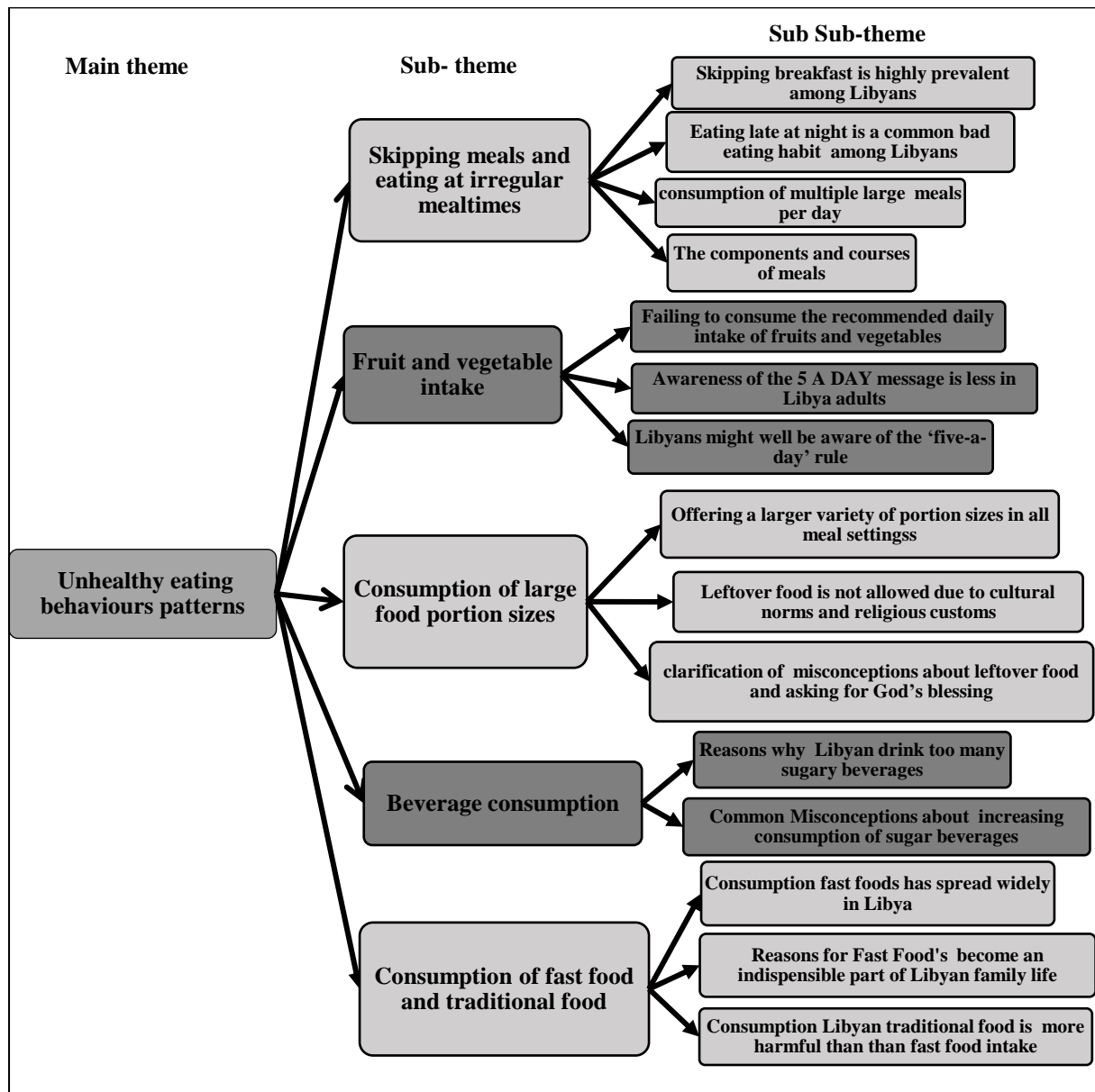
Figure 9.3 Thematic map of 'unhealthy eating behaviours patterns'.

9.3.3.1 Skipping meals and eating at irregular mealtimes

Despite 'skipping breakfast' being a prominent unhealthy eating habit linked to the increased rates of obesity, this topic was raised by only Interviewees ,belonging to LHCP groups, and ignored by the interviewees ,belonging to LCL groups,. The interviewees, belonging to LHCP groups, agreed that skipping breakfast is one of the unhealthy eating habits which most Libyans practise.

"There is another unhealthy eating habit in Libyan culture. Based on the views of my patients, many Libyans usually skip breakfast, thinking this to be a healthy practice and a good way of dieting. They then eat a lot at the next meal. They don't know that skipping breakfast is bad for their health and bodies."

(NK, Female, 48, Diabetologist, Doctor of Medicine)

"Skipping breakfast is a common practice of adolescents and adults in Libya because most Libyans stay up late at night. They are night owls and like eating late. They wake up late morning, and take lunch instead of breakfast."

(YS, Female, 37, Dietician, BSc Dietetics)

Another prevalent unhealthy eating habit mentioned by the interviewees ,belonging to LHCP groups, and disregarded by the interviewees ,belonging to LCL groups, was eating late at night, which is a common behaviour in Libyan culture. They viewed this as a potential factor leading to obesity, which people may not be aware of.

"Let me finish, Libyans love to eat late at night or late midday and immediately go to sleep. I think that is a disaster because it disturbs the digestive system, leads to weight-gain and eventually people become obese."

(NK, Female, 48, Diabetologist, Doctor of Medicine)

"Another bad habit I believe that Libyans have is eating late at night. Also, they do not have regular meal times. You know, our eating is not healthy as we prefer to eat a lot of bread at every meal and several fizzy drinks at every meal. The big meal is lunch, we have it late midday; plus we consume fruit after meals, usually after lunch and immediately we take a nap. I think these eating habits, along with taking a nap immediately after meals, are the main causes of weight-gain."

(ZT, Female, 38, Dietician, BSc Dietetics)

In contrast, both Interviewees ,belonging two both groups, highlighted the number of meals that Libyans consume in a day, arguing that multiple-meal intake per day is disastrous, as it can contribute to weight-gain.

"We eat constantly from [the moment we] wake up till going to bed; at least 5 to 7 meals per day. To me this is an absolute catastrophe which should be fought against. We have two big meals a day: in the early afternoon at 2:00 pm and the second at 10:00 pm at night."

"I reckon that the number of times food is served in a day and food habits are the main reasons for obesity in Benghazi. Residents in this city, believe it or not, eat at least five to six meals per day. And this a tragedy, isn't it?"

Only academic members (LCL groups), mentioned a number of bad eating habits and went further in talking about the components and courses of meals that Libyans favour. They concluded that these factors are likely to be the main reasons driving weight-gain in Libyans.

"… social occasions and overeating late at night, consuming olive oil in the morning, eating late and immediately go to bed. We usually eat a lot of bread at every meal like fizzy drinks at every meal. All these are bad eating habits in Libya, so the worst comes to the worst."

"We practice other complicated unhealthy eating habits in our culture, such as: we love eating oily rice at social events and we love eating late at night before going to sleep. We also love to eat meat with every meal, lunch and dinner, and we skip breakfast, while we love drinking cola more than twice a day. I think all are bad health habits here in Benghazi."

9.3.3.2 Fruit and vegetable intake

The vast majority of interviewees, belonging to both groups, admitted that fruit and vegetables are available, affordable, and accessible in Libya as a whole and in Benghazi in particular. Although the interviewees , belonging to both groups, concurred that the majority of Libyans did not consume the recommended daily amount of at least five portions of fruit and vegetables, the interviewees, belonging to LHCP groups, were not certain if Libyans were conscious of the 'five-a-day' message, due to the absence of health awareness.

"No one can deny that the price of fruit and vegetables is one of the lowest in the North Africa because we grow them here and export some of them. The main problem is that The more educated Libyans are probably aware of the benefits of consuming these things for their health but ordinary Libyans are not aware of the five-a-day fruit and veg recommendation."

"I am sure many Libyan people do not always consume fruits and vegetables, not because it is expensive; no, it isn't, but probably because they are unaware that reduced fruit and vegetable consumption is linked to poor health so that they do not care to buy and eat such stuff continuously. That's why I think our food is worse and also our habits."

On the other hand, The academic members (LCLs) argued that Libyans might well be aware of the 'five-a-day' rule as the most important element of any healthy eating plan, yet they are reluctant to implement it and therefore do not meet the recommended range.

"I do not think the public are unaware of getting at least five portions of fruit and vegetables a day. It is good advice for keeping their weight normal. But the problem is that Libyans are often reluctant to eat the recommended amount, despite the provision of fruits and vegetables during their meals and even at social functions."

(HZ, Male, 46, Lecturer, DrPH)

9.3.3.3 Consumption of large food portion sizes

An overwhelming majority of interviewees, belonging to the two groups, , agreed that Libyans are usually offered large food portion sizes in every meal setting, over the course of the day. Whether at home or at restaurants or social functions, it is difficult to avoid eating whatever food is served. Leftover food is not allowed due to cultural norms and religious customs as well as social pressure from relatives and friends.

"To me the worst habit common in Libyan culture is serving food in large portions. For example, meat on all occasions and large amounts of food in one sitting. We as Libyan guests must eat as much as we can of whatever is being offered to show our respect for our hosts."

(AA, Male, 65, Tribal leader, MA in Social Sciences)

"I understand all the eating habits and how Benghazians behave at social and religious events. They provide a variety of food consisting of carbs, oily rice, margarine and meat in large quantities. They continue to eat and encourage each other until they finish their large plates, even though we know this way of behaving is not good for their bodies."

(KM, Male, 61, Tribal leader, Diploma of Higher Education in Social Sciences)

Although the views of Imams were no different from those of the other interviewees ,belonging to LCL groups, concerning the prodigious quantities of food served at each meal, the Imams clarified misconceptions about leftover food and asking for God's blessing, saying food must be offered or served in appropriate portion sizes at each meal.

"You would not be surprised when I say that, at each meal, Libyan people consume large amounts of food. And whatever is served at each meal, whether at their homes with their families or on social occasions, most Libyans believe in never leaving food on their plate for Satan. This is true and people should accept the food only if it is served in the right amounts. So, Libyans think that eating the whole large portion of the served food is an Islamic command imposed on Muslims, yet Islam is innocent of these misbehaviours."

(TS, Male, 62, Mufti and a member of a house of fatwa)

"The Prophet did not approve of leaving any food on a plate, as he said 'You don't know which portion is blessed'. Food is a blessing from Allah; to misuse it is contrary to Islam. Do not forget the poor and the needy who do not have the portion you are throwing away."

(MA, Male, 64, Imam of a mosque)

9.3.3.4 Beverage consumption

The majority of interviewees, both the interviewees, belonging to LHCP groups, and academic staff (LCLs), acknowledged that Libyans consume cold or hot sugary beverages at each meal and between meals throughout the day. In addition, the dietitians (LHCPs) and academic staff (LCLs) provided explicit reasons why Libyans drink too many beverages: they attributed this habit to Libyans' wanting to rehydrate their bodies when perspiring during the hot weather, and explained the health benefits of drinking tea and coffee. They also mentioned that soft drinks are tasty, inexpensive and available around the clock, despite the adverse health consequence of drinking sugary beverages.

"Libyans love drinking beverages in all forms, whether artificial or natural, cold or hot, during meals or between meals, regardless of what we know about the health benefits of tea, natural juice and coffee. I drink green tea, for instance, as I know this helps to increase metabolic rate and it reduces body-weight, while sugary drinks help to rehydrate our bodies in summer. But consuming them too frequently causes weight-gain, and I think many Libyans are still unaware of this fact."

(WQ, Female, 36, Dietician, BSc Dietetics)

"No one can deny that consumption of sugary beverages is rising. This harms health and causes increased body-weight. This is really true in Libya as I can see how Libyans are eager to have soft even in the morning. The hot weather is one reason that Libyans like to drink such a quantity of, aside from the fact that all kinds of beverages are cheap and available everywhere."

(YS, Female, 37, Dietician, BSc Dietetics)

"I would not go to talk about the size or number of soft drink cans that Libyans drink every day because there is an absence of scientific research. But, based on our experience, what we see in actual life, the size of the cans has become bigger and bigger, and we are consuming beverages at every meal and in between because of the hot weather. We know the health problems that result from this, such as hypertension and obesity, but this is our fate in order to survive."

(RE, Female, 44, Dean of Public Health Department, PhD Epidemiology)

Despite other interviewees, belonging to the LCL groups, admitting that Libyans are addicted to the consumption of sugary beverages, they were unable to give a scientifically sound reason for this. Rather, they held the somewhat naive notion that drinking soft drinks after a heavy meal helps in food digestion. They also held the misconception that no health problems whatsoever result from increasing consumption of sugar-sweetened beverages and they were unaware as to whether consuming sugary beverages leads to weight-gain or not.

"In our society, we always drink tea after meals. This habit probably has an impact on our health, such as causing constipation. Moreover, we consume soft drinks during meals in order to help us to digest the food and help improve our appetite, encouraging us to eat more. I personally do not know if drinking too many sugary beverages impacts on our body-weight. I did not really come across that, did you?"

(GX, Male, 57, Deputy of Municipal Council, Benghazi, MPHC)

"We Libyans like to serve more than one kind of beverage at each meal, both cold and hot drinks, and at all social events. We always encourage each other to eat and drink too much as a curse, but I think there are a lot of health benefits to drinking too many fluids. To me drinking fluids has never caused any health problems; it may even reduce weight instead of increasing it."

(AL, Male, 56, Tribal leader, Diploma of Higher Education)

9.3.3.5 Consumption of fast food vs. traditional food

The vast majority of interviewees, belonging to both groups, discussed the issue of fast-food intake in general. There was consensus that the consumption fast food has spread widely in Libya and that this is attributable to several factors. First, it is delicious, accessible, and affordable to everyone. In addition, Libyans are generally unwilling to cook due to their busy lifestyles, revolving around family and work obligations.

"... know many Libyans in general and my relatives in particular love fast food as much as traditional food. Libyans eat out much more than they did three decades ago, and they simply do not realise how many more calories they get in commercially prepared food."

(NK, Female, 48, Diabetologist, Doctor of Medicine)

"There are many real indicators, such as the busy lifestyle of both parents. Families in Benghazi rarely cook during weekdays and eat out more often, as it's cheap, and the high-calorie fast food and junk food combined leads to people gaining weight."

(HZ, Male, 46, Lecturer, DrPH)

"I have heard a few Libyan people say that fast food is cheap, but in fact, it isn't. It costs me around 20-30 Libyan Dinar [£10-15] a day to buy fast food from a store, or eat it at a restaurant. But I have to admit that most Libyans are considerably more likely to eat fast food because it is convenient, it tastes so good, it is reasonably inexpensive based on public opinion, and those who dislike cooking have many fast food outlets available, encouraging us to eat out."

(GX, Female, 47, Municipal Council Member, Benghazi)

In contrast, only the dietitians (LHCPs) made the sound point that consumption of fast foods – whether takeaway or at restaurants – is not necessarily more dangerous than traditional Libyan foods because traditional food contains a higher concentration of fats and carbohydrates, which are thought to promote weight-gain more than fast foods, do.

"Of course junk food is unhealthy food for our health when they eat it regularly, but Libyans anyhow still love it and eat it frequently. My point is that there is obviously no difference between fast food and home-cooked food, but I think our traditional food is worse than fast food because we use margarine in rice and in all the main meals, so it causes health problems, generally speaking. Whether we eat junk food or homemade food, we will get in trouble, won't we?"

(ZT, Female, 38, Dietician, BSc Dietetics)

"To be fair, most Libyans prefer to eat traditional food on social occasions with high carbs in the form of bread, pasta, rice and meat, the main staple in Liby,. Here in Libya, traditional foods are very fattening. Everything is so oily, even salad and rice. I would rather say oily food because we use margarine so often, and this is a big problem with gaining weight."

(YS, Female, 37, Dietician, BSc Dietetics)

9.3.4 Knowledge about obesity

Presented below, knowledge about obesity patterns is divided into four sub-themes (meaning of obesity, perception about the prevalence of obesity in Libya and Benghazi and lack of knowledge about obesity among the public). The details of this theme shown in Figure 9.4 (overleaf).
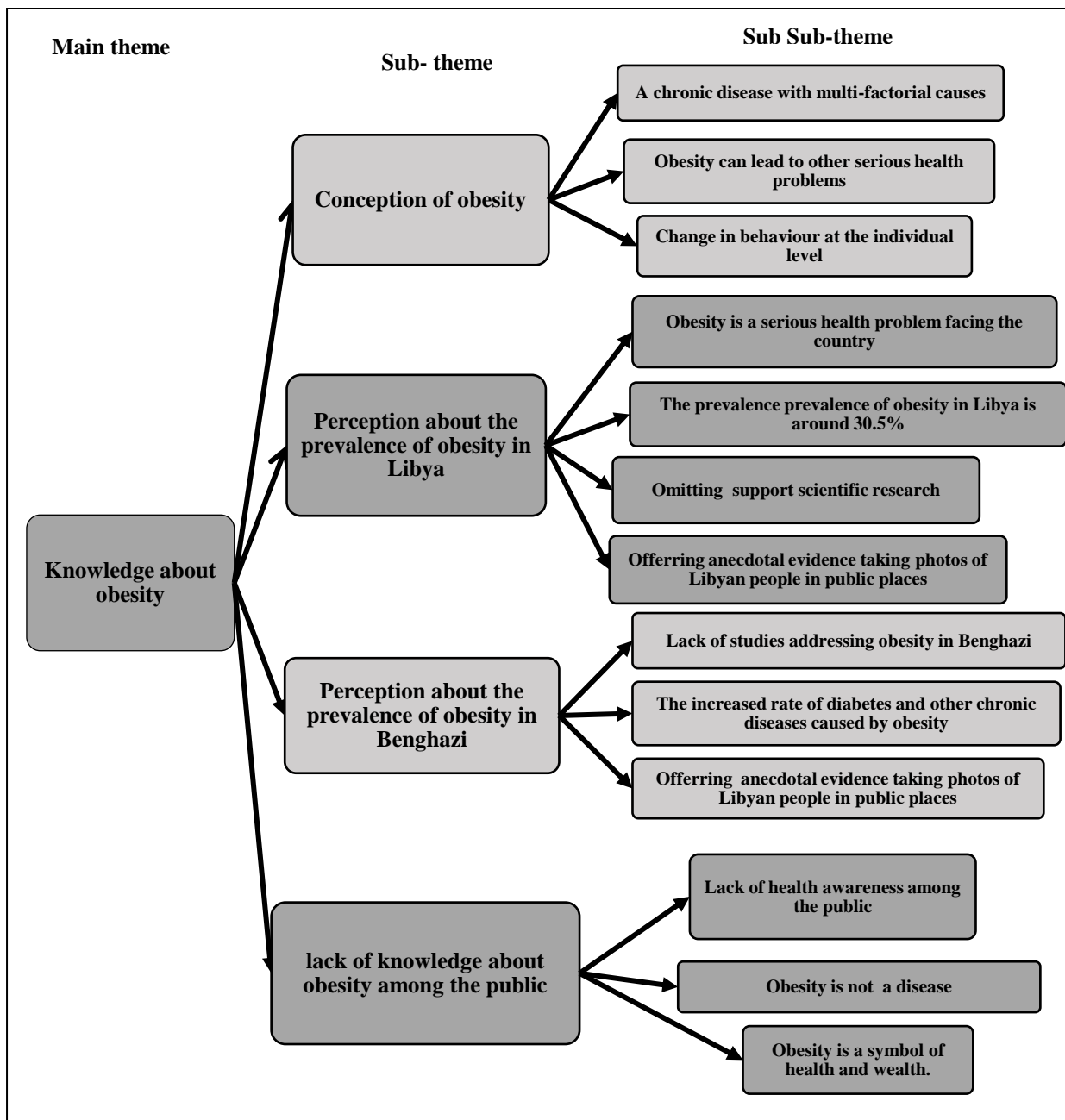
Figure 9.4 Thematic map of 'knowledge about obesity'.

9.3.4.1 Conception of obesity

The most interviewees held diverse views about the origin of obesity. On the one hand, interviewees, belonging to LHCP groups, recognised that obesity is a chronic disease with multi-factorial causes, that it has many health implications, and that it is both treatable and preventable.

"Of course, obesity is a disease likes any other fatal disease, leading to disability and an early death unless it is managed or treated. We know it is treatable and preventable but, at

present, we don't know how achieve these tedious tasks because even highly industrialised countries have failed to do so."

<div align="right">(NH, Female, 38, Diabetes Specialist Nurse, BSc Nursing Studies)</div>

"Obesity per se is a chronic metabolic disorder. I mean that it is a chronic disease per se. A disease is something that we can't control without medical help. Obesity is not our choice. No one would choose to be obese. It's a trap that you get into, not unlike alcohol or drug addiction. Once you are in the trap, you need help to get out."

<div align="right">(ZT, Female, 38, Dietician, BSc Dietetics)</div>

Furthermore, other interviewees, belonging to LHCP groups, particularly diabetologists, supported their views further by stating the consequences of obesity for health, based on their experience with obese patients.

"Obesity increases a person's risk of heart disease, high blood pressure, stroke, type two diabetes, and other serious diseases. What I am specialist in is chronic diseases, and every day I see new people getting either hypertension or diabetes. So what's the reason behind these [diseases] leads to temporary or permanent disability."

<div align="right">(NK, Female, 48, Diabetologist)</div>

"Being overweight or obese puts you at risk for many health problems, such as diabetes, heart disease, stroke, and some types of cancer. There is no question that the rates of these diseases have reached their highest levels in Benghazi."

<div align="right">(GH, Male, 46, Diabetologist)</div>

On the other hand, The interviewees, belonging to the academic staff (LCL groups) voiced two different views, which were as usual not unlike those of the Interviewees, belonging to LHCP groups, The academic staff stated that obesity results from multiple causes that interact to lead to obesity, including interpersonal factors, behaviour, and genetics. Other contributing factors they mentioned included the food consumed and the physical activity environment.

"Obesity is a complex entity that can have many causes, I think the two main factors are the frequency of eating at fast-food restaurants and a sedentary lifestyle like a couch potato and watching TV, and a worse point, which is the ignorance of our society about obesity. Socio-demographic and socio-economic factors are important determinants of obesity but, to my knowledge in Libya, everything is different to what you expect in the world."

<div align="right">(HZ, Male, 46, Lecturer)</div>

"There are many, many factors that influence our body-weight. Obesity is the result of multiple and complex factors: your job, your mental health, the amount and type of food available, other illnesses and conditions, your healthcare, and your social environment. Some people are lazy, they eat and drink too much."

<div align="right">(AB, Male, 46, Deputy of Medical Department, Doctor of Medicine)</div>

In contrast, other LCL interviewees (Imams, municipal council members and tribal leaders) gave less comprehensive reasons than the interviewees ,belonging to LHCP groups, and academic staff about why obesity might develop, although they provided quite sound definitions of obesity, perceiving the condition to be a change in behaviour at the individual level, and easy to take action against or manage.

"Unlike other diseases, obesity comes from a lack of a good diet and is the effect of not being active. Obesity is not a disease; it is your fault if you decide to get fat, and lounge around."

(GX, Female, 47, Municipal Council Member)

"Obesity cannot be considered a disease. Obesity has to do with your fat and fat can be controlled. Obesity also does not just happen overnight; it takes time to fully develop. I mean, time is wasted on indolent activities such as watching TV, playing video games, or even lying around and indulging in food."

(GX, Male, 57, Deputy of Municipal Council)

"Honestly, I could not tell you the exact definition of obesity, but, based on my humble knowledge, I know it is caused by overeating and a lack of physical activity. It is an addiction to food, just like alcoholism and other forms of substance abuse."

(KM, Male, 61, Tribal leader)

9.3.4.2 Perception about the prevalence of obesity in Libya

The vast majority of interviewees, belonging to both groups, acknowledged that obesity is a serious health problem facing the country. The interviewees, belonging to LHCP groups, and academic staff, who belong to the LCL group, asserted that no one in Libya can escape this fact and that the majority of Libyans are either overweight or obese; this is the bare truth. In addition, they supported their views about the prevalence of obesity in Libya by citing trusted sources of information.

"The percentage of obesity has been disclosed by an international organisation, I think the WHO Eastern Mediterranean Region , [it was] reported in 2009 that the obesity rate in Libya is about 30%. I don't know whether this percentage has gone up or down since then."

(NM, Female, 56, Diabetologist)

"I should admit I haven't seen any study focusing on obesity in Libya, but I have recently looked up the WHO website and I found that in 2009, in a national survey, Libya had a high obesity rate of around 30%, [umm] let alone being overweight."

(ZT, Female, 38, Dietician)

"I can bet you that you won't find any city or village in Libya devoid of large-bodied people, even in the Sahara. The problem is everywhere in Libya without exception. I know the prevalence of obesity in Libya is around 30.5%, I read a report on chronic diseases from the Health Ministry."

(HZ, Male, 46, Lecturer)

Although other interviewees, belonged to LCL groups, agreed with the interviewees, belonging to LHCP groups, about obesity being a real problem in Libya, they were unable to give an estimate of the scope of the problem. They did however offer anecdotal evidence. On the one hand, they accused the Libyan authorities of neglecting to support scientific research, not only in the health sector but in other fields as well, therefore it is difficult to find a valid statistic for obesity, with the Ministry of Health and the WHO website probably being the most reliable sources available. On the other hand, other interviewees, belonging to LCL groups, recommended the observational method of taking photos of Libyan people in public places to inform the relevant authorities about the scope of obesity in Libya.

"Yes, obesity exists here in Libya. I can't tell you how big a problem it is or what it is estimated to be. Unfortunately, we have a growing problem. And I do not think you can find reliable resources that you can trust, because based my knowledge, I don't think a study has been done in Libya to address obesity per se."

(TS, Male, 62, Mufti and a member of a house of fatwa)

"Obesity is a big issue wherever you go in Libya, even in the Sahara desert because if fast food is not available, then some traditional foods in Libya lead to weight gain. If you need some information about the number, you can go to the Health Ministry in Tripoli, otherwise you can take photos from the public place to show other people the scope of the obesity epidemic in Benghazi."

(AL, Male, 56, Tribal leader)

9.3.4.3 Perception about the prevalence of obesity in Benghazi

There were no significant disparities among the interviewees belonging to the two groups, in their perceptions of the prevalence of obesity in Benghazi. Although both groups, the interviewees, belonging to LHCP groups, and academic staff (LCL groups), acknowledged the lack of studies addressing obesity in Benghazi, they contended that the obesity rate might be particularly high in this city. They supported their arguments with logical inferences such as the increased rate of diabetes and other chronic diseases caused by obesity.

"Evidence about the spread of obesity is crystal clear when you find out the statistics about diabetes, heart disease or any other disease at the Benghazi Diabetes Centre or any public hospital in Benghazi. As I previously mentioned to you, we know the obesity rate in Libya, but we do not know what the obesity rate look likes in Benghazi, although this is what we are passionate about, and I am sure your study will provide us with the precise number or percentage."

(AB, Male, 46, Deputy of Medical Department)

"I deal with many obese people who come here, not because they are obese, but because they suffer from diabetes or hypertension or other heart diseases. I may be exaggerating when I tell you, but I have found that out of every three people, one is obese or overweight. The problem here is that people do not care about their weight."

(NK, Female, 48, Diabetologist)

On the other hand, other interviewees, belonging to other LCL groups, contended that the obesity rate is high in Benghazi, and supported this perception with anecdotal evidence only, such as informal observation or taking photos in public places to convince others of the high prevalence of obesity in Benghazi, due to the lack of research.

"I know there is a high prevalence rate. I don't know the number or percentage exactly. But, if you are going to convince anyone, you can take some photos in the streets or public places, in markets and stadiums, and show them. Or you can find the statistics for diabetic patients, which may be relevant to your work. But at the end of the day, obesity is huge problem here in Benghazi and no one can deny it."

(AE, Male, 64, Imam of a mosque)

"Personally, I see an increased number of obese people around me in my tribe and in my close family because our eating is not healthy. I am from Benghazi and I believe obesity is a crystal-clear problem and that very few people will discuss it. Obesity is an obvious disease everyone can recognise it with their own naked eye, without looking for evidence or documentation."

(KM, Male, 61, Tribal leader)

9.3.4.4 Lack of knowledge about obesity among the public

Only the interviewees, belonging to LHCP groups, raised the issue of knowledge among the public, perhaps due to their daily contact with the patients. The interviewees, belonging to LHCP groups, affirmed that the level knowledge about obesity among the Libyan population is relatively low, despite many attaining higher education qualifications mostly unrelated to health. They also suggested that such lack of knowledge is probably due to the lack of health awareness among the public; many Libyans still do not believe that obesity is a disease; rather it is widely considered to be a symbol of health and wealth.

"The disaster here in Benghazi or in Libya is that the public have not realised yet that obesity is a health problem. The majority of them believe there is no problem regarding their weight and they come to the clinic to seek treatment for secondary diseases, of which, I believe, obesity is the cause."

(GH, Male, 46, Diabetologist)

"Do not be surprised here in Benghazi if you meet many ignorant people who never consider obesity to be a disease or health issue, but it is a sign of health and wealth. Sorry to say that this is the reality and what I know, based on my work."

"Many Libyan people do not realise that obesity or being overweight has a negative impact on their health. Despite many Libyans earning high qualifications in different fields, and being semi-educated people, some of them even ignore the simplest health concepts, never mind the big health issues like obesity."

(NM, Female, 56, Diabetologist)

9.4 Factors influencing body-weight at the interpersonal level

The main theme in this section is social-cultural influences on obesity. Shown in figure 9, 5 below, this theme embodied four sub-themes and sub sub-themes: Marital status, faith, cultural and acculturation. Elicited from the 21 interview transcripts, these themes were allocated to the interpersonal level of the SEM. The details of this theme shown in Figure 9.5 (overleaf).
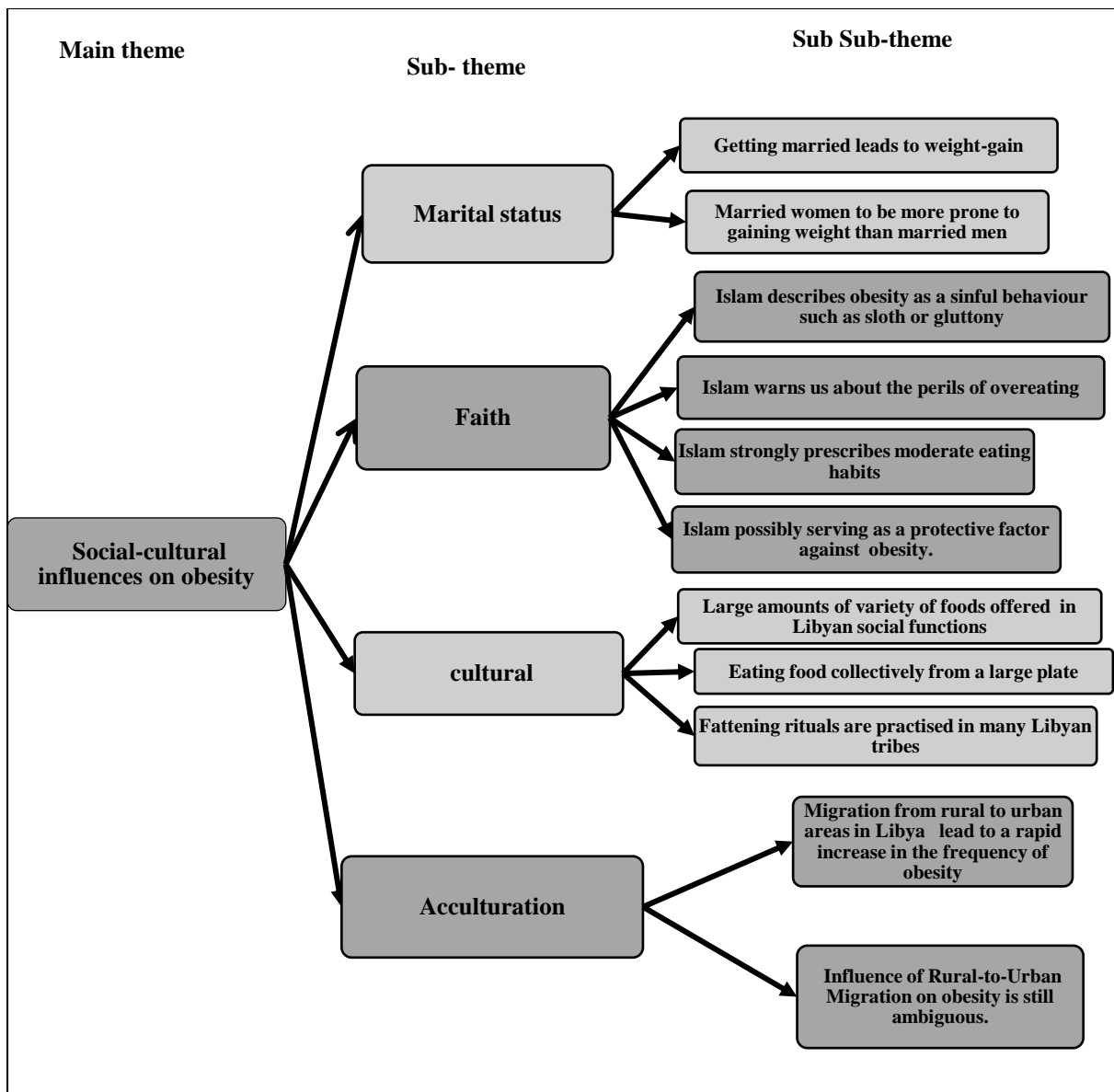
Figure 9.5 Thematic map of 'social-cultural influences on obesity'.

9.4.1 Faith

Despite an overwhelming majority of Libyan Muslims having firm beliefs in Islam, it was only the Imams, belonging to LCL groups,, who raised the topic of Islamic beliefs in relation to obesity; the other the interviewees ,belonging to LHCP and LCL groups, did not mention it. The Imams explained the Islamic perspective on obesity. On this view, gluttony is a sin and obesity is considered to be a risk to human health. As evidence for their views, they cited the Prophet.

> *"Let me bring an example of how Islam informed us about the dangers of obesity. The Prophet said, "The stomach is the pool of the body and the veins lead to it."*
>
> (AE, Male, 64, Imam of a mosque)

*"Islam warns us about the perils of overeating. On seeing a fat man, the holy Prophet said:
"If you did not have a paunch (belly fat), it would be better for you." He also said:
"Overeating does not go with good health.""*

<div align="right">(MA, Male, 64, Imam of a mosque)</div>

*"Like other religions, Islam describes obesity as a sinful behaviour such as sloth or gluttony.
Islam has taught us not to be gluttonous, devouring food as if you have not seen such
excellent food before. Regarding drinking-water, the Prophet said "Do not drink water in
one gulp, just as the camel does. Drink twice or even thrice.""*

<div align="right">(TS, Male, 62, Mufti and a member of a house of fatwa)</div>

All three Imams interviewed acknowledged that Islam has given Muslims broad guidelines to think about and apply to any dilemma that arises in life. The Holy Quran and the Prophet assert that obesity should be tackled through the following Islamic laws. Believers are advised to be moderate in every aspect of life. Islamic rules strongly advocate moderate eating habits and specify which foods are lawful and unlawful for Muslims to eat so as to keep their bodies in good shape.

*"We have been taught not to eat excessively. The Quran said "Eat and drink but not to
excess and do not cast yourselves into destruction by your own hands.""*

<div align="right">(AE, Male, 64, Imam of a mosque)</div>

*The Shariah Law (Islamic law) specifies which foods are halal (lawful) and which are
haram (unlawful) according to the Quran. Islam totally forbids the consumption of
alcohol and intoxicants in any amount, also Islam bans the consumption of pork and
its by-products and birds of prey with claws. In addition, Islam teaches and advises us
to eat and drink in moderation, and to fast, pray, and to engage in physical exercise."*

<div align="right">(AE, Male, 64, Imam of a mosque)</div>

*"Islam advised us, we must be modest in everything in our life. The Quran clearly states: "Ye
people eat of what is on earth, lawful and wholesome." Let me recite another versus from the
Quran. Allah says: "And those who, when they spend, are neither extravagant nor niggardly,
but hold a medium (way) between those (extremes).""*

<div align="right">(MA, Male, 64, Imam of a mosque)</div>

*"Islam has recommended that if we had moderate habits in eating, our bodies would become
strengthened. As the Prophet said: "Eat less and you will be healthier." He also said:
"Nothing is worse than a person who fills his stomach. It should be enough for the son of
Adam to have a few bites to satisfy his hunger. If he wishes more, it should be: one-third for
his food, one-third for his liquids, and one-third for his breath.""*

<div align="right">(TS, Male, 62, Mufti and a member of a house of fatwa)</div>

Other suggestions by Imams regarding how obesity can be tackled included physical activity and fasting during Ramadan. All three Imams supported their views by citing the Prophet.

"Islam persuades us to engage in physical activity. I cite what the Prophet said: "Any action without the remembrance of Allah is either a diversion or heedlessness excepting four acts: Walking from target to target [during archery practice], training a horse, playing with one's family, and learning to swim."

<div align="right">(TS, Male, 62, Mufti and a member of a house of fatwa)</div>

"Our religion actually advises us to be more active, the Prophet said, "In movement is a blessing."

<div align="right">(AE, Male, 64, Imam of a mosque)</div>

"Yes, Islam encourages us to do exercise. Let me tell you what the Prophet's wife said: "I raced with the Prophet and beat him in the race. Later, when I had put on some weight, we raced again and he won. Then he said, 'This cancels that, referring to the previous occasion'."

<div align="right">(MA, Male, 64, Imam of a mosque)</div>

"... the fasting of holy Ramadan has many benefits for our health. It regulates our digestion, promotes healthy bowel function, and enhances metabolic functioning. It's a great chance to obtain the physical benefits as well the best solution to weight loss. The Prophet said, "Fast the month of Ramadan so as to heal your bodies from disease."

<div align="right">(TS, Male, 62, Mufti and a member of a house of fatwa)</div>

9.4.2 Cultural

The vast majority of interviewees, both interviewees, belonging to both groups, expressed similar views concerning the theme of family gatherings and social occasions, which occur frequently in Libyan culture, such as engagements, bereavements, and festivals. Most of them perceived that Libyan social functions offer guests a variety of foods in prodigious quantities. In addition, they stated that hot and cold beverages are served at these social gatherings and that, in Libyan culture, guests are also compelled to over-eat to show their respect for the hosts.

"Social occasions offer traditional food which is oily, and margarine with meat and carbohydrates, which are all unhealthy. And you will be forced to eat a lot to show your respect for the host."

<div align="right">(ZT, Female, 38, Dietician)</div>

"If we are invited to a banquet for any social occasion, we should eat what we are offered and served by the hosts, which in general is traditional Libyan food. Eating too much of the offered food means that we show our respect to the hosts. I think this behaviour leads us to gain weight."

<div align="right">(YS, Female, 37, Dietician, BSc Dietetics)</div>

"Libyans think that there is no point in asking the invited guests what food they prefer to eat, which is a shame. Libyans in general eat what is served; even if they have diseases like diabetes, aligned with the old Libyan proverb "Eat whatever you are served. If it does not kill you, it will make you obese."

<div align="right">(AL, Male, 56, Tribal leader)</div>

However, Imams (LCLs) discussed some misconceptions within Libyan culture concerning family members eating food collectively from a large plate or bowl, serving food in large quantities and encouraging each other not to leave any food so as to be blessed by God.

"... you know this social phenomena may add insult to injury. Libyans encourage each other to eat from the same big plate, even after they reach the satiety stage, because the culture expects them to finish all the food served to get blessings from Allah."

(TS, Male, 62, Mufti and a member of a house of fatwa)

In contrast, the three tribal leaders, belonging to LCL groups, focused on different aspects of culture. They raised the interesting topic of the traditional 'fattening hut' rituals, which are still practiced by many Libyan tribes, including the Arabs and the Berbers living in Sahara desert and countryside. This refers to the practice of deliberately fattened-up women living in 'fattening cottages' before marriage due to the belief that plump women are healthy, beautiful, and fertile, and their family is prosperous.

"Here in Libya there are several tribes living in the desert who are conservative and still follow myths and rituals such as practising fattening, or considering female plumpness to be a sign of social status, which is a cultural symbol of beauty, fertility and prosperity I know it is a misconception, but in our culture it is an acceptance of being fat because the ritual believes obese men or women are attractive and healthy."

(AL, Male, 56, Tribal leader, Diploma of Higher Education)

"It is well-known in our society that obesity is a sign of good health, and being overweight or obese means that you have a healthy body, and are wealthy. Here in Libya, looks how men don't like to marry thin women because they still believe obese women are a symbol of beauty and are fertile."

(AL, Male, 56, Tribal leader)

"Tribes who lives in Libyan villages and in the Sahara, plump women are traditionally seen as more in demand. Our rituals stimulate women before marriage, where women are placed in confinement so they can avoid undoing their effort. They are fed very well with variety of meat and food to prepare them for marriage."

(AA, Male, 65, Tribal leader)

For further results about 'social-cultural influences on obesity', see Appendix 9.2.

9.5 Factors influencing body-weight at the institutional and organisational level

The main theme in this section is Libya's healthcare facilities and their ineffectiveness in preventing and controlling obesity among Libyans. Shown in figure 9.6 below, this theme embodied four sub-themes and sub sub-themes: Failing to take advantage of the free medical services; deteriorating health sector performance; a lack of healthcare information systems; a lack of health education and awareness programmes. Elicited from the 21 interview transcripts,

these themes were allocated to the institutional and organisational level of the SEM. The details of this theme shown in Figure 9.6 (below).
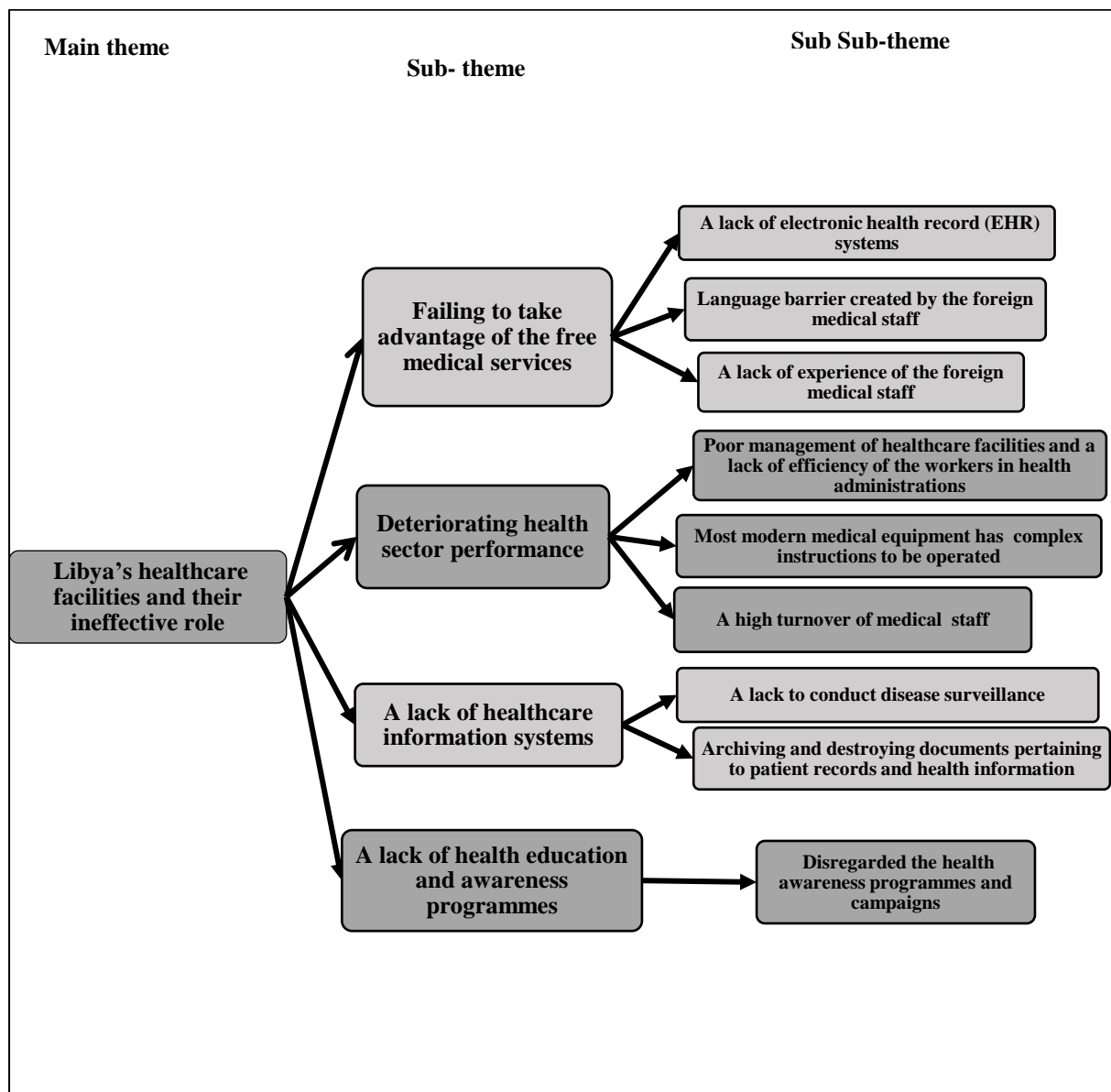
Figure 9.6 Thematic map of 'Libya's healthcare facilities and their ineffective role'.

9.5.1 Failing to take advantage of the free medical services

An overwhelming majority of interviewees, belonging to both groups, expressed divergent views on the topic of free medical service. Due to the interviewees, belonging to LHCP groups, being the healthcare providers, they viewed the disadvantages of healthcare services provided from their own perspective. They stated the Libyan heath system is defunct due to the lack of electronic health record (EHR) systems, and that this dissuades Libyans from utilising the free healthcare services.

"...we do not have electronic health record systems. Actually we do not have the patient's electronic health file to facilitate our job and keep in touch with our patients, notifying them about their schedule and rescheduling their visits, [which] encourages them to take maximum advantage of the free health services provided."

(NM, Female, 56, Diabetologist)

In contrast, the interviewees, belonging to LCL groups, spoke from the perspective of healthcare users. They contended that the language barrier created by the foreign medical staff speaking different languages dissuades Libyans from taking advantage of the free healthcare services provided, coupled with the lack of experience of the foreign medical staff. Unable to communicate with doctors, most Libyans travel abroad for their medical treatment.

"We know our health system's reliance on foreign workers is a problem. What needs to be considered particularly is the language to communicate with the patients socially, as some foreigners do not speak even the English language."

(KM, Male, 61, Tribal leader)

"Many people travel to seek treatment outside of Libya because they do not trust the Libyan health system, which provides free health services, due to medical staff. Whether they are Libyans or foreigners, they are unqualified and lack professional experience."

(GX, Female, 47, Municipal Council Member)

9.5.2 Deteriorating health sector performance

Diverse views were expressed about deteriorating health sector performance. The interviewees, belonging to LHCP groups, asserted that the Libyan public sector healthcare system suffers from poor management in that most healthcare facilities are administered by staff whose qualifications are not relevant to health. As a result, they fail to satisfy the needs of patients such as offering them preventive treatments and cures. A second point pertained to the use of the imported, modern medical equipment. The interviewees, belonging to LHCP groups, claimed that both Libyan and foreign staff fail to operate these properly.

"To be honest, the majority of administrative staff in all health facilities do not belong to the health sector. This is a big disaster facing our health sector. I mean, most of them are unaware about how to improve health services to satisfy patients' needs and they even ignore the difference between preventive and care services."

(GH, Male, 46, Diabetologist)

"Despite our government importing medical equipment and devices, we always struggle to find professionals who can operate this equipment to improve health services and fix any faults that arise."

(SG, Female, 37, Diabetes Specialist Nurse)

Another interesting point raised by the interviewees, belonging to LCL groups, was that continuous changes in the foreign medical staff in the Libyan healthcare facilities deter Libyans from accessing healthcare services. They argued that the high turnover of medical staff affects the quality of healthcare services provided.

"To me the shift of foreign staff in health facilities, whether employed new staff or staff transferred between health facilities, has an adverse impact on the quality of the health services provided."

(NH, Female, 38, Diabetes Specialist Nurse)

9.5.3 A lack of healthcare information systems

The interviewees, belonging to the two groups, expressed two different perceptions about healthcare information systems (HCIS) in Libya. On the one hand, all interviewees, belonging to LHCP groups, said that the absence of HCIS means that health authorities are unable to conduct disease surveillance (monitoring and evaluating the spread of disease patterns) which may contribute to the exacerbation of the obesity epidemic in Libyan adults, since the Libyan government is probably unaware of the escalating prevalence of obesity due to lack of information disease surveillance systems and laboratory information systems.

"Unfortunately despite the huge money spent on the health system in Libya, we still lack the healthcare information systems. I think it is shameful and disappointing that there is no factual information available about disease surveillance systems and laboratory information systems."

(NM, Female, 56, Diabetologist, Doctor of Medicine)

"Due to weak documentation and neglect by the authorities, I mean the health sector has no accurate data because there is no system to keep data confidential. Sometimes, general hospitals burn patients' archives after a three-year period due to insufficient space being available to keep all the paper bundles."

(NK, Female, 48, Diabetologist, Doctor of Medicine)

While The interviewees ,belonging to LCL groups, doubted the efficacy of the healthcare authorities to retain and store huge piles of patient records over a long period of time, which resulted in a lack of data for undertaking any further scientific research.

"I do not know if we have a system which keeps all the archives since the revolution, I mean the disaster of February. The militias have destroyed everything and burnt all the documents as they assumed they were the corrupted documents of the old regime. I do not know if they wanted to hide the fact, but anyhow, no one can hide a ray from the sun by using a sieve."

(AA, Male, 65, Tribal leader)

9.5.4 A lack of health education and awareness programmes

There was an explicit acknowledgement among both groups HCPs and LCLs that the old Libyan regime and the consecutive provisional governments have completely disregarded health awareness programmes and campaigns, whether at the individual, local or national level. This has resulted in an exacerbation of the occurrence of chronic diseases and probably some infectious diseases as well.

"No one can hide during the old or new Libyan regime that the performance of the health system is very weak in terms of the provision of curative and preventive services. Look at the health awareness programmes which are completely omitted. I think the absence of health education leads to an increased misconception of simple health norms among Libyans."

(NK, Female, 48, Diabetologist, Doctor of Medicine)

"Not only have curative services been neglected but also preventive services, which have been destroyed. As you can see, no effective public health awareness has been established yet in Libya. So you cannot blame the public if they show obesity, as obesity as a sign of good health and a sign of great wealth."

(KM, Male, 61, Tribal leader)

"Regardless, some slogans were launched by the old regime in the Green Book of Gaddafi such as "Sport for All" and "Sport is a public activity which must be practised rather than watched": despite these being relevant to public health awareness, I think the old regime did not intend to raise awareness about health and wellbeing. Hence, most Libyans disregarded all these slogans because they did not believe in the Book."

(AE, Male, 64, Imam of a mosque)

9.6 Factors influencing body-weight at in community settings and physical environment level

Three themes categorised, as belonging to the community setting and physical environment levels of the SEM are physical activity and sedentary behaviour; the effect of the neighbourhood environment on physical activity; the effect of the neighbourhood environment on food availability and accessibility. Shown in figure 9.7 overleaf, this theme embodied four sub-themes and sub sub-themes. Elicited from the 21 interview transcripts, these themes were allocated to the community setting and physical environment level of the SEM.

9.6.1 Physical activity and sedentary behaviour

Presented below, physical activity and sedentary behaviour are divided into three sub-themes (physical activity, Barriers to physical activity and sedentary behaviour). The details of this theme shown in Figure 9.7 (below).
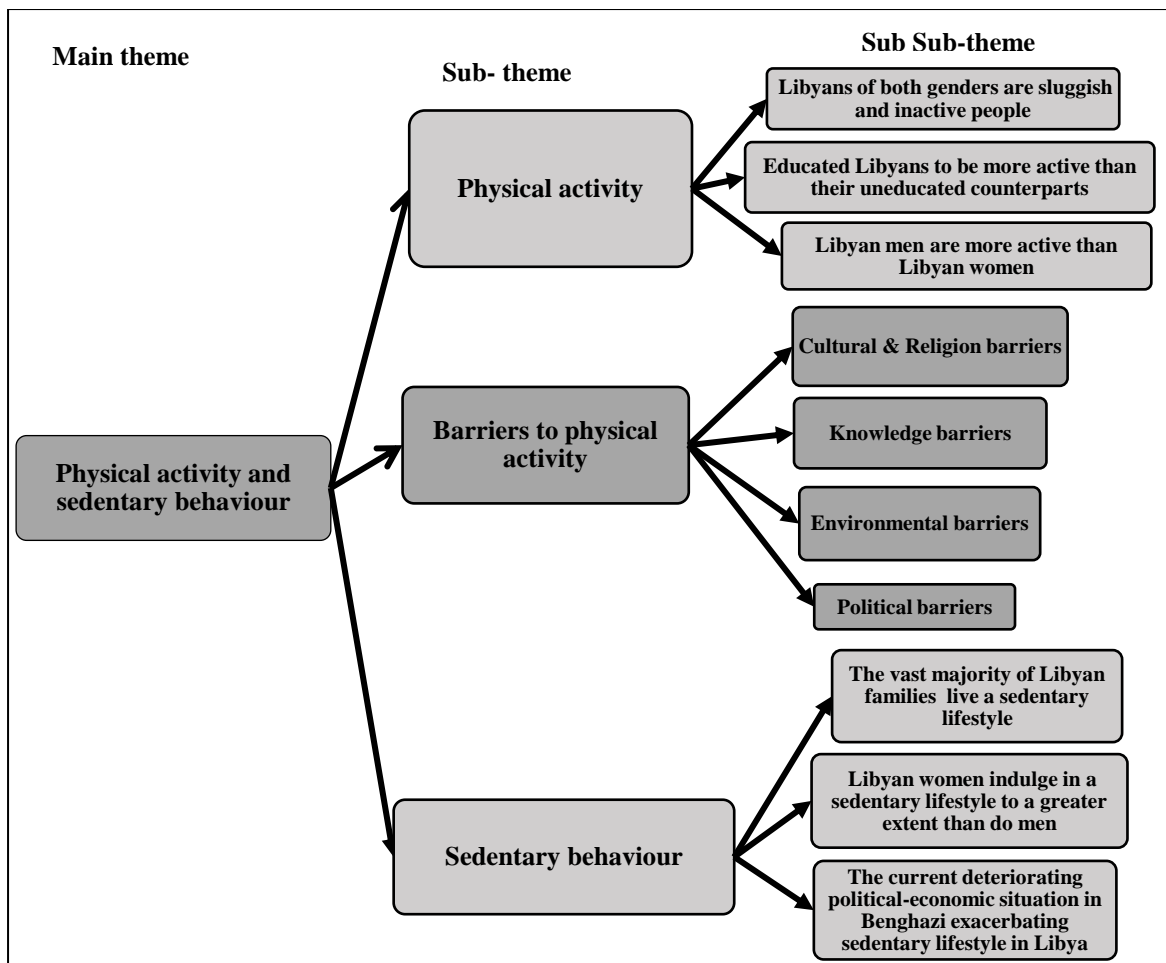
Figure 9.7 Thematic map of 'physical activity and sedentary behaviour'.

9.6.1.1 Physical activity

The vast majority of interviewees belonging to the two groups, held diverse views about physical activities among Libyan citizens. The interviewees, belonging to LHCP groups, held that Libyans of both genders are sluggish and inactive people, indulging in a sedentary lifestyle despite the availability of leisure facilities and recreation centres, both indoors or outdoors.

> *"I do not think Libyans in general ignore the health benefits of regular exercise and physical activity, but Libyans are accustomed to rest and inactivity as a result of improved living conditions. So most of Libyan hate to engage in any physical activity. If you look at their homes, most Libyan families hire domestic workers, and, you know, the majority of their jobs are sedentary. Let alone in their spare time, Libyans love living like a couch potato."*
>
> (PV, Female, 38, Diabetes Specialist Nurse, BSc Nursing Studies)

While the academic staff (LCLs), perceived educated Libyans to be more active than their uneducated counterparts, as the educated ones have more opportunity to engage in different

types of physical activity, whether at home or at work, and to spend their free time indoors or outdoors.

"To me, the more educated people are, the more likely they are to participate in physical activity, whether at home, at work or in their spare time, because they are aware of the benefits of being active. But to me, the uneducated people still lack knowledge about physical activities so they don't care if they spend their life as a couch potato."

(NM, Female, 56, Diabetologist, Doctor of Medicine)

Another view raised by the other interviewees, belonging to LCL groups, was that Libyan men are more active than Libyan women due to the religious and cultural restrictions against women using public spaces to engage in sport or physical activity.

"There are no studies in Libya revealing how active Libyans are in their life, whether at home, work or in their leisure time. But I personally believe that Libyan men are more active than Libyan women because they have spare time to do exercise, while women are busy looking after children and doing household work, in keeping with Libyan cultural beliefs."

(MA, Male, 64, Imam of a mosque)

9.6.1.2 Barriers to physical activity

An overwhelming majority of the interviewees, belonging to both groups, said that there were factors impeding Libyans from engaging in physical activity. The interviewees, belonging to LHCP groups, mentioned that a lack of time due to family and work obligations could be the main reason dissuading Libyan citizens from engaging in any type of physical activity.

"Despite good living standards for the majority of Libyans, Libyan people always suffer from a lack of time due to family responsibilities, including all the housekeeping (despite the fact that they hire domestic workers) and childcare (despite the fact that they hire babysitters). Others often complain about work commitments or generally being 'too busy'. All these are excuses in order to avoid to engaging in any physical activities, which I believe is an unacceptable excuse."

(AB, Male, 46, Deputy of Medical Department)

The interviewees, belonging to LCL groups, mentioned additional barriers that contribute to Libyans' lack of exercise, both indoors and outdoors. These barriers can be categorised into: cultural barriers can include clothing restrictions women cannot be seen in public wearing short sleeves or shorts, knowledge barriers such as the lack of awareness of the benefits of physical activity, religion barriers such as Islam obligates women to wear the dress code for Muslim women (Scarf (hijab) and veil (niqab)) and most sport facilities are not segregated by gender ; environmental barriers such as the hot, dry weather; and politically-related barriers. Finally, political barriers include the following: the evening curfew in Benghazi imposed by the provisional government of Libya; an unsafe environment due to the fighting between the

provisional government and radical Islamic militias; increased crime rates; and the destruction of infrastructure in many districts in Benghazi due to the fighting.

"There are misunderstandings about the view of Islam on whether women should engage in physical activities. In fact, Islam strongly denies these accusations. Actually Islam encourages both men and women to engage in physical activity to maintain healthy lifestyles, provided that segregation is practised between both genders and women wear Islamic clothes."

(TS, Male, 62, Mufti and a member of a house of fatwa)

"Regardless, our religion gives permission for females to engage in physical activities on condition that gender segregation is maintained, and each gender is provided with trainers. Our culture, however, is still unsatisfied with that, so some strict tribes prohibit women from engaging in physical activities under any condition and consider it a violation of the cultural beliefs."

(AE, Male, 64, Imam of a mosque)

"In the current situation, I do not blame Libyans if they cannot engage in outdoor activities for many reasons. As you know, Benghazi is not secure, it is unstable with the fighting still ongoing in some districts, and some infrastructure has been totally destroyed. On top of that, we have an enforced curfew in the evenings by our government."

(EL, Male, 53, Municipal Council Member)

"… we already know that Libyan cultural beliefs and Islamic law perhaps impede Libyan women from engaging in outdoors activities due to families responsibilities. But, to me, I think the current situation in Libya is the crucial cause leading Libyans to stop engaging in any type of outdoor activities due to the destruction of parks, sports and leisure centres, and bicycle lanes, resulting from the war. Not to mention the hot, dry weather which is another barrier."

(AA, Male, 65, Tribal leader)

9.6.1.3 Sedentary behaviour

The vast majority of interviewees belonging to the two groups gave different views about the sedentary behaviour of Libyans. On the one hand, the interviewees, belonging to LHCP groups, perceived that Libyans in general tend to lead sedentary lifestyles, both before and after the Libyan revolution. They described Libyans as being addicted to sedentary indoor activities particularly at home due to extensive screen-time activities, the widespread use of household appliances, and a heavy reliance on cars.

"Libyans like to stay at home during the summer due to the high temperatures and are unwilling to engage in any sports or physical activities outdoors. They are addicted to watching TV or playing video games, and these things are actually reasons for the occurrence of obesity, aren't they?"

(HZ, Male, 46, Lecturer)

In contrast, the academic staff (LCLs) mentioned that Libyan women indulge in a sedentary lifestyle to a greater extent than do men due to the cultural restrictions against women engaging in outdoor physical activity. Although it is culturally expected that women take responsibility for running the household and bringing up their children, many have domestic workers and babysitter and to take over these responsibilities.

"Unfortunately, many Libyans are living less active lifestyles. They prefer to stay at home, resting, sitting on the computer all day, watching TV, and using modern household appliances that promote a sedentary lifestyle for women. Hiring domestic workers impacts on physical activities even in their houses, [as does] travelling in their own cars instead of using public transport. Also, all jobs offered to them are sedentary in nature."

(RE, Female, 44, Dean of Public Health Department)

Other interviewees, belonging to LCL groups, perceived that the current deteriorating political-economic situation in Benghazi influences the daily-life activities of the residents. Not only it is reducing their opportunities for physical activity, it is also exacerbating their already-sedentary lifestyle, to which Libyans were addicted even during the old regime. One reason is the evening curfews enforced by the provisional Libyan government to protect civilians from the unsafe environment, resulting in many Libyans staying at home.

"Actually the Libyan people have a strong desire to live a sedentary lifestyle, aside from the current situation in Benghazi, which seems to me to add insult to injury regarding the already-sedentary lifestyle in Libyans. The unsafe environment and curfew imposed by the government adds fuel to the fire. I think to me now Libyan people will become the laziest people in the world."

(EL, Male, 53, Municipal Council Member)

9.6.2 The effect of neighbourhood environment on physical activity

Presented below, the effect of the neighbourhood environment on physical activity are divided into seven sub-themes (urban residential density, street connectivity, mixed land use, unsafe environment and crime traffic and pedestrian safety, access to recreational facilities and household vehicle ownership). The details of this theme shown in Figure 9.8 (overleaf).
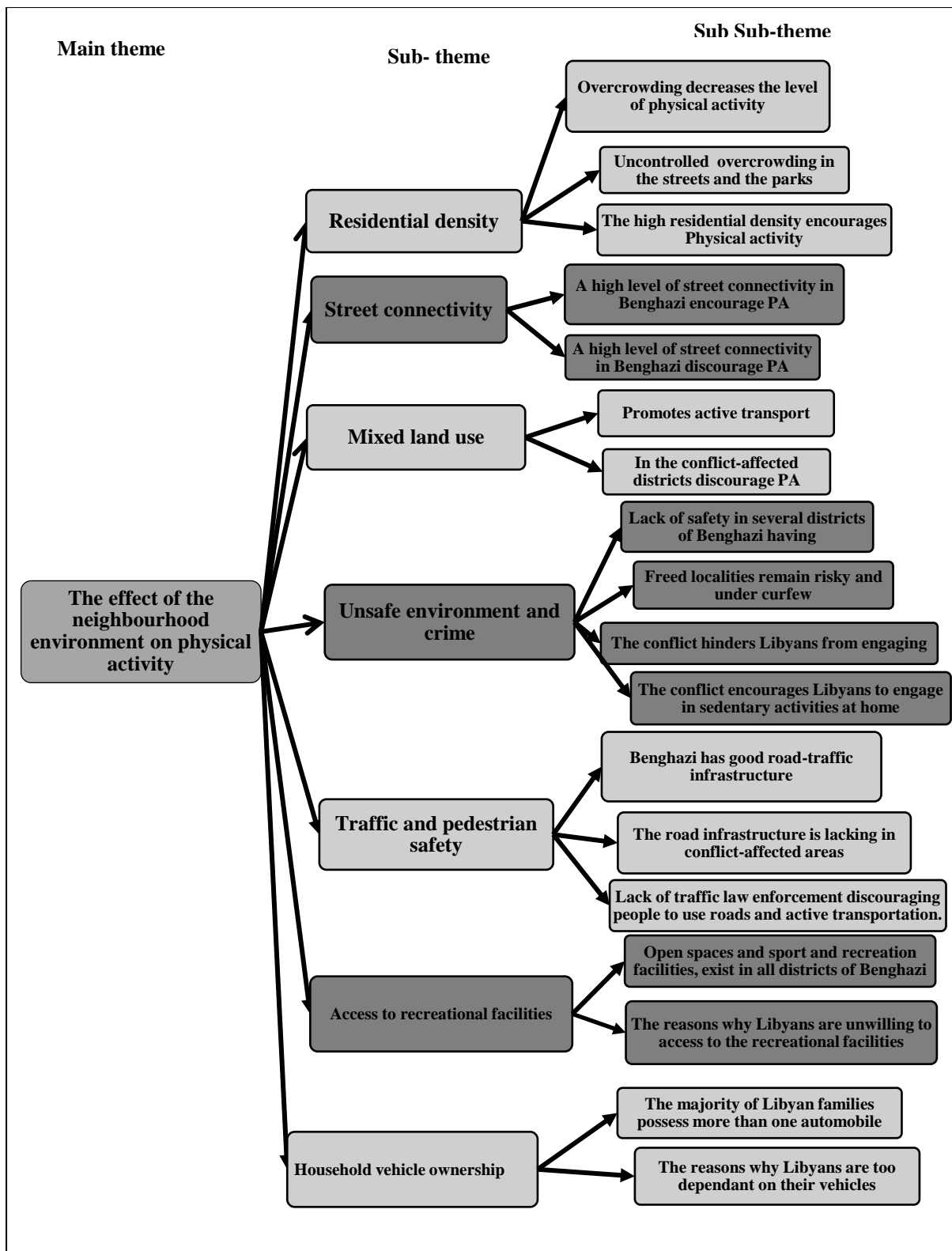
Figure 9.8 Thematic map of 'the effect of neighbourhood environment on physical activity'.

9.6.2.1 Urban residential density

The interviewee, belonging to LHCP groups, perceived that overcrowding increases the likelihood of physical and social problems and restricts the level of physical activity among the Libyan population. In addition, the interviewees (LHCPs) reported that the fragility of the provisional Libyan government makes it difficult to control overcrowding in the streets and the parks, which might have an adverse impact on physical activity levels in Libyans.

> *"Increased population density in Benghazi impacts on our life negatively in terms of increased fear of violence and crime in outdoor areas، increase traffic jams and air pollution. All these discourage Libyans from becoming more active."*
>
> *(SG, Female, 37, Diabetes Specialist Nurse)*

> *"I am sure the increased population density in Benghazi discourages the residents from engaging in physical activity due to overcrowding in parks and streets and increased air pollution. On the top of that, the ineffectiveness of the government in deterring criminals may add insult to injury."*
>
> (NK, Female, 48, Diabetologist)

However, those academic staff interviewees, belonging to LCL groups, had a different view. They argued that the high residential density in Benghazi encourages Libyans to use public transport or walk instead of using their vehicles due to traffic congestion.

> *"Increased population density here in Benghazi encourages residents to use public transport and walk to work. I mean, physical activities increase particularly in cities [since people prefer not to] use their own cars due to traffic jams, due to the Road Traffic Regulation Act."*
>
> (RE, Female, 44, Dean of Public Health Department)

For further results about 'the effect of neighbourhood environment on physical activity', see Appendix 9.3.

9.6.3 The effect of neighbourhood environment on food availability and accessibility

Presented below, the effect of neighbourhood environment on food availability and accessibility are divided into two sub-themes (access to supermarkets and access to grocery stores and fast food outlets). The details of this theme shown in Figure 9.9 (overleaf).
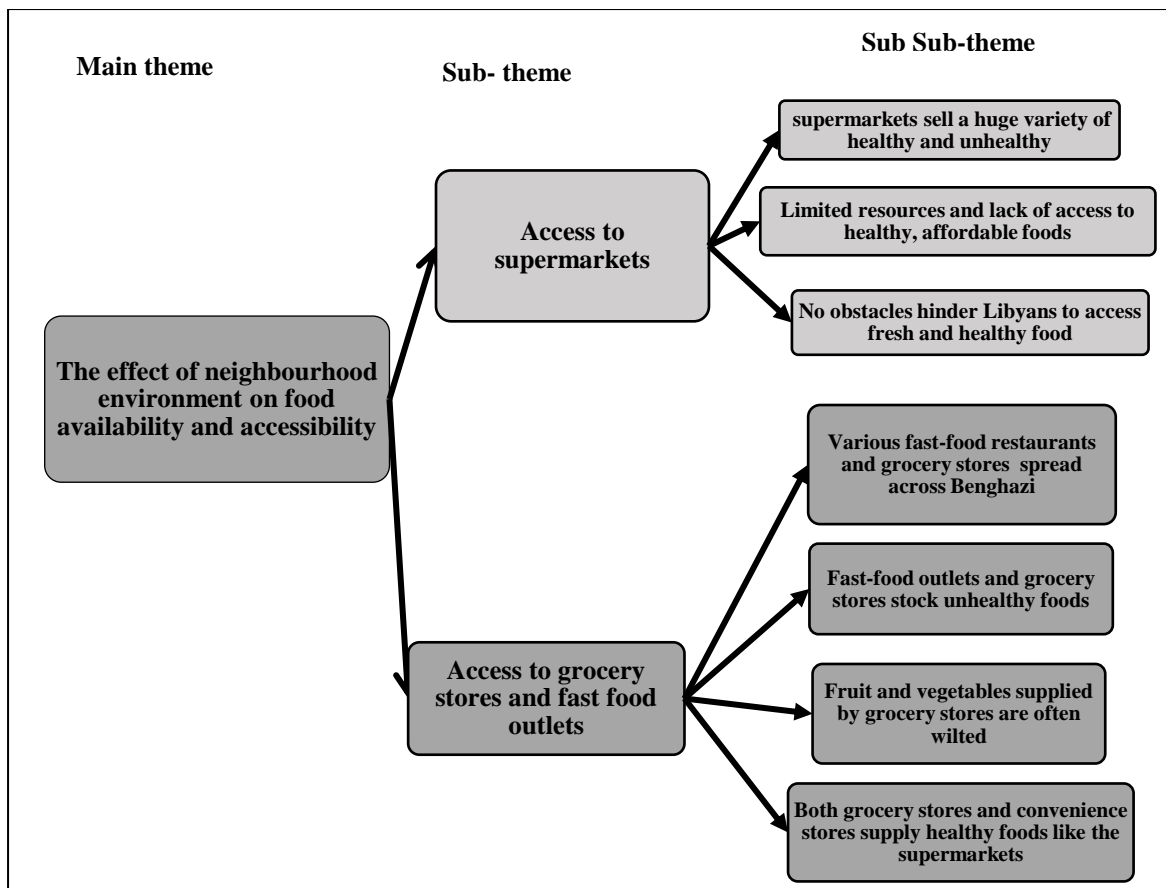
Figure 9.9 Thematic map of 'the effect of neighbourhood environment on food'.

For further results about 'the effect of neighbourhood environment on food'see Appendix 9.4.

9.7 Factors influencing body-weight at public-policy level

The main theme in this section is the Libyan food-subsidy policy. Shown in Figure 9.10 below, this theme embodies three sub-themes: food prices and affordability; extensive food subsidisation; and the media and advertising elicited from the 21 individual interviews, these themes were allocated to the public-policy level of. the SEM. The details of this theme shown in Figure 9.10 (overleaf).
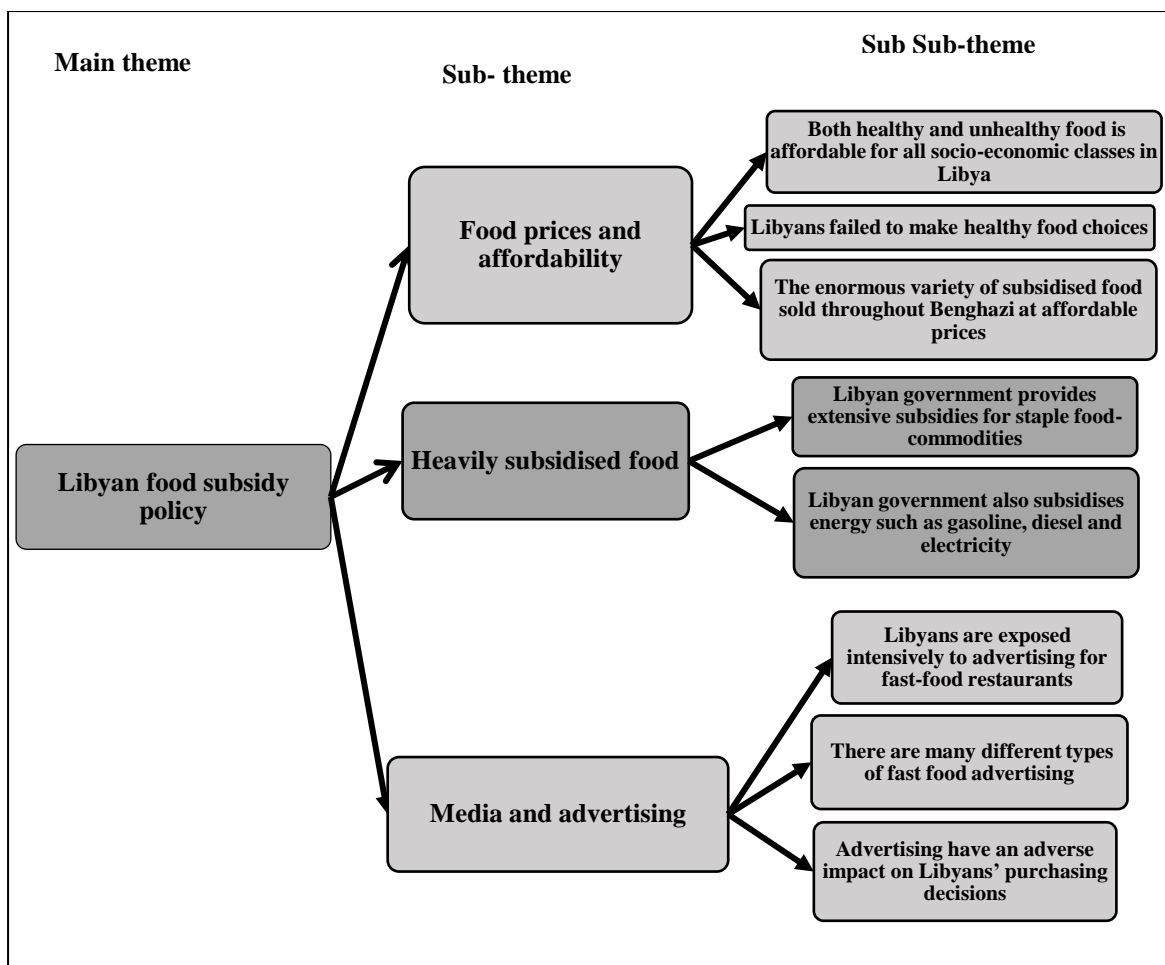
Figure 9.10 Thematic map of 'Libyan food-subsidy policy'.

9.7.1 Heavily subsidised food

The vast majority of interviewees, belonging to the two groups, gave broadly similar views about subsidised food. They admitted that the Libyan government provides extensive subsidies for staple food-commodities including wheat, flour, sugar, rice vegetable oils and other miscellaneous commodities. In addition, they reported that the Libyan government also subsidises energy such as gasoline, diesel and electricity, despite the fact that these subsidies for fuel and food over-tax the Libyan budget. Although this subsidy programme benefits Libyan society in certain respects, it is likely to be one of the risk factors fuelling the obesity epidemic.

> *"Staple food commodities including wheat, flour, sugar, rice vegetable oils, tea, and miscellaneous are offered to Libyans at very low prices, but a large amount of Libyan government revenues was spent on fuel and food subsidies. This burdens the Libyan budget, but removing the subsidies is going to be a very difficult for Libyan population."*
>
> (YS, Female , 37, Dietician)

"The government is subsidising fuel, food, water, and electricity. The goal of having subsidies is initially to help Libyans to receive free services, and access food and energy at affordable prices, where ten loaves of bread costs about 100 Libyan Dirham [five pence]."

(AA, Male, 65, Tribal leader)

"People are heavily dependent on the Libyan government for free health and education services. Even studying at university is free, and there is cheap food, fuel, and electricity. The actual cost of gasoline today is only 150 Libyan Dirham [seven pence] per litre. Diesel is 200 Libyan Dirham [ten pence] litre."

. (EL, Male, 53, Municipal Council Member, Benghazi)

For further results about 'Libyan food-subsidy policy' see Appendix 9.5.

9.7.2 Other themes categorised as belonging to the public-policy level

The theme was 'suggestions for preventing and controlling obesity'. Categorised as belonging to the public-policy level of the SEM, this theme includes three sub-themes: improve the effectiveness of health education; promote healthy eating and encourage physical activity. Elicited from the 21 interview transcripts. The details of this theme shown in .Figure 9.11 (below).
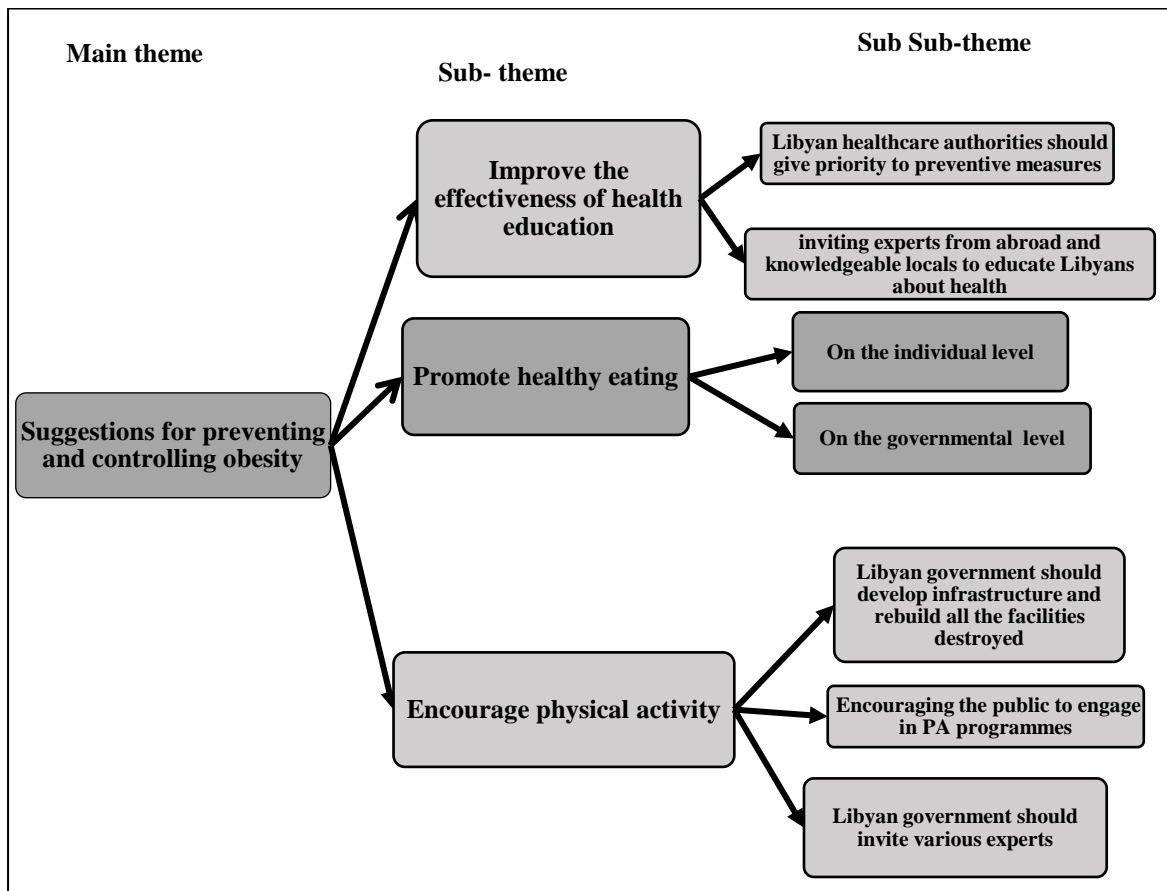
.Figure 9.11 Thematic map of 'suggestions for preventing and controlling obesity' .

9.7.2.1 Improve the effectiveness of health education

The vast majority of interviewees, belonging to the two groups. were capable of contributing ideas and suggestions for supporting and promoting health awareness among the public. The interviewees, belonging to LHCP groups, suggested that Libyan healthcare authorities should give priority to preventive measures such as health education programmes and compulsory lessons on healthy cooking in the school curriculum.

"To raise health awareness among lay people about healthy eating choices and persuade people to be more active, I believe Libyan health authorities should give priority to preventive measure such as health education programmes."
(GH, Male , 46, Diabetologist, Doctor of Medicine)

"The officials should make policies such as making healthy cooking a compulsory subject in schools, and the government should prohibit schools from serving junk food instead of healthy food."
(WQ, Female , 36, Dietician)

In contrast, the interviewees, belonging to LCL groups, suggested that Libyan officials needed to cooperate with each other in order to establish health education programmes through utilising all available resources, such as inviting experts from abroad and knowledgeable locals to educate Libyans about health and propose effective measures to curb obesity.

"Our government should sponsor campaigns by inviting experts and recruiting the local healthcare providers to establish the essentials of health awareness programmes to promote health awareness among Libyans on obesity, and how it could be prevented and controlled."
(AB, Male , 46, Deputy of Medical Department)

9.7.2.2 Promote healthy eating

The vast majority of interviewees, belonging to the two groups, raised very different views about how to promote healthy eating. The Interviewees, belonging to LHCP groups, focused on the individual level in terms what people should eat and avoid, such as sugary soft drinks or fizzy drinks.

"What we know is that Libyans should understand that their traditional food and our eating habits are dangerous. What we all need to do is reduce the use of ghee in our food and soft drinks, and try to eat more fruit and vegetables."
(YS, Female , 37, Dietician)

"Eating five to six servings of fruits and vegetables daily and avoiding sugary soft and fizzy drinks and substitute whole milk with reduced-fat milk (2%), low-fat milk (1%) and fat-free milk."
(YS, Female , 37, Dietician)

In contrast, The interviewees ,belonging to LCL groups, concentrated on the governmental level in terms of what the Libyan government should do in order to curb the obesity epidemic, such as terminating the food subsidy and taxing junk food.

"Our government should quit subsidising staple commodities and support subsidies for healthy food instead,aslo Libyan government should tax junk food, and Libyan authorities should take action to restrict of television advertising for less healthy foods.

(HZ, Male , 46, Lecturer)

9.7.2.3 Encourage physical activity

The vast majority of interviewees, belonging to the two groups, gave numerous suggestions about how physical activities can be promoted. On the one hand, the interviewees ,belonging to LHCP groups, suggested that the government should develop infrastructure such as public transport, renovate old buildings, and rebuild all the facilities destroyed by the conflict, as this will enable them to set up initiatives that encourage physical activity. In addition, they recommended encouraging Libyans at the individual and community level to increase their physical activity levels and limit their time spent being sedentary.

"Our government should draft in experts in a variety of exercise forms from around the world to establish policy regarding physical activities. The government should invite companies of constructors to rebuild the destroyed infrastructure, then redevelop the old buildings and build new infrastructure, such as sidewalks, bike lanes and all the roads."

(GX, Female , 47, Municipal Council Member, Benghazi)

"Limit the use of TVs, computers, DVDs and videogames because they limit time for physical activity. Also our government should revive the World Physical Activity Day on 6 April annually to help get Libyans moving."

(WQ, Female , 36, Dietician, BSc Dietetics).

On the other hand, the interviewees, belonging to LCL groups, recommend that the Libyan government should invite various experts to establish viable programmes for the public that support physical activities.

"Libyan government should invite trainers in all activities to deliver their expertise to Libyans who ignore the essential scientific exercises. They can encourage people to engage in physical activity and reduce their laziness."

(RE, Female, 44, Dean of Public Health Department)

9.8 Visual representation of a theoretical model for the qualitative research

Figure 9.12 (below) shows the a theoretical model derived from the qualitative research findings depicting the 11 main themes and their sub-themes, representing the risk and protective factors obtained from analysis of the qualitative data of the second phase of this study. The themes include the four main predictor variables of the quantitative study (see Chapter 3, Section 3.7.3) and other emerging themes resulting from the qualitative study. Each theme was allocated to the appropriate domain of the SEM, according to pragmatic judgment as well as prior knowledge of the literature. This resulted in a visual representation of the final theoretical model of the qualitative study.

9.9 Verification the findings of a qualitative research study

Several techniques exist to 'verify' the qualitative findings within a mixed-methods design so as to give them more credibility (Leslie et al., 2009). Many researchers recommend allocating at least one experienced researcher to independently review and explore the interview transcripts, data analysis and emerging themes (Burnard et al., 2008). It is believed that this process protects against the potential bias inherent in using one researcher alone and helps to validate all aspects of the research including the findings (Burnard et al., 2008). Other researchers however argue that involving an experienced researcher can generate unique insights from differing perspectives, which may completely diverge from those of the principal researcher; they recommend instead that a single researcher conducts all the coding because he/she is familiar with his/her study – as long as researcher is reflexive about his/her potential biases (Leslie et al., 2009). To align with my pragmatic stance, I conducted all these steps myself and used a interviewees validation exercise to validate the findings: I sent 13 transcripts by email to 13 of the 21 the interviewees who had provided me with their email address (Chapter 8, Section 8.12), a draft of the qualitative study findings and the 13 interviewees were asked to return any comments or feedback on the draft of results within two weeks. A positive outcome of this process was that the feedback from 9 of 13 the interviewees admitted that they were fairly satisfied with the summary of findings and they acknowledged that the draft of findings accurately represented their views. The next chapter discusses the results of the qualitative study and draws together the findings from both the quantitative and qualitative analyses, in order to interpret the findings and produce the final findings of this thesis.
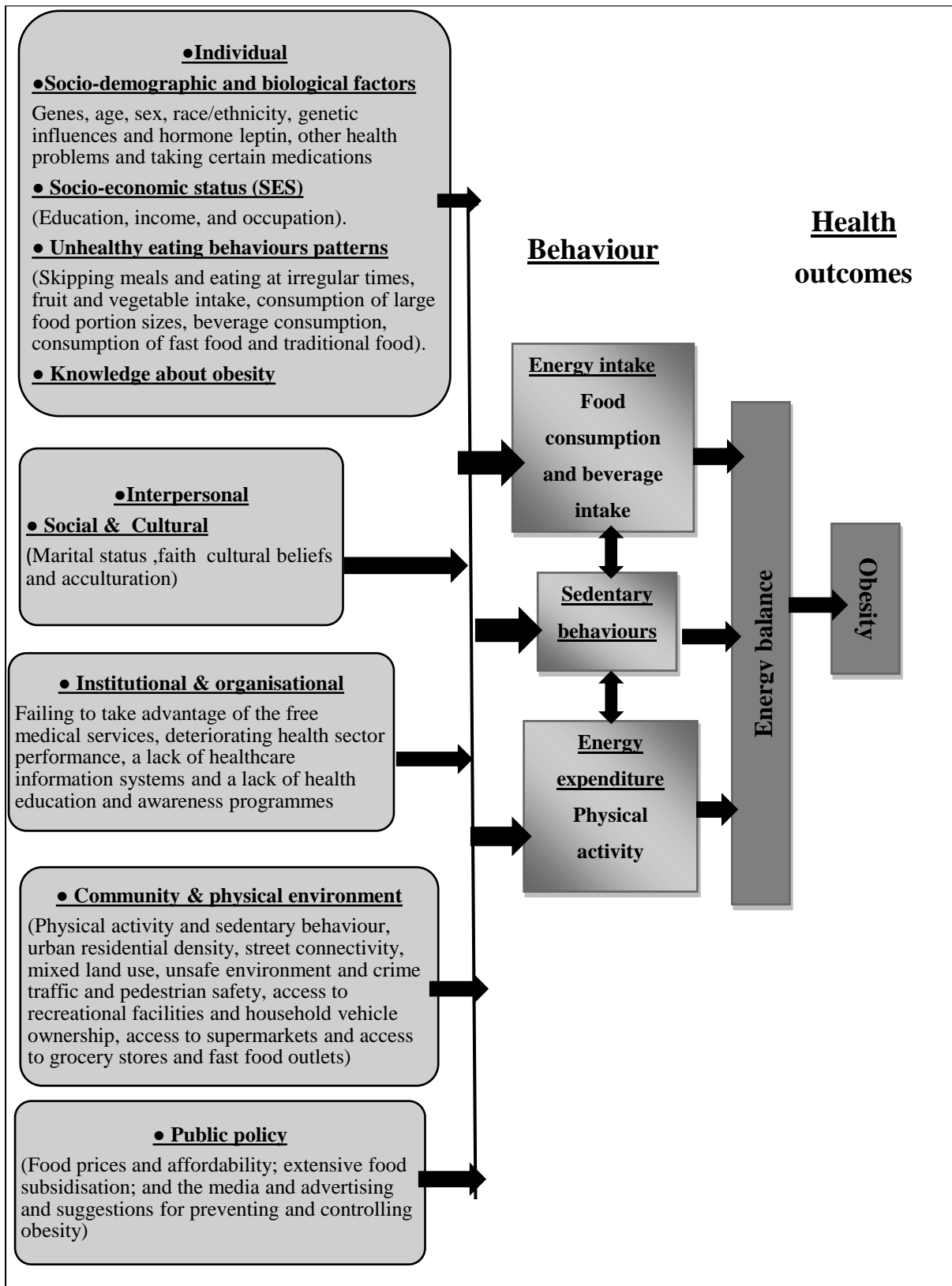
Figure 9.12 A theoretical model derived from the qualitative research findings

Chapter Ten : Discussion of the results of the qualitative study & Integration and synthesis of the quantitative and qualitative research findings

10.1 Introduction

The previous chapter presented the findings in terms of comparisons and contrasts between the two distinct groups of interviewees (LLHCPs and LCLs) in the form of themes and sub-themes. While some of these themes were relevant to the four aforementioned hypotheses, others were categorised as emerging themes pertinent to the risk and protective factors pertaining to obesity in the Libyan context. The findings were supported by verbatim quotes from the research participants.

The present chapter discusses and interprets the results from the qualitative data analysis which addressed my second research question: "What are the views of Libyan healthcare professionals and community leaders in Benghazi with regards to the risk and protective factors associated with obesity among adults from Benghazi, within the context of Libyan culture?" Eleven main themes were elicited from 21 individual interviews and positioned in the appropriate domains of the SEM. The chapter shows in detail how the findings were compared and contrasted with the literature to produce the final findings of this thesis. The second part of this chapter draws together the findings from both the quantitative and qualitative analyses, by applying the qualitative findings to explain and understand the unanticipated results from the quantitative study, by analysing the convergence and divergence of both sets of results. Finally, the chapter presents a visual outline of the final conceptual framework of this mixed-methods design.

10.2 Discussion of the findings of the qualitative phase

This section explains and interprets the findings of qualitative study. Using the Framework Analysis method, 11 themes were identified from verbatim quotes in the 21 interview transcripts. These themes were categorised as belonging to one of the five appropriate levels of the SEM, based on the knowledge, perceptions, beliefs, views and understanding of the 21 LHCPs and LCLs. The extent to which the utterances of each group agree or disagree with each other is identified. Finally, this section shows how the results from the two different phases of this research were integrated and triangulated. The results of the qualitative study were used to interpret or clarify the anomalous or inconsistent findings of the quantitative phase

of this study. They were also used to enhance or refine interpretation of the integrated quantitative and qualitative findings by identifying whether the qualitative results support or contradict the quantitative results. These findings were then compared to current knowledge about obesity to produce the reasoned conclusions presented in the integrated results. This analysis yielded the latest insights about risk and protective factors pertaining to obesity in the Libyan context.

10.3 The four main themes belonging to the individual level

The section below discusses and interprets the four themes that were categorised as belonging to the individual level of the SEM, that is: socio-demographic and biological factors; socioeconomic status; unhealthy eating behaviours; and knowledge about obesity.

10.3.1 Socio-demographic and biological factors

This section presents the first of the four themes belonging to individual level of the SEM. Socio-demographic factors are indicated by four sub-themes, including age, gender, and ethnicity, and genetic influences. These are discussed in turn.

10.3.1.1 Age

Three distinguishable views were obtained with respect of the relationship between obesity and age from the interviewees, both LHCPs and LCLs, suggesting that the age-obesity relationship is a controversial issue. A number of LHCPs argued that age is probably less significant compared to other factors such as gender, ethnicity and genes. They supported their claim by observing that obesity can be found in virtually all ages, therefore age is a weak factor in determining obesity compared with other factors. This perspective is consistent with previous studies which found that obesity affects everyone, from children through to adults, including older adults (Chamieh et al., 2015; Mungreiphy et al., 2012; Villareal et al., 2005). However, other LHCPs asserted that obesity is prevalent in adult age-groups more than in other age-groups. Such views are similar to other studies that argued that the adult age-group is the largest age-group impacted by weight-gain, since BMI gradually increases throughout adult life and weight increases consistently until age 65 in both genders due to physiological and hormonal factors (Sheehan et al., 2003).

The only group who argued that the association between age and obesity is a complicated is academic staff, belonged to LCLs. They contended that the issue needs rethinking before

comparing the prevalence of obesity among the different age groups. Hence, it is not obvious which specific age-groups are most influenced by obesity without taking into account other confounding factors, including individuals and external factors. One possible explanation is that the academic staff, belonged to LCLs perceive the age-obesity association to depend on other factors, before identifying which age-groups are most affected by obesity, such as gender and SES. This result is similar to that of Sobal (2002) who argued that the association between obesity and age was driven by other biological and psychosocial factors.

The quantitative study revealed a significant association between obesity and age in Libyan adults of both genders. My findings revealed that for females, the highest obesity rate was in middle-aged adults aged 40-49 years, while for males, the highest obesity rate was in older adults aged 60-65 years. The lowest rate was found in younger adults aged 20-29 years, of both genders. These findings related to the views of LHCPs who maintained that obesity is prevalent in adult age-groups more than in other age-groups. These findings justify the selection of the adult age-group aged 20-65 years in the current study. The views of LCLs confirmed the existence of confounding factors affecting the relationship between age and obesity. This was consistent with my findings in terms of the disparities between age-groups in gender. My findings were consistent with those of previous studies which found a significant association between age and obesity (Albert & Peng, 2010; Chamieh et al., 2015). This suggests that the prevalence of obesity in both men and women in Libya increases with age. Therefore, it can be concluded that age is one of unmodifiable risk factors contributing to the obesity epidemic in Libya.

10.3.1.2 Gender

The interviewees gave two distinguishable views on the relationship between gender and obesity. LHCPs stated that women are more likely than men to be overweight and obese. The reasons they gave included the fact that women are more influenced than men by biological and hormonal changes as well as cultural restrictions. As discussed in Chapter 7 (Section 7.8.3), women in Libya have little opportunity to engage in physical activity due to cultural or religious barriers similar to other Arab women (Al-Lawati & Jousilahti, 2004; Galal, 2002; Musiager, 2011); physical exercise by women is generally frowned upon in Libya. Furthermore, many Arab communities and tribes in North Africa, including those in Libya, persist with fattening rituals for women before marriage, as a sign of fertility, good health and prosperity (Musaiger, 2011; Rguibi & Belahsen, 2006). These perspectives of LHCPs are aligned with previous

studies in developed and developing countries, which found that obesity tended to be greater in women than in men (Abul Hajj, 2013; ALNohair, 2014; Ng et al., 2011).

The LCLs' views diverged from the literature in terms of overweight, however. Most of the literature has found overweight to be greater in men than in women (Abul Hajj, 2013; Kanter & Caballero, 2012; Musiager, 2011). In contrast, the second view raised by the academic staff of the LCLs was that gender disparities in overweight and obesity depend critically on SES before the association between gender and obesity can be identified. One possible explanation for this finding is that plumpness tends to be more socially acceptable in high-income, high-social prestige groups due to the cultural association between plumpness and healthy, wealthy living. This view of LCLs is inconsistent with the findings of previous studies in developed and developing countries which found an inverse relationship between SES and obesity in women, and an inconspicuous relationship in men (Dinsa et al., 2012; Kim et al., 2014).

The quantitative study revealed a significant association between obesity and gender. The prevalence of obesity and overweight in Libyan women was higher than that in men. According to HCPs, Libyan women have higher rates of overweight and obesity than men. The key informants' perceptions that the prevalence of obesity and overweight in Libyan women is higher than that in men supports the finding of the quantitative study. It can be inferred that the prevalence of obesity in Libyan women is significantly higher than that in Libyan men. Gender is therefore a risk factor might fuel the obesity epidemic in the Libyan context.

10.3.1.3 Ethnicity

Only the academic staff of the LCLs broached ethnic differences in obesity in the Libyan context. This is probably due to their knowledge and epidemiological expertise. They emphasised that the majority of Arab Libyans and Berbers living in big cities are influenced by modern lifestyles such that they are more prone to being overweight or obese than other ethnic minority groups such as the Toubou, Tuareg and Bedouin tribes, who live in the Sahara desert. One possible explanation is that numerous Arab Libyan and Berber from the Sahara desert and mountain villages migrated to Benghazi, which is the equivalent of migrating from one culture to another. Once they become residents in Benghazi, they are likely to adopt the obesogenic behaviours of their new urban culture, which probably fuels obesity rates in Benghazi. Other ethnic minority groups such as the Toubou, Tuareg and Bedouin tribes likely follow the same trajectory if they decide to migrate from their residence of origin to Benghazi

and adapt to a new environment which may impact on their body-weight. The views of these academic staff were similar to previous studies which found a significant positive association between BMI and 'period of residence in an obesogenic environment', referring to migrants (Delavari et al., 2013; Goel et al., 2004; Shah et al., 2015).

The quantitative study found no relationship between BMI and ethnic group. However, the qualitative study found that obesity in Arab Libyans and Berbers is higher than that in any other majority group in Libya such as the Toubou, Tuareg , due to most Arabs and Berbers living in big cities and being influenced by new lifestyles linked to modernisation and urbanisation. In contrast, the qualitative study revealed that ethnic minority groups, such as the Toubou, Tuareg and Bedouin tribes who live in the Sahara desert, are unlikely to be overweight or obese due to less exposure to fast foods and restaurants. Due to the contradictory results between the two phases (quantitative and qualitative), ethnicity remains an inconclusive factor in the development of obesity in the Libyan context.

10.3.1.4 Biological factors

LHCPs and the academic staff were the only the interviewees who debated the influence of biological factors on the obesity epidemic in Libya. Both groups argued that genetic factors could predict obesity in Libya since genes are an inescapable fate that runs in families, causing obesity. A possible explanation is that people who possess a 'thrifty gene' in today's obesogenic environment might face challenges that lead them to overreact, not simply becoming overweight but becoming obese (Speakman, 2007). Some populations may be more vulnerable to obesity than others, such as Pacific Islanders and Native Americans, because they possessed thrifty genotypes (Caprio et al., 2008; Speakman, 2006) which predispose their bodies to store fat as if in a famine, regardless of whether they exercise and eat a healthy diet or not. Arguably Libyans could be considered to be one of these populations who possess a 'thrifty gene'. As a result, they may struggle with their weight.

Another crucial issue regarding biological factors was argued by only the HCPs. They maintained that the hormone leptin plays a role in the development of obesity. Although they did not elaborate on the processes of the hormone in terms of the link between leptin resistance and uncontrolled feeding and weight gain, their views on leptin nevertheless identified one of the predictors of obesity. This finding is consistent with several epidemiological studies which

have established that genetic factors (Bouchard, 2009; Williams & Fruhbeck, 2009) and the hormone leptin (Myers et al., 2010) play a major role in individual susceptibility to obesity.

Despite the importance of biological factors in contributing to obesity, both genetic and hormonal factors were disregarded in the first phase of this study because more advanced empirical studies are needed to investigate the mechanisms and actions of these factors on human body-weight. In the second phase, although some of the key informants mentioned the influence of biological factors on the obesity epidemic, their perceptions are insufficient to draw definitive conclusions regarding this issue; rather, sophisticated longitudinal research is required to prove a relationship. The essence of this argument is that biological factors may contribute to the obesity epidemic in the Libyan context. However, the precise influence of biological factors remains inconclusive and requires further study.

10.3.1.5 Medical causes

In addition, LHCPs argued that obesity can sometimes be traced to medical health problems such as hypothyroidism or taking certain medications, notably steroids and antidepressants. Numerous studies have found that hypothyroidism causes obesity (Bandurska-Stankiewicz, 2013; Longhi & Radetti, 2013; Rotondi et al., 2009). In addition, several studies have proven that antidepressant medication is a potential reason for weight-gain (Hirschfeld, 2003; Kivimäki et al., 2009; Ranjbar & Deng, 2013).

The quantitative study did not deal with any of these topics, whether health problems or medication, in relation to the increase of obesity in Libya because such studies require sophisticated experimental designs to establish the direction of causality. However, based on the views of LHCPs and their knowledge of the topic, it can be concluded that there is insufficient evidence to infer the precise nature of the relationship, which requires sophisticated longitudinal study to be proved.

10.3.2 Socio-economic status

The pilot study was conducted between September and November 2014 (see Chapter 8, Section 8.7.3). One lesson that was learned from the pilot study was the manner in which the question on SES was phrased in the interview schedule; none of the interviewees understood the question about SES as originally formulated 'How do you think socio-economic status impacts upon a person's weight?' and they were therefore unable to express their views on the subject.

Accordingly, I rephrased it so as to address the three components of SES: education, income and occupation, which made it easier for the interviewees to express their views on SES. The following section presents the interpretation and discussion of the second of the four themes belonging to the individual level of the SEM, namely, SES, according to its three sub-themes: education, income, and occupation.

10.3.2.1 Education

The qualitative study revealed three contradictory findings concerning the relationship between educational attainment and obesity. On the one hand, LHCPs asserted that obesity is more likely to develop in uneducated than in educated Libyans. Elaborating their view, they argued that Libyans with higher educational attainment might be aware of obesity and its consequences, and this awareness could help them to minimise the risk of obesity through healthy eating, for example, or engaging in regular physical exercise. This perspective of LHCPs accords with a substantial body of literature that emphasises a significant inverse association between education level and obesity, particularly among women in developed societies, while in men this association is less consistent (Hermann et al., 2011; Tzotzas et al., 2010).

On the other hand, LCLs expressed two distinguishable views. The majority of the LCLs reported that obesity is more likely to occur in more educated Libyans than in those with low educational attainment. A possible explanation is a lack of health awareness among the Libyan public, including a lack of knowledge about the importance of healthy eating and regular exercise. The lack of public messages about health information means that these practices are not perceived as a priority for mitigating obesity among those with higher educational attainment, particularly in those not working in health-related fields. Consequently, they are susceptible to common misperceptions about portion sizes, for example, and they may have difficulty in understanding food-packaging labels. This finding is in line with the results of previous studies undertaken in developing countries, where a positive association between educational status and obesity was established (Al-Mahroos & Al-Roomi, 2001; Al-Nuaim et al., 1996; Al-Nuaim et al., 1997).

The second view expressed by LCLs was largely by the tribal leaders. They argued that education is less significant for obesity compared to the other two SES components in terms of their impact upon weight-gain. Hence, both Libyans with lower educational attainment and

those with higher educational attainment are probably lacking the appropriate health information and are therefore ignorant about diversity of diseases such as obesity and its risks, as well as about the importance of eating healthy food and engaging in physical activity (Eldarrat . 2011; Elfituri et al., 2006; Solliman et al., 2012; WHO, 2007, 2011). This finding is aligned with those of two systematic reviews on overweight and obesity, one undertaken in Arabic-speaking countries (Badran &Laher, 2011), and another in the EMR (Musaiger, 2011). These studies found that the association between education level and obesity is inconsistent and suggested that further research is needed to explore this relationship.

The corresponding finding from the quantitative study was that a strong, significant positive association exists between education level and obesity in the adult Libyan population for both genders. In addition, the binary logistic regression analysis revealed that education is a powerful risk factor compared to the other two SES components associated with increased rates of obesity in both genders (see Chapter 6, Table 6.11). The first finding of qualitative study revealed that obesity is more likely to occur in educated Libyans than in those with low educational attainment.

However, the second finding based on views of the LHCPs was that obesity occurs more frequently in educated Libyans, since those with higher educational attainment tend to earn higher incomes and probably spend their money on luxury items, which increase their sedentary behaviour, and on regularly eating out which may increase their risk of obesity. The second finding provided explicit clarification for the unanticipated finding in my quantitative study of a significant positive association between education level in Libyan adults and obesity in both genders. According to the quantitative findings, education is the strongest risk factor of all the SES components associated with obesity in the Libyan context. This was only partly supported by the qualitative findings; other findings about education from the qualitative study are inconclusive due to the divergence between findings.

10.3.2.2 Income

The income-obesity relationship addressed in the qualitative phase comprises three diverse aspects. The first finding is from the perspective of LHCPs who asserted that high earners in Libya are more inclined to put on weight than are low earners. One obvious factor that could explain their views is that Libyans with higher incomes often purchase fast food and indulge in overeating and sedentary lifestyles (Centre for Administrative Innovation in the Euro-

Mediterranean Region (CAIMED), 2004; Elbendak et al., 2008) (see Chapter7, Section 7.2 for details). This view is consistent with epidemiological studies conducted in developing countries which found that those with a higher income tend to have a higher rate of obesity (Badran & Laher, 2011; Nguyen et al., 2007).

The second finding is from the perspective of academic staff, belonging to the LCL group of participants. They suggested that high earners are less likely to develop obesity than lower earners, and moreover are more likely to be able to maintain this lower weight. A possible interpretation of this is that high earners can afford to buy healthy food, and can afford personal dieticians and the best exercise equipment for maintaining their body-weight. This finding is similar to those of the vast majority of studies undertaken in developed and developing countries where an inverse association has been found between obesity and income level for women, but an inconsistent association was found for men (Chamieh et al., 2015; Dinsa et al., 2012; Xiao et al., 2013).

A third finding regarding the obesity-income relationship derives from the perspective of tribal leaders, belonging to the LCL group of interviewees. They argued that there is no obvious relationship between obesity and income due to the heavy subsidisation of unhealthy food by the Libyan government. Apart from the Libyan government's subsidisation of staple food commodities, another possible explanation for the lack of association is the lack of general health awareness in Libya. Libyans lack of knowledge about health matters and their attitude towards physical activity and healthy eating choice could be fuelling the obesity epidemic in Libya. Such views could be accurate if food were the only factor influencing the obesity risk; however, physical activity levels also influence obesity and this in turn may be influenced by income – factors which LCLs neglected to mention. This finding is aligned with those of a study conducted in China which found no significant correlation between obesity and income (Jin et al., 2013).

The quantitative study found a significant positive association between level of income and obesity in the adult Libyan population for both genders. According to views of LHCPs, the higher the level of income, the higher the BMI in Libyan adults of both genders. This view provided explicit clarification for my unanticipated findings in the quantitative study. It can therefore be inferred that income is one of predictors of obesity in the Libyan context.

10.3.2.3 Occupation

Three different results were obtained concerning the relationship between occupation and body weight (obesity). Firstly, both groups of interviewees explicitly stated that most of the employment offered to Libyans by the Ministry of Labour and Rehabilitation are predominantly desk-bound jobs, while most manual-labour jobs are offered to foreigners. This perspective is dissimilar to the findings of several studies conducted in EMR countries which showed that occupational status is negatively associated with BMI (Chamieh et al., 2015; Al-Nozha et al., 2005). This finding underscores those reported by the WHO and FAO that Libyans generally prefer sedentary or office jobs, and avoid manual labour jobs even though they do not necessarily have the qualifications for an office job (FAO, 2005; WHO, 2007).

The second finding was from the Benghazi Municipal Council members, belonging to the LCLs. They provided details on the current employment situation in Libya, stating that many Libyans receive their monthly salaries despite being dismissed from their posts under the old regime and being transferred to the Human Resources and Unemployment Institution (HRUI). The clarification offered by this finding is that, despite Libyans having been dismissed from their jobs, their jobs can still be referred to as sedentary jobs because Libyans still receive their salary monthly from the government. It can therefore be concluded that employment in the Libyan context may increase the obesity risk. The third result elicited was from the perspective of Imams (Sheikhs), belonging to the LCLs. They noted that most Libyans, regardless of their occupation, are unreliable employees, leaving work after only a few hours due to the lack of management supervision. The ineffective control of employee absenteeism means that Libyans leave their work early without punishment. Thus, despite the varied nature of Libyans' employment, they appear to be reluctant to make an effort in their jobs, and their lack of exertion likely impacts adversely on their body-weight.

My quantitative study found a significant positive association between the BMI of Libyan adults and employed women but not employed men nor unemployed Libyans of either gender. Three results from different angles obtained from qualitative study could add an explicit explanation for the results obtained from quantitative study. First, most of the employment offered to Libyans by the Ministry of Labour and Rehabilitation are desk-bound jobs. As numerous Libyans have been unfairly dismissed from their jobs, and were referred to the Human Resources and Unemployment Institution (HRUI), their jobs can still be referred to as

sedentary jobs because the Libyan government still pays their monthly salaries from the Libyan Treasury Department. The high rate of absenteeism in Libyan government employees suggests a lack of loyalty towards their jobs and employers. A consequence is a work-life that is relatively sedentary, thereby predisposing Libyan adults to developing obesity. It can be concluded that the nature of employment offered to Libyan men and women is comprised primarily of sedentary work, which is associated with weight-gain in Libyan women but not in Libyan men, and that unemployment, resulting from Libyans' being dismissed from their jobs, is a risk factor for developing obesity in Libya. Therefore, employment status is a risk factor, potentially leading to obesity in Libyan women, but this association was inconsistent and contentious in Libyan men. While, unemployment status is a risk factor might fuelling obesity epidemic in Libya adults in both gender.

10.3.3 Unhealthy eating behaviours

This section presents the interpretation and discussion of the third of the four themes belonging to the individual level of the SEM, namely, unhealthy eating behaviours, as indicated by five sub-themes: skipping meals and eating at irregular times; fruit and vegetable intake; consumption of large food portion sizes; consumption of sugar-sweetened beverages (SSB); and consumption of fast food and traditional food.

10.3.3.1 Skipping meals and eating at irregular mealtimes

Four results were obtained from the interviews regarding the topic of skipping meals and eating at irregular mealtimes in connection with obesity in the Libyan context. Only LHCPs argued that skipping breakfast is a common unhealthy eating habit which most Libyans practise. They also said that skipping breakfast may lead to the development of obesity in Libyan adults. A possible explanation is that missing breakfast increases one's appetite for the next meal and that cravings continue throughout the day for fatty and sugary foods, putting one at risk of gaining rather than losing weight. Their views were consistent with several epidemiological studies conducted in developed and developing countries, including Arab countries, which showed that skipping breakfast was associated with increased body fat and with an increased prevalence of obesity (Mesas et al., 2012; Musaiger & Al-Ahdal, 2010; Song et al., 2005).

The quantitative study found a significant negative association between breakfast consumption per week and obesity, in other words, infrequent breakfast consumption is associated with higher BMI in the adult Libyan population of both genders. Thus, the views of the LHCPs

support the findings of the first phase, that is, LHCPs perceived skipping breakfast to be common among the Libyan population and they argued that skipping breakfast is one of risk factors for obesity in Libyan adults. Thus, it can be concluded that regular breakfast consumption can help to protect against obesity (a quantitative result), while skipping breakfast is the most important risk factor for obesity in the Libyan population (a qualitative result).

Another prevalent unhealthy eating habits mentioned by LHCPs, and neglected by LCLs, is eating late at night, which is a common behaviour in Libyan culture. They viewed this as one potential factor that might lead to obesity and of which people may be unaware. Libyans' inability to break the habit of late-night eating may lead to night eating syndrome (NES) (Cleator et al., 2012), which involves binge-eating and could potentially explain the relationship between nocturnal ingestion of food and an increases in BMI. The findings obtained from the views of LHCPs were similar to those of previous studies which found that night-time eating is commonly observed and is related to weight-gain (Andersen et al., 2004; Gallant et al., 2015; Gluck et al., 2008).

The third result was elicited from the majority of interviewees from both LHCPs and LCLs. They asserted that Libyans eat at irregular times throughout the day, which they believed to be a leading cause of weight-gain. A possible explanation is that food consumption is influenced by various factors, one of which is the time of day or chronobiology, which is comprised of three components of time: (i) clock time; (ii) frequency number of meals served per day; and (iii) regularity (Pot et al., 2014). Any defect in this chain is thought to lead to disturbance in the digestion process which may lead to weight-gain. This finding is similar to previous studies which found that an irregular eating frequency is associated with an increased obesity risk (McCrory et al., 2002; Parks & McCrory, 2005).

The final finding was obtained from the academic members of the LCL group. They argued that courses of each meal, including the consumption of sugary drinks, are likely to be the main reasons driving weight-gain in Libyans. A possible explanation is the large food portion sizes in Libya which can contribute to weight gain. Moreover, if there are multiple options, people are likely to try each offering, eating excessively. Therefore "variety" might cause people to eat excessively, based on the concept of 'sensory fullness' or satiety (Ahima & Antwi, 2008). This finding is similar to those previous studies which revealed that a variety of courses at each sitting contributes to weight-gain (Swinburne et al., 2004).

Despite the fact that the quantitative phase failed to investigate all unhealthy eating habits in Libyans, the qualitative phase revealed other unhealthy eating habits common in Libya, such as nocturnal eating, eating multiple or large irregular meals a day, and multiple courses at each meal. These factors may contribute to obesity in Libya, and should be added to the risk factors of obesity in the final conceptual framework of this study.

10.3.3.2 Fruit and vegetable intake

Interviewees from both groups, LHCPs and academic staff from the LCL group, referred to the availability, affordability and accessibility of fresh and frozen fruits and vegetables in Libya. Although these interviewees suggested that the majority of Libyan men and women did not meet the recommended consumption of at least five to seven portions of fruit and vegetables per day, the LHCPs were not certain if Libyans were conscious of the current 'five-a-day' guideline. An explanation for this result is that there is a general lack of awareness about healthy eating in Libya, particularly concerning the recommended minimum daily quantity of FV advised by the NHS (2015). Generally, Libyan eating habits entail the consumption of FV after heavy meals and after reaching the satiety stage. As a result they failed to attain the full five portions recommended for good health. In addition, most Libyans take a nap in the early afternoon or sleep late at night immediately after heavy food-consumption, which may contribute to obesity in the Libya population (Musaiger, 2011; Musaiger et al., 2013).

On the other hand, LCLs, particularly the academics, argued that Libyan men and women might be aware of the 'five-a-day' rule as the most important element of any healthy eating plan, yet they may be unable to meet that quota. A possible explanation is that five portions may be an insufficient quantity to serve as a protective factor against obesity. In support of this, obesity experts and public health activists have recommended doubling the FV intake of five- or seven-a-day to ten-a-day (NHS, 2014). This quota may however be difficult for Libyans to attain. The results of this qualitative study align with previous studies which found no significant association between fruit and/or vegetable intake and obesity (Charlton et al., 2014; Field et al., 2003). On the other hand, my findings are dissimilar to other studies which found a significant inverse correlation between intake of five FV portions a day and the risk of obesity (Azagba & Sharaf, 2012; Tetens, et al., 2009).

My quantitative study found no association between consuming five daily portions of FV and obesity in the adult Libyan population of either gender. The first result of the qualitative study revealed that numerous Libyan men and women did not consume sufficient fruit and vegetables. Despite the widespread availability, affordability and accessibility of fruit and vegetables for Libyan citizens, they consumed less than the recommended minimum of five portions per day. Possibly they are unaware of the 'five-a-day' guideline. Although the second result suggested that Libyans are in fact aware of the 'five-a-day' rule as the most important element of any healthy eating plan, this result aligned with the first result in that Libyan men and women do not consume sufficient FV possibly due to public health activists' raising the recommended amount from five- or seven-a-day to ten-a-day (NHS, 2014).

 Both qualitative results support what the research participants reported in the quantitative study, namely, that the average FV intake among Libyan adults was 3.13 (+/- 1.42) portions per day, which is slightly lower than the WHO recommendation of at least 400g per day, the equivalent of five (80g) portions of fruit and vegetables per day (WHO, 2016h). In conclusion, based on participants' reports in the quantitative phase, discussed above, and on the qualitative findings, consuming less than the recommended number of FV a day is a risk factor for obesity in the Libyan men and women, even though the first phase of this study failed to find an association between FV intake and obesity in Libyan adults of either gender.

10.3.3.3 Consumption of large food portion sizes

The vast majority interviewees, belonging to LHCPs and LCLs, perceived Libyans to consume large food portion sizes (LFPS), whether at home or in restaurants or at social functions and religious and cultural festivals. This is probably because Libyans are forced to eat whatever is served, and leftover food is considered unacceptable due to cultural norms, religious customs, and social pressure from relatives and peers. This finding is similar to those studies conducted in Arab countries that revealed food is always served in such large quantities and leftover food is perceived unacceptable due to, social belief, religious customs (Elbendak et al., 2008; Musaiger, 2011).

Another finding is was what Imams said about food portion sizes. While their views about large portion-sizes and prodigious quantities served at all meals were similar to those of the other LCL groups, they attempted to specify the right amount of food per sitting, including food left over, to obtain the blessing of God. The Imams explained the main misconception among

Libyans about Islamic etiquette on leftovers. The Imams stated that, to receive a blessing from God, food must be offered or served in appropriate portion sizes at each meal. They are referring here to the Prophet who did not approve of leaving any food on one's plate, saying: "You don't know which portion is blessed". Thus, if the food portion sizes are not excessive, Libyans will be able to clean their plates and not leave any food behind, thereby ensuring that they have eaten all the blessed portions of the meal.

It has been noticed that the views of interviewees , belonging to two groups, are in keeping with Arab culture, in which highly palatable food of large portions sizes denotes the host's hospitality to guests (Elbendak et al., 2008; Musaiger, 2011). The view that over-eating is encouraged in Libya, and that leftovers are discouraged, is consistent with the findings of Christakis and Fowler (2007) who argue that obesity is 'socially contagious', spreading from person to person in a social network. It may be concluded that social pressure can be a risk factor for developing obesity in the Libyan context.

The quantitative study revealed a strong significant positive association between the consumption of large FPS and obesity in the adult Libyan population of both genders. Likewise, the findings of the qualitative study showed that encouraging large food portion sizes at all meals, while discouraging leftovers, is consistent with social, cultural and religion norms in Libyan society. It can be concluded that both large food portion sizes and peer pressure to avoid leftovers can contribute to the development of obesity in Libya.

10.3.3.4 Sugar-sweetened beverages (SSBs) consumption

There was virtual consensus among LHCPs and academic staff, belonging to the LCLs, that Libyan people consume a substantial number of hot and cold sugary beverages in all settings over the course of the day. One explanation for the excessive consumption of sugar-sweetened beverages (SSBs) amongst Libyans is the fact that SSBs are widely available, accessible, and affordable. In addition, SSBS tend to be highly palatable and convenient to consume (Drewnowski et al., 2009). Moreover, sugary drinks tend to be heavily promoted using advertising, giveaways and social media. Although they provide energy, they do not seem to induce satiety (Harvard School of Public Health, 2016f). As SSBs are part of the global fast-food culture, a large variety of SSBs are aggressively promoted in Libya (FAO, 2005; Sachithananthan et al., 2012). Accordingly, Libyans consume SSBs excessively – at nearly all meals and on most occasions.

In addition, the dietitians of the LHCP interviewee group and the academic staff of the LCLs offered possible reasons for why Libyans' excessive consumption of SSBs. They attributed this habit to the hot, dry climate, which is dehydrating and leaves people feeling thirsty. Another reason is socio-cultural: Libyans are simply used to consuming SSBs as one of the main items of food being served at most meals and on most occasions. In addition, the LHCPs and the academic staff believe there are health benefits from drinking tea and coffee. The key informants reported that drinking tea could help to reduce the risk of a heart attack, lower cholesterol and reduce weight. Relatedly, previous studies have suggested that the multiple benefits from drinking tea include reducing the risk of cancers, boosting the immune system, and reducing the risk of dementia (Cooper et al., 2005; Dufresne & Farnworth 2001).

In the Libyan culture context, Libyans usually consumes green tea every day and they invariably add sugar, milk, or cream because the green tea tastes bitter or bland on its own. Adding sugar, milk, or cream does not affect the antioxidant benefits in green tea whatsoever (Acevedo et al., 2011). However, adding sugar is known to cause weight-gain and is therefore an unhealthy practice.Finally, they also mentioned that soft drinks are tasty, inexpensive and available around-the-clock, despite the adverse health consequence of drinking sugary beverages. Such reasons compelling Libyans to consume large quantities of SSBs are aligned those of previous studies showing that soft drinks are affordable and readily available (Beaglehole, 2014;Grimes et al., 2013; Mobley et al., 2009).

Despite other interviewees, belonging to other LCL groups, admitting that Libyans are addicted to the consumption of sugary beverages, they failed to give scientifically sound reasons for this claim. Misconception arose among those interviewees who are unspecialised in health matters, such as the tribal leaders, Imams and municipal council members, belonging to the LCLs. These types of interviewees were uncertain as to whether sugary beverages lead to weight-gain or not, but they posited that drinking soft drinks after a heavy meal helps in food digestion. This latter misconception is aligned with Musaiger (2011) who found that many people in several Arab countries hold the mistaken concept that cold beverages help to digest junk food. In fact, SSBs can slow digestion and may cause cramping due to diluting the digestive juices (Wolf et al., 2007).

The first phase of this study found a significant positive association between obesity and the frequency of consuming sugar-sweetened beverages in Libyan females but not in Libyan males. The first finding of the qualitative study revealed that Libyans generally consume SSBs, whether cold or hot, in large quantities, at most meals and on most occasions. This result supports my findings of the first phase which revealed that the average consumption of SSBs for a Libyan adult is 3.68 (+/- 1.23) cans a day. This exceeds the recommended daily maximum amount of SSBs by the American Heart Association, which is no more than three 12-ounce cans per week (Lloyd-Jones et al., 2010). The second result of qualitative study was that key informants suggested many reasons behind Libyans' excessive consumption of SSB, including affordability, round-the-clock availability, the hot weather, and the habit in Libya of serving SSBs at most meals. Another finding was that Libyans tend to drink tea with sugar, milk, or cream in it which might reduce the weight-reducing potential of the tea. The final result is a misconception among LCLs that consuming sugary beverages can help in the digestion of junk food. In addition, LCLs did not know whether consuming sugary beverages leads to weight-gain.

The finding from qualitative study provided partial support for the findings of the first phase regarding Libyans' excessive consumption of SSBs, whether cold or hot. The key informants, however, failed to explain the lack of association between SBB-consumption and obesity in men. Despite the fact that the first phase failed to find an association between SBB-consumption and obesity in Libyan men, it can be inferred that consuming SBBs is a risk factor for developing obesity in the Libyan context for both genders because the qualitative study revealed that SBBs are consumed in excess in Libyan adults of both genders.

10.3.3.5 Consumption of fast food vs. traditional food

There was virtual consensus among the vast majority interviewees, belonging to LHCPs and LCLs, concerning Libyans' preference for consuming fast foods rather than cooking from scratch at home. According to the interviewees, belonging to both groups, Libyans have rapidly adopted fast food as their preferred food of choice probably because it is affordable, convenient and accessible. The majority of Libyans purchase fast food as an alternative to expensive, healthier food (FAO, 2005; Sehib et al., 2013). This view is aligned with my findings of the first phase which revealed a relatively high frequency of fast-food consumption among Libyan adults, with an average frequency of fast-food consumption of 5.54 (+/- 3.1) times per week.

This finding is similar to those of numerous studies, which found that fast-food consumption is positively associated with increased BMI (Burgoine et al., 2014; Cummins et al., 2005).

Of the LHCPs, it was only the dietitians who argued that traditional Libyan foods have a high-energy density, being even higher in saturated fat, sugar and salt than many Western fast foods, yet many Libyans are unaware that such traditional foods are probably more hazardous than fast foods and that they can gain weight through consuming traditional foods. This finding is aligned with previous studies conducted in Arab region which showed that many (local) traditional foods provided by self-catering food outlets – common in most Arab countries including Libya (FAO, 2005; Musaiger and D'Souza 2007; Sehib et al., 2013) – have a high-energy density, even higher in saturated fat, sugar and salt than many Western fast foods.

The dietitians' perceptions are useful for explaining the findings of the first phase. In the first phase of this study, some obese Libyans reported that they are less likely to consume fast food and they never eat out at fast food restaurants. However, those obese Libyans are most likely consuming traditional foods which they think are healthy but which are in fact high in fat, and are contributing to weight-gain. These interviewee insights therefore provide an obvious explanation for my findings in the first phase.

My quantitative study found a strong, significant positive association between obesity and the frequency of eating out, whether in a typical day or in a week, in the adult Libyan population of both genders. Similarly, my qualitative study revealed that numerous Libyans consume fast food regularly and frequently. The other qualitative result pertained to the high-energy density of traditional Libyan food; consuming it was perceived to be no less dangerous than consuming fast food. It can be concluded that both frequent fast-food consumption and consumption of traditional Libyan foods are risk factors for increased obesity.

10.3.4 Knowledge about obesity

This section presents the interpretation and discussion of the fourth and final theme belonging to the individual level of the SEM, namely, knowledge about obesity as indicated by three sub-themes: meaning of obesity; perceptions about the prevalence of obesity; and the lack of knowledge about obesity among the public.

10.3.4.1 Meaning of obesity

Most interviewees, belonging to LHCPs and academic staff, provided sophisticated, comprehensive definitions of obesity, including a classification of obesity, causes of obesity, effects on health, and other various aspects of its epidemiology. In addition, LHCPs, particularly diabetologists, mentioned several consequences of obesity for health conditions, based on their diagnosis of patients during the course of their work. The academic staff, on the other hand, described obesity as having multiple causes that act collectively to lead to obesity; these factors include interpersonal factors, behaviour, and genetics. Those participants not working in health-related fields – that is, other groups affiliated to LCLs – also provided quite sound definitions of obesity, but their views were less significant than those of the health experts in that they provided only basic information about obesity, similar to those conceptions of obesity held by most lay people.

An explanation for this finding is that LHCPs and academic staff are more knowledgeable than other groups affiliated to LCLs about health issues. In addition, they may have researched the topic and updated their existing knowledge, once they were informed that they had been selected to be interviewed about the obesity epidemic in Libya. They may also have shown knowledgeability on the topic of obesity because, in Libyan culture, people generally feel deeply ashamed if they are unable to answer an interview question or if they answer incorrectly.

10.3.4.2 Perceptions of the prevalence of obesity

Perceptions of the prevalence of obesity in Libya as whole and in Benghazi in particular are discussed next.

10.3.4.3 **Perception of the prevalence of obesity in Libya**

There was outright agreement among both groups of interviewees, LHCPs and LCLs, that obesity is a serious health problem that is spreading to all areas in Libya. Evidence for this is the undeniable observation that the majority of Libyans are either overweight or obese. The interviewees used different arguments to support their assertion that obesity is a real problem in all districts in Libya. Most LHCPs and academics, belonging to LCLs, were particularly interested in the topic and could provide precise obesity rates as reported by the Libyan Health Ministry in 2009, that is, 30.2%. In addition, they referred to their knowledge of trusted sources in order to support the prevalence rates they cited. In contrast, other interviewees, belonging to other groups of LCLs, were unable to provide any figures and they were doubtful that any

reliable study could be conducted due to the lack of documentation in Libya. However, they cited anecdotal evidence, with some suggesting taking photos of city-life in Benghazi or visiting the Statistical Department of the Benghazi Diabetes Centre in order to collect data on diabetes, as this has relevance for obesity rates.

10.3.4.4 Perception of the prevalence of obesity in Benghazi

The vast majority interviewees, belonging to LHCPs and and academic staff (LCLs), were unable to give their perception about the prevalence of obesity in Benghazi. Acknowledging the absence of studies addressing obesity in Benghazi, they estimated that the obesity rate is likely to be high in Benghazi, based on their observations. They supported their arguments with logical inferences such as the increased rate of chronic diseases caused by obesity, such as diabetes. While other interviewees, belonging to other LCLs, also contended that the Benghazi obesity rate is likely to be high, they supported their views with anecdotal evidence only, such as informal observation or taking photos in public places to convince others, due to the lack of research.

The quantitative study revealed that the prevalence of obesity among Libyan adults was 42.4%, whereas the prevalence of being overweight was 32.9%. In addition, the prevalence of obesity among women was significantly higher than that among men (47.4% vs. 33.8%). Similarly, the qualitative study revealed that all interviewees perceived the prevalence of obesity to be substantially high in Libya and in Benghazi. In addition, they predicted that the prevalence of obesity will increase due to absence of prevention and control measures in Libya. Thus, based on the perceptions of the interviewees, the results of the qualitative study provided support for the prevalence of obesity in Libya found in the quantitative study.

Although most of the interviewees alleged that obesity is high in Benghazi, they acknowledged that no study has been conducted in Benghazi on obesity. It can be concluded that the lack of data about obesity identified by interviewees and information provides further rationale of the present study, which addresses prevalence rates in Benghazi.

10.3.4.5 Lack of knowledge about obesity among the public

Given their daily contact with the public in the form of their patients, the LHCPs argued that Libyans are suffering from a lack of even the most basic healthcare information, due to an absence of health awareness programmes. A possible explanation is that many Libyans still do

not believe that obesity is a disease. Many Libyan tribes, whether Arabs or Berbers, still practice the tradition of fattening up women before marriage. This finding is aligned with those of previous studies conducted in the Arab region (Mokhtar et al., 2001; Musaiger, 2011; Rguibi & Belahsen, 2006).

While the level of public knowledge about obesity fell outside the scope of the quantitative (first) study, the qualitative study addressed the topic broadly. The LHCPs believed that the lack of knowledge about obesity constitutes a risk factor for developing obesity in Libya. Such interviewees possess relevant knowledge and information about the diverse issues encountered in present-day Libyan society concerning obesity, while many Libyan people are unaware of such issues and information. Only LHCPs raised the issue of knowledge among the public, perhaps due to their daily contact with patients. LHCPs affirmed that the level knowledge about obesity among the Libyan population is relatively low, despite many attaining higher education qualifications, although these are mostly unrelated to healthcare. LHCPs also suggested many Libyans still consider obesity to be a symbol of health and wealth and do not believe obesity to be a disease due to the lack of health awareness among the public.

10.4 One theme belonging to the interpersonal level of the SEM

The section below explains, discusses and interprets the only theme that was categorised as belonging to the interpersonal level of the SEM, namely, social and cultural influences, as indicated by four sub-themes: marital status; religious faith; cultural practices; and acculturation.

10.4.1 Marital status

Two distinguishable findings were obtained about the relationship between obesity and marital status from all interviewees, belonging to both LHCPs and LCLs. The LHCPs perceived married Libyan men and women to be more predisposed to gaining weight than those never married. One possible explanation is that cohabiting couples tend to encourage each other to eat and indulge in a sedentary lifestyle. A second possible explanation is the decline in levels of physical activity in newly married couples, which may occur in conjunction with increased social responsibilities (Craig, 1990; Kahn & Williamson 1990). These views from the LHCPs are aligned with previous studies conducted in developed and developing countries (Fouad et al., 2006; Leahy et al., 2014; Tzotzos et al., 2010).

In contrast, interviewees, belonging to LCLs, thought that married Libyan women are more prone to gaining weight than are married men. They argued that this is because social and cultural barriers restrict married women to staying at home and taking responsibility for household chores, although many have domestic workers who perform such work for them, which compounds the sedentary nature of married women's lifestyles, eventually leading to an increase in their body-weight. Interestingly, these views of LCLs diverged completely from the findings of existing literature which has found that married women are not more prone to gaining weight than are married men (Chamieh et al., 2015). To my knowledge, no existing study has revealed the same result as my study.

My quantitative study found a strong significant association between obesity and 'being married' in women, but not 'being married' in men. In contrast, the qualitative study revealed two different results. The first result is that married Libyans adult are more predisposed to gaining weight than are those never married. The second result is that married Libyan women are more prone to weight-gain than are married men. The view of the interviewees, belonging to LCLs, is similar to my result in the first phase, that is, the association between obesity in married Libyan women but not in married Libyan men. It can be concluded that marriage status is a risk factor for obesity in women, but inconsistent results obtained in the case of married men.

10.4.2 Faith

Despite the fact that the vast majority of Libyan Muslims adhere to Sunni Islam, the Islamic perspective on obesity was fully expounded only by those interviewees who were Imams. They acknowledged that Islam obliges believers to be moderate in their lifestyle and that it prohibits people from being overweight or obese, since gluttony, like lust, is considered to be one of the deadly sins, or a moral deformity (Sayon-Orea et al., 2011).

Another finding gained from the Imams is that Islam strongly prescribes moderate eating habits and it prohibits the consumption of pork, birds of prey, and spirit drinks. The also gave sound theoretical advice and cultural practices for helping to tackle obesity, such as fasting during the holy month, which plays an important role in preventing and managing obesity. Most Imams based their views on citations from the Prophet, quoting lines such as "In movement is a blessing" and pointing out that the Holy Quran persuades people to engage in physical activities. Such views are dissimilar to the findings of previous studies which indicated that

Islamic practices are more likely to promote obesity; for example, through restricting women from engaging in physical activities (Kahan, 2014).

The quantitative study found no association between religion and obesity because 100% of the research participants were Muslim and belong to the Islamic faith. In contrast, the qualitative study revealed that Islamic law warns the nation that obesity is gluttony, a sin and a risk to human health. It also advocates moderate eating habits and identifies which foods are lawful and unlawful to consume according to the Quran. Islam also advocates fasting, praying, and engaging in physical exercise. All these practices are protective factors against obesity. Despite Libya being an Islamic Arabic country, many Libyans do not adhere closely to these tenets, which could explain the current high prevalence of obesity in Libya. Despite a widespread lack of adherence to Islamic teachings regarding health and weight, it can be inferred that Islamic law is a potential protective factor against obesity. Hence Islamic beliefs and practices form part of the final conceptual framework of this thesis.

10.4.3 Cultural practices

The vast majority of the interviewees, belonging to both LHCPs and LCLs, explicitly admitted that cultural factors are a possible influence on the obesity rate in Libya. Three views were distinguished from the two groups. First, almost all agreed that Libyan social occasions, which occur frequently in Libyan society, offer guests a variety of foods in prodigious quantities, and that guests are compelled to over-eat to show their respect for the hospitality of the hosts.

In fact, according to Libyan culture and Islamic law, Muslims should accept all invitations to social functions; however, the hosts invariably disregard the dietary preferences of their guests, who may have a chronic disease such as Diabetes Mellitus (DM). At most social functions, a variety of foods are offered, ranging from fast foods to traditional food, with both hot and cold drinks and different types of soft drinks. To raise public awareness of health in Libya, Imams and healthcare professionals need to be educated about the risks resulting from consuming unhealthy foods in excessive amounts and they should teach Libyans how to prepare healthy foods instead of unhealthy foods. Another possible solution to the challenge of Libyans' eating unhealthy habits is for guests who suffer from chronic diseases to bring their own food. Finally, Libyans can cut back on their attendance at such functions and accept invitations only for special family occasions.

The findings revealed that the influence of social functions on the eating habits of Libyan adults was similar to that found in a few studies conducted in Arab countries which showed that the practice of over-eating is promoted by social norms such as serving food in large quantities and pressurising guests to consume the entire portion served to show their respect for the host (Elbendak et al., 2008; Musaiger, 2011). It can be concluded that these unhealthy practices and behaviours at social functions constitute one of the risk factors contributing to obesity in the Libyan context.

The vast majority of the interviewees, both HCPs and LCLs, raised another common practice in Libyan culture: that of Libyan family members eating food collectively from a large plate or bowl, as well as serving food in large quantities and encouraging each other not to leave any food on their plate so as to be blessed by God (see Section 10.7.3 for details). Imams (LCLs) suggested that the practice of a family eating collectively from one large plate may be a risk factor for obesity in Libya. Islamic law contradicts Libyan culture in two respects. First, Islam advises people to eat and drink moderately, whereas Libyan culture promotes prodigious consumption. Second, Islam advocates small portions and the serving of food on small plates, even for family members eating from as single plate. According to Libyan custom, finishing the food on one's plate translates into receiving greater blessings from God. In contrast, Libyan culture pressurises people to over-eat to show their respect to the hosts. Portions are large and served on a large plate or in a bowl, and Libyans feel compelled to 'clean their plate' or bowl in order to receive the blessing from God. Such misconceptions can be addressed through activating the role of mosques and involving preachers to educate people about healthy and unhealthy eating practices, in order to minimise the risks factors contributing to the obesity epidemic.This finding is aligned with a study conducted in Iraq which found that the prevalence of obesity among those who eat collectively from one large familial plate was higher than those who eat from individual plates (Al-Tawil et al., 2007).

A final cultural practice influencing obesity rates in Libya was mentioned by the tribal leaders (LCLs). This is the ritual of fattening up women before marriage, which is still practised by many Libyan tribes, whether Arabs or Berbers, in many parts of Libya, particularly in the Sahara desert and mountains. Women live in a fattening hut or cottage before marriage, following the belief that plumpness in women is a sign of fertility, prosperity, beauty, health and wealth. Such views are comparable with a previous study conducted in Morocco (Rguibi

& Belahsen, 2006). It can be inferred that misconceptions and myths surrounding obesity is probably a risk factor for obesity in Libya.

Despite the fact that Libyan culture was not addressed in the first phase study, it was discussed broadly in the literature review (Chapter 2) and emerged in the qualitative study in themes pertaining to cultural norms and values as risk factors that might contribute to the rise of obesity in Libyan men and women. The findings from the qualitative study pertained to various cultural norms such as: serving food in large quantities and encouraging each other not to leave any food on the plate so as to be blessed by God; the practice of a family eating collectively from one large plate; and the ritual of fattening up women before marriage. These findings can help to explain some of the ambiguous results obtained in the quantitative study, such as married Libyan women being more prone to gaining weight than are never-married women. It can be concluded that Libyan cultural norms and values are risk factors for obesity in the Libyan men and women, and it is necessary to include them in the final theoretical model of this study.

10.4.4 Acculturation

The association between acculturation and obesity in Libyan context was raised only by the academic staff of the LCLs. This might be because they are more knowledgeable than the other groups about the epidemiological aspects of disease. Interestingly, one of the academics asserted that acculturation is no longer a significant factor leading to obesity in the Libyan context, arguing that the obesogenic environment is everywhere in Libya and that Libyans are constantly exposed to it. Moreover, other academic staff argued that traditional Libyan food is no less toxic than fast food. They also argued that migration from the village to the city is similar to migration from one country to another.

It is possible that acculturation in Libya resembles that described in previous studies (Shah et al., 2015), which highlight the process of acquiring aspects of a foreign culture. In the Libyan context, this process probably occurs when Libyan tribes from the Sahara Desert or the Bedouin from the villages migrate to Benghazi. They assimilate into the different culture, similar to a migrant moving to another country, due to the vast difference between the culture of the Bedouins in the Sahara Desert and villages, and that of urban environments. Thus, migrants to Benghazi are influenced by the dominant lifestyle in Benghazi which is linked to modernisation and urbanisation. This leads to increasing exposure to the obesogenic environment (see Section

10.4.3), which enhances the risk of obesity among the migrants. The participants' views were similar to the findings of a previous study in the Emirates (Shah et al., 2015).

The quantitative study found a significant positive relationship was found between obesity and period of residence in Benghazi. My study found that the mean period of residence for both genders in Benghazi was 34 (+/-13) years and that long-term residents in Benghazi, of 35 years and more, had a higher prevalence of obesity than did short-term residents, of less than 35 years. The views of the academic staff further clarified these findings from the first phase of the study, that is, the presence of a significant positive association between BMI and 'period of residence in an obesogenic environment'. Benghazi qualifies as an obesogenic environment that predisposes 'Libyan immigrants' to gain weight if they experience chronological immersion in Benghazi culture over a period of ten years or more. Therefore, it can be concluded that acculturation is a contributing factor and predictor of obesity in the Libyan context.

10.5 One theme belonging to the institutional and organisational level of the SEM

The section below explains, discusses and interprets the only theme that was categorised as belonging to the institutional and organisational level of the SEM, namely, Libya's healthcare facilities and their ineffective functioning, as indicated by four sub-themes: failing to take advantage of the free medical services; deteriorating health sector performance; a lack of healthcare information systems; and a lack of health education and awareness programmes.

10.5.1 Failing to take advantage of the free medical services

The interviewees, belonging to the LHCPs and LCLs, had differing perspectives on people's failure to take advantage of the free medical services in Libya. From the perspective of seeing patients, LHCPs argued that the lack of an electronic health record (EHR) system discourages healthcare users from using the free medical services because the paperwork is tedious and time-consuming, and records from routine procedures such as anthropometric measurements are not maintained. The lack of EHR systems also means that doctors and other healthcare users are unable to monitor patients' health over time, for example, to compare any changes in their health indicators between one visit and the next. This finding is similar to a study conducted in Saudi Arabia which found that a lack of an EHR system is one of barriers preventing Saudis from capitalising on the free medical services in Saudi Arabia (Al Malki et al., 2011).

In contrast, LCLs gave their views from their perspective as healthcare users. They argued that ordinary Libyans are reluctant to take advantage of the free medical services for several reasons. One reason is the communication problems they experience between healthcare users and many foreign medical staff, in the absence of interpretation services for healthcare users. Since the majority of medical staff are foreigners, it may not be possible for patients to communicate with them in Arabic. These findings are similar to those of studies conducted in the Arab region found that the absence of interpretation services preventing the healthcare users from capitalising on the free medical services (Al Malki et al., 2011; Lamadah & Sayed, 2014; Mebrouk, 2008; El-Fallah et al., 2014).

The qualitative study revealed two new factors which may fuel the obesity epidemic in Libya and which the quantitative study failed to address. One is the lack of patient records due to the lack of EHR systems in the Libyan health system. The other problem pertained to communication problems between healthcare users and medical staff due to the absence of interpretation services for healthcare users. It can be concluded that both these factors deter Libyans from using the free medical services, with the implication that health, weight and other conditions are not being properly monitored, and this could contribute to the prevalence of overweight and obesity in Libya.

10.5.2 Deteriorating health-sector performance

Three distinguishable views were identified from the interviews with both HCPs and LCLs about the deterioration of Libya's public health-sector performance. According to the LHCPs, Libya's health services are ineffective for two reasons. The first is incompetent leadership coupled with executive directors and administrative managers lacking the relevant qualifications for their occupations. This is probably because both the old and new regimes have neglected to apply and enforce the labour codes, general labour and employment acts , in particular,the Employment Rights Act No. 12 (International Labour Organization (ILO) , 2014), which stipulates "the right man in the right place". Consequently, the system is run by unqualified health officials and there are deficits in even the most basic of preventive and curative services. In addition, despite the acute need for such services by healthcare users, many are simply unaware that they exist. This finding is similar studies conducted in Saudi Arabia (Al Malki et al., 2011; El-Fallah et al., 2014) which found similar management incompetence within the healthcare system to that revealed in Libya by my study.

The second reason that Libya's health services are ineffective, according to the LHCPs, is due to the importing of complex and sensitive medical equipment without having the manpower to operate and maintain it. Consequently, LHCPs are unable to capitalise on these instruments to improve the healthcare services provided, and this will inevitably impact adversely upon healthcare users' satisfaction with the healthcare services provided. This finding is similar to those studies conducted in developing countries that investigated the reasons behind deteriorating health-system performance in their countries (Al Malki et al., 2011; Chimezie, 2011; El-Fallah et al., 2014).

On the other hand, the LCLs gave the following reasons for the deterioration of Libya's public health-sector performance. One reason is the persistent short-term contracts for the foreign medical staff which result in a high turnover of staff. Consequently it is difficult for patients to build good relationships with their doctors and for medical staff to keep track of patients' medical backgrounds and progress. Another reason is the constant shift changes for those expatriate HCPs who work full shift patterns in Libyan healthcare facilities. The miscommunication that can result from shift changes can result in medical errors which adversely affect the quality of healthcare services provided to the public. This finding is similar to those of studies conducted in developing countries (Al Hilfi et al., 2013; Almalki et al., 2011; Chimezie, 2011; El-Fallah et al., 2014).

The findings of the qualitative study revealed three main reasons, discussed above, thought to contribute to the deterioration of Libyan healthcare system's performance, which the quantitative study omitted. These are: incompetent leadership including unqualified executive directors and administrative managers; using complex and sensitive medical equipment without having the manpower to operate and maintain it; and constant short-term contracts for the foreign medical staff as well as persistent shift changes for those expatriates HCPs who work in shifts in Libyan healthcare facilities. These three factors are likely to impair the effective functioning of Libyan healthcare systems, thereby preventing people from going for regular health check-ups. Such factors may be seen as contributing or covariant factors leading to an increased risk of obesity.

10.5.3 A lack of healthcare information systems (HCIS)

LHCPs admitted that the absence of healthcare information systems (HCIS) in Libya may contribute to the exacerbation of the obesity epidemic in Libya adults. This is because, without a HCIS, there is a lack of disease surveillance, and the Libyan government is probably unaware of the escalating prevalence of obesity. LCLs argued that the reluctance of the healthcare officials to shift from the traditional paper-based healthcare system to the use of e-health systems means that certain key information is largely unavailable. The information that is lacking includes disease surveillance systems and laboratory information systems. Data from a HCIS could be used to influence policy and decision-making, determine programme action, monitor individual and public health outcomes, disseminate progressive medical education, and conduct innovative research.

The LCLs also pointed out that a great deal of information about the outcomes of healthcare services has been lost due to bundles of paper being burnt or misfiled, and that this is an obstacles to undertaking scientific research. This finding is aligned with a study conducted in Nigeria (Olaronke et al., 2013) which found that a lack of HCIS contributes to poor public health-sector performance. The implications of the absence of healthcare information systems and persistent use of traditional paper-based healthcare system were covered by the qualitative study, whereas the quantitative study failed to address these aspects. It can be concluded that the lack of healthcare information systems is a risk factor contributing to the obesity epidemic in Libya.

10.5.4 A lack of health education and awareness programmes

Another critical issue is the lack of health education and awareness programmes. According to the vast majority interviewees, belonging to both LHCPs and LCLs, the old Libyan regime and the consecutive provisional Libyan governments have neglected to promote health awareness regarding fundamental health issues among Libyan citizens, including initiating appropriate programmes to raise health awareness about diseases, whether chronic or infectious. A lack of health education and awareness is likely to contribute to the many myths and misconceptions surrounding obesity among Libyans, which could be fuels the obesity epidemic in Libya. An obvious implication of the lack of health information is that the myths and misconceptions surrounding obesity in Libyan culture are perpetuated. As in other Arab countries, the ordinary

Libyan persists with the practice of fattening women for marriage, perceiving obesity in women to be a symbol of beauty, fertility, sexuality, health and wealth.

These findings are similar to those of many studies conducted in the Arab region which found that a lack of health awareness contributes to or exacerbates misconceptions about health and diseases, particularly overweight and obesity (Al Malki et al., 2011; Lamadah & Sayed, 2014; Mebrouk 2008). Such myths and misconceptions among Libyans undoubtedly fuel the obesity epidemic in Libya.

10.6 Three main themes belonging to the community-settings and physical-environment level of the SEM

This section explains, discusses and interprets three themes that were categorised as belonging to the community-settings and the physical-environment level of the SEM: physical activity and sedentary behaviour; the effect of the neighbourhood environment on physical activity; and the effect of the neighbourhood environment on food availability and accessibility. Physical activity and sedentary behaviour are discussed separately below.

10.6.1 Physical activity

The interviewees from both groups gave three distinguishable perspectives on the topic of physical activity and obesity among Libyans. LHCPs held that Libyans of both genders are a sluggish and inactive people, and are unwilling to engage in any form of physical activity despite the availability of leisure facilities and recreation centres, both indoors or outdoors. One posited explanation is the current deteriorating political-economic situation in Benghazi, resulting from the conflict between militias and the Libyan military. This situation has led to an unsafe environment and many people opt to stay indoors (Chivvis & Martini, 2014). Further barriers hindering Libyans from engaging in physical activity are discussed in Section 10.6.5 below. This finding is similar other studies conducted in Arab countries which confirmed the stereotype of Arab people preferring to stay at home and engage in sedentary activities rather than adopting a more active lifestyle (Al-Hazzaa, 2004; Al-Nozha et al., 2007; Kahan, 2015).

Of the LCLs, the academic staff felt that Libyans with higher educational attainment had an increased likelihood of engaging in physical activity, compared to their less educated counterparts. They believed that those with a higher education level are more informed about the health benefits of physical activity, hence they are more likely maintain a healthy weight

through engaging in regular physical activity. This view is similar to a substantial body of literature that emphasises a significant inverse association between education level and obesity (Ball & Crawford, 2005; Hermann et al., 2011; Tzotzas et al., 2010) (see Chapter 7, Section 7.2.1).

Another view raised by the key informants, belonging to both LHCPs and LCLs, of interviewees is that Libyan men are more likely to be active than are Libyan women. A possible explanation can be inferred from their perspective: due to the cultural and religious constraints facing Libyan women, they are reluctant to engage in PA. In contrast, men are favoured with special attributes from the Creator, making them physically stronger than women in order to protect the women. Hence, Islamic law regards men as the guardians of their families. It can be concluded that men are likely to be more active than women because their normal duties require that they provide for their wives and children, consistent with the words of the Prophet of Allah: "Man is the guardian of his family and every guardian has responsibilities towards those under his guardianship". The finding of this study is similar to several studies which found that women were more likely to be less active than men (Azevedo et al., 2007; Monteiro et al. 2003).

There were differences between the results obtained from the quantitative study using two different questionnaires to investigate the association between PA and obesity in Libyan men and women. The Greenwood et al. (2008) questionnaire treated PA as one unit and did not divide it up into different domains (work, transport and recreational activities). The first result, obtained using the Greenwood et al. (2008) questionnaire, revealed an inverse association between PA level and obesity in Libyan adults of both genders. The second finding was obtained using the Global Physical Activity Questionnaire (GPAQ). This describes PA in terms of three domains: work, transport and recreational activities. The GPAQ revealed a strong, significant inverse association between total physical activity and obesity in Libyan women but not in Libyan men.

However, the results obtained from both questionnaires were similar in terms of the frequency of engaging in PA per week despite using different measures. According to the first questionnaire, the average number of times that Libyan adults engage in some form of physical activity is 2.70 (+/- 1.56) per week. These figures are similar to the range recommended by the WHO (2015), which stipulates that people should engage in physical activity at least three

times a week or on three days of the week. According to the second questionnaire, the average time spent on PA in the three aggregated settings (work, transport and recreational activities) was 166.16 (+/- 50.71), 163.97 (+/-39.06) and 164.89 (+/- 44.26) minutes per week for males, females and both genders respectively. This is slightly higher than engaging in aerobic PA of moderate intensity for at least 150 minutes (2.5 hours) over the course of a week, which is the level of PA recommended by the WHO (2015). A paradox in the findings of this phase is that the average frequency of engaging in PA among Libyan adults, as measured by two different instruments, falls within the normal range recommended by the WHO, yet the prevalence of overweight and obesity among Libyan adults is high.

Three different findings were obtained in the qualitative study. The first finding revealed that the prevalence of physical inactivity was perceived to be high among Libyan men and women, who are described as lethargic and unwilling to engage in any form of physical activity, despite the availability of leisure facilities and recreation centres. The second finding was that Libyan men and women with higher educational attainment engage in more PA than do their uneducated counterparts. The third finding was that Libyan men are more likely to be physically active than are Libyan women. Despite the disparities between results of the quantitative and qualitative studies, it can be inferred that PA is a protective factor for Libyan women (based on the results obtained from analysis of the two questionnaires) and Libyan men (based on the results obtained from one questionnaire and from the qualitative study). Conversely, the prevalence of physical inactivity is perceived to be higher among Libyan men and women with low educational attainment than among their more educated counterparts.

10.6.2 Barriers to physical activity

The majority interviewees, belonging to both groups, posited numerous barriers that discourage Libyans from engaging in PA, whether indoors or outdoors. LHCPs mentioned a lack of time due to family and work obligations. This finding is similar to those of a cross-cultural study in seven Arab countries which explored the barriers to healthy eating and PA among adolescents (Musaiger et al., 2013).

The vast majority of interviewees, belonging to LCLs, mentioned other barriers to PA. These can be divided into cultural ,religious environmental and political barriers. Libyan culture imposes a clothing restriction on women whereby women cannot be seen in public wearing short sleeves or shorts. The Imams referred to religious barriers whereby Islam obligates

women to wear the typical Muslim dress code, namely a scarf (*hijab*) and veil (*niqab*). Such garments restrict physical movement, thereby constraining Muslim women from engaging in PA. Apart from cultural and religion barriers, they mentioned environmental barriers, such as the hot dry weather, and politically-related barriers such as an unsafe environment, increased crime rates, and the destruction of infrastructure in many districts in Benghazi due to the fighting. These barriers to PA are similar to those identified by a comprehensive study of Arabic adults living in Middle Eastern countries (Benjamin & Donnelly, 2013).

Although my quantitative study did not address obstacles to PA faced by the Libyan population, the qualitative study found numerous of barriers that deter Libyans from engaging in PA. These were categorised into individual, cultural, religious, environmental, and politically-related barriers. Therefore, the findings of the second phase suggest that the barriers of physical activity are risk factors contributing to the obesity epidemic in Libyan adults of both genders.

10.6.3 Sedentary behaviour

The interviewees mentioned two divergent perspectives on sedentary behaviour in the Libyan population. LHCPs stated that Libyans in general indulge in a life of luxury and sedentary behaviour, and tend to be lethargic and lazy, relying on foreigners to perform various jobs particularly manual labour jobs, as well as using numerous household appliances and relying heavily on cars. An implication is that they tend to lead inactive lifestyles. In contrast, the academic staff (LCLs) perceived Libyan women to be more likely than Libyan men to indulge in a sedentary lifestyle are. They cited the cultural and religious restrictions that deter Libyan women from engaging in indoor or outdoor PA and which oblige them to stay at home and raise their children with the cooperation of domestic workers and nannies (see Section 10.8.3).

The other interviewees, belonging to the LCLs, were similar to the LHCPs in their perception that Libyans favour sedentary lifestyles. Inactive lifestyles in Libya are exacerbated by the deterioration of the current political situation in Benghazi which influences the daily life activities of the residents, such as the evening curfew enforced by the provisional Libyan government to protect civilians, and which results in many Libyans staying at home. This action contributes to the increasingly sedentary lifestyle in which Libyans indulge, undoubtedly exacerbating the obesity epidemic. This finding is compatible with previous studies that found a strong relationship between sedentary behaviours in adults and obesity (Heinonen et al.,2013; Healy et al., 2008; Hu et al., 2003).

The quantitative study found a significant positive association between sedentary behaviour and obesity in Libyan women but not in Libyan men. The qualitative study revealed two related results. One is that Libyans tend to indulge in a life of luxury and sedentary behaviour, and are generally lethargic and lazy. The other finding was that women indulge in sedentary lifestyles to a greater extent than do men. It can be concluded that sedentary behaviour contributes to weight-gain and becoming obese in the Libyan population.

10.6.4 The effect of neighbourhood environment on physical activity

The section below explains, discusses and interprets the following seven sub-themes: residential density, street connectivity, mixed land use, unsafe environment and crime, traffic and pedestrian safety, access to recreational facilities, and household vehicle ownership.

10.6.4.1 Urban residential density

Benghazi is a city of relatively high residential density. Both LHCPs and LCLs, with the exception of academic staff, felt that the increasing residential-density levels in Benghazi are leading to an overcrowding of open spaces, parks, public spaces, and pedestrian amenities, leaving little space for residents to walk or engage in outdoor physical activities. Such discouragement from engaging in physical activities in turn leads to obesity. Additionally, high-density areas may generate traffic jams along with safety and pollution concerns, which further serve to deter Libyans from walking or engaging in physical activity. These findings are consistent with those of a US study by Vandegrift and Yoked (2004) and a Nigeria study by Oyeyemal. (2012). Further inhibiting PA among Libyans is the lack of law enforcement due to the fragile political and economic state of the country and the poor performance of the Libyan provisional government which fails to enforce traffic laws, clear traffic in prohibited areas, and arrest criminals.

In contrast, the academic staff of the LCLs argued that the high residential density encourages the residents to engage in different types of physical activity, whether walking or using public transport as an alternative to driving their own cars. Through contributing to adequate levels of physical activity, such factors are associated with a reduced risk of obesity. A possible explanation is that high residential density offers local retail shopping and may provide social support, and perceived safely, all of which collectively encourage PA. High residential density is also thought to increase opportunities for active forms of transport and physical activity,

thereby helping to reduce the risk of overweight and obesity. It should be noted that this inverse association between higher residential density and obesity might however be an artefact of the way in which residential density is measured (see Chapter 7, Section 7.5.1). Nevertheless, the view of the academic staff of the LCLs is similar to numerous epidemiological studies, which showed that people living in high-density neighbourhoods have lower BMIs (Hirsch et al., 2014; Lopez, 2007; Rundle et al., 2007).

The quantitative study found a strong, significant positive association between residential density and obesity in Libyan women but not in Libyan men. The qualitative study identified two diverse views. One was that the relatively high residential density in Benghazi likely encourages higher levels of PA and helps to reduce obesity, while the second was that a higher residential density likely discourages PA and contributes to an increased risk of obesity. It can be concluded that the three findings obtained from the two phases were contradictory, therefore it is difficult to draw conclusive inferences about the association between a higher residential density and obesity, for example, that a higher residential density either encourages or discourages PA, which might contribute to or protect against obesity.

10.6.4.2 Street connectivity

There was a consensus among all the interviewees that Benghazi is characterised by a well-connected and efficient network of streets. However, there were two different views on how this feature of the 'built environment' affects the daily activities of the residents. LHCPs perceived this street connectivity as enabling residents to walk to multiple destinations, whether between residences or to use public transport, and this enhances their level of physical activity. Provided that traffic regulations are enforced so as to protect pedestrians and cyclists and deter lawbreakers such as drivers breaking the speed-limit, it is conceivable that high street-connectivity encourages PA among Libyan adults, which helps to reduce the risk of obesity. These findings are similar to those of numerous studies conducted in developed and developing countries which found that adults living in neighbourhoods with a well-connected, efficient network of streets encourages residents to walk and engage in more physical activity, and this is also associated with having a lower BMI (Bauman & Bull, 2007; Franzini et al., 2009; Sarkar et al., 2013). However, these findings failed to provide clear explanations for my results, which indicated that the street connectivity in Benghazi was positively associated with obesity in Libyan adults.

In contrast to the views of LHCPs discussed above, Benghazi council members (LCLs) had different views on how these attributes of the city (the high level of the street- connectivity) impact on the daily activities of Libyan residents. They felt that it discourages Libyans from engaging in PA. A potential explanation is that key buildings in Benghazi have been damaged or destroyed due to the fighting between the Libyan militias in most districts in Benghazi. In addition, the Libyan provisional government has been ineffectual in enforcing road safety regulations and combating reckless driving and other crimes. The level of traffic is also higher in highly populated and connected neighbourhoods, thereby raising the safety risks of being outdoors which may have an adverse impact on the daily activities of the residents, lowering their level of PA. This finding is similar to those studies which have found high street-connectivity to be inversely related to PA and raises the risk of obesity (Mecredy et al., 2011; Oreskovic et al., 2014).

The quantitative study found a strong, significant positive association between street connectivity and obesity in the adult Libyan population for both genders. The qualitative study however revealed two diverse findings. The first is that street connectivity in Benghazi likely encourages PA and helps to reduce obesity, while the second result was that street connectivity likely discourages PA and raises the risk of obesity – most likely due to the street connectivity in Benghazi being under-utilised due to the intense fighting between militias. The unstable political situation in Libya has created an unsafe environment that might influence both PA and access to healthy foods, which might eventually contribute to the obesity epidemic among the Libya population. It can be concluded that the three findings obtained from the two phases of this study were divergent, therefore conclusive inferences cannot be drawn regarding the association between street connectivity in Benghazi and obesity. It cannot be specified whether street connectivity in Benghazi encourages or discourages PA, and whether it contributes to or protect against the obesity epidemic.

10.6.4.3 Mixed land-use

There was consensus among the interviewees, belonging to the two groups, that Benghazi possesses mixed commercial facilities and diverse land-use. However, LHCPs perceived most districts in Benghazi to have been released from the armed militias, and they perceived Benghazi to have a high level of mixed land-use as it is now populated by pedestrians and the residents using public transport. A potential explanation is that the mixed commercial facilities and diverse land-use in Benghazi encourage residents to walk and on a daily basis, rather than

relying solely on their private vehicles, which raises their PA levels, thereby lowering the risk of obesity (Rundle et al., 2007). This finding is similar to studies which have found a significant inverse association between high land-use mix and obesity (Frank et al., 2008; Grasser et al., 2013; Mackenbach et al., 2014).

In contrast to the LHCPs, interviewees, belonging to the LCLs, argued that although Benghazi has a high level of mixed land-use, most of these areas are disused due to key buildings being damaged by the war and the environment being perceived to be unsafe, which deters Libyans from walking and using public transport. An obvious explanation for the unsafe neighbourhood environment is that the clashing radical militias have destroyed leisure amenities, parks, and other vital places, and Libyan citizens generally remain indoors so as to minimise their exposure to this danger. Conversely, other studies have found that low land-use mix is associated with an increased risk of obesity (Papas et al., 2007; Zhao et al., 2010). In contrast, one study found that living in areas with greater mixed land-use was associated with higher BMI values (Rutt & Coleman, 2005).

The quantitative study found no association between 'mixed land-use' and obesity in the adult Libyan population of either gender. The qualitative study however identified two diverse views on mixed land-use. One view was that the greater the amount of mixed-use land in Benghazi, the greater the opportunities for active travel, which increases physical activity and reduces the obesity risk. The other result is that a higher level of mixed-use land in Benghazi discourages physical activity and may contribute to the occurrence of obesity. Conceptually, it makes sense that mixed land-use in Benghazi is being under-utilised due to the intensity of the fighting between militias as a result of the unstable political situation. This under-utilisation may have the effect of discouraging PA and restricting access to healthy foods, which may contribute to the obesity epidemic among Libyan adults. It can be concluded that the three findings obtained from the two phases of this study were divergent, therefore the association between mixed-land use in Benghazi and obesity cannot be specified. We cannot conclusively infer whether the mixed land-use in Benghazi encourages Libyan adults to engage in PA, or discourages them, or whether mixed land-use enables access to healthy or unhealthy food, which might contribute to or protect against obesity in the Libyan context.

10.6.4.4 Unsafe environment and crime

The vast majority of interviewees, both LHCPs and LCLs, agreed that Benghazi is a risky environment due to the conflicting ideologies and fighting between the Libyan army and militias, which has effectively converted some parts of Benghazi into ghost districts. LHCPs felt that, despite most regions having been freed from Islamic State 'Daesh' control, the Government-imposed curfew is still in place and local supermarkets still have restricted opening hours, which limits residents' access to healthy foods. This in turn can lead to poor diets and increased levels obesity. The posited explanation is that the deterioration of the current situation in Benghazi has limited residents' access to healthy food, whereas unhealthy foods are more accessible. This in turn fuels the obesity epidemic (see Chapter 7, Section 7.5.8).

In contrast to the views of LHCPs, the interviewees, belonging to LCLs, perceived the unsafe environment from a different angle. They felt that the fragile Libyan government is unequipped to combat traffic violations and the increasing variety of crimes being committed. They also felt that the curfew imposed by the Libyan government is exacerbating the obesity situation since Libyans are largely confined to their homes. When it is considered that Libyans previously indulged in sedentary activities at home such as watching TV and probably consuming staple food commodities to excess, the curfew imposed by the Libyan government in Benghazi adds insult to injury as far as Libyans' PA levels are concerned. As these factors may impede Libyans from engaging in PA, they may contribute towards the obesity epidemic. These findings are consistent with studies which have showed that the higher the level of danger in the environment, the higher the risk of obesity (Browna et al., 2014; Burdette & Hill, 2008; Christian et al., 2011).

The quantitative study revealed that 'an unsafe environment and committing crimes at night' was significantly associated with obesity in the adult Libyan population for both genders. However, 'an unsafe environment and committing crimes during the day' was significantly associated with obesity in men only and not in women. The qualitative study found that living in an unsafe neighbourhoods limits to access health food and deters people from engaging in PA, which might contribute to fuel the obesity epidemic. It can be concluded that an unsafe environment and increased crime rates in the current situation in Benghazi are risk factors contributing to obesity in the Libyan population.

10.6.4.5 Road infrastructure and safety

There was a consensus among the LHCPs and LCLs that Benghazi possesses good infrastructure and road safety, for example, pedestrian routes and cycle lanes are located away from the main highway. The city also has traffic laws and regulations to protect pedestrians, cyclists, motorists and their passengers from risk and injury. These features encourage Libyans to walk or use public transport. These findings are similar to those of studies conducted in developed countries (Frank et al., 2007; Li et al., 2009).

Despite similarity between the views of LHCPs and LCLs, some differences were identified too concerning road infrastructure and safety. On the one hand, LHCPs perceived several conflict-affected areas to have poor road infrastructures due to the political conflict which adversely affects the daily-life activities of the residents, prompting them to stay at home and therefore foregoing the PA that would otherwise protect them from obesity. On the other hand, the interviewees, belonging to LCLs, argued that, despite the good infrastructure in Benghazi, the ineffectualness of the fragile government in curbing criminal behaviour, such as drivers breaking the speed-limit, deters the resident from engaging in PA. This failure to prevent drivers from entering auto-free zones and breaking other traffic rules renders these areas risky and unsuitable for the public to practise daily physical activities, which may lead to obesity. This finding is similar to those studies which found a negative association between traffic safety measures and obesity (De Bourdeaudhuij et al., 2015; Humpel et al., 2004).

The quantitative study found that the presence of road traffic infrastructure was not associated with obesity in either gender. The qualitative study revealed that significant damage to road-infrastructure in several conflict-affected areas deters pedestrians and cyclists from using these areas. Another finding from the qualitative study was the lack of traffic law enforcement due to the fragile state of the present government. It can be concluded that, despite the good road-infrastructure in Benghazi, the failure to enforce road safety legislations and maintain the roads makes the city generally unsafe for pedestrians and cyclists, thereby deterring Libyans from engaging in PA, which is likely to fuel the obesity epidemic.

10.6.4.6 Access to recreational facilities

The majority of interviewees, both LHCPs and LCLs, mentioned the amenities for outdoors activities and sports centres that exist throughout Benghazi. However, they differed in what they considered to be barriers that impede Libyans from accessing these recreational facilities and engaging in regular exercise. The majority of these barriers are similar to those that hinder Libyans from engaging in PA (see Section 10.3.4). On the one hand, LHCPs perceived that the lack of professional trainers at many of the sports facilities was a deterrent to engaging in PA because they were unable to operate the latest sports exercise equipment and sophisticated machines. In addition, the membership fees have increased dramatically due to the current situation in Benghazi and the fact that some of the leisure and sports centres have shut down. Such deterrents from using sporting families have been explored in previous studies in Arab countries (Benjamin & Donnelly, 2013; Musaiger et al., 2013).

In contrast, academic staff and Benghazi council members, belonging to the LCL groups, contended that most of the sport centres, both indoor and outdoor, have been damaged or destroyed due to the clashing between militias. Also categorised as LCLs, the Imams suggested that religious customs should not be considered to restrict physical activity among Libyans. As long as gender segregation in sport centres is practiced and the Islamic dress code for women (abayas and hijabs) is adhered to, they claimed, both men and women are free to exercise.A fourth type of LCL, tribal chiefs, mentioned cultural barriers such as tribal prohibitions against women engaging in any type of physical activity whatsoever; these findings are similar to those of numerous studies conducted in the Arab region (Al-Kaabi et al ., 2009; Benjamin & Donnelly, 2013; Caperchione et al., 2009).

The qualitative study revealed that numerous barriers impede Libyans from accessing recreational facilities, which reduces their level of PA and which likely have an adverse impact on their weight. Such factors were not addressed in first phase of this study. It can be concluded that inaccessible recreational facilities is a risk factor contributing to the obesity epidemic, while access to recreational facilities is a protective factors against obesity.

10.6.4.7 Household vehicle ownership

The overwhelming majority of interviewees, both HCPS and LCLs, contended that most Libyan families have more than one automobile, and that Libya's low oil prices and the

affordability of modern cars in Libya encourage a preference for driving rather than using public transport. They also gave the stereotypical view of Libyans as indulging in leisure activities and a sedentary lifestyle, relying on their own cars to run even the smallest errands. Such behaviours and practices reduce PA and likely contribute to the obesity epidemic in Libya (see Chapter 7, Section 7.5.12). This finding was similar to studies which found that car owners have higher BMIs than do non-car owners, in both men and women (Inagami et al., 2009; Jacobson et al., 2011; Martin et al., 2014).

My quantitative study did not find an association between the presence of one or more vehicles in the household and obesity in the adult Libyan population of either gender. However, the qualitative study revealed that Libyans' 'addiction' to using their cars around-the-clock leads to reduced PA, probably contributing to the obesity epidemic in Libya. It can be concluded that household vehicle ownership contributes to weight-gain and becoming obese in the Libyan population.

10.7 The effect of neighbourhood environment on food availability and accessibility

This section explains, discusses and interprets two sub-themes: access to supermarkets and access to groceries and fast-food outlets.

10.7.1 Access to supermarkets

The vast majority of LHCPs and LCLs asserted that the supermarkets chains, both large and small, that are spread across Benghazi are easy to access and offer a large huge variety of healthy and unhealthy foods at reasonable prices. However, LHCPs and the academics (LCLs) perceived that opening hours have been restricted in the conflict-affected areas in Benghazi which restricts access healthy foods during the course of the day. The restricted availability of different types of food likely exacerbates the obesity epidemic in Libya. This finding is similar to those studies which have shown that a lack of access to supermarkets or full-service grocery stores is associated with a higher chance of obesity (Giskes et al., 2011; Morland et al., 2006).

In contrast, the other interviewees, belonging to LCL groups, argued that Benghazi's larger supermarkets generally stock a wide variety of healthy food items at affordable prices, and that the residents can access healthy food around-the-clock even in the conflict-affected areas. As the government's control has been weakened, some supermarkets have not adhered to the curfew and have not curtailed their opening hours. Physical proximity to neighbourhood

supermarkets which offer more healthy food options at lower prices than convenience stores is associated with the consumption of fruits and vegetables, which can protect against obesity. This finding is aligned with studies which found that 'proximity to supermarkets' is a key factor in the success of interventions to help obese people eat better and improve their weight (Drewnowski et al., 2012, Michimi & Wimberly, 2010).

The quantitative study did not address the influences of the built environment on diet. However, the qualitative study revealed that restricted access to supermarkets may reduce consumption of healthy foods, resulting in poor nutrition and increased prevalence of obesity. It can be concluded that the accessibility of full-service supermarkets which stock primary food sources confers protection against obesity.

10.7.2 Access to groceries and fast-food outlets

The majority of LHCPs and LCLs asserted that fast-food restaurants and grocery and convenience stores are located in most urban areas, including in the most deprived areas. LHCPs asserted that many off-licence convenience stores, corner shops, grocery stores and fast-food restaurants are not subject to opening-hour regulations and can remain open until late at night, making unhealthy foods widely available in Benghazi. Being exposed to junk foods around-the-clock is likely to tempt Libyans to consumed unhealthy but appetising food products, which eventually lead to weight-gain and obesity. This finding is similar to studies which found that higher exposure to local fast-food restaurants and small food stores, and less access to large supermarkets, is associated with higher BMI (Bodor et al., 2010; Inagami et al., 2009; Giskes et al., 2011; Morland et al., 2006; Sallis & Glanz, 2009).

In contrast, the interviewees, belonging to LCLs asserted that the political conflict has not affected around-the-clock access to health foods from both grocery stores and convenience stores. However, fruits and vegetables supplied by grocery stores are often wilted and discoloured and are therefore unappetising, likely disposing shoppers to buy frozen and pre-prepared foods instead, which may fuel the obesity epidemic. This finding is consistent with previous studies which found that access to fast-food restaurants and grocery stores leads to an increase in the prevalence of obesity (Bodor et al., 2010; Chen et al., 2009).

The qualitative study found that fast-food restaurants and grocery and convenience stores scattered across Benghazi, which supply unhealthy foods, appear to be a contributory risk

factor for obesity in Libya. However, the quantitative study did not address this issue. It can be concluded that limited access to supermarkets and easy access to fast-food restaurants and grocery and convenience stores may reduce consumption of healthy foods, resulting in poor nutrition and an increased prevalence of obesity.

10.8 Two main themes belonging to the public-policy level of the SEM

The following section explains, discusses and interprets two themes that were categorised as belonging to the public-policy level of the SEM: the Libyan food subsidy policy and suggestions for preventing and controlling obesity.

10.8.1 The Libyan food subsidy policy

This main theme has been categorised into three sub-themes: food prices and affordability; heavily subsidised food; the media and advertising.

10.8.1.1 Food prices and affordability

The vast majority of the interviewees, belonging to LHCPs and LCLs, admitted that both healthy and unhealthy food is cheap and affordable in Libya. Not only has food in Libya been getting cheaper, but it is easier to acquire and prepare. Hence, Libyans are not only consuming more fast food but are also consuming a greater variety of foods and in large quantities due to a general ignorance of healthy eating behaviours. This finding is similar to a recent study in the USA which found that widespread availability of inexpensive foods is the main reason behind the rising rates of obesity, and that cheap foods are largely to blame for the obesity epidemic (Sturm & Ruopeng, 2014). In addition, interviewees ,belonging to LHCPs, contended that the majority of Libyans fail to make healthy food choices because of the general lack of health awareness, discussed in detail in Section 10.5.4. Furthermore, the interviewees, belonging to LHCPs and LCLs, argued that the large variety of foods that are subsidised by the Libyan government, discussed in the next section.

10.8.1.2 Heavily subsidised food

Both groups of interviewees held broadly similar views about subsidised food. They stated that the Libyan government subsidies staple food commodities heavily, including wheat, flour, sugar, rice vegetable oils and other miscellaneous commodities. In addition, the Libyan government subsidises energy prices including gasoline, diesel and electricity. While this

subsidy programme for fuel and food benefits Libyan society, it places a heavy burden on the Libyan budget, and it is likely one of the risk factors for gaining weight and harming Libyans' health. As it is largely fattening foods that are subsidised – that is, made reasonably cheap and abundant, these can be argued to contribute to the obesity epidemic in Libya (Drewnowski & Darmon, 2005; Powell & Chaloupka, 2009.). This finding is similar to that of studies carried out in developed countries (Alston et al., 2008; Drewnowski & Darmon, 2005; Schaffer et al., 2007) and in developing countries in the Arab region (Asfaw, 2006;Ianchovichina et al., 2014).

10.8.2 The media and advertising

Both LHCPs and academics (LCLs) felt that media advertising for junk food may contribute to obesity epidemic in Libya. They contended that Libyans are heavily exposed to food-related advertising on TV and in the street, which influence Libyans' purchasing decisions and promote unhealthy eating habits that fuel the obesity epidemic. Moreover, Libyans tend to be susceptible to propaganda promoting the consumption of sugary drinks and fast foods. There is a significant body of research which reveals that excessive fast-food advertisements are associated with obesity (Anderson et al.,2007; Cezar , 2012; Hakeem., 2013). As my study examines correlational rather than causal relationships, we cannot assume that heavy advertisement of non-nutritious foods causes obesity in Libya. Nevertheless, when combined with other factors, food-related advertising undoubtedly influences food choices and exacerbate the prevalence of obesity in Libyan adults.

How the media and advertising affect Libyan eating habits was not addressed in the first phase of this study. The qualitative study, however, suggested that these factors can contribute to the risk of obesity, whether individually or combined with other factors. It can be concluded that food-related advertising can contribute to the obesity epidemic in Libya, and should therefore be included as a risk factor in the final conceptual framework of this study.

10.9 Recommended strategies to prevent and control obesity

This section presents, interprets and discusses the second theme belonging to the public-policy level of the SEM, that is, 'suggestions for preventing and controlling obesity', categorised into three sub-themes: improve the effectiveness of health education; promote healthy eating; and encourage physical activity.

10.9.1 Improve the effectiveness of health education

The vast majority of interviewees, belonging to both LHCPs and LCLs, expressed similar views about the importance of creating a new, rigorous national health education programme to tackle the obesity epidemic. The interviewees, belonging to LHCP, asserted that food and health subjects should be compulsory in the school curriculum and that schools should educate pupils about obesity prevention measures. They also suggested that health-related information be disseminated to the wider public using mass media. Likewise, the interviewees, belonging to LCLs, suggested inviting experts from abroad to institute health awareness programmes, since there is little expertise among the LHCPs in this field. These suggestions are persuasive when it is considered that the old Libyan regime (Elfituri et al., 2006), and all consecutive provisional Libyan governments have entirely neglected public health awareness (El-Fallah et al., 2014). Consequently, misconceptions about obesity abound in the Libyan population, such as perceiving obesity to be a marker of female beauty for men (Khawaja & Afifi-Soweid, 2004).

10.9.2 Promote healthy eating

The qualitative study revealed two distinguishable views on encouraging healthy eating habits. On the one hand, LHCPs suggested reducing the consumption of unhealthy foods and replacing it with healthy alternatives on the individual level, such as avoiding sugary soft and fizzy drinks and fast foods. Support for these suggestions is from studies which found that shifting from unhealthy to healthy eating patterns is an effective measure for tackling obesity (Garnett, 2015; Swinburn, 2004). In contrast, the interviewees, belonging to LCLs, emphasised the role of the government. They suggested that the government needs to take urgent action to terminate the subsidisation of unhealthy foods, as well as subsidising healthy foods instead and taxing unhealthy food and sugary drinks. Such measures have proven feasible for reducing the obesity epidemic in developed countries (Cornelsen & Carreido, 2015; Franck et al., 2013; Marron et al., 2015).

10.9.3 Encourage physical activity

The interviewees, belonging to LHCPs, expressed two distinguishable views on encouraging PA while the interviewees, belonging to LCL, made one suggestion. The LHCPs asserted that priority should be given to restoring all the facilities destroyed by the conflict as well as renovating old buildings and developing infrastructure for public transport. Another suggestion of the LHCPs was to encourage Libyans to be active, not only individually, such as limiting

time spent being sedentary, but also on the community level, such as reinstating National Physical Exercise Day. In support of these suggestions, numerous studies have found that encouraging people to engage in PA can help to reduce the risk of obesity (Besson et al., 2009; Cho et al., 2009). The interviewees, belonging to LCLs, however suggesting inviting physical-activity experts to work with Libyan authorities in the education and sport sectors in order to develop physical-activity guidelines for the Libyan population. This suggestion is aligned with that of the EMR-WHO (2014) which stated that improving the physical activity levels in developing countries, including the UEA, is a priority (EMR-WHO ,2014a).

From their diverse backgrounds, most of the interviewees made plausible suggestions for preventing and controlling obesity in Libya. It has been recognised that there is no easy solution to preventing or controlling obesity (CDC, 2015e), but there are many ways that Libyans can be encouraged to change their behaviours and adopt healthier lifestyles. When designing intervention programmes, it is important to take into account people's common-sense understandings of the issues. This is because any suggestions for preventing and controlling obesity that fail to understand what and how people are thinking initially are likely to fail in changing people's attitudes, practices, values and behaviours. The key informants' perceptions, thoughts, feelings, understandings and knowledge about obesity were the focus of the qualitative study. Having conducted 21 individual interviews with key informants (HCPs and LCLs), this study has taken people's common-sense understandings into account which no study on obesity in Libya has done before. The views of the key informants did not serve as a proxy for the adult Libyan population as a whole however. It is important to note that the views of the key informants did not serve as a proxy for the adult Libyan population as a whole. To have used the views of HCPs and LCLs to represent the views of Libyan laypeople would have been based on an invalid inference, since the key informants come from particular backgrounds which Libyan laypeople do not necessarily share. Having conducted 21 individual interviews with those key informants, this study has taken people's common-sense understandings into account, which no study on obesity in Libya has done before. The above perceptions and suggestions should therefore be used to inform any interventions formulated to control and prevent obesity in Libya.

10.10 Finalisation and visual representation of the theoretical model

Depicted in Figure 10.1, the final theoretical model of this mixed-methods study was derived from the integration of both quantitative and qualitative findings. It demonstrates that no single factor can explain exactly, why is there an obesity epidemic in Libya and, why the existing protective factors against obesity are ineffective in Libya context ? This framework views obesity in Libyan men and women as the outcome of an interaction of multiple risk and protective factors (predictor variables). The multiple variables resulting from the two phases of this study were categorised as belonging to one of the five nested, hierarchical levels or spheres of the SEM: individual or intrapersonal; interpersonal; institutional and organisational; community and physical environment; and public policy. The variables were allocated to the appropriate level of the SEM based on pragmatic judgment as well as on prior knowledge of the literature, resulting in a visual representation of the final conceptual framework of this study. The long diagonal arrows across the five spheres of the theoretical model denote the interaction between predictor variables at the different levels of the model. The double-headed arrows between variables (or two parallel arrows pointing in opposite directions) denote that each predictor is likely to be of equal importance in influencing each other within a single level. The value of this theoretical model is that it clusters intervention strategies based on the ecological level in which they are located.

The following section discusses the independent variables extracted from this study in terms of the SEM. At the centre of the SEM is the microsystem, referring to the individual or intrapersonal sphere, including: socio-demographic characteristics (age, gender, and ethnicity); socio-economic status (education, income, and occupation); knowledge about obesity; and unhealthy eating behaviours (skipping meals and eating at irregular times; fruit and vegetable intake; consumption of large food portion sizes; beverage consumption; consumption of fast food and traditional food). This next sphere is the mesosystem which is divided into two levels. The first mesosystem refers to interpersonal factors, including: marital status, faith, and acculturation. The second mesosystem refers to the institutional and organisational level, including: failing to take advantage of the free medical services, deteriorating health sector performance; a lack of healthcare information systems; and a lack of health education and awareness programmes. The subsequent sphere is the exosystem which refers to the physical environment or community settings, including: physical activity and sedentary behaviour; barriers to physical activity; urban residential density; street connectivity; mixed land use;

unsafe environment, crime, traffic and pedestrian safety; access to recreational facilities; household vehicle ownership; access to supermarkets, grocery stores and fast food outlets. The final sphere is the macrosystem which refers to the public-policy level of the SEM, including: cultural values and norms; Islamic rules; food prices and affordability; extensive food subsidisation; aggressive advertising by fast-food companies; improving the effectiveness of health education; and promoting healthy eating and encouraging physical activity. The finial sphere is the chronosystem which refer to change or consistency of behaviours over time in the host society through, the obesogenic environment that promote the consumption of energy-dense food and discourage physical activity.

Chronosystem (Obesogenic environment)

Risk factor ■ Protective factor ■

- **Macrosystems Societal & Public policy**
  - •Heavily subsidised food
  - • Aggressive advertising by fast-food companies

- **Exosystems Physical Environment & Community setting**
  - • Sedentary behaviours
  - • Physical activities
  - • Fast food restaurants

- **Mesosystems Institutional & organizational**
  - •Street connectivity
  - • Acculturation
  - • Marital status
  - •Access to convenience stores

- **Msosystems Interpersonal**
  - •Residential density
  - •Sugar-sweetened beverages (SSBs)
  - •Cultural Values & Norms

- **Microsystems Intrapersonal**
  - •Food prices & Affordability
  - • Access to supermarkets
  - •A lack of health education
  - Pressure from relatives & peers
  - Socio demographic factors
    - • Gender
    - •Age
    - • Ethnicity
    - ● SES
    - • Occupation
    - •Education
    - • Income
    - •Knowledge misconceptions myths
  - • Culture
  - • Religion
  - • Obesity BMI kg/m^2
  - • Irregular eating pattern
  - • Eating multiple or large irregular meals a day
  - •Traditional food
  - •Offering variety of foods
  - •Skipping breakfast
  - ●Eating less than 5 a day of fruit and veg
  - ●Owning vehicles
  - • Eating collectively from a single plate
  - • Duration of residence in Benghazi
  - •Deteriorating health sector performance
  - • Access to supermarkets
  - • Improve the effectiveness of health education
  - • Mixed land use
  - • Pedestrian infrastructure
  - • Large food portion sizes (FPS)
  - • Barriers to physical activity
  - • Encourage physical activity
  - • Unsafe from crime, pedestrian & traffic
  - • A frequent social gathering
  - • A lack of healthcare information systems
  - • Pedestrian & cycling infrastructure
  - • Access to recreational facilities
  - • Access to public transport
  - • Islamic Rules
  - • Neighbourhood aesthetics
  - Improve the promote healthy eating and

Figure 10.1 A final theoretical model of this research

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Chapter Eleven : Final discussion, conclusions and future directions

11.1 Introduction

The first two chapters of this thesis identified a gap in literature through a comprehensive review of the literature on the potential risk and protective factors that may promote or protect against obesity in the Libyan context. The two main research questions that resulted from this critical literature review are: "What are the risk and protective factors associated with obesity amongst Libya men and women aged 20-65 in Benghazi, Libya?" and "What are the views of Libyan healthcare professionals and community leaders in Benghazi with regard to the risk and protective factors associated with obesity among adults living in Benghazi, within the context of Libyan culture?"

The theoretical framework of this study, from which the conceptual framework was derived (Chapter Three), was argued to be based on the Socio-Ecological Model (SEM), which guided this study. Chapter Four discussed the choice of methodology in the current study, as well as the timing, weighting and mixing decisions of an adapted mixed-methods sequential explanatory design. To address my first research question, stated above, a deductive research approach in the form of a cross-sectional survey was selected and discussed in Chapter Five. The purpose of this survey was to examine the statistical relationships between BMI and the following four predictor variables: (i) socio-economic status (SES); (ii) unhealthy eating habits; (iii) physical activity (PA) and sedentary behaviour (SB) patterns; (iv) and neighbourhood environmental factors; that is, the risk and protective factors that were derived from the SEM in Chapter Three. In addition, the subsequent three chapters (5, 6 and 7) addressed the following aspects of this deductive study: methodology, presentation and analysis of the numerical data, and discussion and interpretation of the quantitative findings.

Chapter Eight discussed the research design and methodology of the qualitative study (Phase II), while Chapters Nine and Ten continued the analysis and discussion of qualitative data, with Chapter Nine presenting the steps followed for qualitative data analysis, using Framework Analysis, and also presenting the findings of the qualitative analysis of the 21 individual interviews. Representing risk and protective factors pertaining to body weight, each theme identified was categorised logically in the appropriate sphere of the SEM, which is comprised of five spheres in total. Chapter Ten discussed and interpreted the quantitative findings, as well

as the ways in which and extent to which the qualitative results helped to explain the ambiguous results of the quantitative results , through interpreting the findings in the light of the wider literature and current knowledge about obesity epidemic.

This final chapter (Chapter Eleven) presents the key findings of this thesis. It also outlines the implications of my findings are considered from three perspectives: theoretical, methodological and application-related. The strengths and limitations to the study are then considered from a quantitative, qualitative, and mixed-methods perspective. The chapter concludes by making recommendations for future research, policy and practice, followed by the main conclusions of the study.

11.2 Key findings of this mixed-methods study

This section synthesises the findings to answer the study's two main research questions. The two main research questions that resulted from this critical literature review are: "What are the risk and protective factors associated with obesity amongst Libya men and women aged 20-65 in Benghazi, Libya?" and "What are the views of Libyan healthcare professionals and community leaders in Benghazi with regard to the risk and protective factors associated with obesity among adults living in Benghazi, within the context of Libyan culture?"

11.2.1 The key findings from the quantitative study

This section starts by estimating the response rate for the whole study, and then the estimating the prevalence of overweight and obesity. In addition, this section summarises the results obtained from testing the four hypotheses, and the associations between BMI.

11.2.1.1 Estimating the response rate for the whole study

Using multistage cluster sampling, 512 potential participants were drawn from the Benghazi Electoral registry. As 401 Libyan adults were finally included in the study, the actual response rate achieved was 78%. This was slightly higher than the estimated response rate (75%) and falls within the 70-85%, which was moderate to very good in accordance with the experts perspective (Bryman, 2012).

11.2.1.2 Estimating the prevalence of overweight and obesity

The prevalence of obesity amongst Libyan adults was 42.4%, whereas the prevalence of being overweight and being of normal weight was 32.9% and 24.7% respectively. Thus, the prevalence of being overweight and obese was 75.3%. Libyan women were found to have higher rates of overweight and obesity than men. Whereas 33.2% of women and 32.4% of men were overweight, 47.4% of women and 33.8% of men were obese. Interestingly, no participants were found to be underweight in this study.

11.2.1.3 Results for the first hypothesis: Socio-economic status and obesity

My finding indicated that there was a significant positive association between obesity and two SES components (education level and income) in both genders, while occupational status was associated significantly positively with obesity in women only. Such findings indicate that there is sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

11.2.1.4 Results for the second hypothesis: Unhealthy eating habits and obesity

My findings indicated that obesity was significantly positively associated with the frequency of restaurant- and fast-food consumption per week, and the consumption of large food portion sizes (FPS), in Libyan adults of both genders. In contrast, the consumption of sugar-sweetened beverages (SSBs) was significantly positively associated with obesity in Libyan women but not in men. However, a significant inverse association was found between breakfast consumption per week and BMI in Libyan population. All the aforementioned findings indicate that there was sufficient evidence to reject the null hypothesis and accept the alternative hypothesis for fast-food , SSBs and breakfast consumption. However, consuming five daily portions of fruit and vegetables was not associated with obesity of either gender in Libya adults, which indicates that there is insufficient evidence to reject the null hypothesis.

11.2.1.5 Results for the third hypothesis: Physical activity and sedentary behaviour

My findings indicated that the BMI of Libyan adults is significantly negatively associated with total PA under the three domains (work, transport and recreational activities) in Libyan women but not in Libyan men. In contrast, a significant positive association exists between obesity and sedentary behaviour in Libyan women but not in Libyan men. Such findings indicate that there is sufficient evidence to reject the null hypothesis and accept the alternative hypothesis for total PA under the three domains (work, transport and recreational activities) as well as for sedentary behaviour in Libyan women ,but not in Libyan men.

11.2.1.6 Results for the fourth hypothesis: Neighbourhood environmental factors

My findings indicated that a significant association exists between the BMI of Libyan adults in 6 of the 12 neighbourhood environment factors. For both genders combined, these were: street connectivity, 'unsafe environment and committing crimes at night', and neighbourhood aesthetics. For men only, these were: access to public transport, access to recreational facilities, and 'unsafe environment and committing crimes during the day'. Finally, 'residential density zones' was significant for women but not for men. Such findings indicate that there is sufficient evidence to reject the null hypothesis and accept the alternative hypothesis, that is, that there is an association between BMI and the 6 aforementioned neighbourhood environment factors.

Conversely, my study found no association between the BMI of Libyan adults for the remaining 6 of the 12 neighbourhood environment factors: land use mix (access to commercial places, access to public places, and walkable destinations); pedestrian infrastructure (presence of pavements and maintenance of pavements); cycling infrastructure (presence and maintenance of cycle lanes); traffic safety (for pedestrians and for cyclists); pedestrian safety (being active in their neighbourhood); and household vehicle ownership (vehicles in household). Therefore, such findings indicate that there is insufficient evidence to reject the null hypothesis; that is, there is no association between BMI and the 6 aforementioned neighbourhood environment factors.

11.2.2 The key findings from the qualitative study

In the qualitative study, 11 main themes were categorised as belonging to one of the five nested, hierarchical levels or spheres of the SEM: individual or intrapersonal; interpersonal; institutional and organisational; community and physical environment; and public policy.

11.2.2.1 Factors influencing body-weight at the individual level

11.2.2.1.1 Socio-demographic and biological factors

The three main socio-demographic factors are age, gender, and ethnicity.

11.2.2.1.1.1 Age

The qualitative study found that, despite obesity being observed in virtually all age groups, it is more prevalent in adult age groups. Hence, this finding corroborated the quantitative finding. My qualitative findings also affirmed that women are more likely than men to be overweight

and obese due to physiological factors and cultural norms. The second finding of the qualitative study confirmed the existence of confounding factors affecting the relationship between age and obesity. This was consistent with my findings in terms of the disparities between age-groups in gender. Therefore, it can be concluded that age is one of the unmodifiable risk factors contributing to the obesity epidemic in Libya.

11.2.2.1.1.2 Gender

The qualitative study revealed that, Libyan women have higher rates of overweight and obesity than men. The key informants' perception that the prevalence of obesity and overweight in Libyan women is higher than that in men supports the finding of the quantitative study. It can be inferred that gender is a risk factor for fuelling the obesity epidemic in the Libyan context.

11.2.2.1.1.3 Ethnicity

The qualitative finding revealed that obesity in the Arab Libyans and Berbers is higher than that in any other majority group in Libya. Therefore, due to the contradictory results obtained between the two phases of this study, it can inferred that ethnicity remains an inconclusive factor in the development of obesity in the Libyan context.

11.2.2.1.1.4 Biological and medical causes

Genetic factors are undoubtedly a contributing cause obesity, which can run in families, and that the hormone leptin also has a role in contributing to obesity. Furthermore, they mentioned that there are other health problems, such as hypothyroidism or medications such as antidepressants, that can cause Libyans to gain weight. Therefore, these findings from the qualitative study added explicit explanations for the non-modifiable risk factors associated with obesity that were addressed in the first phase of this study. In addition, the qualitative study explored other risk factors involving genetic and biological factors which provide a broader understanding of the non-modifiable risk factors.

11.2.2.1.2 Socio-economic status

Despite the qualitative study not dealing with SES as a single unit, it succeeded in revealing contradictory findings concerning the three component of SES with reference to their contribution to increasing or decreasing weight.

11.2.2.1.2.1 Education

The qualitative study revealed three contradictory findings concerning the relationship between educational attainment and obesity in Libyan. The first finding is that obesity is more likely to develop in uneducated than educated Libyans. The second finding is that obesity is more likely to occur in more educated Libyans than in those with low educational attainment. The third finding is that education is less significant for obesity compared to the other two SES components (income and occupation) in terms of their impact upon weight-gain. According to the quantitative findings, education is the strongest risk factor of all the SES components associated with obesity in the Libyan context. This was only partly supported by the qualitative findings; other findings about education from the qualitative study are inconclusive due to the divergence between findings.

11.2.2.1.2.2 Income

Three contradictory findings were obtained from the qualitative study concerning the income-obesity relationship in Libyan adults. The first finding is that high earners in Libya are more inclined to put on weight than are low earners. The second finding is that high earners are less likely to develop obesity than are lower earners. The third finding is that there is no obvious relationship between income and obesity due to the heavy subsidisation of unhealthy food by the Libyan government. Therefore, it can be concluded that income is a contributing factor to the obesity epidemic in Libya, according to the quantitative findings. This was partly supported by the qualitative finding. However, other findings about income from the qualitative study are inconclusive s due to the divergence between findings.

11.2.2.1.2.3 Occupation

Three diverse findings were obtained from the qualitative study concerning the occupation-obesity relationship in Libyan adults. The first finding is that most Libyan employees engage in sedentary work or low physical job demand. As numerous Libyan employees have been unfairly dismissed from their jobs, their jobs can still be referred to as sedentary because the Libyan government continues to pay their monthly salaries. In addition, there is a high rate of absenteeism in Libyan government employees meaning that they spend more time in sedentary activities. Therefore, it can be concluded that employment status is a contributing factor to the obesity epidemic. However this finding pertained only to Libyan women. According to the quantitative study, this finding is inconsistent for Libyan men. The qualitative study provided some clarification for the unanticipated findings of the quantitative study in terms of the

occupation-obesity relationship in Libyan women, but it failed to do so in the case of Libyan men because it found that the nature of the employment offered to Libyans of both genders is primarily sedentary work or work low in physical job demand. In addition, employment status (employed or unemployed) is a contributing factor to the development of obesity in Libyan adults of both genders.

11.2.2.1.3 Unhealthy eating behaviours

11.2.2.1.3.1 Skipping breakfast

The qualitative study revealed that skipping breakfast is a common unhealthy eating habit which most Libyans practise. It also indicated that skipping breakfast may lead to the development of obesity in Libyan adults. The quantitative study found a significant negative association between breakfast consumption per week and obesity in the adult Libyan population of both genders. Similarly, the qualitative study found that skipping breakfast is one of the risk factors for obesity in Libyan adults. Thus, it can be concluded that regular breakfast consumption might protect against obesity (a quantitative result), while skipping breakfast is might lead to obesity in the adult Libyan population (a qualitative result).

11.2.2.1.3.2 Fruit and vegetable intake

The findings of the qualitative study suggest that the majority of Libyan men and women are not meeting the recommended consumption of at least five to seven portions of fruit and vegetables per day. The qualitative study also found that Libyan men and women might be aware of the 'five-a-day' guideline, yet they may be unable to meet this quota, and this might be fuelling the obesity epidemic in Libyan adults of both genders. This finding partly supports the quantitative findings in terms of the average FV intake among Libyan adults: both studies found that FV intake is slightly lower than the WHO recommendation. However, there are contradictory results between two phases in that the qualitative study found that consuming less than the recommended quantity of FV a day might be a contributing factor to the development of obesity in Libyan men and women, whereas the quantitative study did not find an association between consuming less than five daily portions of FV and obesity in the adult Libyan population of either gender.

11.2.2.1.3.3 Consumption of large food portion sizes (FPS)

The qualitative study found that Libyans tend to consume large portion sizes, and prodigious quantities and multiple courses are served at all meals in Libyan society, whether at home or in restaurants, at social functions and at religious and cultural festivals. According to Libyan culture, it is unacceptable to leave food on the plate; people are pressurised to consume all the food offered so as to show their respect for the hosts and to obtain the blessing of God when 'cleaning one's plate'. The quantitative study revealed a strong positive association between the consumption of large FPS and obesity in the adult Libyan population of both genders, and the qualitative study concurred with the finding that Libyans are pressurised to consume large food portion sizes at all meals. It can be concluded that large food portion sizes is a contributing factor to the development of obesity in Libya.

11.2.2.1.3.4 Consumption of sugar-sweetened beverages (SSBs)

The qualitative study revealed that Libyans generally consume large quantities of SSBs, both cold and hot. This result supports my findings of the first phase which revealed that the average consumption of SSBs for Libyan adults exceeds the daily maximum amount recommended by the American Heart Association. The qualitative study also revealed that Libyans consume excessive SSBs for a number of reasons, including affordability, round-the-clock availability and the hot weather. Finally, the qualitative study revealed that some misconceptions prevail such as that consuming SSBs can help in the digestion of junk food and that consuming SSBs is not related to weight-gain.

The findings from the qualitative study provided partial support for the findings of the first phase in that they explained the association between SSB-consumption and obesity, however this finding pertained only to women; it did not explain the lack of association in Libyan men. It can nevertheless be inferred that consuming SSBs might contribute to the development of obesity in Libyan adults of both genders, since the qualitative study revealed that SBBs are consumed in excess quantities in Libyan adults of both genders.

11.2.2.1.3.5 Consumption of fast food vs. traditional food

The qualitative study revealed that the majority of Libyans consume fast food regularly and frequently. This result supports the finding of the quantitative study that a strong association exists between obesity and the frequency of consumption of fast food, in the adult Libyan population of both genders. Another finding of the qualitative study is that traditional Libyan

foods have a high-energy density, being even higher in saturated fat, sugar and salt than are many Western fast foods; consuming it was perceived to be no less dangerous than consuming fast food. It can be concluded that both frequent fast-food consumption (a qualitative and quantitative finding) and consumption of traditional Libyan foods (a qualitative finding) are contributing factors for increased obesity.

11.2.2.1.3.6 Consuming multiple meals and other unhealthy eating practices

While the quantitative phase was restricted to investigating unhealthy eating habits in Libyans, the qualitative study not only provided explanations for the unanticipated results of first phase but also explored further unhealthy eating behaviours that Libyans practise in their daily lives which could contribute to an increase of obesity in Libyans. These included: eating late at night immediately before going to sleep; consuming multiple meals throughout the day and multiple courses at each meal; eating collectively from a single plate; and 'cleaning one's plate' due to cultural norms and religious customs which disapprove of leftovers and due to social pressure from relatives and friends, resulting in obesity being 'socially contagious'. It can be concluded that such habits might be considered to be contributing factors that fuel the obesity epidemic in Libya.

11.2.2.1.4 Knowledge about obesity

The qualitative study revealed that knowledge about obesity varies among the key informants, with those whose work is affiliated to the health system tending to be more knowledgeable than those who do not work within the health sector. Another finding of this study was that Libyans lack knowledge not only about obesity but also about the most basic health practices, due to the absence of health awareness programmes. In addition, it indicated that Libyans are semi-educated people because, despite earning higher education qualifications in various scientific fields unrelated to health, they ignore the most basic health information. For instance, many Libyans still consider obesity to be a symbol of health and wealth and do not believe it to be a disease. It can be concluded that the general lack of knowledge about obesity is likely to be a contributing factor to the obesity epidemic in Libya.

11.2.2.1.4.1 Perceptions about the prevalence of obesity in Libya and in Benghazi

The qualitative study showed that there was outright agreement among the interviewees that obesity exists and is spreading in all areas of Libya. The prevalence of obesity in Libya was reported on the WHO website for the last national Libyan survey in 2009, while the result

regarding perceptions about the prevalence of obesity in Benghazi is unidentified due to the dearth of previous studies addressing the prevalence of obesity in Libya. This lack of data about obesity and its prevalence in Benghazi provides a further rationale for the present study.

11.2.2.2 Factors influencing body-weight at the interpersonal level

Social and cultural influences on obesity include: marital status; religious faith; cultural practices; and acculturation.

11.2.2.2.1 Marital status

The qualitative phase revealed that Libyan men and women who are married are more predisposed to gaining weight than are those who have never married. Another finding is that married Libyan women are more prone to weight-gain than are married men. This result supports the finding of the quantitative study regarding the association between obesity and 'being married' in women, but not 'being married' in men. In contrast, the qualitative study revealed two different results. It can be concluded that marriage status is a risk factor for obesity in women, but findings were inconsistent in the case of married men (a quantitative and qualitative finding), however the qualitative study suggested that obesity is a contributing factor to obesity in both men and women in Libya.

11.2.2.2.2 Faith

The qualitative study revealed that the Islamic perspective on obesity is similar to that of other religions: it considers obesity to be a sin and provides copious advice to the nation about combating weight-gain including distinguishing between foods that are lawful and unlawful and encouraging people to be active and healthy through complying with Islamic pillars such as fasting, praying, and engaging in physical exercise. Despite contradictory results between the two phases of this study, the quantitative study found no association between religion and obesity, while the qualitative study revealed that Islamic law might be considered to be a protective factor against obesity, hence it is arguable that all these practices and the advice provided by Islamic jurisprudence could serve as protective factors against obesity.

11.2.2.2.3 Cultural practices

This study identified numerous practices derived from Arab culture which exacerbate the risk of obesity. These include: the high frequency of family gatherings and social occasions which encourage guests to overeat; eating off large-sized plates; and encouraging each other not to

leave any food on the plate so as to be blessed by God, as well considering obesity to be a sign of beauty and wealth. Libyans persist in practising 'fattening' rituals on women before marriage. Although not addressed by the first phase of the study, all these factors were mentioned by the interviewees as constituting risk factors for obesity. Such findings support or help to clarify the anomalous findings of the first phase of this study. It can be concluded that Libyan cultural norms and values are risk factors for obesity in Libyan men and women, and it is necessary to include cultural factors in the final theoretical model of this study.

11.2.2.2.4 Acculturation

Based on the findings of the qualitative study, Benghazi constitutes an obesogenic environment that compels Libyans from the Sahara Desert and Bedouins from the villages to migrate to Benghazi and assimilate into an urbanised culture, thereby undergoing processes of urbanisation, modernisation and acculturation It can be concluded that migrating to an obesogenic environment and the subsequent acculturation are contributing factors or predictors of obesity in the Libyan context.

11.2.2.3 Factors influencing body-weight at the institutional and organisational level

Deteriorating health-sector performance is indicated by the following four themes.

11.2.2.3.1 Failure to take advantage of the free medical services

The qualitative study revealed that patient records are lacking due to the lack of an electronic health record (EHR) system. It also revealed a lack of communication between healthcare users and medical staff due to the absence of interpretation services for healthcare users. It can be concluded that both these factors deter Libyans from using the free medical services, and this could contribute to the prevalence of overweight and obesity in Libya.

11.2.2.3.2 Deteriorating health sector performance

The qualitative study revealed three possible factors contributing to the ineffective functioning of the Libyan healthcare system. Neglected by the quantitative study, these factors are: incompetent leadership; using complex and delicate medical equipment without having the manpower to operate and maintain it; and perpetual short-term contracts for the foreign medical staff. The deterioration of the Libyan health system tends to deter people from going for regular health check-ups. It can be concluded that these factors may be contributing or covariant factors leading to an increased risk of obesity.

11.2.2.3.3 Lack of healthcare information systems (HCIS)

The qualitative findings showed that the non-existence of HCIS in Libya results in a lack of disease surveillance. Accordingly, the Libyan government is probably ignorant of the escalating prevalence of NCDs such as obesity. It can be inferred that the absence of HCIS can be considered to be a factor contributing to the obesity epidemic in Libya.

11.2.2.3.4 Lack of health education and awareness programmes

The qualitative study found that raising awareness of healthy lifestyle choices enables people to make choices that can help to reduce their risk of developing obesity. This matter has been neglected by consecutive Libyan governments. A lack of health education and awareness tends to generate many myths and misconceptions surrounding obesity among Libyans, which might lead to an increased risk of obesity.

11.2.2.4 Factors influencing body-weight at the community-setting and the physical-environment level

11.2.2.4.1 Physical activity

Three different findings were obtained in the qualitative study. The first is that the prevalence of physical inactivity was perceived to be high among Libyan men and women. The second is that Libyan adults with higher educational attainment engage in more PA than do their uneducated counterparts. The third finding is that Libyan men are more likely to be physically active than are Libyan women. This contradicted the finding of the first phase which found an inverse association between PA and BMI in Libyan women, but not in Libyan men. It can be inferred that PA is a protective factor for Libyan women (based on the results obtained from the two questionnaires "the Greenwood et al.'s questionnaire and the GPAQ" adopted for the quantitative study) and Libyan men (based on the results obtained from "the Greenwood et al.'s questionnaire" adopted for the quantitative study and from the qualitative study).

11.2.2.4.2 Barriers to physical activity

The qualitative study found that numerous obstacles may deter Libyans men and women from engaging in PA. This is an issue which the quantitative study did not address. Barriers to PA that Libyans encounter include: illness, injury, or a lack of time (personal factors); the hot dry weather conditions (an environmental factor); gender segregation in different types of sport (a religious and cultural factor); the evening curfew in Benghazi due to the fighting between

militias which creates a dangerous environment (a political factor). It can be concluded that the barriers to engaging in physical activity probably may contribute to the obesity in Libyan adults of both genders.

11.2.2.4.3 Sedentary behaviour

The qualitative study showed that Libyans in general indulge in a life of luxury and sedentary behaviour. They tend to be lethargic and unwilling to engage in any form of physical activity, despite the availability of leisure facilities and recreation centres. Moreover, the qualitative study revealed that Libyan women are more likely than Libyan men to indulge in a sedentary lifestyle due to cultural and religious norms. The last result is similar to the quantitative study which found a positive association between sedentary behaviour and obesity in Libyan women but not in Libyan men. It can therefore be concluded that sedentary behaviour contributes to weight-gain and becoming obese in Libyan women (a quantitative result) and in Libyan adults of both genders (a qualitative result).

11.2.2.4.4 The effect of neighbourhood environment on physical activity

11.2.2.4.4.1 Urban residential density

The qualitative study identified two diverse results. The first is that residential density in Benghazi is moderately high, which likely inspires higher levels of PA and helps to reduce obesity. The second is that a higher residential density likely discourages PA and contributes to an increased risk of obesity. The results of qualitative study contradict those of the quantitative study, which found a positive association between residential density and obesity in Libyan women but not in Libyan men. It can be concluded that the three findings obtained from the two phases were inconsistent since the association between residential density and obesity was inconclusive.

11.2.2.4.4.2 Street connectivity

The qualitative study revealed that Benghazi is characterised by a well-connected and efficient network of streets. Two findings follow from this. The first is that street connectivity in Benghazi likely promotes PA which might reduce obesity. The second finding is that street connectivity likely inhibits PA and therefore increases the risk of obesity. It seems reasonable to infer that the street connectivity in Benghazi is being under-utilised due to the intense fighting between militias. This under-utilisation of street connectivity might influence both the

extent to which residents engage in PA and access to healthy foods, which in turn might contribute to the obesity epidemic. This may explain the unanticipated results of the quantitative study which found a positive association between street connectivity and obesity in the adult Libyan population for both genders.

11.2.2.4.4.3 Mixed land-use

The qualitative study found that mixed-use land is an attribute of Benghazi which facilitates engagement in active travel by residents for example, on foot, bicycle or public transport. This in turn increases PA, which likely reduces the risk of obesity. Another finding is that a higher level of mixed-use land in Benghazi discourages residents from engaging in PA and may therefore increase the risk of obesity in Libyan adults. This contradicted the finding of the first phase which found no association between 'mixed land-use' and obesity in the adult Libyan population of either gender.It can be concluded that, despite the quantitative study finding no association between mixed land-use in Benghazi and obesity, the qualitative study provided an explicit explanation for this result. The qualitative study revealed that the mixed land-use in Benghazi is being under-utilised due to the unstable political situation, and that this may have the effect of discouraging residents from engaging in PA and restricting their access to healthy foods. These factors may in turn contribute to the obesity epidemic among Libyan adults.

11.2.2.4.4.4 Unsafe environment and crime

The qualitative study found that Benghazi is a risky environment due to the friction between the Libyan army and the militias. Living in an unsafe neighbourhood probably limits residents' access healthy foods and deters them from engaging in PA, which might in turn contribute to the obesity epidemic. This finding supports the quantitative study which revealed that 'an unsafe environment and committing crimes at night' was significantly associated with obesity in both Libyan men and Libyan women. However, 'an unsafe environment and committing crimes during the day' was significantly associated with obesity in men only and not in women. It can be concluded that an unsafe environment and increased crime rates in the current situation in Benghazi are likely risk factors for obesity in Libyan men and women.

11.2.2.4.4.5 Road infrastructure and safety

The qualitative study revealed that that Benghazi possesses good infrastructure and road safety, but there that the road-infrastructure is being destroyed in several conflict-affected areas. This deters pedestrians and cyclists from using these facilities. Another finding is the lack of traffic

rules which renders these areas risky and unsuitable for the public to engage in daily physical activities, which may lead to obesity. This finding provides further explanation for the finding of the quantitative study that the presence of road traffic infrastructure was not associated with obesity in either gender. It can be concluded that several factors render the city generally unsafe for pedestrians and cyclists: the current destruction of road-infrastructure in many conflict-affected areas; the failure to enforce road safety legislation; and failure to maintain the roads. These factors discourage Libyans from engaging in PA, which probably increases the risk of obesity.

11.2.2.4.4.6 Access to recreational facilities

The qualitative study revealed that, although amenities for outdoors activities and sports centres exist throughout Benghazi, several barriers impede Libyans from accessing such recreational facilities. These include high membership fees and a lack of segregation between genders and destroy many of frailties centres due to the friction between the Libyan army and the militias. These barriers might prevent Libyans from using the recreational facilities, which would reduce their PA levels and likely have an adverse impact on their weight. The first phase of this study found an association between access to recreational facilities and obesity in Libyan men but not in Libyan women. The qualitative study provided further explanation in that it revealed the many barriers that Libyans face regarding access to leisure facilities. It can be concluded that poor access to recreational facilities is a factor contributing to the obesity epidemic, while access to recreational facilities is a protective factor against obesity.

11.2.2.4.4.7 Household vehicle ownership

The qualitative study revealed that the majority of Libyan families possess more than one automobile, and that the low oil price in Libya, coupled with the affordability of modern cars in Libya, largely drive the under-utilisation of public transport. Whereas the quantitative study found no association between the presence of one or more vehicles in the household and obesity, the qualitative study found that Libyans use their cars several times throughout the day, which may lead to reduced PA, which can cause weight gain in the adult Libyan of both genders. It can be concluded that the qualitative finding was unable to explain the divergent findings of the quantitative study, which contradicted those of the qualitative study. However, the qualitative study identified widespread household vehicle ownership as a factor contributing to weight-gain and becoming obese in the Libyan population.

11.2.2.4.5 The effect of neighbourhood environment on food availability and accessibility

11.2.2.4.5.1 Access to supermarkets, convenience stores, and fast-food outlets

The qualitative study found that Libyan citizens have access to large and small supermarkets which are distributed across Benghazi. These supply a variety of products, including both healthy and unhealthy foods, at affordable prices. This accessibility was considered in this study to be a protective factor against obesity. In contrast, supermarkets in conflict-ridden areas have restricted opening hours due to the risky environment, which constitutes a risk factor for obesity since only fast-food restaurants and convenience stores are accessible in these areas, implying a greater availability of unhealthy foods. Although supermarkets and convenience stores were not mentioned in the first phase of this study, they can be added to the risk and protective factors for obesity identified by this study, with convenience stores constituting a risk factor for obesity and supermarkets constituting a protective factors against obesity.

11.2.2.4.6 Factors influencing body-weight at the public-policy level

The following section explains, discusses and interprets two themes that were categorised as belonging to the public-policy level of the SEM: the Libyan food subsidy policy and suggestions for preventing and controlling obesity.

11.2.2.4.6.1 The Libyan food subsidy policy

The qualitative study revealed further factors that could contribute to obesity in Libyan adults. These factors were not explored in the first phase, yet they helped to explain the unanticipated results of the first phase. The first finding of the second phase is that both healthy and unhealthy foods are readily accessible and affordable to Libyan residents. However, Libyans tend not to distinguish between them, preferring to consume fast foods which are highly palatable and often easier to eat in large portions than are healthy foods. Libyans' failure to recognise the difference between health and healthy food, coupled with the appetising quality of unhealthy foods, are possible contributing factors to the obesity epidemic in Libya. A second finding of the qualitative phase pertains to the Libyan government's subsidisation of staple food commodities heavily, including wheat, flour, sugar, rice and other miscellaneous commodities, in addition to fuel and electricity, while more nutritious foods are not subsidised. It can be inferred that the heavy subsidisation of unhealthy foods, electricity, fuel and housing by the Libyan government could be a factor contributing to the obesity epidemic. In addition, the public is exposed to intensive advertising of fast food and sugary beverages, which may

influence their eating behaviour and lead to unhealthy food choices that fuel the obesity epidemic. It can be concluded that food-related advertising might be considered to be a factor that contributes to the obesity epidemic in Libya.

11.2.2.4.6.2 Suggestions for preventing and controlling obesity

The qualitative findings of this study give rise to a number of recommendations for preventing and controlling obesity. Recommendations pertain to three main aspects. First, health education needs to be more effective. This can be implemented through creating a new, rigorous national health education programme to tackle the obesity epidemic that includes inviting experts from abroad to institute health awareness programmes which are disseminated to the wider public using mass media. Second, healthy eating needs to be actively promoted. This can be achieved through taking urgent action to terminate the subsidisation by the Libyan government of unhealthy foods and subsidising healthy foods instead, as well as taxing unhealthy foods and sugary drinks. Finally, engagement in physical activity needs to be encouraged. This can be achieved through restoring all the sport facilities and leisure centres that have been destroyed by the conflict as well as renovating old buildings, developing infrastructure for public transport, and reinstating National Physical Exercise Day.

11.3 Research implications

This section considers some key implications of the findings of the research for theory, research, and practice or policies.

11.3.1 The substantial implications for theory and research

A mixed-methods approach to address obesity in Libyan adults has not previously been used before, particularly in epidemiological studies, within the public health field and health sector. Hence, this study can pave the way for other researchers in diverse scientific fields, including the public health, health and education sectors, as well as psychological, sociological, and economic institutions. This study may also encourage researchers to adopt a mixed-methods approach to address other diseases or to further research obesity in Libya, focusing on diverse aspects such as management and preventive measures for reducing the social and psychological problems that cause obesity, as well as mitigating the financial burden on the state due to treating obesity and its complications.

The data collection techniques used in the present study have not previously been used in the Libyan context, including using the electoral register as a sampling frame. The first electoral register was formulated in Libya in 1952, when the election system was established; this continued until 1969. Subsequently, the electoral register disappeared for approximately 40 years under the Gaddafi Regime, 1969-2011. However, in 2011, the Libyan revolution deposed the Gaddafi Regime, and the election system was reinstated in 2012. Therefore using it as a sampling frame may open doors for other researcher to use it. In addition, methods such as the recruitment of participants and visiting participants in their homes are unlikely to have been used in the Libyan context before because such research was not allowed during the old regime. Not only have such techniques not been used before in Libya, they have not been used in any Arab country with political regimes which prohibit access to research participants. Both the survey questionnaire and the semi-structured interview used in the present study were methods considered workable within the Libyan cultural context. They are also aligned with the pragmatic-worldview stance of the researcher. An implication is that this study can minimise any risks and concerns that future researchers may have about using these data collection methods or following the same procedures within a Libyan context.

Relatedly, this study can offer pragmatic suggestions about collecting data in risky political environments. Due to the proliferation of radical militias in Libya, and a weakened government that is virtually absent, it was necessary for me to seek the protection of the dominant tribe within each district, who appointed chaperones to accompany me while I collected data. Other researchers could benefit from to following similar procedures when conducting their fieldwork in hazardous environments.

Any interview needs to be aligned with the scope of the research. In the literature, the interview schedules for gathering data about obesity from key informants are mostly designed for the parents of obese children or for ordinary people, and they cover a range of topics. This study necessitated the development of a new interview schedule about obesity for the key informants selected for this study: LHCPs and LCLs, with questions tailored specifically to obtain further explanations for the unanticipated results from the quantitative phase. The interview schedule that was developed consisted of three major parts: the opening; the body and; and the closing. An implication of developing this interview schedule is that it could open doors for other researchers to develop other kinds of interview schedules for gathering data from key informants in different health and nutrition topics.

Some implications can be drawn from the researcher's personal experience of the challenges faced while conducting fieldwork in an unstable and insecure environment. These challenges ranged from simple logistic obstacles to complicated safety situations. There were also challenges pertaining to the recruitment process; for example, dealing with highly religious and conservative participants and with participants under the influence of alcohol. The methods used for dealing with such cases can be utilised by other researchers conducting studies within the EMR. In addition, the precautionary procedures used in the present study, both before and during the fieldwork, to deal with the emergent hazards in the fieldwork environment could inform the studies of other researchers also collecting data in dangerous regions. Procedures in the present study involved all the relevant bodies and authorities in the UK and in Libya. Thus, the present study could contribute to then important subject of conducting research in dangerous regions and situations.

Affiliated to the Libyan general postal services, the 'Alfwehat Telecom and Technology Agency' was appointed in this study to contact the research participants via phone. The agency allocated two males and two females to achieve this task. Although a few studies have used some communication agencies to recruit the potential participants via phone, these studies have failed to detail how they implemented these procedures, and dealt with sensitive issues with respect to cultural, social and religious barriers. In contrast, the present study provided full and up-to-date details about how each step was conducted, including methods to notify the potential participants about the impending study and the procedures taken to minimise the cultural and religious barriers to data collection. Such findings could be utilised by other researchers. Another implication is that, to the best of my knowledge, this study is the first to use back-translation processes for each protocol (quantitative and qualitative) in Libya. It applied all stages rigorously in the translation process recommended by the WHO and other researchers, and depicted these in a flowchart. These procedures and the forward-backward-forward translation technique diagrams could be useful to other researchers in Libya or in other Arab countries.

This study justified separately the selection of eligibility criteria for the participants in each study (quantitative and qualitative). These criteria could be used as a foundation for researchers in Libya and in the EMR because most of the existing studies have failed to clarify the reasons behind their selections. Such criteria could be made available to other researchers in the developed countries by documenting them on the official EMR website, including: the age

range selected (20-65 years), the period of residence (over ten years to adapt to the obesogenic environment), and all criteria for selecting the key informants (health professions and community leaders).

Another implication is that the questionnaire for unhealthy eating behaviours and the Physical Activity Neighbourhood Environment Scale (PANES) are unlikely to have been used in the EMR. Hence the findings from the present study could illuminate different angles for studying the topic of obesity in the EMR, while the findings can be compared with other studies in different regions of the WHO.

This study has contributed to the standard list of exclusion criteria used by researchers and experts to exclude potential participants from obesity studies that rely on the use of portable equipment. The portable Tanita BC-601 Segmental Body Composition Monitor Analyser was first used in this epidemic study. The present study amended the exclusion criteria by reducing the list in order to increase the chances of recruiting as many research participants as possible, including those who weigh more than 130kgs and those who wear a wig or a turban (because these impact on height, which affects the BMI equation). On other hand, it added one new exclusion criterion: participants who are amputees, because such cases require a special formula to calculate BMI, adapted to account for the estimated weight of the missing limb (Mozumdar & Roy, 2004).

The procedures followed by the researcher and the appointed qualified nurses with respect to dealing with sensitive issues practically and effectively, including helping to reduce any signs of distress and anxiety noticed in the research participants, contribute to the subject of research ethics. Ensuring that the risk of harm is minimised or eliminated prior to and during the anthropometric measuring is essential for meeting ethical standards. In addition, ensuring that the participants are free from distress and anxiety while the anthropometric measurements are being taken could help to ensure that, when they come to filling in the questionnaire, the validity and consistency the answers they provide are not compromised. This in turn enhances the validity of the final key findings of the topic under study.

11.3.2 The substantial practical or policy implications

This study has revealed several key findings. The first pertains to the collection of data using a questionnaire administered under personal supervision, which achieved a good response rate. To the best of my knowledge, this study is the first of its kind to be conducted in Libya and in the EMR, both of which are characterised by strict regimes which deter researchers from conducting such research. The present study might encourage other researchers in Libya or in other Arab countries to follow the same trajectory in order to contribute to information about subject response rates in the Arab region; to date there is a lack of relevant information about response rates and further studies are required. A second key finding that this study revealed is the prevalence of obesity. The extent to which Libyan men and women are overweight and of normal weight was measured using the Tanita Segmental Body Composition Monitor. Measurements were taken by highly qualified nurses, which contributed to the validity and consistency of anthropometric measurements, and which in turn impacts on the validity of the final findings of this study. These findings contribute to the literature on obesity through providing the latest, rigorous estimations of prevalence, after the last Libyan national survey in 2009 (MoH, 2009). Based on its more up-to-date calculations and findings, my study may necessitate a re-classification of the top-ten fattest countries in the world in 2016.

Thirdly, this study contributes to the literature anthropometric measurements for Libyan male and female adults, including: the mean values for weight, height, visceral fat, body fat percentage and BMI. These measurements could be used as indicators for the Libyan population in comparative research with other developing and developed countries, while the mean values for visceral fat and body fat percentage – both outcome variables analogous to BMI – could be used to test in association with other predictor variables. These findings could be useful to researchers in diverse aspects of health-related research, particularly that related to heart disease and diabetes. Finally, based on Libyan men and women's perceptions of eating and other health-related habits, this study revealed for first time in Libya, and possibly in the majority of EMR countries, the mean values for: consumption of fast foods; consumption of SSBs; consumption of five daily portions of fruit and vegetables; consumption of breakfast; consumption of large food portion sizes (FPS); and engaging in physical activity, and time lying down per day (PA and sedentary behaviour). These findings for Libya could be compared with those of other countries, whether in developing or developed countries. These findings

could also be documented on the EMR website for other researchers to use, whether related to public health, medicine, nursing or sports et cetera.

A further implication of this study derives from my finding on an important preventive measure in controlling the obesity epidemic, namely, heath education, an aspect that Libyan health authorities have generally neglected, especially with regard to chronic diseases (Elfituri, et al., 1999, 2006). A report by the WHO-EMR (2007) confirms that healthcare information about infectious and chronic diseases and their hazards is not available in Libyan primary healthcare. It follows that a lack of awareness of and misconceptions about the causes and sequelae of obesity are widespread. The findings of the present study could contribute to the Libyan health authorities' knowledge about how to prevent and control the obesity epidemic. In addition, through information-related campaigns and policies to prevent and control against obesity, this study could form a keystone for policymakers to establish effective policies for health education about obesity and its complications.

By exploring the perceptions, understandings, thoughts and feelings of Libyan key informtants (note that the views of the LHCPs and LCLs used in this study did not serve as a proxy for the adult Libyan population as a whole) about the risk and protective factors associated with adult obesity, this study can contribute to social awareness of the obesity epidemic as well as the social and psychological implications of obesity in adults. It may open the field for others to conduct further research about the social and psychological aspects of obesity. Furthermore, it may provide obese people with support in managing the associated social issues and psychological disorders.

A further implication is that this study could inform new health policies in Libya, as formulated by EMR-WHO experts. Such policies need to prioritise the implementation of an electronic health information system for scientific research purposes and to maintain up-to-date health information about healthcare users. The second suggestion addresses the language barrier which arises due to the largely foreign workforce in the Libyan healthcare system. This could be addressed by instituting the use of translation, interpretation and communication support services for the benefit of both healthcare users and healthcare providers. Communications about healthcare and obesity-prevention can also be enhanced by disseminating health awareness programmes (see Section 11.4). Currently, Libyan healthcare policies are vague and

fail to elaborate on how prevention programmes could proceed in a country as lacking in health awareness as Libya.

The another substantial contribution of this study is that the recommendations were made based on the multifaceted findings of this study. They concentrated on diet and physical activity together, and individual and community simultaneously, rather than attempting to modify either diet or physical activity alone or addressing individuals without addressing the whole society. This is because prevention and management of obesity in the Libyan context hinges on addressing multiple factors.

11.4 How my findings inform the existing health policies in Libya

In 2010, the old Libyan regime assigned experts from the WHO to conduct a comprehensive survey to evaluate the Libyan healthcare system and devise suitable health policies in order to reform and improve it (El Oakley et al., 2013; Sullivan, et al., 2011, WHO , 2013). Although this committee identified some policies that needed to be upgraded, these were not implemented. Due to the 2011 Libyan revolt, they were disregarded by the three consecutive provisional Libyan governments. Nevertheless, the expert committee recommended the following health policies: creating and developing a comprehensive programme for prevention and control of CDs and NCDs through disease surveillance, vaccination, and laboratory improvement. It was also recommended that health facilities be updated and modernised in terms of medical instruments and medications. There was an emphasis on promoting equal access to healthcare systems and encouraging postgraduate training programmes, whether within Libya or abroad, for both HCPs and administrative staff in order to improve the effectiveness and efficiency of their performance (El Oakley et al., 2013; Sullivan, et al., 2011, WHO , 2013).

There is some similarity between the aforementioned Libyan healthcare policies and the recommendations of the present study, drawing on its key findings, particularly in terms of initiating and developing a programme for the prevention and control of NCDs such as obesity. Another similarity was the recommendation to train, develop and organise human resources among both HCPs and administrative staff to improve the efficiency of their performance. It should be noted that the recommended health policies focus on improving health services, yet they neglect healthcare service users. In contrast, my study recognised and prioritised the need to institute an electronic health information system to enable health-related scientific research

and enhance the health services provided in Libya through minimising the obstacles to stakeholders, such as removing language barriers due to the largely foreign workforce in the healthcare system, and disseminating health awareness programmes. Furthermore, this study also provided recommendations about obesity prevention in more specific terms than did the Libyan health policies (see Section, 11.6), which were vague and failed to elaborate on how prevention programmes could proceed in a country as lacking in health awareness as Libya.

11.5 Strengths and limitations of the present study

Having discussed the research implications the following section provides a discussion of the strengths and limitations that may have influenced the results of this study. First, methodological limitations are discussed before addressing problems related to the implementation of the study.

11.5.1 The Socio-Ecological Model

The SEM was used as the theoretical framework for this thesis as it is a comprehensive public-health approach, highly recommended by the WHO and CDC for investigating or exploring the risk and protective factors for numerous chronic diseases and for addressing the complex phenomena that cause such a multifactorial condition as obesity. However, a limitation of the SEM is the difficulty in placing all the predictor variables of this study within the appropriate domains of the SEM due to the relatively ambiguous distinction between its five spheres. Despite categorising all the potential factors associated with obesity as belonging to an appropriate level of the SEM, this categorisation is open to debate. For example, I placed the three components of SES, embodying education, income and occupation, at the individual level of the SEM; however, some researchers argue that these three components of could be positioned at other levels of the SEM. In other studies, household income was placed within the interpersonal level, while education and occupation were allocated to the public level because they are considered relevant to the public-policy level.

Arguably, unhealthy eating habits include multiple components. While I categorised all these factors as individual-level factors (that is, belonging to the microsystem sphere), others can be categorised as community- and environment-level factors (belonging to the exosystem sphere). Although not every individual within a community is going to having unhealthy eating habits, components such as consumption of fast-foods and sugary beverages might be considered to be community- and environment-level factors if, for example, they use aggressive advertising

and there are many fast-food outlets around. It is possible that the multiple risk and protective factors associated with obesity obtained from this study could be allocated to levels of the SEM different from those argued in the present study, hence this can be considered a critical limitation of this study.

11.5.2 Research designs

In the quantitative phase of this mixed-methods study, based on a deductive approach, a cross-sectional design was used. This precludes determination of causal inferences, since it is sometimes referred to as a 'snapshot' study, and the situation may yield differing results if another timeframe had been chosen (Barratt & Kirwan 2009; Carlson & Morrison, 2009). In the qualitative phase of the study, based on an inductive approach, semi-structured interviews were employed. A weakness of the qualitative approach is the difficulty the researcher faced in identifying the appropriate approach to use among some five possible qualitative approaches (narrative study, case study, phenomenology, ethnography and grounded theory). Aligned with my pragmatic stance, I adhered to previous studies which were satisfied with referring to the qualitative phase as "semi-structured interviews" (Heslehurst et al., 2015; Redsell et al., 2011). Adopting a similar pragmatic solution to these researchers, I have described the deductive approach used in this study as "semi-structured interviews". Although no appropriate approach was chosen for the qualitative study from among the main five qualitative approaches, this is arguably not a serious drawback of this study as it is consistent with perspective of several other qualitative researchers (Chan & Wang, 2014; Roockley, 2014).

The research design used in this study can be described as an adapted mixed-methods sequential explanatory design. The logical reasons behind terming and adopting an adapted mixed-methods sequential explanatory design in this study can be argued as follows: a mixed-methods approach can provide a better understanding of the research problem than using either method alone. However, due to the unsafe fieldwork environment at the time of conducting this study, it was necessary to following certain precautions for conducting fieldwork. These precautions were agreed between my supervisory team at the University of Bedfordshire, UK, the Research Graduate School (RGS) members, and Libyan representatives at the Cultural Affairs attaché of the Libyan Embassy. They entailed assessing the risks that needed to be managed during the fieldwork, and agreeing on the necessary precautions that would be taken to minimise the hazards in the fieldwork environment and ensure the researcher's wellbeing. These precautions affected the study design. In theory, the sequential approach to data

collection entails collecting data for the first, quantitative phase of the study and analysing them, followed by collecting data for the second, qualitative phase based on the unanticipated results of the first phase that needed further explanation and clarification. The following explains what I did in practice.

Having adopted a sequential mixed-methods design, I conducted data collection for the pilot study of the quantitative phase in January-February 2014. Due to unstable and risky fieldwork environment in Libya, I decided to collect as much data as possible in the pilot phase in case the ongoing political conflict in Libya prevented me from travelling to Libya again to conduct the main fieldwork study, particularly considering that an explosion occurred in the same street in which I happened to be collecting data for the pilot study. In the pilot study, I distributed 200 of the 512 questionnaires to the research participants across all five selected polling districts for the pilot study (156 of 200 Libyan adults were included in the pilot study). This suited the timeframe for my research, as stipulated by the Research School Graduate's Regulations (RGS). Once the data of the pilot study was collected and analysed, and unanticipated results were explored between the predictor variables and obesity, it was pragmatically decided that these findings were sufficient and feasible for informing the second phase of the study, including formulating the second research question, justifying the selection of the key informants, and developing a semi-structured interview schedule for the qualitative study.

Collecting the outstanding questionnaires (N=384) was no longer effective for informing the qualitative study because all the procedures of the integrating stage (including wording of the qualitative research question, justification for selecting the key informants, and developing the interview schedule) had been implemented based on the large amount of data that had been collected from the pilot study. Because of the intense fighting in Libya, permission for the researcher to travel again to Libya to conduct the main fieldwork was delayed (the issue was under negotiation between the Libyan authorities and Bedfordshire University, UK). Approval to travel was eventually obtained, although for a restricted timeframe only due to the escalating intensity of the fighting in the fieldwork environment. Accordingly, I was forced to collect data for both phases of the study simultaneously during the main fieldwork in November -December 2014, consistent with my pragmatic stance. Therefore , the research design used in this study can be described as an adapted mixed-methods sequential explanatory design.

11.5.3 Sample design and sampling frame

Employing a multi-stage cluster random sampling technique is considered by methodological experts to be a strength for conducting large-scale survey investigations in large cities. It is relatively convenient, economical and efficient; it also requires less effort to implement than other sampling techniques, and it can generate a more representative sample of the population than other sampling techniques are able to do (Bryman, 2012; Neuman, 2006).

The Electoral Register served as the sampling frame of this study, enabling me to identify my target sample from an accessible population. Strict rules and regulations, and complicated procedures, are enforced by the High National Elections Commission (HNEC) for any researcher interested in accessing the 2012 Electoral Register of the Municipal Council of Benghazi. Yet this was the only available option to me for accessing the accessible population of Benghazi. Accordingly, I sought approval from the numerous relevant bodies and was ultimately granted access to the Electoral Register.

However, a limitation of this sampling frame was that certain groups in the society were excluded as they had been prohibited from voting according to Libyan Electoral Law 2012, Part III: The Right to Vote under article (4). These groups are any persons determined legally to be incompetent, with mental illness, or incarcerated; people involved in the corruption of political life during the old regime; those who are affiliated to official military institutions; and those working in the police force, or as judges; as well as those convicted of crimes stipulated in the penal code (HNEC, 2014). The only viable means of accessing the target population was via the electoral register. Although this study excluded from the survey Libyans adults who were ineligible to vote, this study confirmed that obesity is one of the fastest growing and most serious public health challenges confronting the Libyan government. This finding is similar to the Libyan national survey conducted in 2009, which did not exclude any groups. It revealed a prevalence of 30.5% for obesity in Libya adults, which is lower than that in the present study. Excluded groups in the present study represented only 7 % of the whole of the target population (see Appendix 5.8 for more detail), that is, only a minor proportion of the Libyan population. It can be concluded that the results are still representative of the Libyan adults population and can therefore be generalised. Nevertheless, it is prudent to consider the exclusion of certain groups as one of the limitations of this study.

11.5.4 Response rate

The response rate achieved in this cross-sectional study was 78% which is moderate to very good (Bryman, 2012). However, it is difficult to predict what kinds of responses the non-respondents might have given, which in turn might introduce some bias into the findings (Data Analysis Australia, 2013). Arguably, the broad eligibility criteria for the research participants included in this study adversely affected the response rate in that several groups were excluded due to either physical health problems or practical reasons, for example, advanced techniques were required for measuring the BMI of certain groups such as pregnant women; amputees;, and, if their BMI was in fact obtained, it may vary from the standard BMI cut-point values. In addition, using a portable Tanita BC-601 Segmental Body Composition Monitor is unable to provide BMI readings for the following groups: pregnant women; amputees; those unsteady on their feet, too frail or unable to stand upright. Excluding these groups, as well as those prohibited from voting, whether for practical or legal reasons, is arguably a limitation of this study as it did not take into account the perceptions of the entire population of Libyan.

Although estimating the desired sample size is inapplicable in a qualitative study, experts typically recommend relying on the concept of "saturation" to determine how many participants to recruit (Brayman, 2012; Creswell, 2013). However, the technique of the predetermined sample size was used in the qualitative study despite this in qualitative studies, sample size is rarely predetermined. Therefore, an explicit weakness of this study probably is that it ignored to continue interviewing participants until "data saturation" was achieved. This was due to the restrictions imposed on fieldwork by the unsafe environment in Benghazi, resulting from intensive fighting between multiple militias against the Libyan army. The sample size for the qualitative phase was 21 interviewees, which was a 100% response-rate, since the recruitment process was supported by the directors of the Libyan organisations to which the interviewees belonged. The method used to compute sample size for the qualitative research did not take into account the saturation point. However, this is not necessarily a limitation of this study because experts in qualitative methodology have suggested that a minimum of 20 to 30 participants should be interviewed to reach a good saturation point (Charmaz, 2006; Creswell, 2013). Thus, with 21 healthcare professionals and community leaders being interviewed, saturation-point has been a very high probability accomplished in this study.

11.5.5 Survey questionnaire design

Before administering the questionnaire, the researcher should ensure that the potential participants can easily understand, interpret and complete it (Bryman, 2012; Cohen et al., 2000). In addition, the questionnaire should not take too long to complete and should produce worthwhile data (Bryman, 2012; Cohen et al., 2000). This study employed four pre-existing questionnaires, which were translated using a backward translation technique which ensures that the Arabic translated version is reliable and valid. This technique entails appointing an expert committee to evaluate the backward-forward translation of the questionnaire. The expert committee concurred that the final edited Arabic version of the obesity questionnaire for Libyans adults possessed the following characteristics: straightforward; understandable; all the questions are in a logical sequence; easy for the respondents to answer; meaningful. In the opinion of the expert committee, the final version was readable and understandable and all the questions were clear and discrete so as to minimise the chance of participants' misinterpreting the questions.

However, it may be argued that, despite the wording of the questions being clear and understandable, potential participants might nevertheless interpret them differently (Bryman, 2012; Cohen et al., 2000). It can be difficult to design and develop questionnaires to reduce this effect (Bryman, 2012; Cohen et al., 2000). To minimise this risk, the researcher conducted the pre-testing of the questionnaire with ten Libyan adults living in the UK. The aim of the pre-test was to addresses the contents of the questionnaire from the perspective of the respondents, which is particularly important for the translated version of the instrument. Generally, the questionnaires were completed by the participants within 10-15 minutes. The outcome the pre-testing of the questionnaire indicated that most questions were clearly understood by the Libyan adults. The few items that were not readily understood were refined slightly so that a layperson could understand all the words clearly in the Arabic translated version. It can be concluded that, despite the necessary precautions taken to minimise such confusing questions, some questions may have remained open to interpretation and some participants probably misunderstood and misinterpreted some of the questions. For instance, "What constitutes 'the consumption of large food portion sizes (LFPS)'? The participants should be distinguish between serving sizes and portions sizes"; "How much time do you usually spend sitting or reclining on a typical day? Sitting time often includes the time spent eating, commuting, and socialising, which many participants may perceive that time spent sitting is only the amount of

time spent on TV-viewing" This might have an adverse impact on the consistency of the findings. Accordingly, this issue can be considered to be one of the limitations of this study.

This study employed four pre-existing questionnaires, which have been well validated and tested for reliability. However, they entailed some limitations.

Minor amendments have been made on the WHO STEPS Instrument for Noncommunicable Disease Risk Factor Surveillance in order to avoid any missing data from the respondents concerning age. Instead of asking the respondents for the year in which they were born, it uses age ranges. Similarly for income: instead of asking the respondents for an exact amount of income, income ranges were used. In the present study, a drawback pertained to the occupations data which was categorised into two statuses only: unemployed and employed, while most studies discriminate between professional and non-professional jobs in connection with obesity rather than between unemployed and employed.

 The second instrument is Greenwood et al.'s "Questionnaire for eating behaviours associated with overweight and obesity". Tested for validity and reliability, this contains the most common unhealthy eating behaviour thought to promote weight-gain (see Chapter 5, Section 5.4.1.5 for details how the Greenwood et al.'s "Questionnaire was tested for validity and reliability). In addition, to the best of my knowledge, this study is the first to use the greenwood questionnaire in non clinical groups. It included "physical activities per week" as one of its items to investigate the energy equation per day. This item should have been deleted because the study adopted the Global Physical Activity Questionnaire (GPAQ) to measure physical activity and sedentary behaviour. However, the PA item was not eliminated from the Greenwood et al. (2008) questionnaire as this would have invalidated the scale, necessitating that it be re-tested for reliability and validity, which would have been too time-consuming (Mathers et al., 2009).

A strength of the Global Physical Activity Questionnaire (GPAQ) compared to other tools used to assess physical activities is that it collects information on participation in physical activity in three areas: activity at work; travel to and from places; and recreational activities (WHO, 2013a). It has also been tested for validity and reliability worldwide including in the Arab Gulf States (Herrmann et al., 2013; Hoos et al., 2012). However, self-report tools are prone to recall biases and social desirability effects (Haskell, 2012). In addition this questionnaire addressed

the total reported time spent sitting per day or total sedentary behaviours (TSB) as a one unit. This may constitute a limitation as sitting can occur in various life-domains including leisure as screen-time (e.g., watching TV or using a computer), work (e.g. screen-use and desk-time), and during motorised transport (motorised sitting time), and each of these is likely to have distinct environmental correlates (Van Dyck, et al., 2012). Accelerometer-based monitors have been found to be more accurate than self-report methods for assessing activity (Hoos et al., 2012). However, accelerometers are not always practicable for water-based activities or non-ambulatory activities such as cycling, and they may therefore disregard moderate-to-vigorous physical activity (Cleland et al., 2014). Therefore, it is preferable to combine a subjective and an objective measurement tool to obtain the most accurate assessment of PA.

The Physical Activity Neighbourhoods Environment Survey (PANES) also has some limitations. Although the association between the built environment and physical activity in numerous epidemiological studies is derived mostly from self-report data on individuals' perceptions of their environments (Sallis et al., 2010), other studies used objective measures which are considered to be more accurate estimates of physical activity and the built environment than are self-report questionnaires (Nagel et al., 2008). A limitation of this study is that PA and perceptions of the built environment characteristics were assessed using self-report questionnaires which revealed inconsistent results between neighbourhoods environment characteristics attributed and PA. These results could vary when different data collection methods are used, such as objective measures to assess the geographical settings in which the respondents reside. To minimise this limitation, some researchers use a combination of subjective and objective methods (Lackey et al., 2009).

11.5.6 Data collection techniques

Questionnaires are typically administered either via post, email, or online as website surveys; however, these methods were inapplicable for the present study for two reasons. First, the postal service in Libya is ineffective (Kennard, 2001; Selvik & Utvik, 2016). Libya also has unreliable internet services in many parts of Benghazi (Elareshi et al., 2013; Elzawi et al., 2013). The second reason was that this study necessitated interviewing the potential participants to take their anthropometric measurements. Therefore, a more practicable method of distributing my questionnaires was to administer them under personal supervision to the potential respondents. This method can achieve a much higher response rate than non-face-to-face methods such as postal, e-mailed or online surveys. However, the main drawback of this

approach is that 'captive' subjects may distort their responses according to social desirability effects, and this may bias the study's findings. This method is also time-consuming and involves high costs, as well as the added difficulties encountered due to the unsafe fieldwork environment.

11.5.7 Data analysis

Given that the data of this study follow no specific distribution, distribution-free or nonparametric tests were used. The main disadvantage of nonparametric statistics is that the results are usually less powerful than those of parametric tests (Kitchen, 2009). A strength of this study is that it revealed the relative significance of the risk and protective factors that contribute to or protect against obesity in Libyan men and women, through examining gender disparities in obesity. However, yet to be considered are age-disparities, ethnicity, and SES disparities (comprised of education level, income and occupational status). Using such predictor variables in the non-parametric tests applied in this study to investigate the association between the four main predictor variables and obesity can add significant information to this study. However, conducting these tests relied on the aforementioned socio-demographic data, and the topic of SES is not related to the research questions and is not within the scope of this study's aims and objectives. Another reason for including these variables in future studies is to expand the scope of the discussion of the findings. In sum, the researcher disregarded them in this instance so as to be consistent with the scope of the study; however it can be argued that omitting these tests is a limitation of this study.

11.5.8 Ethical considerations

Ethical approval for this study was obtained for each phase individually, from the following four bodies: the IHREC at the University of Bedfordshire, UK; the Libyan Cultural Affairs attaché at the Libyan Embassy; the Omar Al-Mukhtar University in Bayda, Libya; and the Regional Health Ministry in Benghazi, Libya. These ethical reviews helped to ensure the overall integrity of the study. A second strength pertained to the translation processes. For the quantitative phase, a rigorous method of back-translating into English was applied and the expert committee met for the reconciliation and the validation before pre-testing the Arabic version of the questionnaire. In addition, back-translation into English was implemented in the qualitative phase. However, a limitation pertained to the translators who occasionally misunderstood the difference between idioms, proverbs and metaphors due to translating them literally. This might influence somewhat the soundness of the translated transcript despite the

researcher monitoring the translation process closely through email correspondence with the translators to identify any mistakes and reconcile any discrepancies.

11.5.9 Fieldwork environment

Being the economic and trade capital of Libya, Benghazi is ethnically diverse and multicultural. Thus, sampling from this city is a strength of this study as it captured a broad range of lifestyle influences, which are representative of the entire Libyan population. Consequently, the findings that pertain to the four proposed hypotheses can be generalised to the Libyan population as a whole. However, a drawback of the fieldwork environment was the unpredictable and escalating security risk due to the proliferation of Islamic State (ISIS) (DA`ASH) and other rebel militias fighting against the Libyan Armed Forces. After the Libyan revolution in 2011, many displaced Libyans resettled in Benghazi in search of safety, including thousands of forces families loyal to the old dictatorial regime and a number of nomads who had fled from tribal conflicts in the desert (Bredeloup & Pliez, 2011; Centre for Administrative Innovation in the Euro-Mediterranean Region (CAIMED), 2004; Morris, 2011). However, since the end of the Libyan civil war in October 2011, Benghazi has become a key destination for various radical militias, as well as for armed men and hard-line Islamist groups which have emerged from the conflict. However, in mid-2013, due to the deteriorating security environment in Libya, coupled with weak government performance in upholding the rule of law, human rights abuses have increased and the fieldwork environment has become even more high-risk for the researcher.

11.5.10 Anthropometric measurements

A strength of this study was appointing qualified nurses, both female and male, to take the anthropometric measurements of the participants. This helped to overcome cultural and religious barriers that prohibit women from being interviewed without a male presence (Mahram), thereby maximising recruitment rates. Typically, Muslim women prefer to be examined by a female nurse, and Muslim men prefer to be examined by a male nurse. In addition, the highly qualified nurses helped to ensure the validity of the anthropometric measurements. A possible weakness was the use of the Tanita BC-601 Segmental Body Composition Monitor to give individual body composition readings. As mentioned above, this instrument is unsuitable for certain groups of people (see Chapter 5, Section 5.1.1).

11.5.11 Pilot study of qualitative phase

Another drawback is that the pilot study for the qualitative phase was undertaken in the UK instead of in Libya, due to the deteriorating situation in Benghazi during that time which prevented me from travelling to Libya. I therefore interviewed five Libyans (two males and three females) in the UK between September and November 2014. A limitation is that these five pilot-study participants were unlikely to be aware of the economic and political changes in the current situation in Benghazi since they have all lived in the UK for more than five years. Thus, the interviewees recruited for this pilot study did not meet the eligibility criteria for the participants. Nevertheless, numerous lessons were learned from this pilot study (see Chapter 8, Section 8.10.2).

11.6 Recommendations and future research

The following section puts forward a number of recommendations drawing on the key findings of the study, as well as the strengths and limitations of the study outlined above. It also makes recommendations for future research, policy and practice. The recommendations for this study should encompass multiple components and concentrate on diet and physical activity together, and individual and community simultaneously, rather than attempting to modify either diet or physical activity alone or addressing individuals without addressing the whole society.

11.6.1 Recommendations on preventing unhealthy eating habits

11.6.1.1 At the individual level

Libyans should be encouraged to consume fresh foods such as eating five to six servings of fruits and vegetables daily. The public should be informed that breakfast really is the most important meal of the day. Ideally, Libyans should eat breakfast everyday within 30 to 60 minutes of waking up, as is recommended by experts (Ferguson, 2011). Libyans should restrict the intake of energy-dense, micronutrient-poor foods (e.g., packaged snacks). They should weigh and measure food to gain an understanding of portion sizes and avoid super-sized menu items, particularly at fast-food restaurants. Libyans should restrict the intake of sugar-sweetened soft drinks as well as alcohol because all these drinks, especially soft drinks or fizzy drinks, tend to be consumed at every meal. In addition to reducing the number of meals per day, Libyans should reduce the number of social gatherings attended in order to avoid being socially pressured into eating too much. A final recommendation is that Libyans should adhere

to Islamic prohibitions against smoking, intoxicants and alcoholic beverages, and consuming certain foods such as pork. They should also avoid going to sleep immediately after eating a meal. Other Islamic obligations that could help to reduce weight include eating breakfast and fasting during the holy month, as well as avoiding overeating. The Prophet is reported to have said, "Eat less and you will be healthier" and "Nothing is worse than a person who fills his stomach."

11.6.1.2 At the community level

To reduce the consumption of large food portion sizes (LFPS) comprised of energy-dense food, the Libyan authorities should cooperate with Libyan restaurants and public-service venues to institute smaller food portion sizes, since large LFPS is one of the risk factors of obesity in Libyan adults. The Libyan authorities should take action to limit TV advertising of less healthy foods and beverages. In addition, leaflets, flyers, pamphlets and menu cards should be distributed to homes and in the streets. Libyan officials should continue efforts to discourage excessive consumption of sugar-sweetened drinks through public policy and education. It is extremely important to actively utilise from Libyan mass media to communicate to the general public include broadcast media, digital media, out door media print media, and event organizing and public speaking , to inform Libyans about healthy eating choices , including reducing consumption of sugar-sweetened beverages,Promoting fruit and vegetable consumption ; reducing the portion sizes of foods, promoting eating daily and healthy breakfast.

LHCPs should work closely with shops, supermarkets, restaurants, cafes and Community Service Volunteers to promote healthy eating choices that are aligning with   existing good practice guidance such as substituting water, diet, or low-calorie beverages instead of sugar-sweetened beverages. Choosing low-fat or fat-free milk is a Ideal method to reduce the public calorie intake and they still obtain the nutrients that milk contains. In addition LHCps can take opportunity to discuss weight, healthy and unhealthy food choices and activity with the health users when they visit them at their clinics for seeking health services.

the Libyan goverment should insitute , so called National Obesity Awareness Week (NOAW) that is similar to the NOAW that established in the UK, which   is organised by the National Obesity Forum, UK. The Libyan public health campaign can highlight programmes that prevent or address obesity through raising public health awareness about healthy eating

practices such as cooking more healthily, avoiding snacks. in addition infomrd the public bout barriers to healthy eating such as a lack of time due to a hectic lifestyle and eating on the run, which in turn can lead to unhealthy food choices. Junk food is often less expensive than healthy food, and when you are on a tight budget, healthy eating can be challenging. The news, magazines and Internet are full of information on what eating healthy entails, and it can be confusing to know what is true and what is not.

LHCPs should be invited to be interviewed on radio programmes to provide information about diver aspect such as the distinguish between healthy and unhealthy foods, why accessing healthy food is a challenge for many Libyan families, particularly those living in low income neighbourhoods, knowledge of what constitutes a healthy diet. While, Libyan officials set a higher tax rate on unhealthy foods and beverages .This t taxes is a potential policy measure to discourage over-consumption unhealthy foods and sugar-sweetened beverages consumption is already applied in several countries such as France, Hungary, and Finland (Cornelsen & Carreido, 2015). The Libyan authorities should improve the availability of affordable healthier foods and beverages in public-service venues. Promoting of healthy food choices could be achived through instead of heavily subsiding staple food commodities that fuel obesity, such as wheat, flour, sugar, rice and oil vegetable, the Libyan government should reduce these subsidies and subsidise healthy foods instead such as fruits and vegetables, particularly in deprived areas.

11.6.2 Recommendations on encouraging physical activity

11.6.2.1 At the individual level

Being physically active has been found to lower an individual's risk for obesity. The experts suggest that limiting the time we spend sitting to just three hours a day could add an extra two years to life expectancy. Libyan adults should engage in aerobic PA and reach the levels of PA recommended by the WHO of at least 150 minutes (2.5 hours) over the course of a week. In order to improve the level of physical activity among Libyans, an active lifestyle should be promoted among Libyans adults. They should minimise the amount of time spent being sedentary for extended periods. This can be facilitated through encouraging Libyans to reduce time spent watching TV, using the computer or playing video games and reduce the time spent travelling by car when they could walk or cycle instead. It can also be facilitated by encouraging Libyans to engage in daily physical activity that promotes health-related fitness.

Walking is the simplest way to start and continue a fitness regime. At the individual level, Libyans should be encouraged to do housework themselves instead of hiring someone else to do it. Similarly, they should work in the garden or mow the lawn themselves. They should be encouraged to walk or cycle to the corner shop instead of driving. Finally they should take the stairs instead of the elevator or lift.

11.6.2.2 At the community level

In order to promote and enhance the physical activity levels of the Libyan community, the Libyan government should improve access to outdoor recreational facilities by providing attractive and affordable exercise options, and enhancing the infrastructure to support cycling and walking. It should also support those localities within easy walking-distance of residential areas, improve access to public transportation, have zones for mixed-use development, and enhance traffic safety and personal safety in areas where the inhabitants are or could be physically active. Admittedly, implementing these recommendations is a challenge for the Libyan government, with several districts of Benghazi having been devastated by political unrest. Thus, a massive amount of work will need to be undertaken to restore the city. As a priority, experts from the developed countries in various fields, such as road designers, builders and engineers, should be invited to allocate to rebuild the damaged infrastructure, re-develop the old builds, and build new infrastructure, such as sidewalks, bike lanes and roads.

The Libyan government should follow the policies that have been successful in other Arab countries and in developed countries, such as enhancing school-based physical education, enhance urban design and land-use, and transportation and travel policies and practices that can encourage active transport by facilitating walking and cycling.Libyan religion and culture requires gender segregation at leisure facilities and sports centres. Therefore encouraging this type of segregation and privacy at municipal leisure facilities would help to encourage Libyan Muslim women to engage in outdoor physical activities. To improve physical activities for both genders, Libya should revive 'World Physical Activity Day' on 6 April, which encourages Libyans to be physically active. Reviving this annual campaign to activate physical activity could encourage the public to 'go outside and do some exercise'.

The next section addresses recommendations for improving the Libyan health system. To curb the obesity epidemic in Libya adults, the free health service should provide promotive, preventive, curative and rehabilitative services of high quality.

At present, the Libyan healthcare system (LHCS) suffers from a shortage of local healthcare professionals, and the migration of health professionals and experts from Libya is a substantial financial burden on the Libyan economy. To date, the majority of health personnel have relied on expatriates, but this leads to relative instability of the healthcare workforce. This instability in turns drives demand because the healthcare workforce in Libya is already facing a critical shortfall of health professionals. More medical colleges and training programmes are required to train more doctors and other health professionals to meet the needs of LHCS. New laws and regulations are urgently required to train, develop and organise human resources in the medical field.

Another difficulty with having a foreign workforce of different nationalities working in the LHCS is that they are unable to speak Arabic or even English. This impedes Libyans from communicating with HCPs and utilising the free health services provided. To overcome this problem, Libyan health authorities should enforce the use of the Arabic or English language in all healthcare-related communication and provide interpretation services to ensure that all healthcare users can benefit from the free health services provided by the Libyan government. Another obstacle is the lack of an electronic health record (EHR) system. As the HCPs work in shifts, this means that each time the patient visits the doctor, they are required to provide their medical history all over again. The Libyan Health Ministry should improve the health service by creating an electronic health information system that collates the information from all the public and private health organisations, and ensure that the e-health system for all health-service users is up-to-date. With their medical history maintained in the e-health system, Libyans are more likely to take advantage of the free health services provided.

As mentioned above, a reason for the low level of medical services provided in Libya is that the majority of health officials in Libya are unqualified or their qualifications are not related to administration or to the health field. Therefore, the Libyan government urgently needs to replace the unqualified health officials with qualified members or institute intensive training courses to improve efficiency and recruit those more qualified to administer such health facilities and provide high-quality health services.

The consecutive provisional Libyan governments have completely disregarded health awareness programmes and campaigns, whether at the individual, local or national level.

Consequently, many Libyans still believe that consuming olive oil in the morning is healthy and that obesity is a symbol of affluence and beauty. To dispel many of the myths and misconceptions held by Libyans about obesity, the Libyan government should prioritise the development of a comprehensive health education programme. This can be achieved through either inviting experts from developed countries to give training sessions for health professionals or by raising awareness among the general public through a variety of mass media about global causes of obesity, as well as consequences, prevention, and control. Existing programmes that have succeeded in fighting against the obesity epidemic in other Arab countries could also be applied.

11.7 Future research

This thesis has identified a number of key issues relevant in our understanding of the risk and protective factors associated with obesity amongst Libyan adults. Future research should seek to conduct more focused investigations based of the findings presented.

The first phase of this mixed-methods design used a cross-sectional design. This precludes making causal inferences about the association between obesity and the four predictor variables: socio-economic status (SES); unhealthy eating habits; physical activity (PA) and sedentary behaviour (SB) patterns; and neighbourhood environmental factors; that is, the risk and protective factors. In order to draw causal inferences, results from experimental research and longitudinal studies, such as prospective and retrospective cohort studies, are urgently needed to provide stronger evidence of causality for these associations than the observational studies, in the form of a cross-sectional design, can provide.

There is a substantial lack of qualitative research on obesity in the Arab region (Musaiger, 2011). This thesis failed in the second phase to specify the qualitative approach and therefore followed other studies in describing the inductive approach as "semi-structured interviews". Therefore it is necessary to address the topic of obesity using a pure qualitative approach, whether a narrative study, case study, phenomenology or ethnography or grounded theory. Different data collection methods should be used such as focus group discussions or in-depth interview with obese Libyans adults or with Libyan lay people.

Many groups of Libyan adults were excluded from the present study due to not meeting the eligibility criteria (see Chapter 5, Section 5.1.1). These included pregnant women, amputees,

and those ineligible to vote in the elections. Obesity among such groups should be addressed in future research and participants should be recruited using methods other than the Electoral Register as the sampling frame.

Given the multifactorial causation of obesity, this study dealt with numerous risk and protective factors that contribute to or reduce obesity in Libya. However, there are other risk and protective factors that my study failed to address including other unhealthy eating habits such as: the frequency of unhealthy snacking; emotional eating; food binging; eating during other activities; distracted eating; eating late at night; and drinking too much alcohol. Furthermore, some habits such as quitting smoking cigarettes and psychological factors such as 'emotional eating' were not investigated in the present study. Many people eat excessively in response to emotions such as boredom, sadness, stress, or anger, a lack of sleep and poor body image. Thus, future research is desperately needed to include these additional risk and protective factors and explore their relationship with the obesity epidemic in Libya.

The present study explored the association between built environment attributes, physical activity and obesity. However, it digressed to investigate the association between the neighbourhood food environment and obesity. Future study should therefore explore the association between neighbourhood fast-food restaurants and obesity (i.e., when, where, and what Libyans citizens buy and eat). This should be carried out in various neighbourhoods across Libya.

11.8 Conclusion

Similar to other Arab countries, Libya is undergoing demographic and epidemiological transitions, as well as a nutrition transition, which refers to traditional diets being increasingly replaced by Western diets, including fast foods and sugar-sweetened beverages. The purpose of this study was to investigate and explore a range of risk and protective factors associated with obesity in Libya. An adapted mixed-methods sequential explanatory design, consisting of two distinct phases, was selected, following the recommendation of 'obesity researchers' and 'obesity experts'. The Socio-Ecological Model (SEM) was used to guide the selection of potential risk and protective factors associated with the escalating obesity epidemic in the Libyan adult population. Priority was given to non-modifiable risk factors which mostly belong to the individual level of the SEM. Among the non-modifiable risk factors, priority was given to socio-economic factors since Libya was classified as a 'high human development' country.

Both sides of the 'energy-balance equation' were considered: on the one hand, the factors related to energy intake (represented by unhealthy eating habits) and, on the other hand, the factors related to energy expenditure (represented by physical activity and sedentary lifestyle). Obesity researchers are increasingly paying attention to the role of the neighbourhood environment in creating 'obesogenic environments', hence this factor was explicitly addressed in the present study.

The findings of this study confirmed that obesity is one of the fastest growing and most serious public health challenges confronting the Libyan government. It also confirmed that multifaceted behavioural and societal factors contribute to obesity in Libyan adults. In addition, some differences were identified between Libyan men and women in terms of the risk and protective factors studied in both phases of this mixed-methods study such gender disparities exist in physical activity and sedentary behaviour. This study's findings about the risk and protective factors that may contribute to or alleviate the obesity epidemic in Libyan adults form a sound base from which to develop obesity prevention initiatives, including strategies for minimising the risk factors and enhancing the protective factors in the Libyan population.

While some of the risk and protective factors identified in this study were consistent with the literature such as consuming fast food, others were not such as neighbourhood environment factors, SES , PA and sedentary behaviour. Two prominent risk factors were the deterioration of the Libyan health-sector performance, which discourages Libyans from taking advantage of the free medical services, and the deterioration of the environment in Benghazi due to the fighting between the militias, which has made the environment hazardous for pedestrians and turned some communities into ghost towns. Many streets and vital institutions have been destroyed by the conflict, while the evening curfew imposed by the Libyan government deters the residents further from being physically active and reduces their access to healthy, fresh foods in their localities. The findings of the present study could inform the interventions that are urgently needed for preventing or controlling the obesity epidemic. Such interventions may include reducing the subsidisation of staple food commodities which fuel the obesity epidemic, and increasing the subsidisation of healthy foods instead. Those buildings and infrastructures that have been destroyed need to be repaired or re-developed, and new infrastructure built. In addition, public health awareness needs to be raised in order to dispel the many myths and misconceptions held by Libyans about obesity. Finally, the Libyan healthcare system needs to be improved in order to encourage Libyans to make use of it.

While the present study aimed to address as many risk and protective factors as possible, a number of such factors were not addressed. Factors that should be investigated in future studies include unhealthy eating habits such as the frequency of snacking and emotional eating, and other addictive habits such as excessive alcohol consumption and smoking cigarettes. In addition, more sophisticated analysis is needed to draw causal inferences, such as longitudinal designs and nationally-representative survey to monitor and describe secular trends in obesity. Purely qualitative approaches are also urgently needed to elicit people's beliefs, experiences and perceptions in-depth in order to continue developing our understanding of the factors associated with obesity epidemic.

11.9 Things the researcher would have done differently

If I had to conduct my study all over again, I would change the following three aspects.

- First, the area in which I gathered data, namely, Benghazi, the second largest city in Libya. The fighting between militias in Benghazi emerged unexpectedly midway through my study. This impacted not only on the data collection for the pilot study for the qualitative phase of this study and the main study, but also the research design ,which is then termed an adapted mixed-methods sequential explanatory design. Although it was not possible to predict such political unrest, in hindsight I would have collected my data from the third largest city in Libya, Misrata. After the overthrow of Gaddafi regime in 2011, this has proven to be the most stable and secure area in Libya.

- Second, my study interviewed only key informants (healthcare professionals and Libyan community leaders). It would have enhanced my study to recruit ordinary Libyans (both obese and overweight) for the interviews. This would have enabled me to explore the level of knowledge about health-related matters and obesity among the public, and elicit their perceptions of Libyan men and women is overweight and obese.

- Third, I used only gender as my independent variable. If I had to conduct my study again, I would include other socio-demographic factors such as age and SES as predictor variables. This would further enhance our understanding of the factors influencing obesity.

Chapter Twelve : References

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Chapter Thirteen Appendices

Appendix 2.1 Summary of prevalence of overweight and obesity among Libyan children, adolescents, and adults, 1999-2015.

Table 2.1: Summary of prevalence of overweight and obesity among Libyan children, adolescents, and adults, 1999-2014.

Reference	Name of survey / date	Gender	Age	Sample size	Definition	Overweight %	Obesity %	Both genders overweight %	Both genders obesity %
(Lancet, 2014)	**Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013.**	**Male**	**30-100**	**Est.***	**(BMI) (kg/m²)**		**30·2**	**Overweight and obese 70·6%**	
		Female	**30-100**				**57·2**	**Overweight and obese 77·0%**	
WHO-NCDs Country Profiles, 2011. And MOH, 2010	**National Survey 2009**	**Male**	**20-100**	**1800**	**BMI Crude Estimate**	**57.5%**	**21.4%**	**63.5%**	**30.5%**
		Female		**1790**		**69.8%**	**40.1%**		
WHO Global InfoBase, 2012	**WHO Global comparable, 2005**	**Male**	**15-100**	**est.**	**(BMI) (kg/m²)**	**48.8 %**	**11.4 %**	**53.2 %**	**17 %**
		Female	**15-100**			**57.5 %**	**22.5 %**		
WHO Global InfoBase, 2012	**WHO Global comparable, 2002**	**Male**	**15-100**	**est.**	**(BMI) (kg/m²)**	**47.6 %**	**10.7**	**51.8 %**	**15.9 %**
		Female	**15-100**			**56**	**21.1**		
Eastern Mediterranean Health Journal, 2009	**Nutritional Status of Under-Five Children in Libya; A National Population-Based Survey, 2003**	**Male**	**0-5**	**2702**	**BMI/age > 2SD (WHO)**	**17.5 %**	**8.2 %**	**13.4%**	**10.1 %**
		Female	**0-5**	**2646**		**14.8 %**	**11.8 %**		
MOH, 2001 and FAO, 2005	**A National among all 7 provinces in Libya, 1999**	**Male**	**15-50**	**334**	**(BMI) (kg/m²)**	**19.2%**	**5.8 %**	**20.1 %**	**6.4 %**
		Female	**15-50**	**350**		**21.2 %**	**7.1 %**		
MOH, 2007 and WHO, 2007	**Global school-based health survey (GSHS), 2007**	**Male**	**10-18**	**2242**	**BMI-for-age >= 85th percentile**	**13 %**	**5.8 %**	**15.2%**	**6.5%**
		Female	**10-18**			**17.4 %**	**6.5 %**		
Journal of Obesity, 2012	**Adolescents in Seven Arab Countries: Cross Cultural Study, 2012**	**Male**	**15-18**	**630**	**BMI-for-age >= 85th percentile**	**16.4 %**	**9.6 %**	**21.5 %**	**9.3%**
		Female	**15-18**			**26.6 %**	**10 %**		
MOH,2009 And WHO,2009	**National Libyan family health survey. PAPFAM surveys, 2008**	**Male**	**0-5**	**2 167**	**BMI/age > 2SD (WHO)**	**24.5 %**	**14.4%**	**22.4%**	**16.9%**
		Female	**0-5**	**2 188**		**20.3%**	**18.3%**		

Estimation by WHO-EMR = Est.*

Appendix 5.1 Rationale for specifying the particular inclusion and exclusion criteria.

5.1 Inclusion criteria

5.1.1 Rationale for including ages 20-65 years

A five-year longitudinal follow-up study by Shimokata et al. (1989) found that weight gain continues until about age 65, after which weight tends to drop off. This finding is supported by Chumlea et al. 1999 and Guo and Chumlea (1999), both reporting on the Fels Longitudinal Study, who contend that men and women gain weight until about age 65. Similarly, several prospective cohort studies found that the critical age at which adults, both males and females, gain weight is between middle-age until age 65 years; thereafter weight and muscle mass begin to decline (Sheehan ,.et al2003). The WHO and CDC also suggest that the chronological age of 65 years and above is 'elderly' in both developed and developing countries (CDC, 2016b; WHO, 2016a). As my focus is adults and obesity (explained further below) rather than the elderly, it was logical to select age 65 as the maximum age of participants in my study.

The topic of obesity has been widely researched in both developed and developing countries, including Arabic countries, and its various aspects have been addressed, such as etiology, complications, prevention, and weight management . The 20-65-year-old age group has previously been researched but without justifying its selection (Chamieh, 2013; Dalvand, et al., 2015; Oyeyemi et al., 2013). As these studies use the same age range as in my study, it was useful to compare their findings to those of my study. Selecting 65 years as the upper limit of my age range ensured that a range of lifestyle changes were included in my sample. In addition, the fact that adults tend to be more knowledgeable and experienced about various aspects of life than younger age groups will maximise the chance of generating fruitful dialogue with the participants and obtaining valid information about obesity, particularly when conducting the semi-structured interviews for the second phase of this study. The following section explains why I excluded adolescents from my study.

Despite a lack of consensus among researchers as to when adolescence starts and ends (May, 2001), several prominent international organisations consider adolescence to extend from age 10 to 19; those aged 15-24 years are considered to be 'youths', and those aged 10-24 years are considered to be 'young people' (Unicef 2011; WHO, 2014b). Several studies conducted in Libya have addressed obesity in terms of the lifestyle and behaviours of school children (El Taguri et al., 2008, 2009) and adolescents (Buzgeia et al., 2007; Musaiger et al., 2012). Duplicating these age-groups for my study may therefore fail to add value to the literature. In addition, adolescents tend to be more vulnerable than adults, indulging in unhealthy or risk-

taking behaviours such as consuming fast foods, alcohol and smoking, which may or may not persist into adulthood. Therefore, in order to maximise the chance of analysing more stable and enduring findings, I ruled out adolescents and selected to study adults instead.

According to both the WHO and CDC, calculating BMI using BMI-for-age growth charts for both children and adolescents is problematic because such charts are sensitive to both age-and sex-specific groups and are more complicated for children than they are for adults because children's BMI changes as they mature. According to both the CDC and WHO, children and adolescents aged 2 to 19 years are considered obese if their BMI is at or above the 95th percentile for children and teens of the same age and sex (CDC, 2015b; National Obesity Observatory (NOO), 2011; WHO, 2014b). Like children, adolescents have been found to be sensitive to the BMI cut-off points, compared to adults groups. This was another reason to exclude adolescent groups from my sample: to minimise distortions in my results and maintain homogeneity and standard values of BMI for the entire sample.

5.1.2 Rationale for specifying residency in Benghazi for over ten years

It was necessary for the participants to be sufficiently familiar with the neighbourhood environment in Benghazi, given that neighbourhood environment is one of the key variables of this study for understanding the risk and protective factors associated with obesity. A study of obesity in Nigeria required participants to have lived in the identified neighbourhoods "in the last year" (Oyeyemi et al., 2013); however, one year is arguably insufficient for participants to become acculturated to a neighbourhood environment. On the contrary, a substantial body of literature found that various immigrant subgroups living in a host environment for more than 10 years were significantly more prone to acculturating to an obesogenic environment and to increasing BMI levels than their counterparts who had lived there for fewer than 10 years (Goel et al., 2004; Shah et al., 2015) (see Chapter 2 Literature review, Section 2.6.2).

Given that Benghazi is the economic and trade capital of Libya, it attracts many expatriate workers from various countries, as well as from other Libyan cities and villages, who arrive to invest and live in Benghazi. In addition, after the Libyan revolution in 2011, many displaced Libyans flocked to Benghazi in search of safety and a new settlement, including thousands of forces families loyal to the old dictatorial regime and a number of nomads who fled from tribal conflicts in the desert (Bredeloup & Pliez, 2011; Bredeloup, 2012; Morris, 2013). Migrating from the Sahara Desert and other areas of deprivation in Libya to the city of Benghazi is arguably tantamount to migrating from one culture to another. Consequently, those migrants

are likely to acculturate to an obesogenic environment which might lead to higher levels of obesity among this population. Thus, aligned with my pragmatic approach, I stipulated that participants must have resided in Benghazi for over ten years as one of my eligibility criteria for participation.

5.1.3 To be eligible to register to vote

Several changes were made to Libyan Electoral Law in 2012 after Libyan revolution (2011), including the minimum age at which Libyan citizens are allowed to enrol on the electoral register: this was reduced from age 20 to age 18. According to Libyan Electoral Law 2012 under Part III: The Right to Vote under article (4), any persons determined legally incompetent, with mental illness, or incarcerated, people involved in the corruption of political life during the old regime rule; those who are affiliated to official military institutions and those working in the police force, or as judges, as well as those convicted of crimes stipulated in the penal code are prohibited from participation in the election process (High National Elections Commission of Libya (HNEC), 2013). The following section explains my exclusion criteria.

5.2 Exclusion criteria

Using portable equipment to measure BMI poses some limitations on the types of participants that it can be used on. Two prominent survey studies that have concurred on the exclusion criteria for participants in obesity studies using portable equipment include: the Health Survey for England (HSE) (2006) on cardiovascular disease and risk factors in adults (Craig & Mindell, 2008) and the Scottish Health Survey (SHS) (2011) on obesity (Gray & Leyland, 2011). Both contend that portable equipment is problematic for providing accurate measurements for those who: (1) are pregnant, (2) are chair-bound, (3) weigh more than 130 kilograms (kgs), (4) wear a wig or a turban (because it impacts on height), (5) are unsteady on their feet.

As my study relies on portable equipment, I have adopted three of the above exclusion criteria, aligned with my pragmatic approach: participants who: (1) are pregnant, (2) are chair-bound, (3) are unsteady on their feet, whether as a result of a temporary condition or a chronic problem such as damage to the legs and feet including the bones, joints, blood vessels, muscles, and other soft tissue (Hirani & Stamatakis, 2005). However, it was not necessary to exclude those who (4) weigh more than 130kgs, and (5) wear a wig or a turban, as explained below.

Firstly, I used the Tanita BC-601 Segmental Body Composition Monitor with a maximum capacity graduation of 150kgs or 330lbs or 23 stone. This means that I could include

participants who weigh more than 130kgs. It is important to include those weighing more than 130kgs because they can provide critical information about risk and protective factors associated with obesity, thereby addressing one of the pivotal research questions of this study. If a participant's weight exceeded the capacity of the instrument (150kgs), I referred that person to the nearest health clinic in order to be weighed, at a time mutually convenient to the participant and the clinic. Most clinics in Benghazi are equipped with medical mechanical beam scales called the Health O Meter 500 KL electronic fitness scales which weigh up to 220kgs or 500 pounds.

Secondly, the wearing of wigs has been forbidden for both men and women by Islamic law. In addition, Libyan men are unwilling to wear turbans like their counterparts in Arab Gulf. Hence, it was highly unlikely that the participants in my study would wear them. If such cases were however encountered such as headcovering (headscarf or hijab) worn by Muslim women, the professional nurses could deal with them appropriately (see protocol for taking anthropometric measurements in Appendix 5.15). In reducing the list of exclusion criteria, I have increased my chances of recruiting as many research participants as possible. However, it was necessary to add two new exclusion criteria.

While conducting my pilot study, I encountered some participants who were amputees. In such cases, the measurement obtained by using the standard method was generally an underestimate, incorrectly reflecting their body shape and size and necessitating that the standard BMI formula be adapted to account for the estimated weight of the missing limb (Mozumdar & Roy, 2004). I found that it was more prudent to add amputees to my exclusion criteria.

Lastly, I excluded those Libyans who are not permitted to vote (see Section 5.1.3 on the inclusion criteria) including any persons determined to be legally incompetent or with a mental illness. However, as I used the electoral register of Benghazi as my sampling frame, any potential participant who might be in a state of mental distress was automatically ruled out during fieldwork, due to the voting rules and procedures. Consistent with my pragmatic approach, I have adopted 3 out of 5 of the exclusion criteria stipulated by previous studies the HSE (2006) and the SHS (2011). In addition, I added "amputees" as an additional exclusion criterion for my study, as well as Libyans who were excluded from enrolment and voting.

Libyan Embassy
Cultural Attaché - London

سفارة ليبيا
الملحقية الثقافية - لندن

وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education & Scientific Research

Our Ref 43/11/2013

25/11/2013

Appendix 5.2 Libyan Embassy Approval: to conduct fieldwork and data gathering.

To: The Principal
Omar Al-Mukhtar University
Libya

Hamdi Abdulla Lemamsha (Ref No – 8998)
Field Study in Libya

Dear Principal,

We confirm that Mr Hamdi Abdulla A. Lemamsha is sponsored by the Cultural Attaché at the Libyan Embassy in London to undertake a PhD degree in Public Health at the University of Bedfordshire for the period from 01/10/2012 to 30/09/2015.

Mr Hamdi Lemamsha would like to conduct a fieldwork in Libya as part of his PhD research work about the risk and protective factors associated with obesity amongst adults aged 20 to 65 years.

We would be grateful if you could provide Mr Lemamsha with all support he will need during his fieldwork.

Should you require any further information, please do not hesitate to contacting us.

Yours Faithfully,

Dr Abdelbasit A. Gadour
Cultural Attaché
Libyan Embassy – London
UK

Omar AL Mukhtar University

جامعة عـــمر المختار
الادارة العامة

الموافق : 12، 1، 2014
التاريخ ،
الرقم الاشاري :........U.O.A.18.......

Dear Chairman of the Municipal Council of Benghazi,

Re: Mr. Hamdi Abdulla A. Lemamsha a PhD student at the Institute for Health Research at the University of Bedfordshire, UK.

I/we have included two letters for you to consider. The first is an approval letter from the **Libyan Cultural Attaché at the Libyan Embassy London, UK**, issued in order to allow Mr. Lemamsha to conduct his study. The second is a letter from Professor **Gurch Randhawa**, the student's supervisor, which explains the whole study in detail.

Therefore, we would be grateful if **Mr. Lemamsha** could be allowed to access the Electoral Registry for the purpose of obtaining samples for his study titled, *"Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya."*

This study will receive ethical approval from the Institute of **Health Research Ethics Committee (IHREC)** at **Bedfordshire University, UK**. Once the student provides us with evidence of his permission from the IHREC to undertake his fieldwork, we will issue further ethical approval to enable him to conduct his study.

Should you require any further information or have any additional questions, please do not hesitate to contact us at the above address. We would be pleased to answer any enquiries that you may have.

Yours sincerely

Dr. Agoub A. M. Agoub

Vice President of Omar Al-Mukhtar University, El-Biada, Libya

Omar AL Mukhtar University p.o.box: 919 EL Beida Libya

Omar AL Mukhtar University

جامعة عــمر المختار

الادارة العامة

الرقم الاشاري : ....٢٠١٤/..........   التاريخ :   الموافق : ٨ / ١ / ٢٠١٤

<u>السيد : رئيس المجلس المحلي – بنغازي</u>

السلام عليكم

في أطار التعاون بين مؤسستنا العلميه من اجل الرقي والدفع بعجله التقدم الي الامام. عليه احيل اليكم أجراءات الخاصه

بموضوع : السيد حمدي عبدالله لمامشه طالب دكتوراه في معهد "البحوث الصحية" بجامعة بيدفوردشير، المملكة المتحدة

ويتلخص موضوع الطالب هورغبته في مناشدتكم بتضليل الصعاب لتمكنه لاجراء دراسته الميدانيه بقطاع الصحه ببنغازي أسندا علي الرسائل المرفقه وهي الرسالةالأولي: متضمنه موافقة من "الملحق الثقافي الليبي بالسفارة الليبية لندن، بريطانيا ،تفيد منح الطالب الاذن لتنفيذ الدراسه . والثانيه هو رسالة من البروفيسور قوش راندهاوا، المشرف الاكاديمي للطالب، تتضمن كل التفاصيل المتعلقه باجراء الدراسة الميدانيه بكامل تفاصيلها.

ولذلك، سنكون ممتنين بموافقه سيادتكم للطالب للوصول إلى "السجل الانتخابي" كخطوه أول لغرض الحصول على عينات عشوائية المحتمله المتعلقه بالدراسه الحاليه تحت عنوان، **"استكشاف المخاطر والعوامل الوقائية المرتبطة بالسمنة بين البالغين الذين تتراوح أعمارهم بين ٢٠ و ٦٥ سنة: دراسة حالة في بنغازي، ليبيا"**

في حاله ما أنا كان اي أستفسار أو طلب مزيد من المعلومات أو أي أسئلة إضافية، لا تترددوا في الاتصال بنا على العنوان المذكور أعلاه. سيكون من دواعي سرورنا الإجابة على أي استفسارات لديكم.

ولكم منا جزيل الشكروالتقدير

الدكتور شكري السبيع

رئيس جامعة عمر المختار / درنه

المفوضية الوطنية
العليــا للانتخابــات

High National Elections Commission

Date: 2014/01/27
No. HNEC-01-15-LE-0060

To Whom It May Concern

Good day,

I would like to inform you that "Mr. Hamdi Lemamsha", a PhD Student at the Institute for Health Research at the University of Bedfordshire, UK, Have visited the **High National Election Commission** (HNEC) headquarters based in Benghazi, several times, in order to obtain data from the electoral registry. The objective was to capture the target population for his study to address obesity amongst Libyan adults aged between 20-65 in Benghazi. As a result of his visits, Mr. Lemamsha was able to exclude all the participants who are not eligible for his project. Furthermore, he selected a sample of 512 voters for the purpose of his research, using a multistage cluster sampling technique.

Once we granted him approval to access the entire electoral registry he attended a number of sessions with us, and had the assistance of our experienced staff. The Electoral Commission emphasize that all information concerning the voters has to be confidential and it is prohibited to copy, record or photograph any information from the electoral registry using any form of electronic devices. According to the laws and regulations of the Constitutional drafting Assembly (Law 17). Therefore, He was allowed to take only the data of the sample group, which as previously mentioned, consists of 512 Libyan adults. Consequently, the researcher will be able to make contact with those represented in the final sample, in order to enable him to proceed with his work.

Best regards.

27.01.2014

Dr. Jamal B. Bugrien

Head of Benghazi Election Commission

Associate Professor at Benghazi University

المفوضية الوطنية
العليا للانتخابات
High National Elections Commission
اللجنة الانتخابية بنغازي
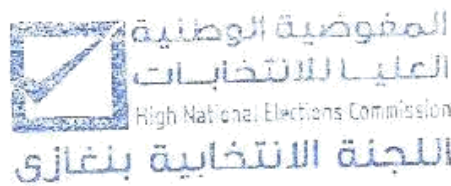
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Libya – ليبيـــا
Tripoli – طرابـلـس
Ghot Al.Shaal – غوط الشعال

Appendix 5.6a Determining Sample Size Using the formula of size and the guidance table.

<u>Approaches to determining the sample size:</u>

1. Using the formula:

$$SS = \frac{Z^2(p) \times (1-p)}{C^2}$$

Where: SS = Sample Size
The Z-value for the desired of confidence level of 95% = 1.96
P = the estimate of expected proportion with the variable of interest in the population (.5 used for the sample size required)
C = the desired Confidence interval (e.g., .04 = +/- 4 percentage points) (Israel, 2013).
Therefore $SS = \frac{1.96^2(0.5) \times (1-0.5)}{0.05^2}$ =**384** individual

2. **Using a web-based sample size calculator:** at (http://calculators.stat.ucla.edu) I entered all desired values in empty cells and I clicked on submit query to obtain the required sample. See figure (5.6.1)

Determine Sample Size

Confidence Level: ◉ 95% ○ 99%

Confidence Interval: 5

Population: 296,813

Sample size needed: 384

3. Using the guidance table: The table provides the value of the required sample size for any study. Several researchers suggest that the first column of the table with a confidence level of 95% and a margin of error of 5% is acceptable for many researchers formula (Kenya Projects Organization (KENPRO), 2012). The guidance table is presented in the following table.

Appendix 5.6b Computing sample using the guidance table

Required Sample Size[†]

Population Size	Confidence = 95%				Confidence = 99%			
	Margin of Error				Margin of Error			
	5.0%	3.5%	2.5%	1.0%	5.0%	3.5%	2.5%	1.0%
10	10	10	10	10	10	10	10	10
20	19	20	20	20	19	20	20	20
30	28	29	29	30	29	29	30	30
50	44	47	48	50	47	48	49	50
75	63	69	72	74	67	71	73	75
100	80	89	94	99	87	93	96	99
150	108	126	137	148	122	135	142	149
200	132	160	177	196	154	174	186	198
250	152	190	215	244	182	211	229	246
300	169	217	251	291	207	246	270	295
400	196	265	318	384	250	309	348	391
500	217	306	377	475	285	365	421	485
600	234	340	432	565	315	416	490	579
700	248	370	481	653	341	462	554	672
800	260	396	526	739	363	503	615	763
1,000	278	440	606	906	399	575	727	943
1,200	291	474	674	1067	427	636	827	1119
1,500	306	515	759	1297	460	712	959	1376
2,000	322	563	869	1655	498	808	1141	1785
2,500	333	597	952	1984	524	879	1288	2173
3,500	346	641	1068	2565	558	977	1510	2890
5,000	357	678	1176	3288	586	1066	1734	3842
7,500	365	710	1275	4211	610	1147	1960	5165
10,000	370	727	1332	4899	622	1193	2098	6239
25,000	378	760	1448	6939	646	1285	2399	9972
50,000	381	772	1491	8056	655	1318	2520	12455
75,000	382	776	1506	8514	658	1330	2563	13583
100,000	383	778	1513	8762	659	1336	2585	14227
250,000	384	782	1527	9248	662	1347	2626	15555
500,000	384	783	1532	9423	663	1350	2640	16055
1,000,000	384	783	1534	9512	663	1352	2647	16317
2,500,000	384	784	1536	9567	663	1353	2651	16478
10,000,000	384	784	1536	9594	663	1354	2653	16560
00,000,000	384	784	1537	9603	663	1354	2654	16584
300,000,000	384	784	1537	9603	663	1354	2654	16586

Confidence level of 95% & a margin of error of 5% for target population of 296,813.

Thus, the sample size = 384 individuals.
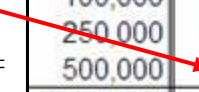
Appendix 5.7 A schematic diagram of multistage cluster sampling.
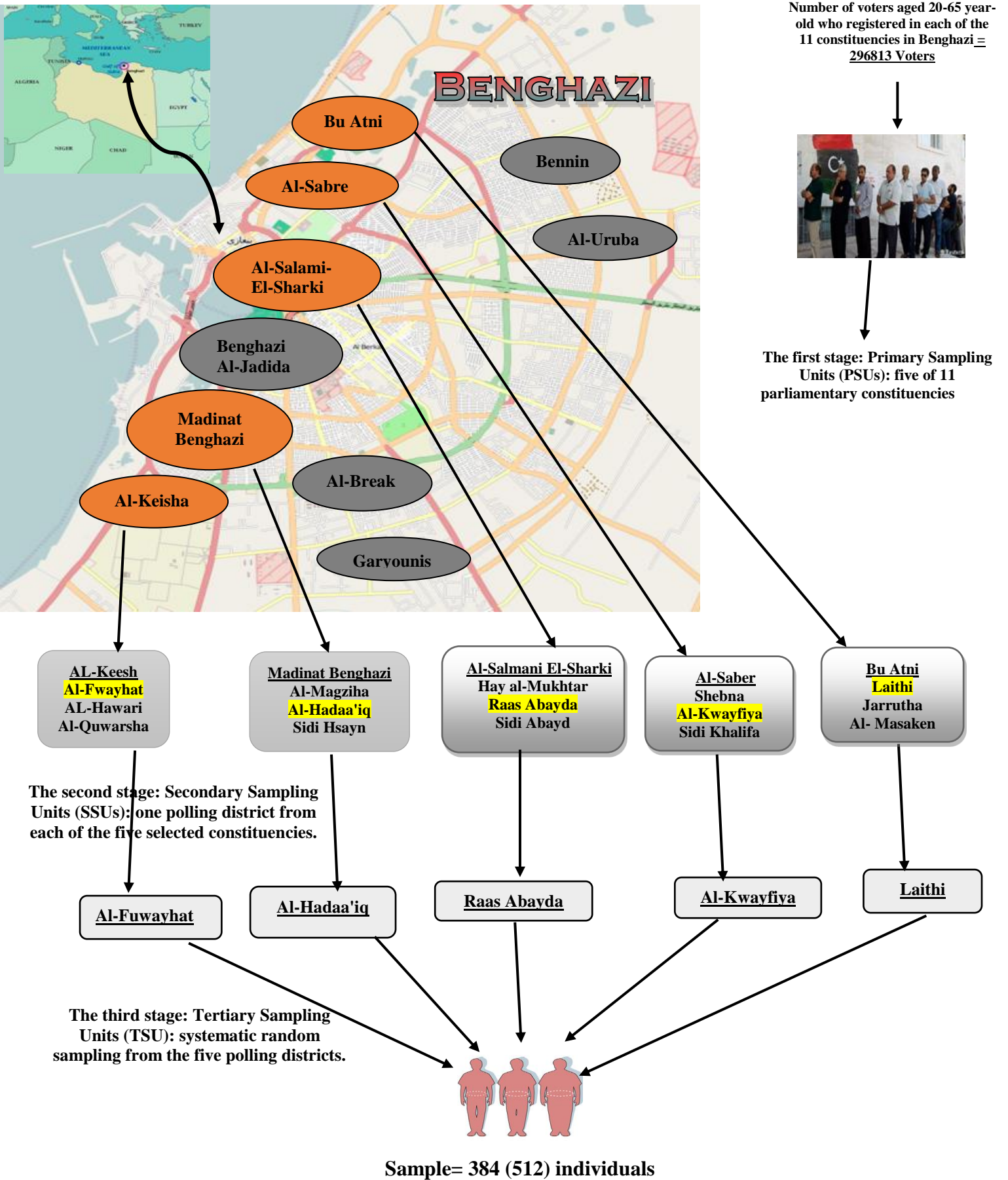
Appendix 5.8 Building the sampling frame and applying multistage-cluster sampling technique

5.0 Sampling procedure for this study

Once the researcher obtained a letter of approval that allowed access to the electoral register, I immediately commenced my task of building the sampling frame for this study. Based on the Libyan Bureau of Statistics and Census (LBSC) (2012), the total population of Libya in (2012) is currently estimated to be 5,185,838. At present, the population of Benghazi stands at **562,167**, with the number of households in Benghazi amounting to **105,381** (LBSC, 2013).

Age group	Males	Females	Total
20-24	28,229	26,667	54,896
25-29	25,931	24,147	50,078
30-34	25,564	24,190	49,754
35-39	23,072	23,795	46,867
40-44	18,957	19,937	38,894
45-49	14,228	14,733	28,961
50-54	10,588	10,517	21,105
55-59	7,097	7,741	14,838
60-65	6,609	7,034	13,643
Total	160,275	158,761	319,036

Table 5.8.1: Targeted age groups in Benghazi based on the 2012 census.

Benghazi's electoral roll is similar to that of other cities in Libya and does not contain the entire population, as in developed countries. This is because some citizens have not enrolled to vote. According to Libyan Electoral Law 2012 under Part III: The Right to Vote under article (4), any persons determined legally incompetent, with mental illness, or incarcerated, people involved in the corruption of political life during the old regime rule; those who are affiliated to official military institutions and those working in the police force, or as judges, as well as those convicted of crimes stipulated in the penal code are prohibited from participation in the election process (High National Elections Commission (HNEC), 2014). The Audience and Business Research Analysis and Development Organization (2006), argues that researchers should avoid using the electoral roll unless it represents at least 90% of the entire population. If it does not then they should search for an alternative list that represents a more suitable target population.

Therefore, to obtain a rigorous structure and representative sample for this study, the researcher calculated the following percentages to assess whether the electoral registry complied with the standard requirements to be adopted as the framework. One of the figures that I calculated was the percentage of all Libyan people registered to vote in the 2012 municipal council election in Benghazi, the eligibility being aged 18 years and over, to the total population of the same group: 349,410 / 371,633 = 94%. As this percentage is within the recommended range, I adopted the electoral register as the sampling frame for this study.

Further consideration was given to the percentage of Libyan people registered to vote in the 2012 municipal council election in Benghazi, aged 20-65 years, to the total population of the same group: (296,813) / (319,036) x 100 = 93%.

In addition to the aforementioned calculation, it is important to compute the percentage of Libyan people included in the 2012 electoral registry municipal council election in Benghazi, aged 20-65 years to the total population in the electoral registry in 2012: (296,813) / (349,410) x 100 = 85%.

The percentages of 93% and 85% were considered satisfactory results in association with the advice of the Audience and Business Research Analysis and Development Organization (2006).

Building the Sampling Frame and Selecting Clusters:

The first step: In compliance with the exclusion criteria for this study, which is based on individuals aged between 20-65 years old, I started to clean and create the sampling frame by eliminating people aged 18 and 19, in addition to those who were more than 65 years old.

Below are two tables: Table 5.8.2 illustrates the entire number of voters aged 18 and above in all 11 parliamentary constituencies, whereas Table 3 shows the number of voters from 20-65 years after cleaning the data.

Table 5.8.2: Number of voters registered **in each of the 11 constituencies in Benghazi** aged 18 and above, who are eligible to vote.

S.N.	11 Constituencies	No of registered voters all ages
1	Al-Break	26237
2	Al-Keisha	32152
3	Al-Sabre	31854
4	Al-Salami-El-Garb	23272
5	Al-Salmani-ElSharki	35556
6	Al-Uruba	29297
7	Benghazi al-Jadida	37968
8	Bu Atni	31908
9	Benina	27728
10	Garyounis	13875
11	Madinat Benghazi	59563
Total		349410

Table 5.8.3: Number of voters aged 20-65 year-old who registered in each of the 11 constituencies in Benghazi.

S.N.	11 Constituencies	No of registered voters aged (20-65 yrs)
1	Al-Break	23,126
2	Al-Keisha	29,588
3	Al-Sabre	25,628
4	Al-Salami-El-Garb	21,517
5	Al-Salmani-ElSharki	30,349
6	Al-Uruba	24,649
7	Benghazi al-Jadida	31,096
8	Bu Atni	28,344
9	Benina	21,060
10	Garyounis	11,036
11	Madinat Benghazi	50,420
Total		296,813

The five constituencies selected in the multistage clustering sampling.

The second step: In this step, I applied the multi-stage cluster sampling method and selected five constituencies. Consequently, five polling districts were withdrawn (see Appendix 5.7 for details).

Table 5.8.4 demonstrates how I performed the calculation to compute the percentage of voters in each selected constituency from the study population, and percentage of voters in each selected polling district from voters in each constituency.

Table 5.8.4: Percentage of voters in each selected constituency from the target population and percentage of voters in each selected polling district from voters in each constituency.

Five constituencies	No of registered voters in each Selected constituency	% of registered voters in each selected constituency from the study population	Five selected polling districts of each constituency	Number of registered voters in each polling district	% of voters in each selected polling district from registered voters in each constituency
Al-Keisha	29,588	9.97 %	Al-Fuwayhat	8,012	27%
Al-Sabre	25,628	8.63 %	Al-Kwayfiya	10,433	40.7%
Al-Salmani-ElSharki	30,349	10.23 %	Raas Abayda	8,480	27.9%
Bu Atni	28,344	9.55 %	Laithi	11,858	41.8%
Madinat Benghazi	50,420	16.99 %	Al-Hadaa'iq	19,102	37.8%
Total	164,329	55.37%		57,885	

The third step: In this step, I calculated the number of potential participants from each one of the five polling districts, which represented the size of the required sample for this study. This resulted in 384 participants. In addition, I estimated the proposal sample when I justified and assumed the assumption of 75% as the maximum response rate that I might achieve. The outcome of the calculation process after taken this assumption into account equalled 512 participants. Table 5.8.5 demonstrates all the relevant processes that were conducted.

S. N.	Five selected polling district of each constituency	Number of registered voters in each polling district in ultimate sampling units	Required % of registered voters in each polling district	Number of participants in each polling district	
				An origin sample size = 384	Hypothesised Sample size = 512
1.	Al-Fuwayhat	8,012	13.8 %	53	71
2.	Al-Kwayfiya	10,433	18 %	69	92
3.	Raas Abayda	8,480	14.7 %	57	75
4.	Laithi	11,858	20.5 %	79	105
5.	Al-Hadaa'iq	19,102	33 %	126	169
Total of ultimate sampling units		57,885	100 %	384	512

Table 5.8.5: Percentages for each polling district signify the required sample size and number of participants.

A sampling interval (SI) is derived by dividing the total number of study population in the sampling frame by the required sample size. After calculating a sampling interval, a random person was selected from each polling district. Despite the fact that some researchers used a table of random numbers in most statistics textbooks to determine an arbitrary point, in order to determine the first random number that had a value in the range between zero and the SI. The researcher used a True Random Number Generator (TRNG) located online at (Random organization ,www.random.org ,2013) from which the first random number was generated, as an arbitrary point. Subsequently, the researcher calculated the systematic interval for each polling district and applied it to select the study participants from each appropriate sampling frame.

- For the first polling district, **Al-Fuwayhat** containing **8,012** voters, the **SI** for a systematic sample of **71** persons was obtained from the sampling frame as follows: SI= $\frac{8012}{71} = \textbf{113.}$ The random number used to determine the starting point for the first cluster had a value in the range between zero and the SI, which was **0-113**. The TRNG was used to generate the random starting point given of **34** and represented the first

individual selected. Subsequently, I added the sampling interval (113) to the random starting point with the aim of selecting the second person. Thus, the second person was **147** and so forth.

- For the second polling district, **Al-Kwayfiya** containing **10,433** voters, the **SI** for a systematic sample of **92** people was obtained from the sampling frame as follows: SI= $\frac{10433}{92} = 113$. The random number used to determine the starting point for the second cluster had a value in the range between zero and the SI, which was **0-113**. The TRNG was used to generate the random starting point given of **94**, which corresponded to the first individual selected.

- For the third polling district, **RaasAbayda** containing **8,480** voters, the **SI** for a systematic sample of **75** persons was obtained from the sampling frame as follows: SI= $\frac{8480}{75} = 113$. The random number used to determine the starting point for the third cluster had a value in the range between zero and the SI, which was **0-113**. The TRNG was used to generate the random starting point given of **86**, which represented the first individual selected

- For the fourth polling district, **Laithi** containing **11,858** voters, the **SI** for a systematic sample of **105** persons from the sampling frame was as follows: SI= $\frac{11858}{105} = 113$. The random number used to determine the starting point for the fourth cluster had a value in the range between zero and the SI, which was **0-113**. The TRNG was used to generate the random starting point given of **112**, which signified the first individual selected.

- For the fifth polling district **Al-Hadaa'iq** containing **19,102** voters, the **SI** for a systematic sample of **196** persons from the sampling frame was as follows: SI= $\frac{19102}{196} = 98$. The random number used to determine the starting point for the fifth cluster had a value in the range between zero and the SI, which was **0-98**. The TRNG was used to generate the random starting point given of **76**, which represented the first individual selected.

Appendix 5.9 Survey questionnaire on obesity epidemic in Libyan adults.

Survey questionnaire on obesity epidemic in Libyan adults
A case study in Benghazi, Libya

Researcher: Mr. Hamdi Lemamsha
Supervisory team: Professor Gurch Randhawa
Dr Chris Papadopoulos

<u>**Instructions for filling in the questionnaire**</u>

- This questionnaire should be filled in by the individual. Those that are chosen to participate, they need to be **between 20 – 65 years old**, resident in Benghazi for over ten years. Remember you will be excluded if you are pregnant, or unable to stand upright.

- The purpose of this questionnaire is to find out what you think and feel about **OBESITY**. Please answer as honestly and completely as you can, and provide only one answer for each item. There are no right or wrong answers and your information will be kept confidential.

- This survey is **seven** pages long and contains five sections. It should take about **10 minutes** to complete.

Thank you for taking the time to participate in this survey

University of Bedfordshire

Participant Identification Number: Da ▢ ▢ ▢   ┌─────────────┐
                                                     │ DD/MM/YYYY │
                                                     └─────────────┘

Section 1: Demographic and socio-economic characteristics

Questions	Response
1. Age group	☐ 20 – 29; ☐ 30 – 39; ☐ 40– 49; ☐ 50 – 59 ;☐ 60 – 65
2. Sex	☐ Male ☐ Female
3. How long have you lived in Benghazi?	Months Ye [ ] [ ]
4. What is your marital status?	☐ Single ☐ Married ☐ Divorced ☐ Widowed ☐ Separated ☐ Refused
5. What is the highest level of education you have completed?	☐ No formal schooling ☐ Less than primary school ☐ Primary school completed ☐ Secondary school completed ☐ High school completed ☐ College/university completed ☐ Post graduate degree ☐ Refused
6. What is your racial group background?	☐ Arabic ☐ Berbers 'Imazighen' ☐ Toubou ☐ Tuareg ☐ African ☐ Refused
7. Which of the following best describes your main work status over the past 12 months?	☐ Government employee ☐ Non-government employee ☐ Self-employed ☐ Non-paid ☐Student ☐ Housework ☐ Retired ☐ Unemployed (able to work) ☐ Unemployed (unable to work) ☐ Refused
8. What is your monthly income (Libyan Dinar = ½ Pound)?	☐ < 500; ☐ 500-999; ☐ 1000 –1999; ☐ 2000 – 2999; ☐ 3000 – 3999; ☐ 4000 – 5000; ☐ Refused
9- What is your religion?	☐ Christian ☐ Muslim ☐ Buddhist ☐ Judaist ☐ Sikh ☐ Atheist ☐ Other ☐ Don't know

Section 2: Eating behaviours

Type of Question	Questions	Response
1. Restaurant and fast food	•How many times did you eat restaurant or fast food yesterday (e.g. McDonalds, Burger King, etc.)?	Times ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ 0 1 2 3 4 5 6 ≥7

	•How many times do you typically eat restaurant or fast food in one week?	☐☐☐☐☐☐☐☐ 0 1 2 3 4 5 6 ≥7
2. Beverage with sugar added	•How many times did you drink juice yesterday (e.g. orange juice, apple juice, Sunny Delight)?	Times ☐☐☐☐☐☐☐☐ 0 1 2 3 4 5 6 ≥7
	•How many cans of non-diet soda pop did you drink yesterday (e.g. Coke, Pepsi, Sprite)?	☐☐☐☐☐☐☐☐ 0 1 2 3 4 5 6 ≥7
	•How many times do you typically drink juice in one day (e.g. orange juice, apple juice, Sunny Delight)?	☐☐☐☐☐☐☐☐ 0 1 2 3 4 5 6 ≥7
	•How many cans of non-diet soda pop do you typically drink in one day (e.g. Coke, Pepsi, Sprite)?	☐☐☐☐☐☐☐☐ 0 1 2 3 4 5 6 ≥7
3. Fruits & vegetables	•How many times did you eat vegetables yesterday (e.g. broccoli, spinach, greens, salad, etc.)?	Times ☐☐☐☐☐☐☐☐ 0 1 2 3 4 5 6 ≥7
	•How many times did you eat fresh fruit yesterday (e.g. an apple, an orange, a handful of grapes, etc.)?	☐☐☐☐☐☐☐☐ 0 1 2 3 4 5 6 ≥7
	•How many times do you typically eat vegetables in one day (e.g. broccoli, spinach, greens, salad, etc.)?	☐☐☐☐☐☐☐☐ 0 1 2 3 4 5 6 ≥7
	•How many times do you typically eat fruit in one day (e.g. an apple, an orange, a handful of grapes, etc.)?	☐☐☐☐☐☐☐☐ 0 1 2 3 4 5 6 ≥7
4. Breakfast	•How many times do you typically eat breakfast in one week (7 days)?	Times in one week ☐☐☐☐☐☐☐☐ 0 1 2 3 4 5 6 ≥7
5. Portion size	•When eating restaurant food, do you eat all of the food served to you at one sitting?	☐Never ☐Rarely ☐Occasionally ☐Sometimes ☐Often ☐Usually ☐Always
6.Physcial activity	•How many days during the past week have you performed physical activity where your heart beats faster and you are breathing harder than normal for 30 minutes or more (in three 10-minute bouts or one 30-minute bout)?	Times ☐☐☐☐☐☐☐☐ 0 1 2 3 4 5 6 ≥7
	•How many days in a typical week have you performed activity such as this (see above)?	☐☐☐☐☐☐☐☐ 0 1 2 3 4 5 6 ≥7

Section 3: Physical activity and sedentary behaviour

Part 1: Job-related physical activity	Response
1. Does your work involve activity of vigorous intensity that causes large increases in breathing or heart-rate, like carrying or lifting heavy loads, digging or construction work, for at least 10 minutes continuously?	☐Yes ☐No If No, skip to Q4.
2. In a typical week, on how many days do you do activities of vigorous intensity as part of your work?	Number of days ☐
3. How much time do you spend doing activities of vigorous intensity at work on a typical day?	Hours Minutes ☐ ☐
4. Does your work involve activity of moderate intensity that causes small increases in breathing or heart-rate, such as brisk walking or carrying light loads, for at least 10 minutes continuously?	☐Yes 1 ☐No 2 If No, skip to Part 2 Q1.
5. In a typical week, on how many days do you do activities of moderate intensity as part of your work?	Number of days ☐
6. How much time do you spend doing activities of moderate intensity at work on a typical day?	Hours Minutes ☐ ☐
Part 2: Transportation: Travel to and from destinations	Response
1. Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?	☐Yes 1 ☐No 2 If No, skip to Part 3 Q1.
2. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	Number of days ☐
3. How much time do you spend walking or bicycling for travel on a typical day?	Hours Minutes ☐ ☐
Part 3: Recreational activities	Response
1. Do you do any sports, fitness or recreational (leisure) activities of vigorous intensity that cause large increases in breathing or heart-rate, such as running or football, for at least 10 minutes continuously?	☐Yes 1 ☐No 2 If No, skip to Q4.

2. In a typical week, on how many days do you do sports, fitness or recreational (leisure) activities of vigorous intensity?	Number of days
3. How much time do you spend doing sports, fitness or recreational activities of vigorous intensity on a typical day?	Hours Minutes
4. Do you do any sports, fitness or recreational (leisure) activities of moderate intensity that cause a small increase in breathing or heart-rate, such as brisk walking, cycling, swimming, volleyball, for at least 10 minutes continuously?	☐Yes 1 ☐No 2 If No, skip to Par 4 Q 1
5. In a typical week, on how many days do you do sports, fitness or recreational activities of moderate intensity?	Number of days
6. How much time do you spend doing sports, fitness or recreational activities of moderate intensity on a typical day?	Hours Minutes
Part 4: Sedentary behaviour	Response
1. How much time do you usually spend sitting or reclining on a typical day?	Hours Minutes

Section 4: Neighbourhood environment factors
Think about the different facilities in and around your neighbourhood. By this we mean the area all around your home that you could walk to in 10–15 minutes.

1. What is the main type of housing in your neighbourhood?

☐ **1. Detached single-family housing**

☐ **2. Townhouses, row houses, apartments of 2-3 stories**

☐ **3. Mix of single-family residences and townhouses, row houses, apartments.**

☐ **4. Apartments of 4-12 stories**

☐ **5. Apartments of more than 12 stories**

☐ **6. Don't know/ Not sure**

S N	Your perception and view about	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Don't know/ Not sure
2	Many shops, stores, markets or other places to buy the things I need are within easy walking distance of my home. Would you say that you…					
3	It is within a 10-15-minute walk to a transit stop (such as bus, train, trolley, or tram) from my home. Would you say that you…					
4	There are pavements on most of the streets in my neighbourhood. Would you say that you…					
5	There are facilities to bicycle in or near my neighbourhood, such as special lanes, separate paths or trails, shared use paths for cycles and pedestrians. Would you say that you…					
6	My neighbourhood has several free or low cost recreation facilities, such as parks, walking trails, bike paths, recreation centres, playgrounds, public swimming pools, etc. Would you say that you…					
7	The crime rate in my neighbourhood makes it unsafe to go on walks at night. Would you say that you…					
8	There is so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighbourhood. Would you say that you…					
9	I see many people being physically active in my neighbourhood, doing things like walking, jogging, cycling, or playing sports and active games. Would you say that you…					
10	There are many interesting things to look at while walking in my neighbourhood. Would you say you…					
11	There are few motor vehicles in working order (e.g., cars, trucks, and motorcycles) at your house -hold? Would you say you…					

12	There are many four-way intersections in my neighbourhood. Would you say that you…					
13	The pavements in my neighbourhood are well maintained (paved, with few cracks) and not obstructed. Would you say that you…					
14	Places for bicycling (such as bike paths) in and around my neighbor - hood are well maintained and not obstructed. Would you say that you…					
15	There is so much traffic on the streets that it makes it difficult or unpleasant to ride a bicycle in my neighbourhood. Would you say that you…					
16	The crime rate in my neighborhood makes it unsafe to go on walks during the day. Would you say that you…					
17	There are many places to go that are within easy walking distance of my home. Would you say that you…					

Section 5: Participant's Anthropometric body measurements

	Participant's Anthropometric	Conducted By health professional
1.	Height (cm)	(cm)
2.	Weight (Kg)	(Kg)
3.	Body Mass Index (BMI) (Kg/M²)	(Kg/M²)
4.	Percent Body Fat (%)	%
5.	Visceral fat level .Rating from 1 – 59.	

Thank you again for taking the time to complete this survey.

5.0 The translation process in the quantitative protocol

5.1 Step 1: Forward translation

I requested the first Libyan certified translator (T1) to translate the prenotification letter, as well as the Participant Information Sheet (PIS) and the informed Consent Form (ICF), from English into Arabic (see all enclosed Arabic documents). I appointed two professional bilingual Libyan certified translators (T1 & T2) to translate the questionnaire from English into Arabic, hence two independent translations were produced (see all enclosed Arabic documents). They both translated the original English version of the questionnaire of this study into Arabic, so that their output could be compared. Both translators met the criteria of (1) having Arabic as their mother tongue, (2) being knowledgeable about English-speaking culture, and (3) being familiar with the terminology contained in the instrument.

Both translators complied with the WHO (2013) guidelines on the 'Process of translation and adaptation of instruments', that is, they aimed for the most common audience (and avoided addressing professional audiences such as those in medicine or any other health professional group), and avoided the use of jargon and any terms that might be considered offensive to the Libyan adults. The following section illustrates how I utilised two forward translations of the questionnaire to implement the second stage of the translation process.

5.2 Step 2: Translations synthesis

Inconsistencies between the forward translations were reconciled in a consensus meeting that was attended by both translators, while a qualified health professional working in the field of public health was involved as an unbiased person on the team who (1) served as a mediator in discussions of translation differences, (2) recorded the process of reaching consensus, and (3) participated in the process of reconciling versions. Working from the original questionnaire, as well as from the first translator's version (T1) and the second translator's version (T2), a synthesis of these translations was produced (see all enclosed Arabic documents), resulting in one common translation (T-1,2).

5.3 Step 3: Back translation into English

A third professional translator (T3), blind to the original instrument, was recruited to translate the new version questionnaire (Arabic version), derived from the previous stage, into the source language (English version) (see all enclosed documents). This third translator was not informed about the concepts underpinning the contents of this questionnaire, and he was not medically

schooled or trained. The primary role of back translation (BT) was not to obtain a perfect conversion to the original version, but rather to identify any incorrectly translated words or expressions. Furthermore, a perfectly corresponding back translation probably means that the scale was not a sound translation, in that differences in language were not taken into consideration.

5.4 Step 4: Expert committee

Following correspondence with the back (third) translator about the adequacy of the original forward translations, a meeting was organised to consolidate all the versions. The committee consisted of one health professional, as well as all three translators (both forward and backward). The expert committee's role was to consolidate all the versions and components of the questionnaire, including the original instrument, instructions, scoring documentation, and all translated versions (T1, T2, T-1,2, BT), and to develop the pre-final version of the questionnaire for field testing (see Appendix 5.11). Therefore, critical decisions were reported by the expert committee in finalising the translated instrument (see Appendix 5.11), and final decisions were made to generate a pre-final version of the survey questionnaire, entitled 'Obesity: A case study in Libya', ready for field-testing.

5.5 Step 5: Test of the pre-final version

The final stage of the adaptation process is the pre-test stage in which I tested the pre-final version amongst 10 Libyan adults living in the UK. Pre-testing is a crucial step in the translation process of the questionnaire as it ensures that any ambiguous words or sentences associated with this tool are minimised. It addresses the contents of the questionnaire from the perspective of respondents, which is particularly important for translated versions and when conducting a direct-supervision survey. Aligned with my pragmatic stance, before submitting the final version of the questionnaire to the Ethics Committee, I administered the pre-final questionnaire amongst ten Libyan adults living in the UK to discuss with them whether each section of the questionnaire and the items within the sections had a logical flow, as well as whether the skip some item-response patterns within the domain of the tool made sense from the perspective of the respondents (see Appendix 5.12 for the whole pre-testing report).

Appendix 5.11 Outcomes of the expert committee meeting.

5.0 Outcomes of the expert committee meeting

This meeting took place on Thursday, December 5th 2013 at 13:00 p.m. on the Derna Campus at the **University Omar Al-Muktar Educational School**. The committee consisted of one health professional, an Arabic proof reader, as well as all three translators (both forward and backward). The role of the Committee of Experts was to consolidate all versions of the questionnaires within one validated questionnaire, in order for it to be eligible to be tested out among the potential participants. The questionnaires discussed during the meeting were: the original, two translated Arabic versions, the synthesis translated version and the back translated questionnaire (T1, T2, T-1, 2, BT).

The Committee started the meeting by reviewing all relevant versions of the questionnaires concerning a study of obesity in Libyan adults, this study conducted by **Mr. Lemamhsa** and his supervisory team from Bedfordshire Unveity, UK ,and then discussing each section separately across all the versions of questionnaires provided by the researcher. Having argued and examined all components within all sections throughout all questionnaire versions, the committee summarized all the notices as follows: -

Section 1: Demographic and socio-economic characteristics:

There was consensus amongst the committee that there were no significant differences or variations amongst across all versions of the questionnaires, particularly in this section. It was noted that all the questions in this section are the same in all versions and worded in a form which is understandable to all the participants.

Section 2: Eating behaviours associated with obesity and being overweight:

The committee felt that elaborating on the questions, such as 'giving many examples', (e.g. orange juice, apple juice, Sunny Delight) might result in respondents misunderstanding the questions. Therefore, to resolve this issue we decided to delete most of the examples to end up with short, understandable questions. In addition, the committee noted that using the phrase 'in *one day' separated with the word typical in the* question may confuse some participants in this study. Therefore, they formulated the question as follows: '*How many cans do you drink in one typical day?*' Instead of: '*How many cans do you typically drink in one day?'*

However, the committee took into account that any change should not affect the overall meaning of the question. It was felt that if this did occur then a re-test questionnaire would be required before being administered in the main study.

Section 3: Physical activity and sedentary behaviour:

The committee believed that giving too much details in a question may confuse the meaning of that particular question. Thus, they felt that removing in depth details from one of the questions was appropriate, and that it needed to be re-worded as follows:

Does your work involve activity of vigorous intensity for at least 10 minutes continuously?

Instead of:

Does your work involve activity of vigorous intensity that causes large increases in breathing or heart-rate, like carrying or lifting heavy loads, digging or construction work, for at least 10 minutes continuously?

Section 4: Neighbourhood environment factors:

There was consensus among the committee in terms of using the word *'forms'* or *'types'*, instead of patterns, whilst describing the style of housing. They agreed that the word pattern in Arabic is usually used in relation to behaviour and customs. Finally, the committee refined all the numbers used within the questionnaire in a grammatical way.

With reference to the back translation version of the questionnaire from Arabic into English:

Having checked the translated back version questionnaire with the other versions, the committee concluded that there was no significant difference between the back version that was translated from Arabic into English, and the original version.

However, one of the things observed in the questionnaire translated from Arabic into English, particularly in the section on physical activity and sedentary behaviour, was that the back translator preferred to allocate a time frame at the beginning of most of the questions. For example, in the original version of the questionnaire one question was formed as follows:

Does your work involve activity of a moderate intensity that causes small increases in breathing or heart-rate, such as brisk walking or carrying light loads for at least 10 minutes continuously?

The back translator formulated the question as follows:

'Does your work involve activity of a moderate intensity for at least 10 minutes continuously, which causes a small increase in your breathing or heart-rate? '

Finally, the committee concluded that all versions of the questionnaires, including the final Arabic edited version relevant to the study of obesity in Libyans adults living in Benghazi incorporated the following characteristics:

- Straightforward
- Understandable
- All the questions are in a regular sequence
- Easy for the respondents to answer
- Meaningful

Therefore, we admitted that all questions relevant to these versions of the questionnaires are worded in an understandable manner and are very relevant to Libyans' daily lives. Hence, a lay person would be able understand all the words clearly in the Arabic translated version. Therefore, we fully recommend the final Arabic version is now available to be tested out amongst potential participants in the study, whenever the researcher wishes to conduct it. The next page contains the original signature and stamp from each committee member.

Committee Sign Up Sheet

Dr. Bin Taher A
Legal Translator

Dr. Sassi S
Legal Translator

Mr. Steita M
Legal Translator

SALEH M. SASI
CERTIFIED TRANSLA
DERNA LIBYA

Elshaary A
Health Expert

Mr. Bozhidar A
Proofreader
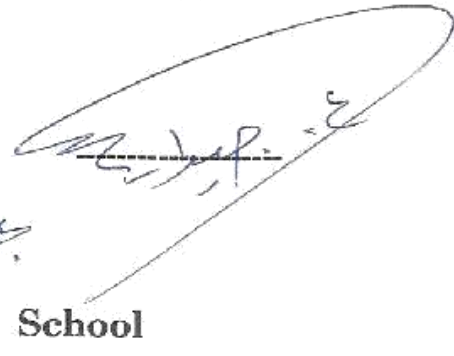
Educational School

Omar Al – Muktar University

Appendix 5.12 Pre-testing the Arabic version of the questionnaire report.

5.1 Pre-testing the Arabic version of the questionnaire report

Pre-testing is a crucial step in this study as it ensured that any errors associated with the wording of the questionnaire could be minimised and amended prior to the issue of the final ethical approval from the Institute of Health Research Ethics Committee (IHREC) at the University of Bedfordshire, UK. The committee requested that the researcher had to submit all relevant documents in relation to the research, including the finalised questionnaire, so that they could take into consideration the researcher's application regarding the ethical approval for this study. Failure to do so meant that the committee would discontinue with the application and no further action would be taken.

Having decided to administer the questionnaires under my personal supervision to potential participants in their homes, this method enabled me to gain an advantage when I pre-tested the questionnaire amongst Libyan adults. The rationale behind pre-testing the questionnaire was to addresses the contents of the questionnaire from the perspective of the respondents, which is particularly important for translated versions of the instrument. In alignment with the pragmatic stance, I conducted the pre-testing of the questionnaire with ten Libyan adults living in the UK. This was in order to discuss whether the sections in the questionnaire and the questions flowed logically, as well as to ascertain whether the skip patterns made sense and were correct.

Table 5.12.1: Presents a variety of demographic data in relation to the participants who took part in pre-testing the questionnaire. Ten Libyan adults from 20-65 years of age participated in the study. The participants consisted of four females and six males. The highest age range was from 20-59 years of age, whilst there were no participants from 60 – 65 years of age. Seven were married and three were single. Regarding their BMIs two were within normal weight; five were overweight and three obese.

Demographic characteristics	Number of participants
Age:	
20 – 29	1
31 – 39	3
41 – 49	4
51 – 59	2
60 – 65	-
Gender:	
Male	6
Female	4
Marital Status:	
Single	3
Married	7
Body stature types:	
Normal BMI (<25) (kg/m²)	2
Being overweight BMI (25–30) (kg/m²)	5
Obese BMI (>30) (kg/m²)	3

Interview outcomes indicated that most questions in the questionnaire were clearly understood by the Libyan adults. Generally, the questions were completed quickly at a consistent speed by the participants, within approximately 10-15 minutes. Occasionally, participants hesitated or corrected a previously reported answer. In estimating the respondents' level of comprehension, there were no difficulties with understanding the words, terms or concepts used in the questionnaire. The respondents interpreted most of questions as the researcher intended and used the response categories or choices offered. The respondents were willing and able to perform the tasks required and to provide accurate and complete answers. Finally, the respondents were attentive and interested in the questions, which provided a clear indication that participants understood the items as was intended.

The only exception to the above were some items in section 2 on eating behaviours, in particular item 2:

('*How many times do you typically drink juice in one day (e.g. orange juice, apple juice, Sunny Delight)?*') and item 3 ('*How many times do you typically eat vegetables in one day (e.g. broccoli, spinach, greens, salad, etc.?*').

A number of respondents were hesitant when attempting to answer these questions, reported that the period of recall was ambiguous and were uncertain as to whether one day is considered typical. Four of the ten participants spent considerably more time answering this question than other questions; whereas three of these particular four respondents asked for additional information concerning the meaning of the question. These outcomes indicated that this item was not readily understandable by the Libyan adults. Consequently, these Arabic translated

questions were refined slightly, hence, a lay person would be able understand all the words clearly in the Arabic translated version. In addition, two questions in section 4, neighbourhood environment factors, contained repetitive content, which precluded respondents from giving a reliable answer.

The first was item 7 ('The crime rate in my neighbourhood makes it unsafe to go on walks at night. Would you say that you Strongly Agree; Agree; Undecided; Disagree and Strongly Disagree?').

The second problem concerned item 16 ('The crime rate in my neighbourhood makes it unsafe to go on walks during the day. Would you say that you Strongly Agree; Agree; Undecided; Disagree and Strongly Disagree?').

Eight of the ten participants indicated that it was not possible for them to offer a consistent answer to this question, while two of the ten declared that their experience of the Libyan situation was restricted, due to the fact that they had spent most of their lives away from Libya. Therefore, they were unable to assess whether the neighbourhood is a safe environment or not. The respondents might interpret these questions as asking for their judgements or perceptions of the current situation in Libya. As the actual study will only include the respondents who have lived in Benghazi for over ten years, they should be able to comment on questions concerned with neighbourhood safety. Consequently, it may be difficult for some to provide accurate or reliable responses based on their experiences and memories. Several may feel that they do not have the knowledge or authority to comment on the political situation in Libya. However, because this dispute does not appear to stem from the translation of the items or from cross-cultural issues, these items were not modified.

The Physical Activity Neighbourhood Environment Survey (PANES) used in section 4, neighbourhood environment factors, has three sets of carefully chosen items that reflect current thinking in this field, specifically, neighbourhood environment: core items (1-7), recommended items (8-11) and optional items (12-17). Question 16, cited above is one of the optional items in the PANES. If participants skip this question for logical reasons, their missing answer would not impact on the results of this study because it was only an optional question. Meanwhile, question 7, also cited above, will elicit approximately the same information.

Omar AL Mukhtar University

جامعة عـــمر المختار
الادارة العامة

الموافق : 2014/2/13   التاريخ،   الرقم الاشاري U.O.A 88

Headquarters of the Post office, Benghazi.

Re: **Mr. Hamdi Abdulla A. Lemamsha**, a PhD student at the **Institute for Health Research at the University of Bedfordshire, UK.**

Dear Sir/Madam,

Re: **Delivering of a questionnaire and correspondence by the postal service.**

As the postal post service in Libya is currently quite ineffective, I am writing to you in order to seek your help for **Mr. Lemamsha** and his research work.

Mr. Lemamsha wishes to have his very important pre-notification letter delivered by the postal service to a number of residents in Benghazi, who have been chosen randomly from the electoral roll to participate in his research entitled, *"Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya."*

As he has not been able to contact some of them individually by phone for some reason, he will provide you with all the present addresses for the participants, who need to have the introductory letter delivered to them.

We would like to ensure that all the administrative and financial procedures pertinent to this commission will be taken into consideration through the University regulations. We would also like to inform you that this letter will be valid for both **the pilot** and **the main** study to be undertaken in this research.

If you have any further questions or require any additional information, please do not hesitate to contact us.

Thank you for your time and consideration.

Yours sincerely

Dr Shukri Esbia
President of Omar Al-Mukhtar University

Omar AL Mukhtar University   p.o.box: 919 EL Beida Libya
Fax: +21869437052   Tel: +2186942946 - 964632233

Appendix 5.14 A pre- notice letter sent to the potential participant of the study.

University of
Bedfordshire

20 January 2014

Dear Sir/Madam,

My name is **Hamdi Lemamsha** and I am a student at **Bedfordshire University** in the **United Kingdom**. I am conducting a study about the issue of obesity in Benghazi. This project is under the supervision of a supervisory team that includes **Professors Gurch Randhawa** and **Dr Chris Papadopoulos,** who are both located at the Institute for Health Research at the University of Bedfordshire (website: http://www.beds.ac.uk/research/ihr). This study has received the permission of the following institutions: **the University of Bedfordshire, UK; Libyan Embassy London, UK, Omar Al-Mukhtar University, Libya and the Local Health Authority in Benghazi.**

The purpose of this research is to explore the risk factors that might be attributed to Libyans becoming more obese. It will also explore the protective factors that can guard against obesity in adult Libyans. Hence, participating in this research provides us with the opportunity to explore both the risks and the protective factors associated with obesity amongst Libyan adults. The outcome of this study could assist researchers, public health experts, health authorities and psychologists to control and reduce obesity, as well as ease the financial burden on the state from treating it and the numerous complications that are associated with it.

I am contacting you to request your participation in my study as your name has been randomly selected from the electoral registers of five districts in Benghazi. Due to the existing problems with the postal services in Libya, I am writing to inform you that I will not be able to seek the participants' permission to take part in the study, until the actual day of my visit.

This visit will be a one-off, taking place at some point in (**February 2014 or December 2014**). The duration of the visit will be approximately twenty minutes. In relation to where the interview will take place you have a choice of it being either conducted at your home or held

in a comfortable location. This can be agreed between the researcher and yourself. During the visit I will be accompanied by either a male or female nurse depending on your gender.

During this visit, we will provide you with our project package, including an Information Sheet, an Informed Consent Form, and a Survey Questionnaire, to which there are no right or wrong answers. You will also be asked to give permission for a qualified nurses to take some body measurements.

You will be given the opportunity to read through the Information Sheet and Consent Form (or I will read each of them to you) and you will then be able to decide whether you would like to participate or not. If you consent, you will be asked to sign the Informed Consent Form (ICF) ,and then we will then ask you to fill in the survey questionnaire by yourself. Alternatively, we can leave you with the package and return to collect it at a mutually agreed time. Please note that you are free to participate in this study or opt out once you have read the Information Sheet.

Thank you for your time so far. We look forward to meeting you at some point in (**February 2014 or December 2014**).

Yours faithfully

Mr. Hamdi Lemamsha

Appendix 5.15 Protocol for taking height measurement by a qualified

1. Ask the participant to remove their shoes.

2. Assemble a portable Stadiometer (see Figure 5.15.1) and raise the head plate to allow sufficient room for the participant to stand underneath it. Double check that you have assembled the Stadiometer correctly.

3. Ask the participant to stand with their feet flat on the centre of the base plate, feet together and heels against the rod. The participant's back should be as straight as possible, preferably against the rod but not leaning on it. They should have their arms hanging loosely by their sides. They should be facing forwards (see Figure 515..2).

4. Move the participant's head so that the Frankfort Plane is in a horizontal position, i.e., parallel to the floor (see Figure 5.3). The Frankfort Plane is an imaginary line passing through the external ear canal and across the top of the lower bone of the eye socket, immediately under the eye (see diagram). This position is important if an accurate reading is to be obtained. An additional check is to ensure that the measuring arm rests on the crown of the head, i.e. the top back half. To make sure that the Frankfort Plane is horizontal, you can use the Frankfort Plane Card to line up the bottom of the eye socket with the flap of skin on the ear. The Frankfort Plane is horizontal when the card is parallel to the Stadiometer arm.

5. Instruct the participant to keep their eyes focused on a point straight ahead and to breathe in deeply. It can be difficult to determine whether the stadiometer headplate is resting on the participant's head. If so, ask the participant to tell you when they feel it touching their head.

6. Ask the participant to step forward. If the measurement has been done correctly, the participant will be able to step off the stadiometer without ducking their head. Make sure that the head plate does not move when the participant does this.

7. Look at the bottom edge of the head plate cuff. There is a green arrowhead pointing to the measuring scale. Take the reading from this point and record the participant's height in centimetres and millimetres. If a measurement falls between two millimetres, it should be recorded to the nearest even millimetre.

8. Record the participant's height on the measurement record card.

9. Push the head plate high enough to avoid the next participant hitting their head against it when getting ready to be measured. Once you have finished measuring everyone, lower the head plate to its lowest position, ready for dismantling.

Figure 5.15.1: The Stadiometer
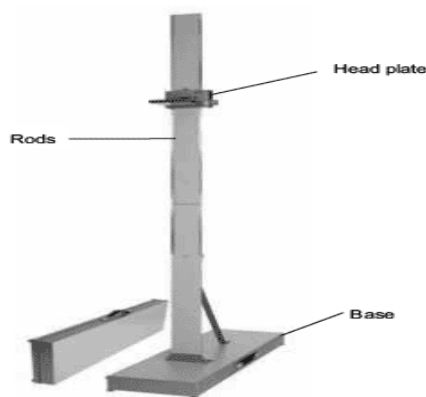
Figure 5.15,2: Position of participant
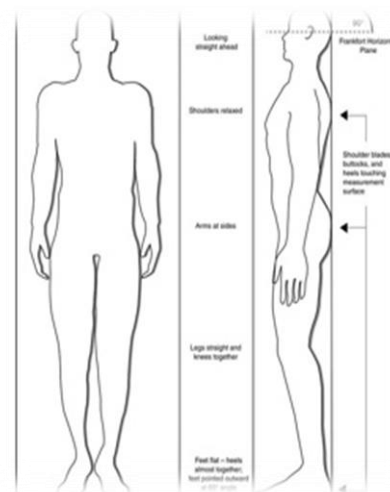
Figure 5.15.3: Frankfort Plane
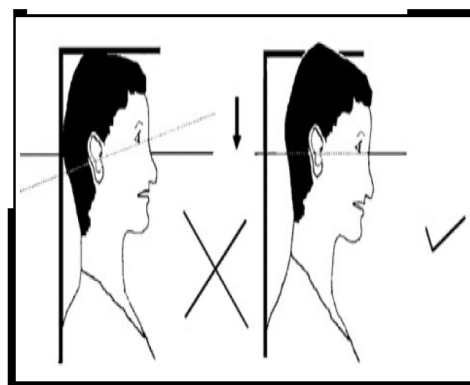
Appendix 5.16 Protocol for Using Tanita BC-601 by a qualified professional nurses.

II-Protocol for taking Body Mass Index (BMI) (Kg/M²), Percent Body Fat (%) and Visceral Fat Level measurements for healthcare professionals: Using Tanita BC-601 Segmental Body Composition Monitor*.

1. For optimum accuracy, place the unit on a flat and level surface.

2. If the participant steps onto the platform before "0.0" appears, the display will show "Error" and you will not obtain a reading. Furthermore, if the participant does not step onto the platform within about 30 seconds after "0.0" appears, the power is shut off automatically (see Figure 5.16.1).

Figure 5.16.1: Tanita BC-601 Segmental Body Composition Monitor

3. Setting and entering personal information for each participant include: age, gender, activity level (standard or athletic), and height.

4. Bear in mind the weight will be measured using this scale to the nearest 0.1 kilogram, and Body Fat increments of 0.1%, while height is to the nearest 0.1 centimetre.

5. Ask the participant to empty their pockets of all items and to remove shoes, heavy jewellery, and heavy outer garments such as jackets and cardigans. Ensure the soles of his/her feet are clean before stepping onto the measuring platform. Use a soft cloth and appropriate disinfectant to clean the weighing platform after each use to prevent cross-contamination.

6. When "0.0" appears on the display, ask the participant to stand with his or her heels correctly aligned with the electrodes on the measuring platform, then ask them to grip the handle-electrode so that all fingers are making contact with the electrodes, meanwhile to keep their arms by their sides while making sure that they do not touch their legs or any part of their body with their arms or hands.

7. Ask participant to stay on the platform until all measurements are displayed by the unit and recorded. Ask participant to step off the scale and press a button to see the reading.

8. Record the following measurements for each participant: BMI, % Body Fat, and Visceral Fat Level, on the section allocated on the questionnaire.

9. The unit will automatically shut off after 40 seconds of displaying result with inactivity.

---

*Nurse Protocols for Measurements and samples (2010)
National Centre for Social Research (2010)

Appendix 5.17: Ethical approval from (IHREC).

University of Bedfordshire

Institute for Health Research
Putteridge Bury
Hitchin Road
Luton
Beds LU2 8LE

28 January 2014

Hamdi Lemamsha
Student number: 1138055

Dear Hamdi Lemamsha

Re: IHREC Application No: IHREC303 (REVISED)
Project Title: Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya

The Ethics Committee of the Institute for Health Research has considered your revised application for ethical approval and has decided that the proposed research project should be approved.

Please note that if it becomes necessary to make any substantive change to the research design, the sampling approach or the data collection methods a further application will be required.

Yours sincerely

Dr Yannis Pappas
Head of PhD School, Institute for Health Research
Chair of Institute for Health Research Ethics Committee

Appendix 5.18 Ethical approval from Libyan Cultural Attaché.

Libyan Embassy
Cultural Attaché - London

سفارة ليبيا
الملحقية الثقافية - لندن

وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education & Scientific Research

18 November 2013

Professor Gurch Randhawa,
Director of the Institute for Health Research
University of Bedfordshire
Bedfordshire, UK

Dear Professor Randhawa,

<u>Fieldwork in Benghazi, Libya for Mr. Hamdi Lemamsha</u>

We hereby confirm that we agree that Mr Hamdi Abdulla Lemamsha, who is currently studying his PhD at the Institute for Health Research at the University of Bedfordshire, can conduct his fieldwork study on the risk and protective factors associated with obesity among adults aged 20 to 65 years in Benghazi, Libya.

We hope that this approval will help Mr Lemamsha to receive ethical approval for his intended study.

Please do not hesitate to contacting us should you require any further information.

Yours faithfully,

Dr Abdelbasit A. Gadour
The Cultural Attaché
Libyan Embassy
London

61-62 Ennismore Gardens, London SW7 1NH   +44 (0)20 3006 9891   +44 (0)20 7581 2393   culturalaffairs.libyanembassy.org

Libyan Embassy
Cultural Attaché - London

سفارة ليبيا
الملحقية الثقافية - لندن

وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education & Scientific Research

التاريخ : 22-10-2013
الرقم الاشاري : 2013-10-9436
رقم الملف : 8998
رقم قرار الإيفاد: 469/2009
بداية الصرف : 02/10/2012
نهاية الصرف : 31/08/2015
اشهر المنحة : 35

Appendix 5.19 Ethical approval from Libyan Cultural Attaché Arabic version.

اسم الطالب : حمدى عبدالله عبدالكريم لمامشه
الدرجة العلمية : دكتوراة
التخصص : الصحه العامه

الى من يهمه الامر

بعد التحية ،،،

الموضوع / تعريف طالب لدراسة حقلية

تشهد الملحقية الثقافية بأن الأخ / حمدى عبدالله عبدالكريم لمامشه احد الطلبة الموفدين لدراسة الدكتوراه في مجال الصحه العامه على حساب الدولة الليبية في المملكة البريطانية المتحدة من الفترة 01/10/2012 إلى 30/09/2015 م . يرغب الطالب فى جمع بعض البيانات والمعلومات المتعلقة ببحثه العلمي لذا يرجى تسهيل مهمته وإبداء المساعدة في هذا المجال.

أعطيت له هذه الإفادة بناءً علي طلبه لاستخدامها فيما يخوله القانون و تعتبر رسمية بعد التوقيع و الختم.

وشاكرين حسن تعاونكم معنا مسبقاً .

والسلام عليكم ورحمة الله وبركاته ،،،

د. عبدالباسط قدور
المستشار الثقافي

Omar AL Mukhtar University

جامعة عــــمر المختار
الادارة العامة

الموافق: 29 / 1 / 2014م   التاريخ :   الرقم الاشاري U.O.A-42

Dear Mr. Lemamsha,

Re: Your Research project

I would like to inform you that your research project titled *"Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya"*, which you submitted with the enclosed documents to the Research Ethics Committee (REC) at the Omar Al-Mukhtar University for ethical review has been approved. The decision was made at a meeting held on **29 January 2014**.

On behalf of the committee I would like to wish you good fortune with your research study and we hope that you will be well rewarded for your hard work.

Best regards,

Mr El-Shaary A. F.

The Chairman of Faculty members and the Secretary of the Research Ethics Committee.

Omar AL Mukhtar University   p.o.box: 919 EL Beida Libya

Omar AL Mukhtar University

جامعة عـــمر المختار
الادارة العامة

الرقم الاشاري : .U.O.A-44

التاريخ /

الموافق: 29 / 1 / 2014 م

Ref: Mr. Hamdi Abdullah A Lemamsha

PhD Student at the Institute for Health Research

University of Bedfordshire, UK.

Dear Mr. Lemamsha,

Subject:

"Approval of Research Project Named: Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya."

Your protocol has been reviewed and discussed by the Research Ethics Committee (REC) at its meeting held on 29 January 2014. We are pleased to inform you that the Committee has granted ethical approval of the above research project that under the supervision of Professor Gurch Randhawa and Dr. Chris Papadopoulos.

We would like to request that you kindly provide us with a copy of the ethical approval letter that will be sought from the local Health Authorities in Benghazi, once you have obtained it.

Please be advised that we stress the need for anonymous collecting of data to protect the participants from any harm and to respect their confidentiality. Finally, may I reiterate that if any further ethical concerns arise at any time during the course of your study, then it is paramount that the Committee are informed as soon as possible.

I would to take this opportunity to wish you every success with this very important study.

Yours Faithfully

Dr. Agoub A. M. Agoub

Chairman of Research Ethics Committee/ Omar Al-Mukhtar University.

Omar AL Mukhtar University   p.o.box: 919 EL Beida Libya

الخدمات الصحية بنغازي

الرقم الإشاري خ.ص.ب /

التاريخ : 30/ 1

Ref: Mr. Hamdi Abdullah A. Lemamsha

PhD Student at the Institute for Health Research

University of Bedfordshire, UK.

Dear Mr. Lemamsha,

Subject: *"Approval of Research Project Named: Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya."*

Having reviewed and discussed all documents that you were submitted to the Research Ethics Committee (REC) at localizes Health authorities at Benghazi for obtaining the ethical approval from the committee at its meeting held on **29 January 2014**. The submitted documents include your research proposal and all relevant documents, as well as both ethical approval letters.

We are delighted to notify you that the Committee conferred ethical approval of the above research project that under the supervised team: Professor Gurch Randhawa and Dr. Chris Papadopoulos.

Please be advised that in accordance with the REC' regulations, we emphasize that ethically sound data collection procedures are **voluntary, informed, safe, and confidential**. You should inform the committee of the following:

Any proposed changes to the research protocol or to conduct of the research.

Any new information that may affect adversely on obligations to keep anonymous of data collection and lessen protection of participants from any ham that might face under any circumstances.

We really wish you every success in this important research

Yours Faithfully

Dr. Hassan Yidry

Director of Medical Affairs, Benghazi
Chair of Research Ethical Committee / Benghazi

الفويهات الغربية – المعهد الصحي سابقا   هاتف : 2241121 - 2241119 - 2224294 فاكس : 2241118

University of Bedfordshire

Information Sheet for Participants

Invitation

My name is Hamdi Lemamsha and I am a PhD research student at the University of Bedfordshire, in the UK. I am conducting research into obesity, which affects many Libyans – both men and women. This sheet provides you with information about my research and invites you to participate in the study.

The title of my study is:

'Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya'.

Before you decide to participate in this study, it is important to understand why the research is being conducted and what it will involve. Please take time to read carefully the following information and discuss it with friends and family before deciding whether or not you wish to take part. Please do not hesitate to ask if anything is unclear or if you would like any further information.

1. Purpose of the research

The purpose of this research is to explore the risk factors that might be attributed to Libyans becoming more obese. It will also explore the protective factors that can guard against obesity in adult Libyans. Hence, I am interested in undertaking a study of the population of Benghazi, which will involve interviewing both healthcare professionals and community leaders. In addition, I am passionate about understanding your point of view in terms of your thinking; about the factors that can lead to weight gain 'obesity' and can promote weight loss.

2. Selection of participants

You have been selected to participate in this study because you met all of the following criteria:

2.1 Inclusion criteria
- Aged 20-65 years.
- Resident in Benghazi for over ten years.
- Eligible to register to vote.

2.2 Exclusion criteria
- Less than 20 years of age or more than 65 years of age.
- Pregnant.
- Unsteady on their feet.
- Chair-bound.
- Amputee; a person who has had a limb amputated.
- Too frail or unable to stand upright.
- Is subject to any legal incapacity to vote.

3. Procedures and time involved:

If you choose to participate in this study, we will provide you with our project package, including an Information Sheet, an Informed Consent Form (ICF), and a Survey Questionnaire. Firstly, you will be asked to sign the ICF and you will also be asked to give permission for a qualified Healthcare Professional to undertake body measurements. Subsequently, you will be asked to complete a questionnaire, to which there are no correct or incorrect answers. You may answer the questionnaire yourself or you give your responses to the companion who will note them down this is only ,in case if the potential participant is illiterate. If you do not wish to answer a question, you will be able to miss it and move onto the next question. To maintain confidentiality, you will not be identified personally with any information that you provide.

4. Benefits of participating in this study:

You will not benefit directly from taking part in this study. Nevertheless, this study will provide us with the opportunity to gain a better understanding of obesity amongst Libyan adults. The information you supply could assist researchers, public health experts, health authorities and psychologists to control and reduce obesity and the numerous complications that are associated with it, as well as ease the financial burden on the state, which comes from treating this disease.

5. Risks or discomforts of participating in this study:

There are no risks or personal discomfort anticipated from participating in this study. If you feel uncomfortable with any of the questions, you can leave out that question or withdraw from the study altogether. If you decide to give up at any time before you have finished the questionnaire, your questionnaire will be destroyed.

Information pertaining to the study may be communicated to others in the research team via e-mail. Every precaution will be taken to safeguard your data, including using password protected

computers. Only the main researcher and the supervisory team will have access to the information that you provide.

6. **Anonymity and confidentiality:**

Any information you provide will not be shared with anyone outside of the research team. This information will be kept confidential and will not be released to other parties without your written permission, unless compelled to by law.

Participants in the survey will be accorded confidentiality and anonymity. All personal information collected during the course of the research will be kept confidential. The questionnaire will not be shared until all identifying information has been encoded and/or removed. The quantitative data collected will be analysed and stored anonymously using a password-secured SPSS (Statistical Package for Social Sciences) software. All these documents will be held securely in a locked cabinet in the researcher's house. Once the data collection has been completed, all identifying information about the participants will be destroyed.

7. **Ethics approval:**

Ethics approval has been sought and acquired from:

- The Institute for Health Research Ethics Committee (IHREC) at Bedfordshire University, in the UK.
- The Libyan Cultural Attaché at the Libyan Embassy affiliated to the Ministry of Higher Education and Scientific Research in Libya.
- The Omar Al-Mukhtar University in Bayda, Libya,
- The Regional Health Ministry in Benghazi, Libya.

8. **Right to withdraw**

Participation in this study is completely voluntary. You are free to withdraw from this study at any time without giving an explanation. You are also free to leave out any questions or any parts of the study that you choose to without giving an explanation.

9. **Compensation**

We will not offer any monetary compensation or other incentives for people who participate in the questionnaire at the first phase of this study.

10. Participant responsibilities

Your participation in this study is voluntary. If you choose to participate, the responsibilities to which you will commit are as follows:

- You will be asked to sign the Informed Consent Form (ICF)

- Complete the survey questionnaire (approximately 17 minutes).
- You will be asked to give permission to a health professional to determine your anthropometric measurements, including height, Body Mass Index (BMI) (Kg/M²), Percent Body Fat (%) and Visceral fat level, using portable instruments.

Contact detail

If there are any issues regarding this research that you would like to discuss further, please do not hesitate to contact one of the members of the research team listed below.

Hamdi Lemamsha

Email: hamdi.lemamsha@beds.ac.uk.

M: +218 (0) 924887865

The supervisory team:

Professor Gurch Randhawa

Professor of Diversity in Public Health
Director, Institute for Health Research (IHR)
Putteridge Bury campus
Hitchin Road
Luton, LU2 8LE
T: +44 (0)1582 743797
M: +44 (0)7718 517196
Email: gurch.randhawa@beds.ac.uk
Website - www.beds.ac.uk/research/ihr

Dr Chris Papadopoulos
Senior Lecturer
University of Bedfordshire
Room 32, Putteridge Bury
Hitchin Road
Luton, LU2 8LE
T: +44 (0)1582 743 273
Email: chris.papadopoulos@beds.ac.uk
Website - www.beds.ac.uk/research/ihr

Dated: 1 October 2013

Appendix 5.24 Informed Consent Form for Quantitative study.

University of Bedfordshire

Participant Identification Number: [0 0 0]

<u>Informed Consent Form for Quantitative study</u>

Title of the study : **Exploring the risk and protective factors associated with obesity**

amongst adults aged 20 to 65 years: A case study in Benghazi, Libya.

The researcher: **Hamdi Lemamsha**

The Supervisory team:

Professor Gurch Randhawa

Dr. Chris Papadopoulos   **Please tick the box**

1. I confirm that I have read and understood the research Information Sheet for the above study, or that the Information Sheet has been read to me, and I have had the opportunity to ask questions about it, and any questions that I have asked have been answered to my satisfaction.   ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without my legal rights being affected.   ☐

3. I understand that only the above researcher, Mr. Hamdi Lemamsha, and his supervisory team from the University of Bedfordshire, who is working on the research, will have access to the data that I provide.   ☐

4. I understand that any data or information used in any publications which arise from this study will be anonymous.   ☐

5. I understand that all data will be stored securely and is covered by the UK Data Protection Act 1998.   ☐

6. I consent voluntarily to take part as a participant in this research.   ☐

7. I would like to receive a summary report of the study and I am happy for the researcher to store my address details on a secured server in order to post the report to me when it is available.   ☐

Signature of Participant Date

<div style="border:1px solid black; width:300px; height:120px;"></div>

DD/MM/YYYY

On behalf of illiterate research participants
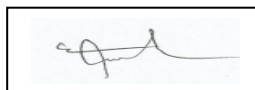
I have witnessed the accurate reading of the consent form to the participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Signature of Participant Date

<div style="border:1px solid black; width:300px; height:120px;"></div>

DD/MM/YYYY

I confirm that the participant has not been coerced into giving consent, and the consent has been given freely and voluntarily. A copy of the Informed Consent Form (ICF) and the Information Sheet has been provided to the participant.

Print Name of Researcher Signature of Researcher Date

Mr. Hamdi Lemamsha

DD/MM/YYYY

Appendix 5.25 Ethical considerations.

5.9 Ethical considerations

5.9.6 Competence

It was vital to ensure that all the research participants were capable of comprehending the relevance of the information being provided regarding the research, so that they could form a reasonable judgment about whether to give their informed consent. Precautions were taken to exclude any Libyan adults determined to be legally incompetent or with mental illness, in accordance with Libyan Electoral Law 2012 under Part III: The Right to Vote under article (4), (High National Election Commission (HNEC, 2013).as well as those who being under the influence of alcohol, as determined by the nurses. However, I did not encounter any cases of mental distress in the course of my fieldwork. I did however encounter three potential participants who were inebriated. After some negotiation with each of them, two of the three were excluded from my study (see Section 5.15 Field work challenges).

5.9.7 Consent

The three key components of the informed consent form (ICF) – disclosure, capacity and voluntariness – were mentioned above. The participants were informed of the voluntary nature of their participation, that is, that they had the right to decline to answer any question posed to them and/or to withdraw from the study at any time without penalty (Adams , 2013; NHMRC, 2015). I provided each participant with two copies of the ICF, since he/she was required to sign them immediately if he/she met the eligibility criteria and before any further procedures were under taken. Each ICF was signed by both the researcher and the potential participant . One signed copy was given to the participant, while the other was retained by the researcher. To comply with ethics regulations the participants had the right to withdraw their consent at any time, without incurring any legal liability (Adams & Callahan, 2014, 2014; NHMRC, 2015).

5.9.8 Confidentiality and anonymity

In order to allay the potential participants' concerns about their privacy, they were assured of confidentiality and anonymity (Adams & Callahan, 2014; NHMRC, 2015). Confidentiality and anonymity are associated with the rights to beneficence and dignity during the course of a research study. All the information collected relating to the participants during the research was kept confidential and all the survey questionnaire responses were not shared until all identifying information had been encoded and/or removed (Alcock. et al. 2014). All participants were assured of the privacy, confidentiality and the secure storage of the questionnaire (the computer ,files and folders were password-protected). Each questionnaire was anonymised by allocating it a case number and date; thus, they were not identifiable by

name (Adams & Callahan, 2014). The quantitative data collected was analysed and stored anonymously using a password-secured SPSS (Statistical Package for the Social Sciences) format. After entering all the data in the SPSS for analysis, all the collected questionnaires are currently being kept in a secure storage cabinet in the researcher's own home. Once the outcome of the research is revealed, all the questionnaires will be destroyed

Libyan Embassy
Cultural Attaché - London

سفارة ليبيا
الملحقية الثقافية - لندن

وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education & Scientific Research

To: Professor Gurch Randhawa
Director of Institute for Health Research
University of Bedfordshire
Putteridge Bury Campus
Hitchin Road
Luton LU2 8LE

Appendix 5.26 A letter concerning the confirmation the safety of fieldwork environment for a pilot study.

Subject: Hamdi Abdulla Lemamsha (Libyan Embassy Ref No – 8998)

Dear Professor Randhawa,   05/09/20132

We confirm that it is safe for Mr Hamdi Lemamsha, who is currently undertaking PhD (IHR Health) under your supervision, to undertake his field study in Libya and also to collect data required for this study.

Should you require any further information, please do not hesitate to contacting us.

Kind regards,

Dr Nasser Gharir
Academic Relations Coordinator
Libyan Embassy – London
Cultural Attaché

Institute for Health Research
University of Bedfordshire
Putteridge Bury Campus
Hitchin Road
Luton
Bedfordshire LU2 8LE
United Kingdom
http://www.beds.ac.uk/research/ihr uk

7 October 2013

Libyan Cultural Attaché
Libyan Embassy
61-62 Ennismore Gardens
London SW7 1NH
United Kingdom

Dear Sir/Madam

Fieldwork in Benghazi, Libya for PhD dissertation in Health Research

I write to seek your approval for my PhD student, **Mr. Hamdi Lemamsha**, to conduct fieldwork for his study in Benghazi, Libya. **Hamdi** is studying at the Institute for Health Research at the University of Bedfordshire, UK. He is studying the risk and protective factors associated with obesity amongst adults aged 20 to 65 years in Benghazi, Libya. To date, no studies have yet been published on obesity amongst Libyan adults. His study will therefore help to fill this gap in the literature. The Supervisory team of this study: **Professor Gurch Randhawa** and **Dr. Chris Papadopoulos**.

The purpose of this study is twofold: to explore the risk and protective factors associated with obesity amongst adults aged 20-65 in Benghazi, Libya, and to understand the nature and level of public knowledge about the risk and protective factors amongst Libyan adults.

Given that obesity among adults is under-researched in Libya, this will be an exploratory study which could be useful to researchers, public health experts, health authorities and psychologists for developing further studies on obesity in Libya, with the overall aim of reducing related diseases as well as the psycho-social problems caused by obesity. The financial burden on the state from treating obesity and its complications has been found to be considerable; therefore this study could also help to identify ways of mitigating the economic aspects of obesity.

Email: gurch.randhawa@beds.ac.uk   Tel: 01582 743797 or 07718 517196   Page 1 of 2

The main part of Hamdi's thesis is to gather primary data from abroad. His time plan necessitates that he commences his fieldwork in Benghazi in a period between **1st December 2013 until 31st January 2014**, starting with a primary study of phase one of mixed method which will enable him to refine his research instruments for the main study.

This study will receive ethical approval from the **Institute for Health Research Ethics Committee (IHREC)** once the candidate meets all requirements for approval and we hope that it will meet with your approval. Please find enclosed an information sheet giving further details about the study, including the research aims and objectives. Should you have any queries or require any further information, please contact me at the above address. I would be happy answer any questions you may have.

Yours faithfully

Gurch Randhawa, PhD FFPH

Professor of Diversity in Public Health

Director of the Institute for Health Research

University of Bedfordshire

Bedfordshire, UK

University of
Bedfordshire

Institute for Health Research
University of Bedfordshire
Putteridge Bury Campus
Hitchin Road
Luton
Bedfordshire LU2 8LE
United Kingdom
http://www.beds.ac.uk/research/ihr uk

7 October 2013

Omar Al-Mukhtar University
P.O.Box 991
Al-Bayda, Libya

Dear Sir/Madam

Fieldwork in Benghazi, Libya for PhD dissertation in Health Research

I write to seek your approval for my PhD student, **Mr. Hamdi Lemamsha**, to conduct fieldwork for his study in Benghazi, Libya. **Hamdi** is studying at the Institute for Health Research at the University of Bedfordshire, UK. He is studying the risk and protective factors associated with obesity amongst adults aged 20 to 65 years in Benghazi, Libya. To date, no studies have yet been published on obesity amongst Libyan adults. His study will therefore help to fill this gap in the literature. The Supervisory team of this study: **Professor Gurch Randhawa** and **Dr. Chris Papadopoulos**.

The purpose of this study is twofold: to explore the risk and protective factors associated with obesity amongst adults aged 20-65 in Benghazi, Libya, and to understand the nature and level of public knowledge about the risk and protective factors amongst Libyan adults.

Given that obesity among adults is under-researched in Libya, this will be an exploratory study which could be useful to researchers, public health experts, health authorities and psychologists for developing further studies on obesity in Libya, with the overall aim of reducing related diseases as well as the psycho-social problems caused by obesity. The financial burden on the state from treating obesity and its complications has been found to be considerable; therefore this study could also help to identify ways of mitigating the economic aspects of obesity.

Email: gurch.randhawa@beds.ac.uk   Tel: 01582 743797 or 07718 517196

University of
Bedfordshire

Institute for Health Research
University of Bedfordshire
Putteridge Bury Campus
Hitchin Road
Luton
Bedfordshire LU2 8LE
United Kingdom
http://www.beds.ac.uk/research/ihr uk

7 October 2013

Regional Health Ministry
P.O.Box : 97521
Benghazi, Libya

Dear Sir/Madam

Fieldwork in Benghazi, Libya for PhD dissertation in Health Research

I write to seek your approval for my PhD student, **Mr. Hamdi Lemamsha**, to conduct fieldwork for his study in Benghazi, Libya. **Hamdi** is studying at the Institute for Health Research at the University of Bedfordshire, UK. He is studying the risk and protective factors associated with obesity amongst adults aged 20 to 65 years in Benghazi, Libya. To date, no studies have yet been published on obesity amongst Libyan adults. His study will therefore help to fill this gap in the literature. The Supervisory team of this study: **Professor Gurch Randhawa** and **Dr. Chris Papadopoulos**.

The purpose of this study is twofold: to explore the risk and protective factors associated with obesity amongst adults aged 20-65 in Benghazi, Libya, and to understand the nature and level of public knowledge about the risk and protective factors amongst Libyan adults.

Given that obesity among adults is under-researched in Libya, this will be an exploratory study which could be useful to researchers, public health experts, health authorities and psychologists for developing further studies on obesity in Libya, with the overall aim of reducing related diseases as well as the psycho-social problems caused by obesity. The financial burden on the state from treating obesity and its complications has been found to be considerable; therefore this study could also help to identify ways of mitigating the economic aspects of obesity.

Email: gurch.randhawa@beds.ac.uk   Tel: 01582 743797 or 07718 517196

Schedule of survey visits in February 2014

The first polling district: Al-Fuwayhat: 28 participants

S.N	Date	Time	Participant number	Gender	Meeting place	Outcome
1	04-02-2014 Tuesday	9:00-9:25	7707	F	Home	✓
2		9:25-9:45	7594	F	Home	✗ Refused
3		10:00-10:25	1051	F	PCT-F	✓
4		10:30-10:55	599	M	PCT-F	✓
5		11:05-11:10	938	F	Home	✗ Pregnant
6		11:30-11:55	**147**	F	Home	✗ Refused
7		12:05-12:25	7820	F	PCT-F	✓
8		12:40-13:00	6351	F	Home	✓
		13:00-14:00	Lunch time			
9		14:00-14:20	1164	M	Home	✓
10		14:35-14:55	712	M	Polyclinics F	✓
11		15:30-15:50	6464	F	Polyclinics F	✓
12		16:00-16:20	1390	F	Home	✓
13		16:30-16:50	7255	F	Polyclinics F	✓
1	05-02-2014 Wednesday	9:00-9:20	6690	M	Home	✓
2		9:35-9:45	6916	M	Home	LQRC ✓
3		10:00-10:25	486	M	Home	✓
4		10:40-11:00	7933	M	PCT-F	✓
5		11:15-11:20	34	M	Home	✗ Chair-bound
6		11:40-11:50	373	F	Home	LQRC ✓
7		12:20-12:40	7029	M	PCT-F	✓
8		12:40-13:00	7368	F	PCT-F	✓
		13:00-14:00	Lunch time			
			Visited all 7 participants who were informed by post			
9		14:00-14:07	260	M	Home	✗ Refused
10		15:30-15:50	825	F	Home	✓
11		15:05-15:17	7481	F	Home	LQRC ✓
12		15:40-16:00	6577	F	Home	✓
13		16:15-16:25	6803	F	Home	✗ High-security building
14		16:40-16:57	7142	M	Home	✓
15		17:08-17:25	1277	F	Home	✗ Incomplete survey

Legend for table:

▯ Meeting place at the clinic

▯ Meeting place at home

▮ Lunchtime

▮ Ineligible, not approached and participants who refused

▯

People informed about research *"received a pre-notification letter"* by mail.

Acronym:
LQRC: Leave the **Q**uestionnaire with the participant and **R**eturned to **C**ollect it later,
PCT-F: Primary Care Trust Al-Fuwayhat
Polyclinics F: Polyclinics Al-Fuwayhat

<u>Outcome of visits to the first polling district Al-Fuwayhat:</u>

Outcome of 1st district Al-Fuwayhat 28 participants.	No of ineligible participants	Refusals to participate	Not approached	Incomplete survey	Completed surveys from eligible participants			Total of The prospective participants
					Male	Female	Total	
Total	1 Chair-bound 1 Pregnant 2	3	1	1	9	12	21	28

<u>Response rate the First polling district Al-Fuwayhat:</u>

$$\frac{20}{28} \text{ x100= 71\%}$$

Schedule of survey visits in February 2014

The second polling district: Al-Kwayfiya: 36 participants

S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
1		9:00-9:20	4649	F	PCT-K	✓
2		9:25-9:45	3406	M	PCT-K	✓
3		09:50-10:10	4084	F	PCT-K	✓
4		10:25-10:35	5327	M	Home	LQRC ✓
5		10:47-11:10	6005	F	Home	LQRC ✓
6		11:30-11:37	5666	M	Home	✗Leg injury
7	06-02-2014 Thursday	12:00-12:20	6457	F	PCT-K	✓
8		12:40-12:50	6231	M	Home	✗Nobody present
		13:00-14:00			Lunch time	
9		14:00-14:10	5553	F	Home	LQRC ✓
10		14:35-14:55	5202	F	Polyclinics K	✓
11		15:10-15:20	3623	F	Home	LQRC ✓
12		15:35-15:55	4875	F	Polyclinics K	✓
13		16:10-16:30	2954	F	Home	✓
14		16:45-16:57	3745	F	Home	LQRC ✓
15		17:15-17:25	3858	F	Home	✗Religious family
16		17:40-18:00	4310	M	Home	✓
		9:00-13:00			Holiday: It was imposable to recruit any participants due to the prayer Time	
		13:00-14:00			Lunch time	
1		14:00-14:20	5101	M	Home	✓
2		14:35-14:55	6344	F	Home	✓
3		15:10-15:30	3180	M	Home	✓
4	07-02-2014 Friday	15:40-15:50	4197	F	Home	LQRC ✓
5		16:10-16:30	4423	F	Home	✓
6		16:45-16:55	4988	F	Home	✗ Nobody present
7		17:10-17:30	5440	F	Home	✓
8		17:40-17:45	5510	F	Home	✗ Refused over phone call

S.N	Date	Time	Participant number	Gender	Meeting place	Outcome
		9:00-11:**00**	Holiday: some participants accepted to meet after 11 am			
1		11:00-11:10	2728	M	Home	LQRC ✓
2		11:35-11:55	5779	M	Polyclinics K	✓
3		12:10-12:30	6118	M	Home	✓
4		12:40-13:00	5892	F	Home	✓
	08-02-2014 Saturday	13:00-14:00	**Lunch time**			
1		14:00-14:20	8291	M	Home	✓
2		14:35-14:55	3971	F	Home	✓
3		15:10-15:20	4536	F	Home	LQRC ✓
4		15:40-15:50	6213	F	Home	✕ Incomplete survey
5		16:02-16:20	3293	M	Home	✓
6		16:32-16:50	3067	F	Home	✓
7		17:05-17:24	2615	M	Home	✓
8		17:30-17:53	4512	F	Home	✕ Refused over phonecall

Legend for table:

☐ Meeting place at the clinic

☐ Meeting place at home

☐ Lunchtime

☐ Ineligible, not approached and participants who refused

☐ People informed about research *"received a pre-notification letter"* by mail.

Acronym:
LQRC: Leave the **Q**uestionnaire with the participant and **R**eturned to **C**ollect it later,
PCT-K: Primary Care Trust Al-Kwayfiya
Polyclinics K: Polyclinics Al-Kwayfiya

Outcome of visits to the second polling district Al-Kwayfiya:

Outcome of Al-Kwayfiya: 36 participants.	No of ineligible participants	Refusals to participate	Not approached	Incomplete survey	Completed surveys from eligible participants			Total of The prothe research participants
					Male	Female	Total	
Total	1 Leg injury	2	3	1	11	18	29	36

Response rate the First polling district Al-Kwayfiya:

$$= \frac{29}{36} \text{ x100=80.6} = 81 \text{ \%}$$

Schedule of survey visits in February 2014

The third polling district: Raas Abayda: 29 participants

S.N	Date	Time	Participant number	Gender	Meeting place	Outcome
1		9:00-9:10	5112	F	Home	LQRC ✓
2		9:30-9:50	6016	F	PCT-R	✓
3		10:05-10:25	6920	M	Home	✓
4		10:45-10:55	6355	M	Home	Resident< 5 yrs
5		11:10-11:15	6242	F	Home	Resident< 5 yrs
6		11:40-12:00	7146	M	Home	✓
7	09-02-2014 Sunday	12:10-12:30	7711	F	PCT-R	✓
8		12:40-13:00	6581	F	Home	✓
		13:00-14:00	Lunch time			
9		14:00-14:20	8050	F	Home	✓
10		14:35-14:45	7372	F	Home	LQRC ✓
11		15:00-15:20	4999	M	Home	✓
12		15:35-15:45	5790	M	Football club	✗ incomplete survey
13		16:05-16:25	5451	M	Home	✓
14		16:40-16:50	5677	F	Home	✗ Pregnant
15		17:05-17:23	5564	M	Football club	✓
16		17:35-17:53	7598	F	PCT-R	✓
1		9:00-9:20	5903	M	Home	✗ Nobody home
2		9:35-9:45	8163	F	Home	LQRC ✓
3		10:00-10:20	5225	M	Home	✓
4		10:40-11:00	5338	M	Polyclinics R	✓
5		11:10-11:20	7033	M	Home	✗ Nobody home
6		11:35-11:55		F	Home	✗ Refused
7	10-02-2014 Monday	12:10-12:20	7824	F	Home	✗ Nobody home
8		12:30-12:40	5512	F	Home	✗ Refused
		13:00-14:00	Lunch time			
9		14:00-14:20	7259	M	Home	✓
10		14:35-14:55	6129	M	Home	✓
11		15:45-16:05	6468	M	Home	✓
12		16:20-16:40	6694	M	Home	✓
13		17:20-17:40	6807	M	Home	✓

Time explosion happened

Legend for table:

☐ Meeting place at the clinic

☐ Meeting place at home

☐ Lunchtime

☐ Ineligible, not approached and participants who refused

☐

People informed about research *"received a pre-notification letter"* by mail.

Acronym:
LQRC: Leave the **Q**uestionnaire with the participant and **R**eturned to **C**ollect it later,
PCT-R: Primary Care Trust Raas Abayda:
Polyclinics R: Polyclinics Raas Abayda:

Outcome of visits to the third polling district Al-Kwayfiya:

Outcome of Raas Abayda:: 29 participants.	No of ineligible participants	Refusals to participate	Not approached	Incomplete survey	Completed surveys from eligible participants			Total of The research participants
					Male	Female	Total	
Total	2 Resident< 5 yrs 1 Pregnant 3	2	3	1	14	8	20	29

Response rate the First polling district Raas Abayda::

$$= \frac{20}{29} \text{ x100=69\%}$$

Schedule of survey visits in February 2014

S.N	Date	Time	Participant number	Gender	Meeting place	Outcome
1		9:00-9:20	2582	F	Home	✓
2		9:35-9:55	2695	F	Home	✓
3		10:05-10:15	2356	F	Home	✗Pregnant
4		10:30-11:50	2130	M	Home	✓
5		11:05-11:25	2469	F	PCT-L	✓
6		11:25-11:45	3034	F	PCT-L	✓
7	11-02-2014 Tuesday	11:45-12:05	3586	F	PCT-L	✓
8		12:25-13:00	3147	F	Home	✓
		13:00-14:00			Lunch time	
9		14:00-14:20	3260	M	Home	✓
10		14:35-14:55	2243	F	Home	LQRC ✓
11		15:05-15:25	2017	F	Home	✓
12		15:40-16:00	2921	M	Home	LQRC ✓
13		16:10-16:30	3373	M	Home	✓
14		16:45-17:05	3712	M	Home	✓
15		17:15-17:25	3147	M	Home	✗Chair-bound
16		17:40-18:00	4164	M	Home	✓
1		9:00-9:20	5068	M	Home	✓
2		9:35-9:45	6537	M	Home	LQRC ✓
3		10:00-10:20	5407	M	Home	✓
4		10:40-11:00	4729	M	Polyclinics L)	✓
5		11:15-11:35	3938	M	Home	✓
6		11:50-12:10	5520	M	Home	✓
7		12:20-12:40	5859	F	Polyclinics L	✓
8	12-02-2014 Wednesday	12:50-13:00	6311	F	Home	✗Confined to bed
		13:00-14:00			Lunch time	
9		14:00-14:20	6424	F	Home	✓
10		14:35-14:55	6198	F	Home	✓
11		15:10-15:20	5972	M	Home	✗Can't stand upright
12		15:35-15:45	4277	M	Home	LQRC ✓
13		16:00-16:25	5746	F	Home	✓
14		16:40-16:50	5294	F	Home	LQRC ✓
15		17:05-17:25	5633	F	Home	✓
16		17:40-18:00	6085	F	Home	✗ High-security building

Militias deployed in the area

The fourth polling district: Laithi: 41 participants

1	13-02-2014 Thursday	9:00-9:10	5181	F	**Home**	**✕High-security building**
2		9:25-9:35	4051	M	Home	LQRC ✓
3		09:50-10:00	3825	F	Home	LQRC ✓
4		10:15-10:35	3490	F	Home	✓
5		10:50-11:10	4955	F	PCT-L	✓
6		11:10-11:30	4842	F	PCT-L	✓
7		11:30-11:50	4616	F	PCT-L	✓
8		12:05-12:25	4503	M	Home	✓
9		12:40-12:47	4233	M	Home	✕ Refused

Legend for table:

☐Meeting place at the clinic

☐Meeting place at home

☐Lunchtime

☐Ineligible, not approached and participants who refused

☐People informed about research *"received a pre-notification letter"* by mail.

Acronym:
LQRC: Leave the **Q**uestionnaire with the participant and **R**eturned to **C**ollected it later,
PCT-L: Primary Care Trust Laithi
Polyclinics L: Polyclinics Laithi

Outcome of visits to the foourth polling district Laithi:

Outcome of **Laithi:** 41 participants.	No of ineligible participants	Refusals to participate	Not approached	Incomplete survey	Completed surveys from eligible participants			Total of The research participants
					Male	Female	Total	
Total	1 Pregnant 1 Hunchback 1 Confined to bed 1 Chair-bound 4	1	2	Nil	15	19	34	41

Response rate the First polling district Raas Abayda::

$$= \frac{34}{41} \times 100 = 83\%$$

Schedule of survey visits in February 2014

The fifth polling district: Al-Hadaa'iq: 66 participants

S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
		13:00-14:00	Lunch time			
		14:00-14:20	Moved from 4th district to 5th district			
1	13-02-2014 Thursday	14:35-14:55	12495	M	Home	✓
2		15:10-15:20	11123	F	Home	✕ Vacant dwelling
3		15:40-16:00	11809	F	Home	✓
4		16:15-16:25	13617	M	Home	LQRC ✓
5		16:40-16:50	8869	M	Home	LQRC ✓
6		17:05-17:25	9359	M	Home	✓
7		17:40-17:50	8575	M	Home	✕ Unsteady on their feet

S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
		9:00-13:00	Holiday: It was imposable to recruit any participants due to the prayer Time			
		13:00-14:00	Lunch time			
1	14-02-2014 Friday	14:00-14:20	12005	M	Home	✓
2		14:35-14:55	13475	F	Home	✓
3		15:10-15:25	11417	F	Home	LQRC ✓
4		15:40-15:50	12299	F	Home	LQRC ✓
5		16:05-16:25	9065	F	Home	✓
6		16:40-17:00	8967	M	Home	✓
7		17:10-17:30	12103	M	Home	✓
8		17:40-18:00	14259	M	Home	✕ Pregnant

S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
		9:00-11:**00**	Holiday: some participants accepted to meet after 11 am			
1		11:00-11:20	11221	F	PolyclinicsH	✓
2		11:20-11:30	11907	M	PolyclinicsH	✓
3		11:40-12:00	12789	F	PolyclinicsH	✓
4		12:20-12:40	12985	F	Home	✓
	15-02-2014 Saturday	13:00-14:00	Lunch time			
5		14:00-14:20	9751	F	Home	✓
6		14:35-14:55	8183	F	Home	✓
7		15:10-15:30	8673	F	Home	✓
8		15:40-15:50	11319	M	Home	✗ Unable to stand
9		16:05-16:25	14063	F	Home	✓
10		16:40-17:00	8281	M	Home	✓
11		17:10-17:30	10633	F	Home	✓
12		17:40-17:57	9849	M	Home	✓
S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
1		9:00-9:10	10829	M	Home	✗Nobody home
2		9:20-9:37	12201	F	Home	✓
3		9:45-10:03	9947	M	Home	✓
4		10:15-10:33	8379	F	Clinic	✓
5		10:43-11:00	8771	F	Home	✓
6		11:12-11:30	13279	F	Home	✓
7		11:37-11:54	12543	M	Home	✓
8		12:02-12:21	13215	M	Home	✓
9		12:32-12:48	10045	F	Home	✓
	16-02-2014 Sunday	13:00-14:00	Lunch time			
10		14:00-14:20	11515	F	Home	✓
11		14:35-14:55	12539	F	Home	✓
11		15:10-15:20	13769	F	Home	LQRC ✓
13		15:35-15:55	10043	F	Home	
14		16:10-16:20	13965	F	Home	✗Recently moved
15		16:35-16:45	13181	F	Home	LQRC ✓
16		17:00-17:20	12887	F	Home	✓
17		17:35-17:40	13083	F	Home	✗ Pregnant

S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
1		9:00-9:20	9457	F	Home	✓
2		9:35-9:55	10535	F	Home	✓
3		10:10-10:30	11613	F	PolyclinicsH	✓
4		10:30-10:50	10214	F	PolyclinicsH	✓
5		11:10-11:30	14455	F	Home	✓
6		11:45-11:55	14161	F	Home	LQRC ✓
7	18-02-2014 Tuesday	12:10-12:25	11025	M	Home	✗ Resident< 5
8		12:40-13:00	10339	F	Home	✓
		13:00-14:00			**Lunch time**	
9		14:00-14:20	8085	F	Home	✓
10		14:35-14:45	8477	F	Home	LQRC ✓
11		15:00-15:10	9163	F	Home	LQRC ✓
12		15:07-15:21	10829	F	Home	✓
13		15:30-15:45	7012	F	PCT-H:	✓
14		15:47-16:02	8911	F	PCT-H:	✓
15		16:07-16:21	10445	F	PCT-H:	✓
16		16:27-16:43	10121	F	PCT-H:	✓

Legend for table:

☐ Meeting place at the clinic

☐ Meeting place at home

☐ Lunchtime

☐ Ineligible, not approached and participants who refused

☐ People informed about research *"received a pre-notification letter"* by mail.

Acronym:
LQRC: **L**eave the **Q**uestionnaire with the participant and **R**eturned to **C**ollect it later,
PCT-H: Primary Care Trust Hadaa'iq:
PolyclinicsH: Polyclinics Hadaa'iq:

Outcome of visits to the foourth polling district Laithi:

Outcome of Al-Hadaa'iq: 66 participants.	No of ineligible participants	Refusals to participate	Not approached	Incomplete survey	Completed surveys from eligible participants			Total of The research participants
					Male	Female	Total	
Total	2 Pregnant 2 Unable to stand 1 Resident< 5	6	3	Nil	13	39	52	66
	5							

Six means participants refused to take part over the phone calls once the day of recruitment therefore I excluded to add them in the schedule.

Response rate the First polling district Al-Hadaa'iq::

$$= \frac{52}{66} \times 100 = 78\%$$

Appendix 5.31 Map of Benghazi shows the locations of health facilities and the site of the explosion.

An EXPLOSION occurred in the Raas Abayda district on Monday, 10 February 2014 at 10:00 am, during the course of the data collection.

The **Mediterranean Sea**

Garyounis

Al-Keisha

Madinat Benghazi

Al-Salami-El-Garb

Benghazi Al-Jadida,

Hospital

Al-Sabre

Bu Atni

Polyclinic

Al-Break

Al-Salami-El-Sharki

Al-Uruba

Benghazi

Bennina

Primary Health Care Centre (PHC)

Distribution of hospitals, polyclinics and primary health care (PHC) centre's in Benghazi (WHO, 2005)

Libyan Embassy
Cultural Attaché - London

سفارة ليبيا
الملحقية الثقافية – لندن

وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education & Scientific Research

15/07/2014

5 Houghton Road
Bedford
MK42 9HQ

Re: Mr Hamdi Abdulla A. Lemamsha

Dear Mr Lemamsha,

We would like to inform you that the documents you submitted for the ethical approval of your research project entitled *Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya* have been reviewed and approved. We are happy to endorse the ethical approval of the qualitative protocol design of this project under the supervision of Professor Gurch Randhawa and Dr Chris Papadopoulos.

We hope that this approval will enable your supervisory team to obtain the main ethical approval from the appropriate committees.

If you require any further support throughout the course of your study, please do not hesitate to contact us.

Yours sincerely,

Dr Nasser Ghaith
Deputy Cultural Attaché for Academic Relations
Libyan Embassy
London

Appendix 5.33 Updated letter of fieldwork environment for a main study.

Professor Gurch Randhawa
Director of Institute for Health Research
University of Bedfordshire
Putteridge Bury Campus
Hitchin Road
Luton LU2 8LE   28/10/2014

Subject: Hamdi Abdulla Lemamsha (Libyan Embassy Ref No – 8998)

In reference to Mr Hamdi Lemamsha request, who is currently undertaking PhD (IHR Health) under your supervision, to undertake his field study in Libya and also to collect data required for this study, We would like to inform you that a permission for undertaking the main study entitled Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya." by the above named Libyan sponsored student has been approved. We also confirm that the situation in Libya is quite safe at present. However, we strongly recommend that the student should follow the Government's instructions regarding the areas that are safe to approach.

We hope that our approval will assist you as well as the University of Bedfordshire to make an appropriate judgment with regards to granting permission for Mr Lemamsha to conduct his quantitative and qualitative research work.

We trust that Mr Lemamsha will get the right support and guidance from his supervisory team in order to successfully complete his research project on time.

Should you require any further information, please do not hesitate to contacting us.

Kind regards,

Dr Abdelbasit Gadour
The Cultural Attaché
Libyan Embassy
London

Appendix 5.34 A letter of allocation of the qualified nurses in the fieldwork.

Dear Managers of the Benghazi Health Clinics,

Re: Assigning Nurses for research into obesity in Benghazi

Mr. Hamdi Abdulla A.Lemamsha PhD student at the **Institute for Health Research at the University of Bedfordshire, UK.,** who wishes to conduct the fieldwork for his research titled, *"Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya."*

This research requires assistance from the Health Authority in Benghazi to minimize any obstacles that the researcher maybe confronted by. Therefore, we would like to commission nurses from each health setting to work with the researcher, based on each of the determined districts that the participants are from.

The role of the nurse is to take the anthropometric measurements of the participants in the research, either at their homes, at a clinic or elsewhere based on an agreement made with the subjects.

If you have any further questions or require any additional information, please do not hesitate to contact us.

Yours sincerely

Dr. HASSAN YIDRY

Director of Medical affairs, Benghazi

Appendix 5.35 The home visiting logs of the main study

Scheduled of Survey Visits in December 2014

First: Poling district: Al-Fuwayhat : Outstanding was 43 participants.

S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
		8:00-8:45	Physician –AB (Male) Diabetes Hospital			✓
1		9:00-9:17	4554	F	Home	✓
2		9:23-9:40	4102	F	Home	✓
3		9:47-10:04	2294	F	PCT-F	✓
4		10:05-10:20	2746	F	PCT-F	✓
5		10:27-10:44	3085	M	Home	✕ Not approached
6		10:50-11:07	1503	F	PCT-F	✓
7		11:08-11:28	2859	M	PCT-F	✓
8		11:30-11:47	2972	M	PCT-F	✓
9		11:48-12:07	2068	M	PCT-F	✓
	03-12-2014 Wednesday	12:07-13:00	Lunch time			
10		13:00-13:18	2181	M	PCT-F	✓
11		13:20-13:35	6249	F	PCT-F	✓
12		13:36-13:53	5797	M	PCT-F	✓
13		13:55-14:12	5232	F	PCT-F	✓
14		14:15-14:20	1955	M	Home	✕ Chair Bound
15		14:26-14:30	3537	M	Home	✕ live in Benghazi < 5Yrs
16		14:36-14:54	4215	F	Home	✓
17		16:00-16:20	4780	F	Home	✓
18		16:27-16:32	4441	F	Home	✕ Not approached
19		16:40-17:00	5006	F	Polyclinics F	✓
		19:00- 20:00	The interview with a Nurse has been cancelled due to the interrupted electricity and rescheduled on Tuesday 09/12/2014 at 14:15			
		8:00-8:45	Physician –AB (Male) Diabetes Hospital			✓
1		9:00-9:19	5910	M	Home	✓
2		9:26-9:5:45	5119	M	Home	✓
3		10:00-10:25	3876	M	Polyclinics F	✓
4		10:30-10:55	3311	M	Polyclinics F	✓
5		11:00-11:25	1842	M	Polyclinics F	✕ Not coming
6		11:30-11:55	2520	F	Polyclinics F	✓
7	04-02-2014 Thursday	12:00-12:25	3198	M	Polyclinics F	✓
8		12:30-12:55	5458	F	Polyclinics F	✓
		13:00-14:00	Lunch time			
9		14:00-14:10	6136	M	Home	✕ Refused
10		14:20-14:30	5571	F	Home	LQRC ✓
11		14:37-14:56	6023	F	Home	✓
12		15:05-15:23	2407	F	Home	✓
13		15:33-15:40	3763	F	Home	✕ Not approached
14		15:50-15: 57	3650	F	Home	✕ Not approached

15		16:07-16:17	4667	F	Home	LQRC ✓
16		16:26-16:36	4328	F	Home	LQRC ✓
17		16:45-16:55	2633	F	Home	✕ Not approached
		19:00- 20:00	Nurse Has been cancelled due to the interrupted electricity and rescheduled on Tuesday 09/12/2014 at 14:15			
	05-12-2014 Friday	9:00-13:00	*Holiday: It was opposable to recruit any participants due to the prayer Time*			
		13:00-14:00	**Lunch time**			
1		14:00-14:25	5345	M	Home	✓
2		14:31-14:53	5684	F	Home	✓
3		15:00-15:10	1729	M	Home	✕ Refused
4		15:22-15:40	3424	F	Home	✓
5		15:53-16:11	3650	F	Home	✓
6		16:20-16:38	4893	F	Home	✕ Pregnant
7		16:50-17:10	3989	F	Home	✕ Hunchback

Legend for table:

⬜ Meeting place at the clinic

⬜ Meeting place at home

⬛ Lunchtime

🟥 Ineligible, not approached and participants who refused

🟨 People informed about research *"received a pre-notification letter"* by mail.

Acronym:
LQRC: Leave the **Q**uestionnaire with the participant and **R**eturned to **collect** it later,
PCT-F: Primary Care Trust Al-Fuwayhat
Polyclinics F: Polyclinics Al-Fuwayhat

Outcome of visits to the first polling district Al-Fuwayhat:

Outcome of 1st district Al-Fuwayhat 71 participants.	No of ineligible participants	Refusals to participate	Not approached	Incomplete surveys	Completed surveys from eligible participants			Total of the research participants
					NO of male	NO of Female	Total	
Pilot study	2	3	1	1	9	12	21	28
Main study	3	2	7	Nil	13	18	31	43
Total	5	5	9	1	21	30	51	71

Response rate the third polling district Al-Fuwayhat:

Response rate in a pilot study	Response rate in the main study	Total response rate in the 1st district
$\frac{21}{28}$ x100= 75%	$\frac{31}{43}$ x100= 72%	$\frac{51}{71}$ x100= 72 %

Scheduled of Survey Visits in December 2014

2nd Polling district: Al-Kwayfiya: 56 participants: Table (2)

S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
1		11:00-11:15	6683	F	Clinic	
2		11:15-11:30	7135	F	Clinic	
3		11:30-11:45	6570	M	Clinic	✕ Not coming
4		11:45-12:00	6909	F	Clinic	
5		12:10-12:26	6796	F	Home	
6		12:29-12:34	7022	M	Home	
7	06-12-2014 Saturday	12:40-12:48	7474	M	Home	
		13:00-14:00	Lunch time			
8		14:00-14:15	7361	F	Clinic	
9		14:15-14:30	7248	F	Clinic	
10		14:30-14:45	8039	M	Clinic	✕ Arm amputed
11		14:45-15:00	7813	M	Clinic	
12		15:00-15:15	7587	F	Clinic	
13		15:15-15:30	8265	F	Clinic	
14		15:30-15:45	8604	M	Clinic	
15		15:45-16:00	8152	M	Clinic	✕ Not coming
1		9:00-9:15	8717	M	Clinic	
2		9:15-9:30	9169	F	Clinic	
3		9:30-9:45	8830	M	Clinic	
4		9:50-10:06	8378	F	Home	✕ Refuse by household
5		10:10-10:15	7926	F	Home	✕ Social occasion
6		10:25-10:47	7700	F	Home	
7		10:52-11:10	1674	M	Home	
8	07-12-2014 Sunday	11:20-11:40	2126	F	Home	
9		11:50-11:55	8491	F	Home	✕ Pregnant
10		12:20-12:20	8943	M	Home	
11		12:25-12:45	9395	M	Clinic	
		13:00-14:00	Lunch time			
12		14:00-14:25	9056	F	Home	
13		14:30-14:55	9282	F	Home	
14		15:05-15:20	9621	M	Grocery	
15		15:20-15:35	9847	M	Clinic	✕ Not coming

S. N.	Date	Time	Number of Participant	Gender	Meeting place	Outcome
1		9:00-9:15	9734	F	Clinic	
2		9:15-9:30	92	F	Clinic	
3		9:30-9:45	544	M	Clinic	
4		9:50-10:00	883	F	Clinic	
5		10:00-10:15	1109	M	Clinic	
6		10:30-10:45	657	M	Clinic	✕ Not coming
7		10:45-11:00	205	F	Clinic	
8		11:00-11:15	431	M	Clinic	
9		10:15-11:30	996	F	Clinic	
10	08-12-2014 Monday	11:30-11:45	2352	M	Clinic	
11		11:45-12:00	2239	F	Clinic	✕ Not coming
12		12:00-12:15	1787	F	Social Service Institute	
13		12:15-12:30	2013	F	Social Service Institute	
14		12:30-12:45	1561	F	Social Service Institute	
15		12:45-13:00	1900	F	Social Service Institute	
		13:00-14:00	Lunch time			
		14:00-15:00	Interview schedule			
		15:30-16:30	Interview schedule			
1		9:00-9:15	1448	M	Clinic	
2		9:15-9:30	10186	M	Clinic	
3		9:30-9:45	10412	F	Clinic	
4		10:05-10:26	9508	F	Home	
5		10:36-10:52	10299	M	Home	
6	09-12-2014 Tuesday	11:00-11:20	318	F	Home	
7		11:30-11:55	770	F	Home	✕ Leg injury
8		12:00-12:20	1222	F	Home	
9		12:25-12:45	2126	F	Clinic	
		13:00-14:00	Lunch time			
10		14:30-14:52	9960	F	Home	
11		15:10-15:35	1335	F	Home	

Legend for table:

☐ Meeting place at the clinic

☐ Meeting place at home

■ Lunchtime

■ Ineligible, not approached and participants who refused

☐ People informed about research *"received a pre-notification letter"* by mail.

Outcome of visits to the second polling district: Al-Kwayfiya:

Outcome of 2nd district Al-Kwayfiya: 92 participants.	No of ineligible participants	Refusals to participate	Not approached	Incomplete surveys	Completed surveys from eligible participants			Total of the research participants
					NO of male	NO of Female	Total	
Pilot study	1	2	3	1	11	18	29	36
Main study	3	2	5	Nil	17	29	46	56
Total	4	4	8	1	28	47	75	92

Response rate the second polling district: Al-Kwayfiya

Response rate in a pilot study	Response rate in the main study	Total response rate in the first district
$= \frac{29}{36}$ x100=80.6 = 81 %	$= \frac{46}{56}$ x10= 82%.	$= \frac{75}{92}$ x10= 81.5= 82 %.

Scheduled of Survey Visits in December 2014

Table (3): The third polling district 'Raas Abayda': 64 participants

S.N	Date	Time	Participant's Number	Gender	Meeting place	Outcome
1		9:00-9:15	22	F	Walk-in Clinic R	✓
2		9:17-9:32	926	F	Walk-in Clinic R	✓
3		9:35-9:48	1152	M	Walk-in Clinic R	✓
4		9:49-9:55	1717	F	Walk-in Clinic R	✕ Not coming
5		11:00-10:15	1943	F	Walk-in Clinic R	✓
6		10:17-10:34	2395	M	Walk-in Clinic R	✓
7	10-12-2014 Wednesday	10:35-10:40	2734	M	Walk-in Clinic R	✕ Not coming
8		10:43-11:00	3186	F	Walk-in Clinic R	✓
9		11:09-11:28	1604	F	Home	✓
10		11:45 12:02	3299	F	Home	✓
11		12:10-12:15	2508	F	Home	✕ Not approached
12		12:25-12:40	2847	F	Home	✓
13		12:49-13:56	2169	F	Home	✕ Chair bound
		13:00-14:00	Lunch time			
		14:00-15:00	Interview schedule			
		16:00-17:00	Interview schedule			
1		9:00-9:15	361	M	Polyclinic R	✓
2		9:17-9:30	1378	M	Polyclinic R	✓
3		9:33-9: 43	248	F	Polyclinic R	✓
4		9:45-10:00	813	M	Polyclinic R	✓
5		10:03-10:18	4768	M	Polyclinic R	✓
6		10:20-10:33	2056	F	Polyclinic R	✓
7		10:40-10:47	474	F	Home	✕ Fled from conflict
8	11-12-2014 Thursday	10:57-11:15	135	F	Home	✓
9		11:23-11:40	700	F	Home	✓
10		11:50-12:08	1265	F	Home	✓
11		12:15-12:22	1491	M	Home	✕ Fled from conflict
		13:00-14:00	Lunch time			
12		14:00-14:14	587	F	Health care setting R	✓
13		14:16-14:30	2282	M	Health care setting R	✓
14		14:35-14:48	2960	F	Health care setting R	✓
15		14:51-14:57	4542	F	Health care setting R	✕ Not coming
16		15:00-15:16	3638	F	Health care setting R	✓
17		16:20-16:39	4316	M	Health care setting R	✓
S.N	Date	Time	Participant's Number	Gender	Meeting place	Outcome

	Date	Time	Participant's Number	Gender	Meeting place	Outcome
		9:00-13:00	Holiday: It was imposable to recruit any participants due to the prayer Time			
1	12-12-2014 Friday	13:00-13:20	3977	M	Home	✓
2		13:25-13:43	4203	F	Home	✓
3		13:50-14:10	4429	M	Home	✗ Fled from conflict
4		14:15-14:35	4655	F	Home	✓
5		14:40-15:00	4881	F	Home	✓
6		15:10-15:27	2621	F	Home	✗ Pregnant
7		15:33-15:50	3073	F	Home	✓
8		16:00-16:20	3525	M	Home	✗ Limp
9		16:32:16:50	3751	F	Home	✓
S.N	Date	Time	Participant's Number	Gender	Meeting place	Outcome
	13-12-2014 Saturday	9:00-11:00	Holiday: some participants accepted to meet after 11 am			
1		11:00-11:20	8276	M	Polyclinic R	✓
2		11:25-11:43	3412	F	Polyclinic R	✓
3		11:50-12:10	3864	M	Polyclinic R	✓
4		12:15-14:35	4090	M	Polyclinic R	✓
			Lunch time			
5		13:00-13:22	8389	F	Home	✗ Hunchback
6		13:30-13:50	1039	F	Home	✓
7		14:10-14:36	1830	F	Home	✗ Refuse due to head of household

Legend for table:

☐ Meeting place at the clinic

☐ Meeting place at home

☐ Lunchtime

☐ Ineligible, not approached and participants who refused

☐ People informed about research *"received a pre-notification letter"* by mail.

R: Raas Abayda district.

Outcome of visits to the third polling district Raas Abayda:

Outcome of 3th district Raas Abayda: 75 participants.	No of ineligible participants	Refusals to participate	Not approached	Incomplete surveys	Completed surveys from eligible participants			Total of the research participants
					NO of male	NO of Female	Total	
Pilot study	3	2	3	1	12	8	20	29
Main study	4	1	7	Nil	11	23	34	46
Total	7	3	10	1	23	31	54	75

Response rate the third polling district Raas Abayda:

Response rate in a pilot study	Response rate in the main study	Total response rate in the Thrid district
$=\frac{20}{29}$ x100=69%	$=\frac{34}{46}$ x100= 74%.	$=\frac{54}{75}$ x100= 72 %.

Scheduled of Survey Visits in December2014

4th Polling district:: Laithi :64 participants:

S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
1	14-12-2014 Sunday	9:00-9:17	7102	F	Polyclinics L	✓
2		9:19-9:35	6650	F	Polyclinics L	✓
3		9:36-9:40	6763	M	Polyclinics L	✗ Not coming
4		9:42-9:56	7893	M	Polyclinics L	✓
5		10:03-10:15	8119	F	Polyclinics L	✓
6		10:25-10:47	8458	F	Polyclinics L	✓
7		10:52-11:10	8345	F	Home	✓
8		11:20-11:40	8684	M	Home	✓
9		11:50-11:55	7554	F	Home	✓
10		12:00-12:20	7328	F	Home	✓
11		12:27-12:52	9249	M	Home	✓
		13:00-14:00	Lunch time			
12		14:00-14:17	10605	F	Polyclinics L	✓
13		14:25-14:35	6876	F	Home	✓
14		14:42-15:00	6989	M	Home	✓
15		15:11-15:30	7215	M	Home	✓
16		15:38-15:50	7667	F	A primary care trust (PCT- L)	✓
1	15-12-2014 Monday	9:00-9:15	9588	F	PCT- L	✓
2		9:19-9:30	9023	F	PCT- L	✓
3		9:33-9:45	10153	M	PCT- L	✓
4		9:54-10:00	9927	F	Home	✗ Chair bound
5		10:06-10:11	9475	F	Home	✗ social occuasion
6		10:18-10:23	9814	F	Home	✓
7		10:30-11:38	10379	M	Home	✓
8		11:45-11:52	8232	F	Home	✓
9		12:00-12:05	8571	F	Home	✗ Pregnant
10		12:15-12:38	9136	F	Home	✓
11		12:45-13:07	10944	F	PCT- L	✓
		13:00-14:00	Lunch time			
12		14:00-14:25	10831	F	Home	✓
13		14:30-14:55	11396	F	Home	✓
14		15:05-15:20	103	M	PCT- L	✓
15		15:20-15:35	329	M	PCT- L	✗ Not coming
16		15:35-15:50	10266	F	Home	✓

S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcom
1		9:00-9:15	11283	F	Walk-in Clinic L	✓
2		9:16-9:30	11735	F	Walk-in Clinic L	✓
3		9:33-9:47	1685	M	Walk-in Clinic L	✓
4		9:50-10:00	1459	F	Walk-in Clinic L	✓
5		10:03-10:18	1233	M	Walk-in Clinic L	✓
6	16-12-2014 Tuesday	10:20-10:25	1007	M	PCT- L	✕ Not coming
7		10:35-10:42	668	F	PCT- L	✓
8		10:45-11:00	1911	F	PCT- L	✓
9		11:03-11:30	894	F	PCT- L	✓
10		11:38-11:43	8910	F	Home	✕ Refused due to head of household
11		11:54-12:15	9362	F	Home	✓
12		12:22-12:43	9701	F	Home	✓
		13:00-14:00	Lunch time			
		14:00-15:00	Interview schedule			
		16:00-17:00	Interview schedule			
		8:00-8:00	Interview schedule			
1		9:00-9:12	11057	F	Home	✓
2		9:15-9:30	11509	F	Home	✓
3		9:30-9:45	10040	M	Home	✕ Not approached
4		9:50-10:06	442	F	Home	✓
5		10:10-10:15	216	F	Home	✓
6		10:25-10:47	11848	F	Home	✓
7		10:52-11:10	11622	F	Home	✓
8		11:20-11:40	1572	F	Home	✓
9	17-12-2014 Wednesday	11:50-11:55	1798	M	Home	✕ Opted out to participate
10		12:20-12:20	1346	M	Home	✕ Not approached
11		12:25-12:45	781	M	Home	✕ Not approached
		13:00-14:00	Lunch time			
		14:00-15:00	Interview schedule			
12		15:07-15:12	7441	M	Home	✕ Drunk
13		15:20-15:26	8006	M	Home	✕ Not approached
14		15:35-15:41	7780	M	Home	✕ Not approached
15		15:48-15:54	10492	M	Home	✕ Not approached
16		16:02-16:07	1120	M	Home	✕ Fled from conflict.
17		16:14-16:20	555	M	Home	✕ Not approached
18		16:27-16:32	11170	M	Home	✕ Not approached
19		16:38-16:44	8797	F	Home	✕ Opted out to participate
20		16:51-17:00	10718	M	Home	✕ Incorrect address
		I revisited the last potential participants in the next day in order to improve the response rate due to the reason went the most of them to 'Refill gases cylinders'				
1	1 8	9:00-9:20	781	M	Home	✓

2		9:27-9:43	10040	M	Home	✓
3		9:50-10:08	10492	M	Home	✓
4		10:19-10:30	555	M	Home	✗ Despite revisiting no body at home
5		10:40-10:58	7441	M	Home	✗ he was not at his house during the second visit.
6		11:10-11:30	8006	M	Home	✗ Desipte revisiing no body at home
		13:00-14:00	Lunch time			
		14:00-15:00	Interview schedule			

Legend for table:

☐ Meeting place at the clinic

☐ Meeting place at home

☐ Lunchtime

☐ Ineligible, not approached and participants who refused

☐ People informed about research *"received a pre-notification letter"* by mail.

L: Laithi district.

Outcome of visits to the fourth polling district Laithi:

Outcome of 4th district Laithi:105 participants	No of ineligible participants	Refusals to participate	Not approached	Incomplete surveys	Completed surveys from eligible participants			Total of the research participants
					Male	Female	Total	
Pilot study	4	1	2	Nil	15	19	34	41
Main study	3	1	8	Nil	18	34	52	64
Total	7	2	10	Nil	33	53	86	105

Response rate the fourth polling district Laithi:

Response rate in a pilot study	Response rate in the main study	Total response rate in the Thrid district
$=\dfrac{34}{41}$ x100=83%	$\dfrac{52}{64}$ X100= 81%.	$=\dfrac{86}{105}$ x100= 82 %.

Scheduled of Survey Visits in December 2014

5th Polling district:: Al-Hadaa'iq :103 participants

S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
		9:00-13:00	Holiday: It was imposable to recruit any participants due to the prayer Time			
		Lunch time				
1	19-12-2014 Friday	14:00-14:18	14945	F	Home	✓
2		14:27-14:44	15043	F	Home	✓
3		14:52-15:10	14847	M	Home	✓
4		15:17-15:22	14553	F	Home	✕ Pregnant
5		15:29-15:47	14651	F	Home	✓
6		15:56-16:00	15631	M	Home	✕ Not approached
7		16:10:16:27	14749	F	Home	✓
8		16:35:16:40	15141	M	Home	✕ Not approached
9		16:47:16:52	15239	F	Home	✓

S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
1	20-12-2014 Saturday	11:00-11:18	15337	F	Polyclinic H	✓
2		11:23-11:40	15435	F	Polyclinic H	✓
3		11:48-12:06	15533	M	Polyclinic H	✓
4		12:15-12:33	16317	M	Polyclinic H	✓
		13:00-14:00	Lunch time			
5		13:00-13:18	16415	F	Home	✓
6		13:29-13:47	16219	M	Home	✓
7		13:55-14:12	16513	F	Home	✓
8		14:21-14:38	15827	F	Home	✓
9		14:47-14:52	15925	M	Home	✕ Not approached
10		15:03-15:22	16611	M	Home	✓
11		15:35-15:40	17101	M	Home	✕ Not approached
12		15:53-16:12	17885	M	Home	✓
13		16:33-16:50	16121	M	Home	✓

S. N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
1		9:00-9:17	15729	F	Polyclinics H	✓
2		9:25-9: 43	16023	M	Polyclinics H	✓
		10:00-11:00			Interview schedule	
3		11:14-11:31	16905	M	Polyclinics H	✓
4		11:34-11:50	16807	F	Polyclinics H	✓
5	21-12-2014 Sunday	11:52-11:00	17199	F	Polyclinics H	✓
6		12:12-12:28	16709	M	Polyclinics H	✓
7		12:31-12:50	17983	F	Polyclinics H	✓
		13:00-14:00			Lunch time	
		14:00-15:00			Interview schedule	
8		15:15-15:31	17689	F	Polyclinics H	✓
9		15:34-15:50	17297	M	Polyclinics H	✓
10		15:35-16:00	17493	M	Polyclinics H	✓
11		16:03-16:19	17787	F	Polyclinics H	✓
12		16:30-16:37	17395	F	Home	✕ Refused
1		9:00-9:16	18375	F	PCT-H	✓
2		9:20-9:33	18473	F	PCT- H	✓
3		9:35-9:40	18571	M	PCT- H	✕ Confined bed
		10:00- 11:00			Interview schedule	
4		11:18-11:35	18277	F	Home	✓
5		11:43-11:48	18081	M	Home	✕ Less than 5 years
6		12:00-12:17	19061	F	Home	✓
7	22-12-2014 Monday	12:25-12:43	18767	F	Home	✓
		13:00-14:00			Lunch time	
		14:00-15:00			Interview schedule	
8		15:12-15:25	743	F	PCT-H	✓
9		15:28-15:45	18963	M	PCT- H	✓
10		15:49-16:07	155	M	PCT- H	✓
11		16:17-16:35	2507	F	PCT-H	✓
12		16:37-16:43	547	M	Home	✕ Hunchback
13		16:50-16:55	17591	F	Home	✕ Refused

S. N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
1		9:00-9:16	645	F	PCT-H	✓
2		9:18-9:31	841	F	PCT-H	✓
3	23-12-2014 Tuesday	9:34-9:48	351	M	PCT-H	✓
4		9:53-10:08	1135	F	PCT-H	✓
5		10:11-10:26	1233	M	PCT-H	✓
6		10:40-10:45	939	M	Walk-in Clinic H	✕ Refused
7		10:48-11:03	1527	F	Walk-in Clinic H	✓

8		11:05-11:20	1331	F	Walk-in Clinic H	✓
9		11:35-11:49	3291	F	Walk-in Clinic H	✓
10		11:52-11:58	1429	M	Walk-in Clinic H	✕ Limp
11		12:02-12:18	2017	F	Walk-in Clinic H	✓
12		12:21-12:38	1723	M	Walk-in Clinic H	✓
13		12:41-13:00	1821	F	Walk-in Clinic H	✓
		13:00-14:00	Lunch time			
		14:00-15:00	Interview schedule			
14		15:12-15:25	17003	F	Home	✕Not approached
15		15:28-15:45	18669	F	Home	✓
16		15:49-16:07	18179	F	Home	✓
17		16:17-16:35	18865	F	Home	✓
1		9:15-9:32	2703	M	Clinic	✓
2		9:34-9:49	2311	M	Clinic	✓
3		9:53-10:08	2997	F	Clinic	✓
4		10:18-10:36	2213	F	Home	✓
5		10:47-11:05	3193	M	Home	✓
6		11:17-11:34	4663	F	Home	✓
7	25-12-2014 Thursday	11:42-12:00	3683	F	Home	✓
8		12:09-12:27	5251	M	Home	✓
9		12:35-13:03	4957	F	Home	✓
		13:00-14:00	Lunch time			
		14:00-15:00	Interview schedule			
10		15:07-15:25	5055	M	Home	✓
11		15:32-15:47	5349	M	Home	✓
12		15:53-16:11	3487	M	Home	✓
13		16:21-16:37	4271	M	Home	✓
14		16:44-17:00	4173	M	Home	✓

S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
		9:00-13:00	Holiday: It was imposable to recruit any participants due to the prayer Time			
			Lunch time			
1	26-12-2014 Friday	14:00-14:18	3977	F	Home	✓
2		14:27-14:44	4467	M	Home	✓
3		14:52-15:10	4075	M	Home	✓
4		15:17-15:22	57	F	Home	✗ Hunchback
5		15:29-15:47	253	F	Home	✓
6		15:56-16:00	449	M	Home	✗ Not approached
7		16:10:16:27	2605	F	Home	✓
8		16:35:16:40	1037	M	Home	✗ Not approached
9		16:47:16:52	2115	F	Home	✓
S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
1	27-12-2014 Saturday	11:00-11:18	1625	F	Home	✓
2		11:23-11:28	2801	F	Home	✗ Not approached
3		11:46-12:03	1919	F	Home	✓
4		12:15-12:34	2899	M	Home	✓
		13:00-14:00		Lunch time		
5		14:00-14:19	3095	F	Home	✓
6		14:27-14:43	2409	F	Home	✓
7		14:55-15:12	3389	F	Home	✓
8		15:21-15:26	3781	F	Home	✗ Pregnant
9		15:35-15:52	3879	F	Home	✓
10		16:04-16:22	4565	F	Home	✓
11		16:34-16:40	3585	F	Home	✗ Not approached
S.N	Date	Time	Number of Participant	Gender	Meeting place	Outcome
1	28-12-2014 Sunday	9:12-9:19	4761	F	Home	✗ Refused
2		9:30-9:47	4859	F	Home	✓
3		9:53:-10:00	5153	F	Home	✓
4		10:12-16:30	4369	F	Home	✓
5		10:37-16:55	5447	F	Home	✓

Legend for table:

☐ Meeting place at the clinic

☐ Meeting place at home

▨ Lunchtime

▮ Ineligible, not approached and participants who refused

☐ People informed about research *"received a pre-notification letter"* by mail.

H: Al-Hadaa'iq.

Outcome of visits to the third polling district Al-Hadaa'iq :

Outcome of 5th district Al-Hadaa'iq 169 participants	No of ineligible participants	Refusals to participate	Not approached	Incomplete surveys	Completed surveys from eligible participants			Total of the research participants
					NO of male	NO of Female	Total	
Pilot study	5	6	3	Nil	13	39	52	66
Main study	7	4	9	Nil	29	53	82	103
Total	12	10	12	Nil	42	93	135	169

Response rate the third polling district Al-Hadaa'iq:

Response rate in a pilot study	Response rate in the main study	Total response rate in the Thrid district
$= \frac{52}{66}$ x100=79%	$= \frac{83}{103}$ x100= 81%.	$\frac{135}{169}$ X100= 80 %.

Appendix 5.36 Summary the main findings of the main fieldwork enquiry.

Table 5.37.1 shows how I computed the number of research participants in each polling district for my pilot study. The table shows the percentage of the calculated sample size for each polling district, the total research sample and the numbers of participants in each polling district for both the pilot and main study (see Appendices 5.7 and 5.8 for details).

Table 5. 37.1 : The % of the calculated sample size for each polling district and number of participants for the whole study (pilot and main).

S N	Polling district name	Number of registered voters in each polling district	% of the calculated sample size for each polling district for the 512 participants	Number of the participants for each polling district (For total sample size n = 512)	Number of the participants for each polling district (Sample size of the pilot study n = 200)	Number of the participants for each polling district (Main study sample) = 312
1.	Al-Fuwayhat	8,012	13.8 %	71	28	43
2.	Al-Kwayfiya	10,433	18 %	92	36	56
3.	Raas Abayda	8,480	14.7 %	75	29	46
4.	Laithi	11,858	20.5 %	105	41	64
5.	Al-Hadaa'iq	19,102	33 %	169	66	103
	Total	57,885	100 %	512	200	312

Having determined the number of outstanding participants who were recruited in the main study and selected them from each of the five polling districts, the next step was to notify each individual, either by phone or by post based on the mean viability.

5.37.1 A summary of the recruitment of the study participants:

Table 5.37.2 Illustrates the percentage of potential participants, 62% (n=194), who were informed by phone, with regards to the research, whilst the percentage of other respondents, 38 % (n=118) had pre-notification letters mailed to them by the post office

	Five polling districts selected from each of the 5 constituencies	Number of the prospective participants in each of the five polling districts Sample size = 312	Number of the prospective participants recruited by a phone call	Number the prospective participants recruited by post
1	Al-Fuwayhat	43	32	11
2	Al-Kwayfiya	56	44	12
3	RaasAbayda	46	25	21
4	Laithi	64	31	33
5	Al-Hadaa'iq	103	62	41
	Total	312	194 (62%)	118 (38%)

Table 5.37.3 Illustrates the summary of recruiting of the potential participants in each of selected polling district of the main study.

Names of Polling districts	Number of ineligible participants	Number of the participants who refused	Number of the participants who not approached	Incomplete surveys	Completed surveys from eligible participants			Total of the prospective participants
					Number of male	Number of Female	Total	
Al-Fuwayhat	3	2	7	Nil	13	18	31	43
Al-Kwayfiya	3	2	5	Nil	17	29	46	56
Raas Abayda:	4	1	7	Nil	11	23	34	46
Laithi	3	1	8	Nil	18	34	52	64
Al-Hadaa'iq	7	5	9	Nil	29	53	82	103
Total	20	11	36	Nil	88	157	245	312

5.37.2 A summary of the recruitment of the study participants:

Table 5.37.4 Clarifies the percentage of all the potential participants, 68% (n = 347), who were recruited by phone with reference to the research, whilst the percentage of other respondents, 32 % (n = 165) had pre-notification letters posted to them by the post office.

S N	Five polling districts selected from each of the 5 constituencies	Number of participants chosen in each of the five polling districts Sample size = 312	Number of participants informed by a phone call in each of the five polling districts	Number of participants informed by post in each of the five polling districts
1	Al-Fuwayhat	71	53	18
2	Al-Kwayfiya	92	72	20
3	RaasAbayda	75	45	30
4	Laithi	105	63	42
5	Al-Hadaa'iq	169	114	55
Total		512	347 (68%)	165 (32%)

5.10 The summary of the whole recruitment process:

Table 5.37.4 Illustrates the summary of recruiting of the potential participants in each of selected polling district.

Names of Polling districts	Number of ineligible participants	Number of the participants who refused	Number of the participants who not approached	Incomplete surveys	Completed surveys from eligible participants			Total of the prospective participants
					Number of male	Number of Female	Total	
Al-Fuwayhat	5	5	9	1	21	30	51	71
Al-Kwayfiya	4	4	8	1	28	47	75	92
Raas Abayda:	7	3	10	1	20	34	54	75
Laithi	7	2	10	Nil	37	49	86	105
Al-Hadaa'iq	12	10	12	Nil	42	93	135	169
Total	35	24	49	3	148	253	401	512

5. 37.3 Estimating the response rate for the main fieldwork study

Table 5.37.5 Clarifies the response rate in each polling district and the response rate for the main fieldwork study.

Polling district	Response rate achieved for each polling district
Al-Fuwayhat	$\frac{31}{43}$ x10= 72 %
Al-Kwayfiya	$\frac{46}{56}$ x100= 82 %
RaasAbayda:	$\frac{34}{46}$ x100 = 74%
Laithi	$\frac{52}{64}$ x100 = 81%
Al-Hadaa'iq	$\frac{82}{103}$ x100 = 81 %
The overall response rate in the pilot study	$\frac{245}{312}$x100 = 79 %.

OMAR EL-MUKHTAR UNIVERSITY

جامعة عمر المختار

U.O.A-812 الرقم الإشاري

الموافق 2014/12/11 م

2014/12/11 ه التاريخ

Dear official protection in the affected areas of Benghazi,

Re: *Research entitled "Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya."*

The research is conducted by **Hamdi Abdulla A. Lemamsha, a PhD student** *at the Institute for Health Research at the University of Bedfordshire, UK.*

In response to your request, an official letter has been provided by the Libyan institution, which the researcher is affiliated to, in order to allow him to continue to visit people in their homes, or meet them at the nearest clinic.

We would like to inform you and confirm that *Hamdi Abdulla A. Lemamsha, a PhD student at the Institute for Health Research at the University of Bedfordshire, UK* would like to conduct his fieldwork by collecting the main data for his research under the supervision of *Professor Gurch Randhawa and Dr. Chris Papadopoulos*.

As is clearly evident, several districts in Benghazi, which were hazardous a few months ago, have begun to recover and become more secure than before. However, despite this fact we would appreciate it if you could cooperate with the researcher and provide him and his team (Nurses and Chaperon) with the necessary protection until he achieves the task which he is entrusted to accomplish. It is believed that collection of the data will take approximately one week.

Ultimately, we would like to minimize any obstacles that the researcher might encounter whilst implementing his main study. The main thing we would like to request is that the researcher and his medical team are provided with protection until they accomplish this task.

I would to take this opportunity to thank you in advance for your cooperation and assistance.

Thank you for your time and consideration.

Yours sincerely

Dr. Jibreel S Eldiabani

Dean of Omar Al-Mukhtar University-Derna

OMAR AL MUKHTAR UNIVERSITY

Appendix 5.38 Photographs of the current situation in Benghazi.

The photos below show some of the destroyed houses, which belonged to the leaders of the militia. The Libyan army destroyed several houses, as shown in the photos below. Because these houses were used to by the the leaders of the militia leaders as the shelters for snipers and mercenaries from various Middle Eastern and neighbouring countries.

As a considerable number of the residents have fled Libya due to the deteriorating situation, several streets remain empty, and some properties, which were destroyed, have not yet been rebuilt.

The following photos demonstrate that the official army and police have resumed their normal day-to-day activities after releasing Benghazi from various militias. Thus, the residents are gradually returning to the streets to resume their work and daily routines.

The photos below accurately illustrate the current situation, with Libyans queuing for hours to purchase gas and petrol.

There are interruptions to the electricity supply every day in the majority of districts in Benghazi due to damage to the main electricity supply
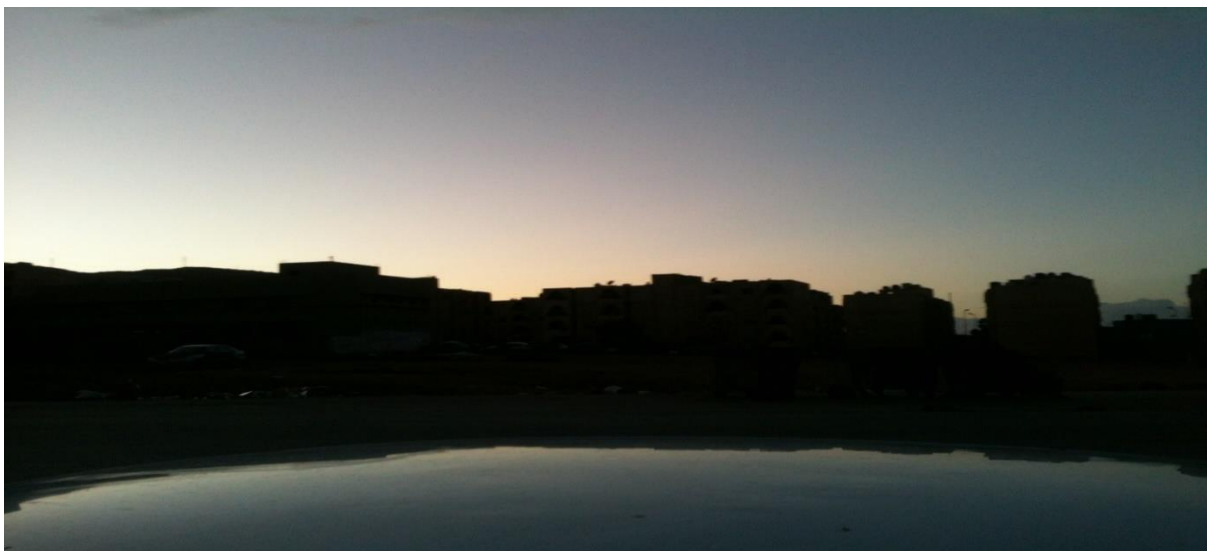
Grouping and Recoding Variables

Table 6.1: Description of socio-demographic variables:

Variable Name	Questionnaire Codes	Variable recoding
Section 1: Demographic and socio-economic **Age**	**Age groups:** 20 – 29 31 – 39 41 – 49 51 – 59 60 – 65	• **Coded into the same age groups for descriptive analysis:** • **Coded into two age strata for regression analysis:** ✖ Young adults: 20- 39 years. ✖ Older adults: 40-65 years.
Residence in Benghazi	**Months Years**	• **Coded into 2 categories for regression analysis:** ✖ **Period of residence** $<$ **35.** ✖ **Period of residence ≥ 35.**
Marital Status	• Single • Married • Divorced • Separated • Widowed • Refused to answer	• **Coded into 2 categories for descriptive analysis and regression analysis:** ✖ Single: (Never Married). ✖ Married: (Includes those who reported being married, divorced, separated, and widowed).
Level of education	• No formal schooling • Less than primary school • Primary school completed • Secondary school completed • High school completed • College/university completed • Post graduate degree • Refused	• **Coded into 3 categories for descriptive analysis and regression analysis**: ✖Low Level: No formal schooling, less than primary school and primary school completed ✖Moderate level: Secondary school and high school completed. ✖High level: College/university completed. Post -graduate degree.
Occupation	• Government employee • Non-government employee • Self-employed • Non-paid • Student • Housework • Retired • Unemployed (able to work) • Unemployed (unable to work) • Refused	• **Coded into 2 categories for descriptive analysis and regression analysis:** ✖**Employed:** Government employee, non-government employee, self-employed, non-paid, student. ✖**Unemployed:** retired, housework, unemployed (able to work) and unemployed (unable to work).
Income **(Libyan Dinar = ½ Pound)**	• $<$ 500 • 500-999 •1000 –1999 •2000 – 2999 •3000 – 3999 •4000 – 5000 •Refused	• **Coded into 3 categories for descriptive analysis and regression analysis:** ✖**Low income:** $<$ 500 & 500-999**.** ✖**Moderate income**: 1000 –1999 & 2000 – 2999. ✖**High income:** 3000 – 3999 & 4000 – 5000.

Section 2: Eating behaviour variables:		
Fast-food consumption	• The amount of fast food consumed One-day recall. **0 1 2 3 4 5 6 ≥ 7 times**	• **Coded into 2 categories for regression analysis:** ✠**Low fast food consumption:** ≤ 1 time. ✠**High fast food consumption:** ≥ 2 times**.**
	• Amount of fast food consumed in a typical recall: one-week. **0 1 2 3 4 5 6 ≥ 7 times**	• **Coded into 2 categories for regression analysis:** ✠**Low fast food consumption:** ≤ 3 times per week. ✠**High fast food consumption**: >3 times per week.
Beverage consumption	• The amount of sugar-sweetened beverages consumed one-day recall. **0 1 2 3 4 5 6 ≥ 7 times**	**Create a cumulative variable for consumption of beverages by combining responses for beverage with sugar added, and non-diet soda and juice consumption, in one variable either one-day recall or typical recall.** • **The new combined variable coded into 2 categories for regression analysis:** ✠**Low & moderate beverages consumption:** ≤ 3 times. ✠**High beverages consumption:** >3 times.
	• The amount of sugar-sweetened beverages consumed typical recall: one-day. **0 1 2 3 4 5 6 ≥ 7 times**	• **The new combined variable coded into 2 categories for regression analysis:** ✠**Low & moderate beverages consumption:** ≤ 3 times. ✠**High beverages consumption:** >3 times.

Table 6.2: Description of eating behaviour variables:

Fruits & vegetables Consumption	• **The amount of vegetable and fruit consumed one-day recall:** **0 1 2 3 4 5 6 ≥ 7 times**	**Create a cumulative variable for fruits and vegetables intake by combining responses for both, in one variable either one-day recall or typical recall.** • **The new combined variable coded into 2 categories for regression analysis:** �されInadequate fruits and vegetables intake: ≤ 3 times. ✻**Adequate fruits and vegetables intake:** >3 times.
	• **The amount of vegetable and fruit consumed typical recall: one-day.** **0 1 2 3 4 5 6 ≥ 7 times**	• **The new combined variable coded into 2 categories for regression analysis:** ✻**Inadequate fruits and vegetables intake:** ≤ 3 times. ✻**Adequate fruits and vegetables intake:** >3 times.
Breakfast consumption	• **The number of times of breakfast consumed in a typical week.** **0 1 2 3 4 5 6 ≥ 7 times**	• **Coded into 2 categories for regression analysis:** ✻**Irregular breakfast consumption:** ≤ 3 times ✻**Regular breakfast consumption:** >3 times.
Food portion size	• **Scales of food portion size intake.** **Never ; rarely; occasionally; sometimes ; often ; usually ; always**	• **Coded into 2 categories for regression analysis:** ✻**Uncommon intake all food served:** Never, and rarely. ✻**Common intake all of the food served:** Occasionally, sometimes, often, usually and always.

| Physical activity | ● **Number of doing physical activity in One-week recall**.

0 1 2 3 4 5 6 ≥ 7 times | • **Coded into 2 categories for regression analysis:**

✄**Irregular physical activity:** ≤ 3 times

✄**Regular physical activity:** >3 times. |
| | ● **Number of doing physical activity in a Typical recall: one-week.**

0 1 2 3 4 5 6 ≥ 7 times | • **Coded into 2 categories for regression analysis:**

✄**Irregular physical activity:** ≤ 3 times.

✄**Regular physical activity:** >3 times. |

Table 6.3: Description of physical and sedentary activity variables:

<u>Section 3: Physical and sedentary activity</u>		<u>MET value across 3 domains:</u>
Part 1: Job-related physical activity **Part 2: Transportation: Travel to and from** **Destinations** **Part 3: Recreational activities** **Part 4: Sedentary behaviour**	Total physical activity MET-minutes/week (= the sum of the total MET minutes of activity computed for each setting) Equation: Total Physical Activity MET-minutes/week = [(P2 * P3 * 8) + (P5 * P6 * 4) + (P8 * P9 * 4) + (P11 * P12 * 8) + (P14 * P15* 4)]	**Work** • Moderate MET value = 4.0 • Vigorous MET value = 8.0 **Transport** • Cycling and walking MET value = 4.0 **Recreation** • Moderate MET value = 4.0 • Vigorous MET value = 8.0 --- **Meets the WHO recommendations** If : Total Physical Activity MET minutes per week is ≥600 **Not meeting the WHO recommendations** If: Total Physical Activity MET minutes per week is < 600 • **Coded into 2 categories for regression analysis:** ✄**Irregular physical activity:** MET minutes per week is ≤ 600. ✄**Regular physical activity:** MET minutes per week is >600.

Table 6.4: Description of neighbourhood environment variables:

Section 4: Neighbourhood environment variables:		
Type of housing:	**Thee housing type variable**: • Detached single-family housing • Townhouses, row houses, apartments of 2-3 stories • Mix of single-family residences and townhouses, row houses, apartments. • Apartments of 4-12 stories • Apartments of more than 12 stories • Don't know/ Not sure	• **Coded into 2 categories for regression analysis:** ✠**Low residential density:** Detached single-family housing. ✠**High residential density:** **To the 4 other housing types:** Town houses, row houses, apartments or condos of 2-3 stories; mix of single-family residences and town houses, row houses, apartments or condos; apartments of 4-12 stories; apartments of more than 12 stories; don't know/ not sure.
Neighbourhood environment variables	**Using a 4-point Likert-type scale:** • Strongly disagree • Disagree • Agree • Strongly agree	• **Coded into 2 categories for regression analysis:** ✠**Agree:** Strongly agree and agree. ✠**Disagree:** Strongly disagree, disagree.
Body Mass Index (BMI):	• Underweight: BMI < 18.5 • Normal weight:18.50 - 24.99 • Overweight: $25.00 \leq BMI < 30.00$ • Obese I, II, III: ≥ 30.00	• **Coded into 2 categories for regression analysis:** ✠**Not obese: < 25.00** ✠**Obese: ≥25.00**

Appendix 6.2 Association between socio-demographic factors and BMI

6.2.1 Association between age and BMI for all participants

Table 6.2.1 demonstrates that Libyan adults aged 40–49 years had the highest percentage of obese, at 53.0%. In contrast, the group for both gender with aged 20- 29 had the highest percentage of overweight and normal weigh at 39.7, 42.3%, respectively. The Pearson Chi-Square test was computed, and a statistically significant association was established between BMI and the age of the participants (*p*=.000).

Table 6.2.1 Age and BMI for all participants .

Variable Category			Body Mass Index (BMI)				Chi-square (X²)	Sig P-Value
			Normal weight 18.5–24.9	Over- weight 25.0–29.9	Obesity 30.0 and Above	Total		
Age	20 – 29	(N)	33	31	14	78	37.18	.000**
		%	42.3%	39.7%	17.9%	100.0%		
		Total	8.2%	7.7%	3.5%	19.5%		
	30 – 39	(N)	27	45	71	143		
		%	18.9%	31.5%	49.7%	100.0%		
		Total	6.7%	11.2%	17.7%	35.7%		
	40 –49	(N)	17	37	61	115		
		%	14.8%	32.2%	53.0%	100.0%		
		Total	4.2%	9.2%	15.2%	28.7%		
	50 – 59	(N)	16	16	18	50		
		%	32.0%	32.0%	36.0%	100.0%		
		Total	4.0%	4.0%	4.5%	12.5%		
	60– 65	(N)	6	3	6	15		
		%	40.0%	20.0%	40.0%	100.0%		
		Total	1.5%	0.7%	1.5%	3.7%		
Total		(N)	99	132	170	401		
		Total	24.7%	32.9%	42.4%	100.0%		

**P value of<.001 is highly significant

6.2.2 Association between marital status and BMI

Table 6.2.2 depicts that the percentages of obesity and overweight amongst married people were higher than those amongst single people, at 32.2% and 20.9% respectively for married people, compared with 10.7% and 12% respectively for unmarried people. Using the Pearson Chi-Square test, it was determined that there was a positive statistically significant association between BMI and gender ($p=.003$).

Table 6.2.2 Association between marital status and BMI.

Variable Category			Body Mass Index (BMI)				Chi-square (X^2)	Sig P-Value
			Normal weight 18.5–24.9	Overweight 25.0–29.9	Obesity 30.0 and Above	Total		
Marital Status	Single	(N)	43	48	41	132	11.63	.003*
		%	32.6%	36.4%	31.1%	100%		
		Total	10.7%	12%	10.2%	32.9%		
	Married	(N)	56	84	129	269		
		%	20.8%	31.2%	48%	100%		
		Total	14%	20.9%	32.2%	67.1%		

* p value of <.05 is statistically significant.

6.2.3 Association between racial group and BMI

Table 6.2.3 shows that the Arabic group had the highest percentage of obese and overweight participants compared to the other two groups (Berbers and Toubou), at 27.4% and 34.9% respectively. The Pearson Chi-Square test was used, and it revealed that there is no relationship between BMI and racial group. In addition, the table indicates that all participants belong to the Islamic faith; thus no further statistical analysis needs to be calculated.

Table 6.2. 3 Association between racial group and BMI.

Variable Category			Body Mass Index (BMI)				Chi-square (X^2)	Sig P-Value
			Normal weight 18.5–24.9	Overweight 25.0–29.9	Obesity 30.0 and Above	Total		
Racial group	Arabic	(N)	89	110	140	339	6.214	.184
		%	26.3%	32.4%	41.3%	100%		
		Total	22.2%	27.4%	34.9%	84.5%		
	Berbers	(N)	6	13	24	43		
		%	14%	30.2%	55.8%	100%		
		Total	1.5%	3.2%	6%	10.7%		
	Toubou	(N)	4	9	6	19		
		%	21.1%	47.4%	31.6%	100%		
		Total	1%	2.2%	1.5%	4.7%		

Appendix 6.3 Results of variances of BMI means against demographic data.

6.3.1 The comparison between the mean and median of BMI against gender

Table 6.3.1 depicts the comparison between the mean and median of BMI against gender. The Mann-Whitney test indicated that there was a statistically significant difference between the genders (Mann Whitney U, Z=-4.22, *p*=.000). Female participants had a median of 29.50, which was higher than that for male participants (median =27.10) In addition, female participants had a mean rank of 219.68, while male participants had a mean rank of 169.0. That is, the group with the highest median was the female group, which probably had higher BMI values (obesity) than the males.

Table 6.3.1 Results of variances of BMI means against gender.

Comparison groups	N	Mean Rank	Sum of Ranks	U Value	Z-Score	Sig P-Value	Median
Male	148	169.07	25022.50				27.10
Female	253	219.68	55578.50	13996.50	-4.22	.000*	29.50
Total	401						28.50

* The difference is highly significant since p<.001.

6.3.2 Gender-related differences in the association between age and BMI :

6.3.2.1 the association between age and BMI in men :

Table 6.3.2 demonstrates that males aged 60–65 years had the highest percentage of obese, at 50.0%. In contrast, the group with males aged 40–49 had the highest percentage of overweight, at 35.1%. The Pearson Chi-Square test was computed, and a statistically significant association was established between BMI and the age of the males (*p*=.016).

Table 6.3.2 Age and BMI by gender (for male N=253).

Variable Category			Body Mass Index (BMI)				Chi-square (X²)	Sig P-Value
			Normal weight 18.5–24.9	Overweight 25.0–29.9	Obesity 30.0 and Above	Total		
Age	20 – 29	(N)	15	10	2	27	18.73	.016*
		%	55.6%	37.0%	7.4%	100.0%		
		Total	10.1%	6.8%	1.4%	18.2%		
	30 – 39	(N)	16	18	26	60		
		%	26.7%	30.0%	43.3%	100.0%		
		Total	10.8%	12.2%	17.6%	40.5%		
	40 –49	(N)	8	13	16	37		
		%	21.6%	35.1%	43.2%	100.0%		
		Total	5.4%	8.8%	10.8%	25.0%		
	50 – 59	(N)	9	6	3	18		
		%	50.0%	33.3%	16.7%	100.0%		
		Total	6.1%	4.1%	2.0%	12.2%		
	60– 65	(N)	2	1	3	6		
		%	33.3%	16.7%	50.0%	100.0%		
		Total	1.4%	0.7%	2.0%	4.1%		
	Total	(N)	50	48	50	148		
		Total	33.8%	32.4%	33.8%	100.0%		

** p value of <.001 is highly significant.

6.3.2.1 the association between age and BMI in women :

Table 6.3.3 shows that females aged 40–49 years for had the highest percentage of obese, at 57.7%. In contrast, the group with females aged 20–29 age group had the highest percentage of overweight, at 41.2%. While, the 60–65 age group had the highest percentage of normal weight, at 44.4%.The Pearson Chi-Square test was computed, and a statistically significant association was found between BMI and the age of the females (p=.002).

Table 6.3.3 Age and BMI by gender (for female N=253).

Variable Category			Body Mass Index (BMI)				Chi-square (X^2)	Sig P-Value
			Normal weight 18.5–24.9	Overweight 25.0–29.9	Obesity 30.0 and Above	Total		
Age	20 – 29	(N)	18	21	12	51	24.32	.002*
		%	35.3%	41.2%	23.5%	100.0%		
		Total	7.1%	8.3%	4.7%	20.2%		
	30 – 39	(N)	11	27	45	83		
		%	13.3%	32.5%	54.2%	100.0%		
		Total	4.3%	10.7%	17.8%	32.8%		
	40 –49	(N)	9	24	45	78		
		%	11.5%	30.8%	57.7%	100.0%		
		Total	3.6%	9.5%	17.8%	30.8%		
	50 – 59	(N)	7	10	15	32		
		%	21.9%	31.2%	46.9%	100.0%		
		Total	2.8%	4.0%	5.9%	12.6%		
	60– 65	(N)	4	2	3	9		
		%	44.4%	22.2%	33.3%	100.0%		
		Total	1.6%	0.8%	1.2%	3.6%		
	Total	(N)	49	84	120	253		
		Total	19.4%	33.2%	47.4%	100.0%		

** p value of <.001 is highly significant.

Appendix 6.4 Results of variances of BMI means against SES.

6.4.1 Variances of BMI means against education levels

Table 6.4.1 shows the results of variances of BMI mean and median against education levels. The result of the Kruskal-Wallis H test, revealed that there was statistically significant difference of BMI against education, (p=0.000). Additionally, the table 8 presents that the mean rank educational level of 123.06 for the low level, 193.73 for the moderate level, and 234.30 for the high level. The table also indicates that participants with the highest level of education had the highest (median=30.80), in comparison to other participants, who had moderate and low educational levels, with medians of 27.90 and 23.80 respectively. In conclusion, participants with the highest level of education had the highest BMI.

Table 6.4.1 Results of variances of BMI means against education levels.

Comparison among educational level groups	N	Mean Rank	Chi-Square	Sig P-Value	Median
Low	77	123.06			23.80
Moderate	118	193.73	52.30	.000**	27.90
High	206	234.30			30.80
Total	401				28.50

 ** p value of <.001 is highly significant.

6.4.2 Variances of BMI means against income levels

Table 6.4.2 shows the variance between BMI means and medians against income levels.by using a Kruskal-Wallis H test (0.000), there was a statistically significant difference in level of income between the different levels, with a mean rank income level of 134.38 for the low level, 153.21 for the moderate level and 225.33 for the high level. The table 6 also shows that participants with the highest income level had the highest (median =31.75), in comparison to other participants, who had moderate and low income levels, with medians of 26.90 and 26.50 respectively.

6.4.2 the results of variance of BMI means against education levels.

Comparison among income Level groups	N	Mean Rank	Chi-Square	Sig P-Value	Median
Low	97	134.38			26.50
Moderate	80	153.21	56.05	.000**	26.90
High	194	225.33			31.75
Total	371				28.70

**p value of <.001 is highly significant.

6.4.3 Variances of BMI means against income levels

Table 6.4.3 shows variances of BMI means against occupation statuses using. The Mann-Whitney U test indicated that there were statistically significant variances between the median of occupations (p=.015). That is, the group with the highest mean rank was the employed participants (Mean rank=208.58 and Median=29.00), which probably had higher BMI values (obesity) than the unemployed participants (Mean rank =174.80 and Median =27.10).

Table 6.4.3 Results of variances of BMI means against occupation statuses.

Comparison groups	N	Mean Rank	Sum of Ranks	U Value	Z-Score	Sig P-Value	Median
Employed	311	208.58	64869.00				29.00
Unemployed	90	174.80	15732.00	11637.00	-2.435	.015*	27.10
Total	401						28.50

* p value of <.05 is statistically significant.

Appendix 6.5 Further findings of neighbourhood environmental characteristics and obesity

Table 6.5.1 shows that 308 participants (76.8%) reported living in high residential density zones, whereas 93 (23.2%) reported living in a low residential density region. Additionally, obese people, who represented 63.8% (256 of 401) of the sample and comprised the highest number of participants, reported living in high-density areas.

Concerning land use mix and transit access, 279 (69.6%) participants reported being aware of commercial places, 272 (67.8%) reported being aware of public transport, and 259 (64.6%) reported being aware of public places and walkable destinations. A smaller percentage reported difficulty accessing public accommodation (122 or 30.4%) and commercial facilities (129 or 32.2%) and public transport (142 or 35.4%). Of the participants categorised as obese, the following percentage reported recognising that the following were within walking distance of their homes: commercial places (201 or 50.1%), public transport (191 or 47.6%) and public places (184 or 45.9%).

Pertaining to pedestrian and cycling infrastructure, 279 (69.8%) participants reported that pavements are present while 163 (40.6%) reported that bike lanes are present. Similarly, 282 (70.3%) participants reported that pavements were maintained and repaired while 196 (48.9%) reported that cycle lanes were maintained and repaired. Moreover, 121 (30.2%) commented on a lack of pavements, and 238 (59.4%) commented on a lack of cycle lanes, while 119 (29.7%) reported that pavements have maintenance issues while the corresponding figure for and cycle lanes was 238 (59.4%).

It is notable that obese people, who constitute the highest number of participants (63.8%), reported that their neighbourhoods have good pavements, and similar numbers of participants reported that pavements are present pavements 216 (54.0%), while the participants reported that pavements were maintained and repaired 215 (53.6%). However, a fewer number of obese participants reported a lack of bike lanes 198 (49.4%), and recognised that the cycle lanes in their neighbourhood have maintenance issues 169 (42.1%).

Turning to crime, 302 (75.5%) participants perceived crimes to be committed at night and reported feeling unsafe to walk in their neighbourhood and 287 (71.6%) perceived crimes to be committed during the day and reported feeling unsafe to walk in their neighbourhood In contrast, 98 (24.5%) participants denied the presence of crime in their neighbourhood at night , while 114 (28.4%) denied the presence of crime in their neighbourhood during the day.

Moreover, obese people represent the highest percentage of participants who reported that crimes are occurring in their neighbourhood at night 254 (63.5%), with 244 (60.8%) saying that crimes are occurring in their neighbourhood during the day.

Turning to traffic, 253 (63.1%) perceived there to be a considerable amount of traffic on the streets which makes it difficult or unpleasant to walk in their neighbourhood, while 263 (65.6%) perceived it difficult or unpleasant to ride a bicycle in their neighbourhood. However, 148 (36.9%) felt that the traffic was not severe enough to hinder people from walking, while 138 (34.4%) felt that it was not severe enough to hinder people from riding bikes. Of those categorised as obese (63.8% of the sample), 207 (51.6%) said that the amount of traffic is the main issue preventing people from walking, while 216 (53.9%) said it prevented people from riding bikes in the neighbourhood.

A number of participants stated that it was easy to access recreational facilities (289 or 72.1%), that 'aesthetics' or beautiful things are present (270 or 67.5%), and that they see numerous people being physically active in their neighbourhood (269 or 67.2%), whereas those who reported that they disagreed with all the aforementioned categories constituted 112 (27.9%), 130 (32.5%) and 131 (32.8%) respectively. Obese people, who comprise the highest percentage of participants, denied the aforementioned positive aspects, represented by 211 (52.6%), 179 (44.8%) and 211 (52.8%) obese participants respectively.

With reference to street connectivity and household vehicle ownership, 264 (65.8%) reported that there are several four-way intersections in their neighbourhood, while 283 (70.6%) reported that they have a number of cars and vans available for use in their households. Those who commented on the absence of street connectivity and a lack of a vehicle in their households were represented by 137 (34.2%) and 118 (29.4%) participants respectively. It is notable that obese people, who comprised the highest percentage of participants (63.8%), reported excellent street connectively (221 or 55.1%), and reported that their households owned a number of vehicles (225 or 56.1%).

Table 6.5.1 Summary of a descriptive analysis of Benghazi's environmental neighbourhood characteristics from the perception of the participants.

Neighbourhood environment variables	Participants perceived and responded	Body Mass Index (BMI)		
		Not obese < 25.00 N (%)	Obese ≥25.00 N (%)	Total N (%)
Residential density	**Low**	**46 (11.5%)**	**47 (11.7%)**	**93 (23.2%)**
	High	**52 (13.0%)**	**256 (63.8%)**	**308 (76.8%)**
Access to commercial places	**Disagree**	**20 (5.0%)**	**102 (25.4%)**	**122 (30.4%)**
	Agree	**78 (19.5%)**	**201 (50.1%)**	**279 (69.6%)**
Access to public transport	**Disagree**	**17 (4.2%)**	**112 (27.9%)**	**129(32.2%)**
	Agree	**81(20.2%)**	**191 (47.6%)**	**272 (67.8%)**
Presence of pavements	**Disagree**	**35 (8.8%)**	**86 (21.5%)**	**121 (30.2%)**
	Agree	**63 (15.8%)**	**216 (54.0%)**	**279 (69.8%)**
Presence of cycle lanes	**Disagree**	**40 (10.0%)**	**198 (49.4%)**	**238 (59.4%)**
	Agree	**58 (14.5%)**	**105 (26.2%)**	**163 (40.6%)**
Access recreational facilities	**Disagree**	**20 (5.0%)**	**92 (22.9%)**	**112 (27.9%)**
	Agree	**78 (19.5%)**	**211 (52.6%)**	**289 (72.1%)**
Crime / safety at night	**Disagree**	**50 (12.5%)**	**48 (12.0%)**	**98 (24.5%)**
	Agree	**48 (12.0%)**	**254 (63.5%)**	**302 (75.5%)**
Traffic safety	**Disagree**	**52 (13.0%)**	**96 (23.9%)**	**148 (36.9%)**
	Agree	**46 (11.5%)**	**207 (51.6%)**	**253 (63.1%)**
See people as being active	**Disagree**	**39 (9.8%)**	**92 (23.0%)**	**131 (32.8%)**
	Agree	**58 (14.5%)**	**211 (52.8%)**	**269 (67.2%)**
Presence of beautiful things 'Aesthetics'	**Disagree**	**7 (1.8%)**	**123 (30.8%)**	**130 (32.5%)**
	Agree	**91 (22.8%)**	**179 (44.8%)**	**270 (67.5%)**
Household vehicle ownership	**Disagree**	**40 (10.0%)**	**78 (19.5%)**	**118 (29.4%)**

	Agree	**58 14.5%**	**225 (56.1%)**	**283 (70.6%)**
Connectivity of streets	**Disagree**	**55 (13.7%)**	**82 (20.4%)**	**137 (34.2%)**
	Agree	**43 (10.7%)**	**221 (55.1%)**	**264 (65.8%)**
Maintenance of pavements	**Disagree**	**31 (7.7%)**	**88 (21.9%)**	**119 (29.7%)**
	Agree	**67 (16.7%)**	**215 (53.6%)**	**282 (70.3%)**
Maintenance of cycle lanes	**Disagree**	**36 (9.0%)**	**169 (42.1%)**	**205 (51.1%)**
	Agree	**62 (15.5%)**	**134 (33.4%)**	**196 (48.9%)**
Traffic safety for cyclists	**Disagree**	**51 (12.7%)**	**87 (21.7%)**	**138 (34.4%)**
	Agree	**47 (11.7%)**	**216 (53.9%)**	**263 (65.6%)**
Crime / safety during the day	**Disagree**	**55 (13.7%)**	**59 (14.7%)**	**114 (28.4%)**
	Agree	**43 (10.7%)**	**244 (60.8%)**	**287 (71.6%)**
Public places and walkable Destinations	**Disagree**	**23 (5.7%)**	**119 (29.7%)**	**142 (35.4%)**
	Agree	**75 (18.7%)**	**184 (45.9%)**	**259 (64.6%)**

Appendix 7.1 Discussion of the results unhealthy eating habits

7.1   Unhealthy eating habits

The following section discusses and interprets my results concerning the association between BMI and each of the three SES components: education level, income, and occupational status. This section discusses and interprets the association between BMI and each of these components of unhealthy eating habits, operationalised as follows: an excessive consumption of sugar-sweetened beverages (SSBs); eating less than five daily portions of fruit and vegetables; a high frequency of skipping breakfast; consumption of large food portion sizes (FPS); and engaging in physical activity.

7.1.1   Consumption of sugar-sweetened beverages (SSBs)

My results were unexpected in terms of finding no association between the consumption of SSBs and an increase in BMI in men, despite the average consumption of SSBs for a Libyan adult being 3.68 (+/- 1.23) cans a day. This amount exceeds the recommended daily amount of SSBs by the American Heart Association, which is no more than 450 kilocalories (kcal) of SSBs: the equivalent of approximately three 12-ounce cans per week (Lloyd-Jones et al., 2010). Likewise, the WHO recommends that the consumption of SSBs should be limited to less than a single can of SSBs per person per day. My findings demonstrated that the average consumption of SSBs by Libyan adults was higher than the average consumption of SSBs amongst Americans. Whereas American adults consume on average 200 kcal per person per day – the equivalent of more than one can of SSB s (355 mls or 12 ounces) (Ogden et al , 2012), Libyans consume on average 545 kcal of SSBs per person per day – the equivalent of 3.6 cans of SSB per day (1,278 mls or 43.2 ounces). Libyan adults also consume more than Australian adults, whose average consumption of SSBs is 2.1 cans per day – in Australia the standard can size is 375 mls or 12.7 ounces, therefore Australians consume on average 789 mls or 26.67 ounces or 315 kcal (Hector, 2009). However, Libyan adults consume less SSBs than do Saudi, Egypt and the UAE adults, whose average consumption of SSBs ranges from 4-5 cans per day (1,420 mls or 48 ounces) (Fareed, 2012 ; Honkala et al., 2012; Musaiger, 2011).

7.1.2 Eating less than five daily portions of fruit and vegetables

Another explanation is that , although Libyans reported slightly acceptable level of daily FV intake, they tended not to reach the recommended minimum advised by the NHS (2014) and WHO (2008). This may be because Libyan eating habits entail the consumption of FV after heavy meals and after they have reached the satiety stage, after which they may take a nap

(Musaiger, 2011 ; Musaiger et al., 2013). All these unhealthy eating behaviours may influence metabolism and the absorption process, so that their bodies cannot utilise the fruit and vegetables that they do consume; hence, the way in which they consume fruit and vegetables may be contributing to the increase in weight among Libyans rather than reducing weight (Musaiger, 2011; Rethaiaa et al., 2010). Therefore, the BMI of Libyan adults is not associated with the consumption of five daily portions of FV, in either gender.

The findings of my study indicate that the average FV intake among Libyan adults was 3.13(+/-1.42) portions a day, which is slightly lower than the WHO recommendation of at least 400g of fruit and vegetables per day, equating to approximately five portions, where one portion weighs about 80g (WHO, 2016h). Despite this manageable level of FV intake, my findings revealed no association between daily FV intake and obesity. The average reported daily FV intake among Libyan adults in my study was lower than that in another EMR country, namely, Iran where the mean daily FV intake is 4.58±1.31 and 4.65±1.28, for men and women respectively (Sabzghabaee et al., 2010).

My results align with those of Charlton et al. (2014), Field et al. (2003) and Woodward-Lopez et al. (2006), which found no significant association between fruit and/or vegetable intake and obesity. However, my findings are unexpected because they are contrary to a substantial body of literature including previous epidemiological studies – both cross-sectional and prospective human cohort studies – which found a significant inverse correlation between intake of five daily FV portions and the risk of obesity (Azagba & Sharaf, 2012; Hallund et al., 2007; He et al., 2004; Heo et al., 2011). In contrast, several studies have established a significant positive correlation between daily FV intake and obesity (Ham &Kim , 2014; Kim et al., 2014; te Velde, 2007).

7.14 The consumption of large food portion sizes (FPS)
One explanation for a positive association between large FPS and obesity in Libya is that large FPS provide an excess of calories for the body in a single sitting, which can contribute to individuals' putting on weight (Ledikwe et al., 2005; Rolls et al., 2002). This is because the human body cannot handle large amounts of food all at once; consequently the body's metabolism may be decline, leading the human body to store the extra calories as fat (Almiron-Roig et al., 2013). Large FPS can also result in over-eating and a higher daily caloric intake

than is necessary. Hence, persistent consumption of large FPS can eventually lead to adverse results, such as weight-gain and obesity (Almiron-Roig et al., 2013; Benton, 2015). The higher the frequency of consuming large FPS, the higher the BMI in Libyan adults, was unsurprising result due to the general lack of health awareness in Libya (Elkhammas & Singh, 2010; WHO, 2007), which may result in increasing ignorance about what constitutes an appropriate FPS. There is a widespread ignorance that consuming food that is high in energy density in large portion sizes may lead to excess energy intake which in turn may contribute to the development of obesity.

Another explanation for consuming large FPS is that, in addition to under-estimating the calories in large portion sizes, many people adhere to the expectation to "clean our plate", leading eventually to obesity (Benton, 2015; Wansink & Van Ittersum, 2007). According to the etiquette of eating in Islam, people are taught to serve food in small portions and must not leave even a bit of their food for 'Satan' (Attar, 2013). The plate of food should be finished without leftovers, because nobody knows in which portion of the food the blessing from God lies (Attar, 2013). However, most Libyans misunderstand the etiquette concerning FPS. In keeping with Libyan culture, the food served must be highly palatable and in large portions as this is how the host demonstrates his or her hospitality to guests (Elbendak et al., 2008; FAO,2005; Musaiger, 2011). Consequently, Libyan etiquette forces people to consume all food that is served (Elbendak et al., 2008). The excess energy intake from this practice arguably contributes to the development of obesity. Therefore, there is a strong significant positive association between the consumption of large FPS and obesity in the adult Libyan of both genders, namely: the higher the frequency of consuming large FPS, the higher the BMI in Libyan adults.

My findings are consistent with the findings of previous epidemiological studies, including randomised controlled trials (RCTs), one study conducted by Gilhooly, 2007, and another performed by Hannum, 2006), a case-control study (Pearcey & de Castro 2002), and a cross-sectional study (Fisher et al., 2007; Shah et al., 2014), which concluded that the consumption of large FPS was positively associated with overweight and obesity in adults. To further understand the relationship between large FPS and obesity in Libyan adults, it is necessary to raise this issue with the Libyan health professionals and community leaders.

Appendix 7.2 Discussion of the results PA and sedentary behaviour

7.2   Physical activity and sedentary behaviour

7.2.1   Physical activity under the three domains (work, transport and recreational activities)

My findings for the average time spent on PA in the three aggregated settings (work; transport and recreational activities) were 166.16 (+/- 50.71), 163.97 (+/-39.06) and 164.89 (+/- 44.26) minutes per week for males, females and both genders respectively. This is slightly higher than the levels of PA recommended by numerous prominent organisations for adults aged 18-64 years; they recommend that adults should engage in aerobic PA of moderate intensity for at least 150 minutes (2.5 hours) over the course of a week (CDC, 2015c; PAG in the UK, 2015; WHO, 2016f).

In addition, my findings were unexpected concerning total PA measured in mean the metabolic equivalent of task (MET) minutes per week, which were 892.5, 888.9 and 890.4 for males, females and both genders respectively. According to the new Physical Activity Guidelines (PAG) for Australian Adults, total MET minutes per week are categorised as following: low (40 to <600 MET.min/week); moderate (600 to <1,200 MET.min/week); and high (1,200+ MET.min/week) (Brown et al., 2015). My results therefore fall within the 'moderate' range. As a further gauge, the most current the PAG for Americans suggest that there are significant health benefits for adults engaging in 500-1,000 MET minutes per week. This confirms that my findings fall within the 'moderate' PA categories and ,therefore, meet the current recommendations stipulated by the PAG for Australians and the PAG for Americans. Furthermore, my results indicate that the prevalence of physical inactivity in men is less than that in women (24% of men versus 38% of women). These figures are much lower than those recorded in a recent study in Saudi Arabia: here, the prevalence of physical inactivity in men was 85.6% while that in women was 90.2% (Al-Zalabani et al., 2015).

Most epidemiological studies in both developing and developed countries converge on an inverse relationship between PA and increased BMI (Bovet et al., 2007; Rupps et al., 2012; Tiruneh, 2009). These results are aligned with my preliminary findings on PA, as mentioned in Appendix 7.2 about engaging in physical activity. This inverse relationship, however, was dissimilar to my findings with respect to obesity and total physical activities under the three domains (work, transport and recreational activities). In terms of gender, my results are

consistent with those of a prospective study undertaken in China (Paeratakul et al., 1998) and cross-sectional studies in developing and developed countries, which concluded that PA was inversely associated with changes in BMI in women but not in men (Alsaif et al., 2002; Klein-Platat et al., 2005). However, my findings were also dissimilar to other epidemiological studies conducted in developed and developing countries, which indicated an inverse relationship between PA and obesity in men, but not in women (Duvigneaud et al., 2008; Maddah et al., 2003; Peixoto et al., 2007). Therefore, further exploration is needed to understand why a lack of association between BMI and PA under the three domains (work, transport and recreational activities) emerged in Libyan men but not in women.

7.2.2 Sedentary behaviours

In my study, the respondents reported sitting during their leisure time for an average of (2.8 hours/day) for males, (2.7 hours/day) for females, and (2.8 hours/day) for both genders. Although there is some ambiguity within public health guidelines on the maximum period of time for which adults should sit before endangering their health, Australia's Physical Activity and Sedentary Behaviour Guidelines (APA & SB Guidelines) recommend that adults should not spend more than two hours a day sitting or lying down (DoH Australia, 2014). Thus, at well over 2.5 hours/day, the results of my study indicate that Libyans are spending more than the recommended amount of time per day in sedentary activities. This could be a risk factor which increases the obesity rate in Libyan adults.

However, my figures for time spent in sedentary activities are relatively low in comparison with those of other studies, particularly in developed countries. For instance, the Health Survey for England (HSE) (2012) revealed that, on average, men spend 4.9 hours/day and women 4.7 hours/day being sedentary (Health and Social Care Information Centre, 2013)., whereas the Scottish Health Survey (SHS) (2012) reported that sedentary leisure time was broadly similar for men and women, with men spending 5.5 hours per day and women 5.4 hours per day being sedentary, while both genders spend on average 5.5 hours/day in their leisure activities The (Scottish Government, 2013). Likewise, Australian adults spend on average 4 hours/day in sedentary leisure activities (Australian Bureau of Statistics, 2015), whereas in America, men spend an average of 6 hours/day on sedentary leisure activities, while women spend an average of 5.2 hours according to the American Time Use Survey (ATUS) (2014) (U.S. Bureau of Labour Statistics, 2015).

My findings are consistent with those of previous epidemiological studies which revealed a significant association between time spent watching TV and increased BMI for women but not for men (Crawford et al., 1999; Jeffery & French, 1998). However, my findings were unlike a more recent study which found positive significant associations between prolonged uninterrupted sedentary periods (or lack of breaks in sedentary periods) in the form of sitting and the risk of obesity in men but not in women (Mummery et al., 2005). Additionally, my findings contradict the pattern of association found between sedentary behaviours and BMI in men and women by several recent, extensive cross-sectional studies conducted in developed and developing countries; such studies concurred that sedentary behaviours are strongly associated with an increased risk of obesity for both genders (Cleland et al., 2008; Salmon et al., 2012; Sugiyama et al., 2008). Therefore, further exploration is needed to understand why a lack of association between BMI and sedentary behaviour emerged in Libyan men but not in women.

7.3 Neighbourhood environmental factors

7.3.1 Mixed land use

My study found no association between 'mixed land-use' (referring to 'access to commercial places', 'access to public places' and 'walkable destinations') and obesity in the adult Libyan population, of either gender. Furthermore, after adjusting for all probable confounding factors, 'mixed land use' was not associated with obesity in either gender. Such findings indicate that there is insufficient evidence to reject the null hypothesis.

We might expect that the higher the level of mixed land-use, the lower the risk of obesity. There is consensus in the literature about how mixed land-use influences neighbourhood walkability: where goods and services can be obtained nearby to residences and public transport is available (that is, a high level of mixed land-use), residents may be encouraged to walk and practise physical activity on a daily basis, as well as discouraged from using their private vehicles, thereby reducing the obesity epidemic (Rundle et al., 2007). Despite the majority of participants in my study speaking favourably about Benghazi's neighbourhood attributes, comprising a high level of mixed land-use, no association was found between land-use mix and obesity. This is likely attributable to the unsafe neighbourhood environment due to the clashing radical militias which have destroyed leisure amenities, parks, and other vital places. Libyan citizens generally remain indoors so as to minimise their exposure to this danger. All these circumstances may contribute to an escalation of the obesity epidemic in Libya. Therefore the BMI of Libyan adults is not associated with mixed land-use in either gender.

My study found no association between land-use mix and obesity in Libyan adults, of either gender. This is contrary to a substantial body of literature that found a significant inverse correlation between high land-use mix and obesity: the greater the land-use mix, the lower the BMI (Frank et al., 2008; Mackenbach et al., 2014; Saelens & Handy, 2008; Velásquez-Meléndez et al., 2013). Conversely, other studies found that low land-use mix is associated with an increased risk of obesity (Papas et al., 2007; Zhao et al., 2010). In contrast, one study found that living in areas with greater mixed land-use was associated with higher BMI values (Rutt & Coleman, 2005), while another established that a diverse land-use mix in a neighbourhood is positively associated with BMI for women only (Raja, 2010). To the best of our knowledge, no previous studies found the compatible findings for the findings of this study.

Therefore, further exploration is needed to understand why a lack of association between land-use mix and obesity in Libyan adults, of either gender.

7..3.2 Access to public transport

My study found a significant positive association between access to public transport and obesity in Libyan adults, for both genders. In contrast, after adjusting for all possible confounding factors, access to public transport was significantly associated with obesity in men but not in women. My findings indicate that there was sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

Despite some 68% of participants both men and women in my study reporting that they are satisfied with access to public transport, many prefer to use their own automobiles. My findings diverged from those of literature in that 'access to public transport' was positively associated with obesity in men but not in women. A possible explanation is that Libyan men who reported higher use of or greater access to public transport had only a short distance to walk or to engage in PA, with the implication that they failed to reach the recommended level of PA (Lachapelle & Frank, 2008). Another possible explanation is that the destruction of infrastructure due to clashing armed groups contributes to Libyans' reluctance to walk to use public transport. As vehicle users tend to be less physically active than those who use public transport, they may accordingly have a higher BMI. The final possible explanation for no association between access to public transport and obesity in Libyan women, is that Libyan women encounter cultural and religious barriers which restrict them from utilising public transport, despite the provision of public transport in Benghazi. Therefore, the BMI of Libyan adults is significantly associated with access to public transport in men but not in women. In other words, the greater the access to public transport, the higher the BMI in Libyan men but not in Libyan women.

My finding is contrary to a substantial body of literature that found the greater the access to or use of public transport, the more likely people are to walk or engage in physical activity daily, with a subsequent reduction in BMI (Burns & Inglis, 2007; Flint et al., 2014; Laverty et al., 2015), while other studies have found that transport-users have higher daily levels of total physical activity, which is associated with reduced weight (Saelenset et al., 2014).In addition, my findings are dissimilar to those of Wen and Risse (2008) who found that men who used public transport to travel to work were significantly less likely to be overweight and obese, but this did not apply to women who used public transport. Given the disparities between my

findings and the literature, further explanations are needed through raising this topic with LHCPs and LCLs.

7.3.3 Street connectivity

My study found a strong, significant positive association between street connectivity and obesity in the adult Libyan population, for both genders. Furthermore, after adjusting for possible confounding factors, the same strong, significant positive association between street connectivity and obesity was found in both genders. My findings indicate that there was sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

There is consensus in the literature that street connectivity is a critical factor influencing walkability, as well as other combinations of factors such as proximity to destinations, intersection density, and residential density (Frank et al., 2006). Since walking is currently the most popular form of physical activity in the world (CDC, 2013), neighbourhood factors that restrict walking comprise one set of environmental attributes that might be expected to contribute to obesity risk. Conceivably, walkability may be at a lower level in women, because they spend most of their time on childrearing and domestic duties, and are less likely to participate in employment outside the home (Prskawetz et al., 2006). A lower level of walkability may have greater influence on obesity risk. Therefore, the BMI of Libyan adults is significantly associated with street connectivity in both genders, In other words, the higher street connectivity, the higher the BMI in Libyan adults, for both men and women.

Despite most respondents in my study (65.8%) reporting a high level of street connectivity in Benghazi, my finding that street connectivity is ineffective for supporting walkability in Benghazi, not only for men but also for women, is at odds with the literature. A possible explanation is that citizens are discouraged from walking due to the ineffectual role of the government in deterring law-breakers. In addition, the destruction of infrastructure by feuding militias creates an unsafe environment that discourages walking. Finally, we should not discount the religious and cultural restrictions on women which inhibit them from going out without their Maharim.

My finding that the greater the street connectivity, the higher the BMI values in Libyan adults, for both men and women, is inconsistent with previous studies which showed that street connectivity is inversely associated with BMI and obesity risk (Rundle et al., 2008; Stafford et

al., 2007; Wen & Kowaleski-Jones, 2012). In contrast, other studies found that street connectivity was not significantly associated with BMI (Ball et al., 2012; Ross et al., 2007). Similarly, my finding are contrary to those of previous studies that established an inverse association between neighbourhood walkability indices and BMI more among males than among females (Frank et al., 2004; Frank et al., 2008). The inconsistent findings in previous studies may be due in part to disparities in data availability, definitions of walkability, and geographic levels of analysis. It is therefore necessary to raise this issue further with LHCPs and LCLs as they might be able provide more information about such associations.

7.3.4 Pedestrian infrastructure

My study found no association between pedestrian infrastructure (referring to 'presence of pavements' and 'maintenance of pavements') and obesity in the adult Libyan population, of either gender. Furthermore, after adjusting for all probable confounding factors, pedestrian infrastructure was not associated with obesity in either gender. Such findings indicate that there is insufficient evidence to reject the null hypothesis.

Although obese Libyan adults, who constituted the majority of participants in my study (63.8%), reported that their neighbourhoods have good pavements, and a similar proportion of participants reported that pavements were maintained (54.0%) and repaired (53.6%), the BMI of Libyan adults was not associated with pedestrian infrastructure ('presence of pavements', 'maintenance of pavements'). One possible explanation is that consistent fighting between militias is creating unsafe neighbourhoods, such that Libyans are remaining indoors rather than going outside and risking injury or harm from militias. A second possibility is that infrastructure has been destroyed during this clashing between armed groups, making it difficult for Libyans to find suitable areas in which to practice physical activities, leading to an increase in their weight.Therefore the BMI of Libyan adults is not associated with pedestrian infrastructure in either gender.

My study is inconsistent with several previous of studies, which showed and concurred that a neighbourhood with pavements and good connections is associated with residents' doing more walking and physical activity and having a lower BMI (Bauman & Bull,2007; Franzini et al., 2009; Giles-Corti et al., 2003). Likewise, my study contradicts those that found that the provision of pavements was positively associated with obesity (Boehmer et al., 2007). Given

the disparity of findings, it is necessary to further explore the absence of association between pedestrian infrastructure and obesity in the Libyan context.

7.3.5 Cycling infrastructure

My study found no association between cycling infrastructure (referring to 'the presence of cycle lanes' and 'the maintenance of cycle lanes') and obesity in the adult Libyan population, of either gender. Furthermore, after adjusting for all probable confounding factors, the presence of cycling infrastructure was not associated with obesity in either gender. Such findings indicate that there is insufficient evidence to reject the null hypothesis.

A possible explanation for the lack of association between cycling infrastructure and obesity is the lack of car-free zones and the lack of a 'Vision Zero Task Force' at City Hall which is enacted and implemented in many developing and developed countries for safety improvements such as traffic calming in residential neighbourhoods, speed cameras, and 'slow zones' on streets. These restrictions on motor-vehicle use in cities help to promote cycling and pedestrians. Thus, despite the existence of cycling lanes, the absence of such traffic regulations in Libya means that Libyans nevertheless tend to avoid cycling due to traffic hazards, and this lack of cycling might influence BMI. Woman particularly prefer biking in low-traffic streets and feel more relaxed riding on off-street bike paths rather than on streets (Parker et al., 2013). In addition, Libyan culture or Islamic laws restrict Libyan women from cycling. These constraints on their daily-life activities may contribute to an increase of obesity. In sum, although cycling infrastructure exists in Benghazi, Libyans are reluctant to engage in physical activities. Terefore, that the BMI of Libyan adults is not associated with cycling infrastructure, in either gender.

My finding that there is no association between cycling infrastructure and obesity is inconsistent with several previous of studies, which have shown that cycling is associated with reduced levels of obesity, thereby supporting the idea that neighbourhoods that are more walkable and bikeable help to raise PA and lower BM (Bassett et al., 2008; Gordon-Larsen et al. 2009; Wen & Rissel, 2008.). The lack of association between cycling infrastructure and obesity in my study warrants further exploration, through interview discussions with LHCPs and LCLs.

7.3 .6 Access to recreational facilities

My study found no association between access to recreational facilities and obesity in the adult Libyan population, of either gender. In contrast, after adjusting for all possible confounding factors, access to recreational facilities was significantly associated with obesity in men but not in women. My findings indicate that there was sufficient evidence to reject the null hypothesis and accept the alternative hypothesis.

Although my study reveals that the majority of Libyans (72.1 %) perceive recreational facilities to be accessible, a positive association was found between access to recreational facilities and obesity in men, but not in women. One possible reason is that most find such facilities unaffordable and contrary to Islamic laws and cultural norms which require gender segregation. In addition, women face restrictions against engaging in PA, as mentioned in Section 7.3.6. A final explanation is that most of these recreational facilities are deserted due to the conflict between outlaw militias which the public are motivated to avoid. As a result of these factors, Libyans may fail to engage in PA, which is likely to have an adverse impact on their weight. Therefore, the BMI of Libyan adults is significantly associated with access to recreational facilities in men but not in women. In other words, the greater the access to recreational facilities, the higher the BMI in Libyan men but not in Libyan women.

My finding that the BMI of Libyan adults is significantly positive associated with access to recreational facilities in men but not in women is inconsistent with previous studies which found that access to recreational facilities has an inverse association with BMIs (Gebel et al., 2007; Jilcott Pitts et al., 20013; Joshu et al., 2008). Likewise, my findings are dissimilar to those of studies which found that an absence of public outdoor sports facilities was associated with an increased likelihood of obesity (Catlin et al., 2003; Giles-corti et al., 2003), while one study found a negative association between access to such facilities and BMI in women, but not in men. Other studies have found a lack of association between access to leisure facilities and BMI (Albaladejo et al., 2014; Rutton & Coleman 2005; Witten et al., 2008). Such contentious relationships warrant further discussion with LHCPs and LCLs to understand more about this theme.

7.3.7 Traffic safety

Despite the fact that some 63% of participants reported that traffic safety measures have been implemented in their neighbourhoods, my study found no association between traffic safety

(referring to 'safety for pedestrians' and 'safety for cyclists') and obesity in the adult Libyan population, of either gender. Furthermore, after adjusting for all probable confounding factors, traffic safety was not associated with obesity in either gender. Such findings indicate that there is insufficient evidence to reject the null hypothesis.

Consensus exists among researchers that improving traffic safety through traffic-calming measures, such as incorporating auto-free zones throughout the city, may encourage and support the public to engage in physical activities, thereby helping to reduce the obesity risk (Frank et al., 2007; Sallis & Glanz,2009). A possible explanation for the lack of association between traffic safety measures and BMI in this study is the ongoing fighting among militias in Benghazi, which may discourage Libyans from practicing their daily-life activities, thereby contributing to an increase in obesity rates. Another possible explanation is the ineffectiveness of the officials in preventing criminals from taking advantage of the country's current circumstances by breaching the laws and entering auto-free zones, rendering these areas risky and unsuitable for the public to practise daily physical activities.Therefore, the BMI of Libyan adults is not associated with the traffic safety in either gender.

My findings are similar to those of a Japanese study which found a lack of association between traffic safety measures and obesity (Foster et al., 2004; Li et al., 2005). However, my study is unlike other studies that variously showed a negative association between traffic safety measures and obesity (De Bourdeaudhuij et al., 2015; Humpel et al., 2004), or a positive association (Oyeyemi et al., 2012). The results of previous studies investigating the relationships between traffic safety and obesity are inconsistent (Van Dyck et al., 2012). Hence further exploration is required to understand the lack of association between traffic safety and obesity in my study, through raising this issue with LHCPs and LCLs.

7.3.8 Pedestrian safety
My study found no association between pedestrian safety (referring to 'perceiving people as being active') and obesity in the adult Libyan population, of either gender. Furthermore, after adjusting for all probable confounding factors, pedestrian safety was not associated with obesity in either gender. Such findings indicate that there is insufficient evidence to reject the null hypothesis.

Improving pedestrian safety will inevitably improve walkability, which encourages physical activity and reduces the risk of obesity (Sallis & Glanz,2009). Despite some 67% of participants reporting that they perceive their neighbourhoods to have a high level of pedestrian safety, my study found no association between pedestrian safety and obesity. A possible explanation is that the conflicts between militias are resulting in unsafe neighbourhoods, with increased crime rates and traffic accidents. Pedestrian vulnerability is further exacerbated by Libyan traffic laws being inadequately enforced (Shaw & Mangan, 2014; Chivvis & Martini, 2014; Tabib, 2014). Another explanation the clashing between militias has damaged the pedestrian infrastructure, which encourages the public to stay at home rather than engaging in PA. Therefore, the BMI of Libyan adults is not associated with pedestrian safety in either gender.

My finding that there is no association between pedestrian safety and obesity is inconsistent with several previous studies which found that pedestrian-related safety was positively associated with walking, which may reduce the risk of obesity (Bracy et al., 2014; Rothman, et al., 2014; Owen et al., 2004). My findings are also dissimilar to those of studies that found a negative association between pedestrian safety and exercise, which may increase the likelihood of obesity (Bracy et al., 2014; Villaveces, 2012). Due to the contentious findings in previous studies and the lack of an association between pedestrian safety and obesity in my study, further exploration is required through discussions with LHCPs and LCLs.

7.3.9 Neighbourhood aesthetics

My study found a strong, significant positive association between neighbourhood aesthetics and obesity in the adult Libyan population, for both genders. Furthermore, after adjusting for possible confounding factors, the same a strong, significant positive association between neighbourhood aesthetics and obesity was found in both genders. My findings indicate that there was sufficient evidence to reject the null hypothesis and accept the alternative hypothesis. Neighbourhood aesthetics, such as the presence of street trees, is frequently shown to be important for physical activity through promoting active transport (cycling and walking) and encouraging the public to engage in physical activities (Sugiyama et al., 2012). Based on the perceptions of the research participants, the presence of street trees in Benghazi provides welcome shade in the hot weather and creates pleasant and safer routes for pedestrians and cyclists. The pleasant atmosphere created by the trees may encourage Libyans to engage in physical activity as part of their daily routine, thereby helping to reduce the risk of overweight

and obesity. Surprisingly, my study found that the presence neighbourhood aesthetics is associated with a higher BMI. This suggests that there might be confounding factor such as an unsafe neighbourhood environment created by the current conflicts between armed groups operating outside of the law. Consequently, Libyans are constrained from enjoying these green spaces to engage in daily PA, such as walking or cycling for transport or exercising for pleasure and fitness. The absence of all these activities has probably contributed to the rapid rise of obesity levels.Therefore,the BMI of Libyan adults is significantly associated with neighbourhood aesthetics in both genders. In other words, the higher the level of neighbourhood aesthetics, the higher the BMI in Libyan adults in both men and women.

My findings of a positive association between neighbourhood aesthetics and obesity in Libyan adults is inconsistent with previous studies, which found a significant negative association between the presence of neighbourhood aesthetic and BMI (Pereira et al., 2013; Potwarka et al., 2008; Sugiyama et al., 2012). My findings are also dissimilar to those of studies that found a positive association between obesity and poor aesthetics (Boehmer et al., 2007; Carter & Dubois, 2010; Powell-Wiley et al., 2013). My findings differ from those of other epidemiological studies which reported gender differences: whereas some found that enjoyable scenery was positively associated with attaining the recommended level of physical activity in women (Inoue, et al., 2010; Shibata et al., 2009; Spence et al., 2006), other studies found that neighbourhood aesthetics is significantly associated with neighbourhood walking in men but not in women (Humpel et al., 2004). Due to these contentious results from a variety of studies, further explanation is required to understand the association from the perspective of LHCPs and LCLs.

7.3.10 Household vehicle ownership

My study found no association between the presence of one or more vehicles in the household and obesity in the adult Libyan population of either gender. Furthermore, after adjusting for all probable confounding factors, household vehicle ownership was not associated with obesity in either gender. Such findings indicate that there is insufficient evidence to reject the null hypothesis.

Studies concur that relying on vehicles instead of using active transport, such as walking or cycling, contributes to obesity, since vehicles constitute a passive form of transportation. An emerging body of evidence suggests that sedentary behaviours, such as sitting in cars, are

associated with an increased risk of chronic diseases such as obesity, since people who have longer commutes tend to purchase much of their food and run numerous errands on their way to and from work, which could contribute to weight-gain (Bell et al., 2002; Douglas et al., 2011; Parra, et al., 2009). A facilitating factor for Libyans' reliance on their cars rather than walking or cycling, even for short distances, is the fact that Libyan petrol is inexpensive, and among the cheapest in the world, with the average price per litre being approximately (150 Libyan Dirham = 8 pence), compared to approximately £1.09 per litre in the UK in October 2015.

Most of participants in this study (70.6%) reported that their household owned a number of vehicles, rather than a single vehicle. Those Libyans who reported a lack of car ownership may be more likely to visit fast food restaurants rather than supermarkets, grocery stores, convenience stores or full service restaurants (FSRs) in their neighbourhood, whereas those who have cars may rely less on fast food outlets. Accordingly, those without cars could be more prone to gaining weight than their counterparts with cars, due to their greater consumption of fast foods. Another possible explanation is that most Libyan women rely on male relatives to drive them. However, there is no official or strict Islamic law that bans Libyan women from driving as in Saudi Arabia where women are prohibited from driving (Rajkhan , 2014). Despite the high percentage of participants in this study who reported that they own one or more household vehicles, few Libyan women are willing to drive cars by themselves, probably due to commitments at home or other cultural or tribal restrictions. Therefore, conclude that the BMI of Libyan adults is not associatd with household vehicle ownership, in either gender

My findings are similar to those of a recent study in China that found car ownership was not a statistically significant predictor for BMI in rural areas (Du et al., 2014). However, my findings are contradictory to those of a number of epidemiological studies in developed countries (Frank et al., 2004; Inagami et al., 2009; Parra et al., 2009) and in developing countries, including the Arab region (Al-Mannai et al., 1996), which found that household motor-vehicle ownership was positively associated with obesity. Due to these contentious findings about the association between household car ownership and obesity in different studies, the lack of association between motor-vehicle use and BMI in Libyan adults of both genders requires further exploration.

My findings with respect of the fourth hypothesis – the relationship between neighbourhood environmental factors and BMI – are equivocal. In addition, the paucity of data from developing countries, particularly Arab countries, means that many of my interpretations are equivocal due to having to compare my results with those of developed countries, which do not necessarily have the same characteristics as Libya, namely Libya differs from developed countries e.g., perhaps neighbourhood built environmental attributes differ between Libya developed countries , or different cultural restrictions in Libya, or developed countries have fewer religious barriers, or no wars. Therefore, to understand these findings further, it is necessary to solicit the insights of LHCPS and LCLs. People in both these roles are likely to be in position to provide reliable information about the actual daily-life activities of Libyan residents in their neighbourhoods. Accordingly, their insights may help to clarify these ambiguous results.

Appendix 7.4 Discussion of the results of demographic data.

7.4 Discussion of the results of demographic data

7.4.1 Religion and ethnic groups

As Islam is the dominant religion in Libya, with 96.6% of the population associating with the faith, it was unsurprising that 100% of my participants were Muslims and belong to the Islamic faith. Most Libyans adhere to the Sunni denomination of Islam (CIA World Fact Book, 2015; Sehib et al., 2013). As no other religion appeared in my sample, it may be concluded that secularism has not entered Libyan society at all. Correspondingly, the most common ethnic group in this study are the Arabs (84.6%), followed by the Berber (Amazigh) (10.7%), whilst the smallest percentage is constituted by the Toubou (4.7%). This finding was unsurprising in keeping with the natural structure of ethnic groups in Libya is that the Arabs and Berber constitute the majority ethnic groups , while the Tuareg, Toubou and other indigenous make up most of the minority ethnic groups (MEGs) (CIA World Fact Book, 2015).

7.4.2 Duration of residence in Benghazi

My study found that the mean period of residence amongst both genders in Benghazi was 34.25 (+/-13.92) years. In addition, long-term residents in Benghazi, of 35 years and more, had a higher prevalence of obesity than short-term residents, of less than 35 years. Another important finding concerning residency was the significant positive correlation between BMI and period of residence in Benghazi.

Numerous explanations can be posited for the correlation between the duration of residence in Benghazi, which may be considered obesogenic, and an increase in the obesity rate. One is the acculturation process whereby Libyans from the Sahara Desert and other areas of deprivation in Libya migrate to the city of Benghazi (Bredeloup & Pliez, 2011; Bredeloup, 2012; Morris, 2013), which may be tantamount to migrating from one culture to another. Once they become residents in Benghazi, they tend to adopt the obesogenic behaviours of their new urban culture, and accordingly become same or more overweight or obese than their local counterparts. This scenario of change probably occurs due to their chronological immersion in Benghazi culture over a period of ten years and more, and is therefore consistent with one of inclusion criteria for this study "Resident in Benghazi for over ten years". Therefore, my findings were unsurprising concerning the significant positive correlation between BMI and period of

residence in Benghazi. This association may be attributable to the nature of that obesogenic environment that exists in Benghazi, which predisposes 'Libyan immigrants' to gain weight.

My findings were consistent with those of previous studies which found that various immigrant subgroups living in a host environment for more than 10 years are significantly more prone to acculturating to an obesogenic environment and to an increase in their BMI than are their counterparts who have lived in the host environment for less than 10 years (Delavari et al., 2013; Goel et al., 2004; Shah et al., 2015) (See the Chapter 2, Literature review (Section 2.10.1.5).

Appendix 8.1 Eligibility criteria for participants.

The following section discusses the reasons for specifying the subsequent inclusion and exclusion criteria.

8.1 Inclusion criteria

8.1.1 Rationale for selecting healthcare professionals and community leaders

Due to the neglect pervading many Libyan primary healthcare centres, the general absence of health awareness among Libyans fosters misconceptions among the public about the causes and sequelae of diseases, such as obesity. For instance, Libyans perceive obesity to be a sign of 'good living' and 'good health', with some individuals holding fatalistic, 'naïve beliefs' about one's body being 'God given' and therefore perceiving it to be unamenable to change (Badran & Laher, 2011; Mokhtar, 2001).

Recruiting research participants who currently work in Benghazi, whether healthcare professionals or community leaders, is a logical choice since both groups are likely to have an understanding of the recent changes of the socio-economic and political circumstances in Benghazi and their influences on citizens' well-being. Interviewing a diverse cross-section of these groups enabled me to gather rich, qualitative data on the risk and protective factors associated with obesity in Libyan adults, which I used to explore and clarify any ambiguous or surprising findings in the quantitative study (see Chapter 8, Section 8.3 about the rationale for selecting the interviewees).

8.1.2 Must speak an Arabic language

This criterion was specified because the main language spoken in Libya is Arabic, which is also the official language. Although the Arabs and Berber people constitute the main ethnic groups in the country (97%), Tamazight (i.e. Berber languages) do not have official status in Libya (CIA World Fact Book, 2015). The remaining 3% is comprised of minority peoples, including sub-Saharan Africans (United Nations High Commissioner for Refugees (UNHCR), 2015). An additional reason for stipulating that the interviewee speaks Arabic is that the researcher himself is a native Arabic language speaker.

8.1.3 Must have been resident in Benghazi for over ten years

This eligibility criterion was discussed in depth in the quantitative study (see Chapter 5, Section 5.2.2).

8.1.4 Must have at least five years' work experience

Several studies have stipulated as one of their inclusion criteria the requirement that participants have at least five years' experience in their respective fields, which may result in their being promoted to senior positions (experts) within their institutions, based on their knowledge and experience (Perera, 2005; Wu, Patel, 2015). Aligned with my pragmatic approach, I specified five years' duration as the minimum required experience in their position for including Libyan HCPs (LHCPs) and community leaders (LCLs) in my study.

8.1.5 Must meet the eligibility criteria for appointments as set out in the internal regulations of the Social People's Leadership Institution

Many Libyan institutions enact terms and conditions regarding the appointment of leaders in the community such as an Imam, tribal leader or a member of a municipal council. One such condition is that the applicant must meet the eligibility criteria as set out in the regulations for the internal appointment of community leaders. These include: the attainment of an educational qualification, at least the Diploma of Higher Education (DipHE), and he/she must be aged 30 years or older. Adding to this the five years' minimum experience in the job, stipulated as one of my inclusion criteria, results in 35 years' as a minimum age for the interviewees in my study. The second consideration is the participants' qualifications. For instance, physician is one my study's sub-group targets. As physicians usually qualify from medical school at age 26 years or older, adding 5 years' experience equals 31 years at least. Therefore, it was sensible to specify 35 years as the minimum age of the research participants for inclusion in my study.

8.2 Exclusion criteria
8.2.1 Speaks the Berber language
Arabic is the official language in Libya as opposed to Berber languages, which the minorities speaking fluently. In addition, Arabic is my native language.

8.2.2 Healthcare professionals not affiliated to the Benghazi Diabetes Centre (BDC)
It has been acknowledged that the Libyan health authorities have neglected preventive measures including the promotion of health education, especially with regard to chronic and infectious diseases (Elfituri, et al., 1999; 2006). For example, the WHO-EMR (2007; 2010; 2014b) has issued several reports concluding that the Libyan government has neglected

primary healthcare facilities, such as local clinics, health facilities and district hospitals in deprived districts. Despite improvement and re-development of health facilities in the first year after the 2011 revolution, health infrastructure has been badly damaged due to clashes over the past three years among extremist militias (WHO-EMR, 2012, 2014b).

In addition, the poor administrative performance of many health officials, along with the 'brain drain' of foreign medical staff due to the political conflicts, has resulted in an cessation of services at most of the health facilities located in the fighting zones. The Benghazi Diabetes Centre (BDC) remains the only hospital equipped with high-level professional medical staff and modern equipment. It continues to provide all health services to all residents in Benghazi. These include: curative, preventive, rehabilitative, and nutritional counselling for diabetic patients, as well as for overweight and obese patients with type 2 diabetes (Badr et al., 2014; Elkharam et al., 2013; Roaeid. & Kablan, 2007; WHO-EMR, 2014b). I selected the BDC as my final destination for conducting all interviews with healthcare professionals affiliated to the Centre because such HCPs deal with overweight or obese patients frequently in the course of their jobs.

The penultimate exclusion criterion, namely, any participant who 'has been *recently* appointed at any of the institutions from which the respondents were recruited' was stipulated because interviewees need to have at least five years of work experience, as per the inclusion criteria. The final criterion, "fails to meet the requirements for appointment as set out in the internal regulations of the Social People's Leadership Institution" was specified because if they are less than 35 years old and lack a higher-education qualification, Libyan Civil Law for public employments (Al-Hadad, 2015) prohibits them from working as community leaders.

Libyan Embassy
Cultural Attaché - London

سفارة ليبيا
الملحقية الثقافية - لندن

وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education & Scientific Research

Our Ref 43/11/2013

25/11/2013

To: The Principal
Omar Al-Mukhtar University
Libya

Hamdi Abdulla Lemamsha (Ref No – 8998)
Field Study in Libya

Dear Principal,

We confirm that Mr Hamdi Abdulla A. Lemamsha is sponsored by the Cultural Attaché at the Libyan Embassy in London to undertake a PhD degree in Public Health at the University of Bedfordshire for the period from 01/10/2012 to 30/09/2015.

Mr Hamdi Lemamsha would like to conduct a fieldwork in Libya as part of his PhD research work about the risk and protective factors associated with obesity amongst adults aged 20 to 65 years.

We would be grateful if you could provide Mr Lemamsha with all support he will need during his fieldwork.

Should you require any further information, please do not hesitate to contacting us.

Yours Faithfully,

Dr Abdelbasit A. Gadour
Cultural Attaché
Libyan Embassy – London
UK

OMAR EL-MUKHTAR UNIVERSITY

جامعة عمر المختار

الرقم الإشاري :ج م ع ١ :406/٢   الموافق :2014/11/6م   التاريخ : / /   هـ

Dear Chairman of theElders of Benghazi Council

Re:*Research entitled "Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya." Conducted by* **Hamdi Abdulla A. Lemamsha, a PhD student** *at the Institute for Health Research at the University of Bedfordshire, UK.*

Within the frame of fruitful cooperation and solidarity amongst Libyan organizations and institutions, and in order to enhance and develop scientific research, we would like to take this opportunity to inform you that:

Having granted ethical approval for the current study mentioned above, I am writing to ask for your help to enable Mr. Lemamsha to deliver the information sheets and informed consent forms to a number of workers affiliated to your institution and moreover, who are Libyans resident in Benghazi. In conjunction with this, I would like to ask for your permission for Mr. Lemamsha to conduct interviews with some employees who meet the inclusion criteria for his

The researcher will present you with all the relevant documents, in order to obtain your permission to contact employees affiliated to the institution and provide them with information sheets regarding the current study. Prospective participants wishing to take part in the study will be provided with an informed consent form to sign. Once this stage is conducted, the researcher will complete any further procedures, such as arranging a time and date with the participants for the interviews to take place.

Your assistance, co-operation and time with this matter will be greatly appreciated by Mr. Lemamsha and his supervisory team, as it will allow him to conduct his study and furthermore, to develop and improve scientific research in the State of Libya.

If you have any further questions or require any additional information, please do not hesitate to contact us.

Thank you for your time and consideration.

Yours sincerely

Dr.Jibreel S.Eldiabani

Dean of the university of Omar Al-Mukhtar-Derna

**OMAR EL-MUKHTAR
UNIVERSITY**

جامعة عمر المختار

التاريخ : / / هـ   الموافق : 16/1/2014   الرقم الإشاري : ج.ع.أ/408

Dear Director of the Diabetes Hospital, Benghazi

Re: *Research entitled "Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya." Conducted by* **Hamdi Abdulla A. Lemamsha, a PhD student** *at the Institute for Health Research at the University of Bedfordshire, UK.*

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OMAR EL-MUKHTAR UNIVERSITY   جامعة عمر المختار

التاريخ : / / هـ   الموافق : 2014/1/16م   الرقم الإشاري :ج ع /1/ 407

Dear Chairman of the Benghazi Municipal Council

Re: *Research entitled "Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya." Conducted by Hamdi Abdulla A. Lemamsha, a PhD student at the Institute for Health Research at the University of Bedfordshire, UK.*

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Yours sincerely

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جامعة عمر المختار

الرقم الإشاري: ح/ع/409 .. المواقف: 6/11/2014م .. هـ / / : التاريخ

Dear Dean of Faculty of Public Health, Al Arab Medical University, Benghazi,

Re: *Research entitled "Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya." Conducted by **Hamdi Abdulla A. Lemamsha, a PhD student** at the Institute for Health Research at the University of Bedfordshire, UK.*

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Thank you for your time and consideration.

Yours sincerely

Dr.Jibreel S.Eldiabani

Dean of the university of Omar Al-Mukhtar-Derna

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جامعة عمر المختار

الرقم الإشاري : ح.أ.ع/410   الموافق : 6/11/2014م   التاريخ : / /   هـ

Dear Chairman of the Civic Leaders

Re: *Research entitled "Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya." Conducted by **Hamdi Abdulla A. Lemamsha, a PhD student** at the Institute for Health Research at the University of Bedfordshire, UK.*

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If you have any further questions or require any additional information, please do not hesitate to contact us.

Thank you for your time and consideration.

Yours sincerely

Dr.Jibreel S.Eldiabani

Dean of the university of Omar Al-Mukhtar-Derna

Appendix 8.8 Methods of data collection.

8.2 Methods of data collection

8.2.1 Focus groups

Focus group research involves organised discussion with a selected group of individuals who are prepared to discuss their perspectives and experiences regarding the specific topic being investigated (Kairuz et al., 2007). Focus groups facilitate the exploration or derivation of hypotheses (Powell & Single, 1996). They can also refine questions or concepts for survey questionnaires and interview schedules (Leung& Savithiri,2009; Hoppe et al., 1995; Lankshear, 1993).

Whereas observational studies involve waiting for things to happen, focus groups require participants to follow an interview schedule (Brayman, 2012; Gill et al., 2008). Compared with observational methods, focus groups enable the researcher to obtain a relatively large amount of information in a relatively short period of time (Brayman, 2012; Gill et al., 2008). However, focus groups tend to be resource-intensive, and a drawback of focus-group interviews is the lack of generalisability of the findings due to the small sample size.

Focus groups were unsuitable for the Libyan context for several reasons. Firstly, there is no history of qualitative research in Libya; it has begun to emerge only recently, although in the form of interviews rather than focus groups among novice researchers (see Chapter 4 Section 4.8.3). Secondly, it is customary in Libyan culture for Libyans to interrupt each other during dialogues, even in official meetings, and they often feel embarrassed when they make a mistake while talking about a topic in front of others. Finally, as I do not have an advanced experience in administering focus groups, I eliminated their use for gathering qualitative data in my study. The next section justifies the choice of semi-structured interviews over the other methods.

8.2.2 Individual interviews

Interviews range from highly-structured, verbally-administered questionnaires, in which a list of predetermined questions is asked, to an open-ended, more conversational format (Brayman, 2012; Gill et al., 2008). The most common types of interview are: structured, unstructured and semi-structured. The first two types were unsatisfactory for my study, as argued below.

Structured interviews inevitably limit responses, and the data obtained may not be reliable if there are biases in the way in which questions are asked or understood by the respondents (Raymond,2006). As this method is more suitable for generating quantitative rather than

qualitative data, I ruled it out for collecting data for the qualitative stage of this study. Although unstructured interviews tend to be less intimidating than structured interviews, the interviewee's responses may be subject to social desirability bias. Another drawback of unstructured interviews is that they can be time-consuming in comparison to other research methods ((Brayman, 2012; Creswell, 2013), which may limit the sample size. In addition, the possibility of respondents' digressing from the topic means that the data collected may not be generalisable or representative of the topic.

Appendix 8.9 Interview Timetable.

Date of interview	Time of day of interview	Occupation (Responsible)	Initial names & Gender	Place of interview
Monday 1/12/2014	Early morning 8 am -9 am	Physician	Dr NE Female	Benghazi Diabetes Center (BDC)
	Early evening 7 pm -8 pm	Nurse	GR Female	BDC
Tuesday 2/12/2014	Early morning 8 am -9 am	Physician	Dr MD Male	BDC
	Early evening 7 pm -8 pm	Nurse	MB Female	BDC
Wednesday 3/12/2014	Early morning 8 am -9 am	Physician	Dr RF Female	BDC
	Early evening 7 pm -8 pm	Nurse	MM Male	BDC
Thursday 4/12/2014	Early morning 8 am -9am	Clinical nutritionists	HS Female	BDC
	Early evening 7pm -8 pm	Clinical nutritionists	TH Male	BDC
Saturday 6/12/2014				
	Early evening 7 pm -8 pm	Clinical nutritionists	NB Female	BDC
Monday 8/12/2014	Early afternoon 2 pm -3 pm	Member Benghazi Municipal Council	SD Male	Benghazi Municipal Council Headquarters
	Late afternoon 4 pm -5 pm	Member Benghazi Municipal Council	WF Male	Benghazi Municipal Council Headquarters
Wednesday 10/12/2014				
	Late afternoon 4 pm -5 pm	Member Benghazi Municipal Council	GM Male	Benghazi Municipal Council Headquarters
Saturday 13/12/2014	Early afternoon 2 pm -3 pm	Lecturer	Dr RZ Female	Al-Arab Medical University
	Early morning 9 am -10 am	Lecturer	Dr HZ Female	Interviewee's house

Monday 15/12/2014				
	Late evening 7 pm -8 pm	**Lecturer**	**Dr AG Female**	**Interview's house**
Thursday 18/12/2014				
	Late evening 7 pm -8 pm	**Imams (Sheikhs)**	**TB Male**	**Mosque**
Sunday 21/12/2014	**Morning 10 am -11am**	**Tribal leader**	**SB Male**	**Elders of Benghazi Council headquarters**
Monday 22/12/2014				
	Late morning 10 am -11 am	**Imams (Sheikhs)**	**RL Male**	**Mosque**
	Early afternoon 2 pm -3 pm	**Imams (Sheikhs)**	**NM Male**	**Mosque**
Tuesday 23/12/2014				
	Early afternoon 2pm -3 pm	**Tribal leader**	**YB Male**	**Interviewee's house**
Wednesday 25/12/2014				
	Late afternoon 6 pm -7 pm	**Tribal leader**	**HG Male**	**Interviewee's house**

Appendix 8.10 Interview schedule for semi-structured interviews.

Section 1: Introduction

- I would like to thank you for taking the time to meet with me today.

- My name is Hamdi Lemamsha. I would like to talk to you about your views on obesity amongst adults in Benghazi, within the context of Libyan culture. In particular, I am interested in what you think are the biggest causes of obesity and what can best prevent obesity.

- I would like to reassure you that this interview is confidential. This means that your responses will be shared only with research team members. We will ensure that any information included in our report does not identify you as the respondent.

- You have signed a consent form which outlines your rights as a research participant. I want to remind you that you may withdraw from this study at any time. My contact information is provided on both the participants information sheet and informed consent sheet if you have any questions or concerns.

- I request your permission to audio-record this interview so that your responses can be transcribed later. The interview should take less than an hour and recording it will provide a more accurate representation of your responses to the questions. Recording will also facilitate my analysis of the data during the course of this project.

- It is important to maintain the integrity of your words; therefore, I may ask you to review the transcription if I have any difficulties with the interpretation.

- Please feel free to discuss your views openly during the interview. From time to time, I may ask for further clarification to assist me in understanding your response. Please remember, all responses are confidential.

- If you do not have any further questions, I would like to briefly introduce you to the subject of this interview. Thank you for sharing your thoughts with me. Let us begin.

Section 2: Qualitative interview questions

1. Can you tell me what you know about obesity?
Probes:

- Could you tell me a little more about obesity?

2. What do you think causes obesity?
Probes:

- Could you tell me more about other factors you think lead to obesity?

3. A) Is obesity an issue in Libya?

Probes:

- Why do you think obesity is an issue in Libya ?
- Could you tell me more about your thinking on that?

3. B) Is obesity an issue in Benghazi?

- Why do you think obesity is an issue in Benghazi?
- Could you tell me more about your thinking on that?

4. How do you think obesity can be prevented?

Probes:

- Could you tell me more about your thinking on that?

5. Questions with respect to socioeconomic status impacts upon obesity:

- Do you think well-educated people are more or less likely to be obese than relatively uneducated people? If so,why

- Do you think wealthier or poorer people are more likely to be obese?

- Do you think employed people are more or less likely to be obese than relatively unmplyed people? If so, why?

Probes:

- Could you tell me more how income impacts upon a person's weight?
- Could you tell me more how education impacts upon a person's weight?
- Could you tell me more how occupation impacts upon a person's weight?

6. How do you think diet and eating habits impacts upon obesity?

Probes:

- In your view, how do you think unhealthy eating habits impacts upon obesity?
- In your view, how do you think healthy eating habits impacts upon obesity?
- How can this be dealt with?

7. How do you think physical activity impacts upon obesity?

Probes:

- How can this be dealt with?

8. How do you think physical inactivity impacts upon obesity?

Probes:

- How can this be dealt with?

9. How do you think sedentary behaviours impacts upon obesity?

Probes:

- How can this be dealt with?

10. How do you think access to healthy food could be improved in your neighbourhood built environment?

Probes:

- How do you think your neighbourhood built environment impact upon accessing unhealthy food , which in turn may impact on your weight ?
- How can this be dealt with?

11. How do you think access to physical exercise could be improved in your neighbourhood business environment?

Probes:

- How do you think your neighbourhood built environment impact upon hindering Libyans to engage in physical activities , which in turn may impact on your weight ?
- Can you tell me a bit more about that?

12. How do you think the current political situation in Benghazi impacts upon obesity?

Probes:

- Could you tell me more about your thinking on that?

Section 3: Closure

- ➢ We have covered a great deal of ground. Thank you for being so patient with me.
- ➢ Do you think there is anything we have missed out?
- ➢ Do you have any other comments about what we have discussed or about the research as a whole?
- ➢ We will send your interview transcript to you so you can confirm your accuracy.
- ➢ We will send you a summary of the research findings some time in 2015, probably June of that year to review and make any changes you thought would be necessary.
- ➢ You are welcome to have a full copy of the final report too after I finished my study.

Thank you very much for taking the time to talk to me.

Appendix 8.11 A questionnaire on demographic profile of the interviewee.

University of Bedfordshire

Participant Identification Number: Date: ☐ ☐ | DD/MM/YYYY

Demographic information	Response
Participant Initials	|___||___||___|
Age:	☐Years
Gender:	☐ Male ☐ Female
Religion:	☐ Christian ☐ Muslim ☐ Buddhist ☐ Judaist ☐ Sikh ☐ Atheist ☐ Other ☐ Don't know
Participant qualification:	……………………………………………………
Occupation:	…………………………………………………..
Duration of employment:	☐ ☐
Institutional affiliation:	…………………………………………………..
Place of interview:	…………………………………………………
Date of interview:	|_..__||_..__||__1_||__2_||_1_||_4__|
Time of interview:	☐
E.mail adress	…………………………………………………

Thank you again for taking the time to complete this survey.

وزارة الصحة

مركز بنغازي لتشخيص وعلاج السكر

الاشاري : 05-226

التاريخ : ....
الموافق : .... 11 - 1 - 2015

To whom it may concern .

To supervisory team of PHD student hamadi lemamsha

Ref : Mr Hamadi abdullah A lemamsha

PhD student of the Instiute for health research university of bedfordshier UK .

SUBJECT

Approval of research project named : Exploring the risk and protective factors associated with obesity amongst adult   aged 20 to 65 years : Acase study in Benghazi libya.

We hereby confirm that the above mentioned APHD student from the university of bedfordshier UK successfulhy accomplished his data collection in two stayes (Quationnaires when he met some participants at this center and interview with nice medical hospital Staffs (3 doctors , 3 detain and 3 nurses) at the (Diabetes center Benghazi)
If you have any futher questions or require any additional information , please do not hesitate to contact us .

general manger
Dr. NAJLA ALLAGHI

سيدي حسين - هاتف : 9098037-9098036-9098035-9098034

8.13.1 Methods of translation

According to Liamputtong (2010) and Neuman (2011), three types of translation exist that can be used in qualitative studies: single translation, parallel translation and back-translation. Single translation is the most straightforward and the quickest to use (Neuman, 2011), yet it lacks transparency and trustworthiness because it is done by one translator only, making it subject to bias (McGorry, 2000). Parallel translation, also called the committee approach, requires two or more translators to translate the research instruments or interview transcripts independently; a panel of experts then compares them all at once to produce the best translation version (Neuman, 2011). This procedure is generally more costly and time-consuming than other methods (Guest et al., 2013). In addition, a lack of experience among some translators in some academic subjects may skew the final translation result towards their own interpretation, rather than the research participant's original voice and opinion (McGorry, 2000).

A preferable method, recommended by Liamputtong (2010) and Lopez et al. (2008), is back-translation, a process of translation in which documents that had already been translated into a target language (English) are translated back into the original language (Arabic) by appointing a Libyan certified translator, who has never looked at the previous translated documents. This method minimises any ambiguity or inaccuracies in the translation and maximises equivalence across languages. Accordingly, this back-translation method was used in this study.

8.13.2 Appointment of translators

Translators have an important role in the interpretation of the research data (Regmi et al., 2010), enabling researchers to obtain accurate and meaningful transcripts and to achieve conceptual equivalence. This is best achieved through regular communication with the translators during the translation process (Regmi et al., 2010). However, given the shortage of qualified translators in Libya, as well as recent emergence of the qualitative research in Libya, high-level professional translators are not easy to find (Deeb, 2005; Elabbar, et al., 2011) Aligned with my pragmatic stance, the three experienced translators who had previously translated my survey questionnaire in the quantitative phase were appointed to translate the relevant documents of the qualitative phase, including the interview transcripts. All three translators met the inclusion criteria, namely: were certified Libyan translators; were knowledgeable about Libyan culture as well as about medical terms; and were fluent in both English and Arabic.

They were familiar with my study, and they communicated diligently throughout the translation process which facilitated the validation of the interview transcripts (WHO,2015c) .

It is recommended that only one translator be appointed to translate the set of interview transcripts in order to provide consistency in the translation of qualitative data (Choi et al., 2013). However, appointing only one translator was inappropriate in this study due to the relatively large number of interview transcripts that needed to be translated: 21 transcripts from 21 interviews (9 Libyan healthcare professionals and 12 Libyan community leaders). As it was unviable to request one translator to handle all 21 transcripts, I split the workload by engaging two translators. (T1) translated the 9 interview transcripts of healthcare professionals while (T2) translated the 12 interview transcripts of community leaders. The third translator did the back- translation. The next section discusses the translation process in further detail.

8.13.3 The back-translation process

There is consensus among researchers about the stages to be implemented in the back-translation process (Choi et al., 2012; Regmi, et al., 2010). The stages are as follows: determination of the relevance or context; forward-translation of the research instruments (in the case of the interview schedule, the PIS and the ICF, from English to Arabic; while in the case of the interview transcripts, from Arabic back into English); backward-translation (in the case of the interview schedule from Arabic back to English; while in the case of the interview transcripts from English back into Arabic); examination of the translated meaning in both source and target languages; and finally, revisiting the whole process to obtain similar interpretations see Chapter 8, Figure 8.1.

Step 1: Forward-translation process for the interview protocol

I requested the first Libyan certified translator (T1) to translate the interview schedule, as well as the PIS and the ICF, from English into Arabic. Once I transcribed all 21 recorded interviews into Arabic, I send them immediately to the interviewees , who I already have their email addresses, so they can confirm their accuracy .In addition, once I received their comments and feedback, I sent them to the two translators (T1 & T2) for forward translation from Arabic into English. To save time, I divided this task between the two translators as follows: T1 translated 9 interviews from the LHCPs, while T2 translated 12 interviews from the LCLs. To ensure the confidentiality of the participant's information, all Arabic interview transcripts that were

translated into the target language (English) were emailed to the two translators using password-protected files and folders.

Step 2: Back-translation process for the interview protocol

Firstly, once I received the translated documents from T1, I sent the interview schedule to the third, independent translator (T3) only, who did not have knowledge of or contact with the original text. T3 then back-translated it from Arabic into English. Once I received both documents, I reviewed and compared them to ensure accuracy.

Secondly, once I received all the English-translated transcripts from both translators (T1 & T2), I sent two random translated interview transcripts from each of the translators (T1& T2) to the third independent translator (T3) for back -translation. Once I received the four back-translated versions of the four interview transcripts, I reviewed and compared them to the original Arabic transcripts to ensure accuracy see Chapter 8, Figure 8.1.

Finally, I compared the original Arabic transcript with the back-translated transcript in accordance with the conceptual equivalence principle. I firstly examined the similarity between the original (Arabic) transcripts and the translated (English) transcripts by focusing on the similarity of concepts rather than on linguistic units at word- and phrase-levels. The final comparison of the original transcripts and the back-translated transcripts was also conducted in accordance with the conceptual equivalence principle. Apart from the use of a few synonyms for describing the same concept, due to each translators' idiosyncratic word choice, there were no significant differences between the two transcripts.

Appendix 8.14 Ethical approval from (IHREC).

University of
Bedfordshire

Institute for Health Research
Putteridge Bury
Hitchin Road
Luton
Beds LU2 8LE

31 Octoberber 2014

Hamdi Abdulla Lemamsha
Student number: 1138055

Dear Hamdi Abdulla Lemamsha

Re: IHREC Application No: IHREC439

Project Title: Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya

The Ethics Committee of the Institute for Health Research has considered your application and has decided that the proposed research project should be approved with no amendments and a following note:

1. When collecting data in Benghazi, Libya please follow the Libyan Government's instructions regarding the areas that are safe to approach as outlined in the permission for entry granted to you by Libyan Embassy, and remain in daily contact with your supervisor as agreed.

Please note that if it becomes necessary to make any substantive change to the research design, the sampling approach or the data collection methods a further application will be required.

Yours sincerely

Dr Yannis Pappas
Head of PhD School, Institute for Health Research
Chair of Institute for Health Research Ethics Committee

Libyan Embassy
Cultural Attaché - London

سفارة ليبيا
الملحقية الثقافية – لندن

وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education & Scientific Research

20/10/2014

Professor Gurch Randhawa
Director of Institute for Health Research
University of Bedfordshire
Putteridge Bury Campus
Hitchin Road
Luton LU2 8LE

Ref: Mr. Hamdi Abdullah A. Lemamsha

Dear Professor Randhawa,

We would like to inform you that a permission for undertaking the main study entitled *Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya."* by the above named Libyan sponsored student has been approved.

We hope that our approval will assist you as well as the University of Bedfordshire to make an appropriate judgment with regards to granting permission for Mr Lemamsha to conduct his quantitative and qualitative research work.

We trust that Mr Lemamsha will get the right support and guidance from his supervisory team in order to successfully complete his research project on time.

Yours sincerely

Dr. Abdelbasit Gaudour
The Cultural Attaché
Libyan Embassy,
London, UK
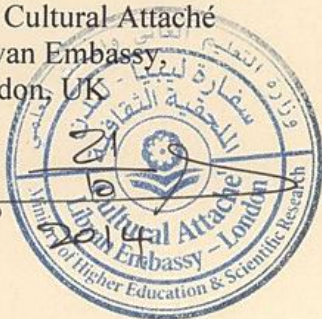
OMAR EL-MUKHTAR UNIVERSITY

جامعة عمر المختار

الرقم الإشاري شع 2909 المواقق : / / م التاريخ ١٤١١هـ ٢٠١٥م

Ref: Mr. Hamdi Abdullah A_Lemamsha

PhD Student at the Institute for Health Research

University of Bedfordshire, UK.

Dear Mr. Lemamsha,

Re: *"Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Lihya"*,

I would like to forward the decision of the Research Ethics Committee (REC) at the Omar Al-Mukhtar University to you with respect to your application for the second phase of your study. The meeting of the Ethical Committee took place in the Post-Graduate building at the Omar Al-Mukhtar University, on the main Bayda campus on Wednesday 5th November 2014 at 11 am. The committee has reviewed and re-considered your second application for the Phase II (Qualitative Protocol) enclosed with all documents. I would to inform you that approval has been granted for the above application in relation to the qualitative protocol.

On behalf of the committee, I would like to wish you all the best in your research and we hope that you will be well rewarded for your hard work.

Please do not hesitate to contact me should you wish to discuss this matter further.

Best regards

06.11.2014

Mr. Elshaary A.F.
The Chairman of Faculty members
The Secretary of the Research Ethics Committee.

OMAR AL MUKHTAR UNIVERSITY

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**OMAR EL-MUKHTAR
UNIVERSITY**

جامعة عمر المختار

U.O.A. 619   الرقم الإشاري   الموافق : 6 / 11 / 2014 م   التاريخ : / 6 / ه

Ref: Mr. Hamdi Abdullah A Lemamsha

PhD Student at the Institute for Health Research

University of Bedfordshire, UK.

Dear: Mr. Lemamsha

Re: *"Application for Ethical approval of second phase of the mixed methods study entitled: Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya"*

All the previous documents, which were submitted for the first ethical approval, affiliated to the thesis entitled above, as well as the new documents enclosed for the qualitative protocol, were reviewed and discussed by the *Research Ethics Committee (REC) at the Omar Al-Mukhtar University* with respect to your application for the second phase of your study. The meeting of the Ethical Committee took place in the Post-Graduate building at the Omar Al-Mukhtar University, on the main Bayda campus on Wednesday 5th November 2014 at 11 am.

We are pleased to notify you that our committee has awarded and ensured ethical approval for the qualitative protocol design of this thesis under the supervision of *Professor Gurch Randhawa and Dr. Chris Papadopoulos*.

Finally, I would like to reiterate that if any further ethical concerns arise at any time during the course of your study the following standard requirements of approval must be undertaken:

- You must notify the committee in writing regarding any alteration to the research.
- You must notify the committee immediately in the event of any adverse effects to any of the participants.

Ultimately, we will do our utmost to minimize any obstacles that you might encounter whilst implementing your main study.

I would to take this opportunity to wish you every success with this very important study.

Yours sincerely

Dr.Agoub A. M. A.
Chairman of Research Ethics Committee
Vice Chancellor of Omar Al-Mukhtar University

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Appendix 8.18 Ethical approval from the Regional Health Ministry in Benghazi.

وزاره الصحة

إ دارة الخدمات الصحية

إدارة
الخدمـــات
الصحيـــة
بنغـازي

Ref: Mr. Hamdi Abdullah A Lemamsha
PhD Student at the Institute for Health Research
University of Bedfordshire, UK.

Dear: Mr Lemamsha

<u>**Re:**</u> *"Application for Ethical approval of second phase of the mixed methods study entitled: Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya"*

Thank you for your recent correspondence regarding the second application for ethical approval with respect to the qualitative protocol. The meeting of the Research Ethics Committee (REC) held on Monday 10th November 2014 at the headquarters of the local health authorities in Benghazi. The committee has reviewed and reconsidered your application for the qualitative design and all the relevant documents, including all ethical approvals for the relevant bodies. The revised documentation has been reviewed and approved by our committee. We are pleased to inform you that **our committee conferred ethical approval of the second stage of this mixed methods study** under the supervision team of Professor Gurch Randhawa and Dr. Chris Papadopoulos.

Please be advised that in accordance with the REC's policies, which emphasize that ethically sound data collection procedures are <u>voluntary, informed, safe and confidential.</u> You should inform the committee of the following: Any proposed changes to the research protocol or to the conduct of the research. Any new information that may adversely affect the obligation to keep data collection anonymous and reduce the protection of participants from any harm they might face under any circumstances. I would to take this opportunity to wish you every success with this crucial study.

Yours faithfully

Dr. Hassan Yidry
Director of Medical Affairs/ Benghazi
Chairman of Research Ethics Committee

Appendix 8.19 Information Sheet for Participants.

Information Sheet for Participants

Invitation

My name is Hamdi Lemamsha and I am a PhD research student at the University of Bedfordshire, in the UK. I am conducting research into obesity, which affects many Libyans – both men and women. This sheet provides you with information about my research and invites you to participate in the study.

The title of my study is: **'Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya'.**

Before you decide to participate in this study, it is important to understand why the research is being conducted and what it will involve. Please take time to read carefully the following information and discuss it with friends and family before deciding whether or not you wish to take part. Please do not hesitate to ask if anything is unclear or if you would like any further information.

1. Purpose of the research

The purpose of this research is to explore the risk factors that might be attributed to Libyans becoming more obese. It will also explore the protective factors that can guard against obesity in adult Libyans. Hence, I am interested in undertaking a study of the population of Benghazi, which will involve interviewing both healthcare professionals and community leaders. In addition, I am passionate about understanding your point of view in terms of your thinking; about the factors that can lead to weight gain 'obesity' and can promote weight loss.

2. Selection of participants

Eligibility criteria for participating in the semi-structured interviews:
Being selected as an interviewee in this study, a potential participant should meet the following criteria:

2.1 Inclusion criteria

Interviewees selected for participating in the interviews must meet all of the following criteria:

- Currently works as a healthcare professional, community leader or both.

- Speaks an Arabic language.

- Has been resident in Benghazi for over ten years.

- Has at least five years' work experience.

- Must meet the eligibility criteria for appointments as set out in the internal regulations of the Social People's Leadership Institution, that is, 35 years of age or older and has achieved an educational qualification(s).

2.1 Exclusion criteria

Any potential participant was excluded if they met one or more of the following criteria:

- Speaks only the Berber language as opposed to Arabic.

- Healthcare professional who is not affiliated to the Benghazi Diabetes Centre (BDC).

- Has been recently appointed in any of the institutions from which the respondents were recruited.

- Fails to meet the requirements for appointments as set out in the internal regulations of the Social People's Leadership Institution.

3. Procedures and timescales

Being a healthcare professional and/or a community leader and you are willing to take part in this study, you will be provided with the Information Sheet, an Informed Consent Form (ICF) , and then you will be asked to participate in an interview with myself, lasting approximately one hour. During the interview, you will be asked to share your views regarding obesity. The interview will be held in a comfortable location agreed by you and the researcher. If you wish to decline to answer any question during the interview, you may say so and the interviewer will then move on to the next question. Aside from the interviewer, no one else will be present unless you request someone to be there. The entire interview will be audio-recorded; however, you will not be identified by name at any time.

4. Benefits of participating in this study

You will not benefit directly from taking part in this study. Nevertheless, this study will provide the opportunity to gain improved understanding of obesity amongst Libyan adults. The information you supply could assist researchers, public health experts, health authorities and psychologists to control and reduce obesity and the numerous associated complications; thereby easing the financial burden on the state, which comes from treating this disease.

5. Risks or discomforts of participating in this study

There are no anticipated risks or personal discomfort from participating in this study. If you feel uncomfortable with any of the questions, you can leave out that question or withdraw from the study altogether. If you decide to withdraw before completion, your tape-recorded will be destroyed.

Information pertaining to all the interviews will be communicated to certified Libyan translators by email in password-protected files. Every precaution will be taken to safeguard your data, including using password-protected computers. Only the main researcher, the supervisory team and certified Libyan translators will have access to the information you provide.

6. Anonymity and confidentiality

Any information you provide will not be shared with anyone outside of the research team. The data will be kept confidential and will not be released to other parties without your written permission, unless compelled by law.

If you are a healthcare professional or community leader and you decide to participate in the one-to one interview, your responses will be afforded full confidentiality. Anyone who takes part in the research will be identified only by their initials. The interview will be recorded using a digital voice recorder, transcribed by the researcher and subsequently translated by certified Libyan translators. All information in connection with the interview will be stored in a password protected file on the researcher's password protected computer. All the information gathered from the interview will be destroyed at the earliest opportunity, following the completion of the study. Copies of the interview transcript will be made available to you on request. The interview will be analysed using a computer package [NVivo version 10]. It is possible that the results of this study may be published in an academic journal; however, no identifying information will appear in the article.

7. Ethics approval

This study has been reviewed and approved by:

- The Institute for Health Research Ethics Committee (IHREC) at the University of Bedfordshire, in the UK

- The Libyan Cultural Attaché at the Libyan Embassy, affiliated to the Ministry of Higher Education and Scientific Research in Libya
- The Omar Al-Mukhtar University in Bayda, Libya
- The Regional Health Ministry in Benghazi, Libya.

8. Right to withdraw

Participation in this study is completely voluntary. You are free to withdraw at any time without giving an explanation. You are also free to leave out any questions or any parts of the study you choose without providing an explanation. At the end of the interview/discussion, you will have the opportunity to ask any questions in order to review your remarks and make any modifications or deletions that you wish.

9. Compensation and reimbursement

The nature, amount and method of payment or other remuneration should not comprise undue incentive to participate in this study. If you decide to take part in a face-to-face interview, you will be offered a free three-day pass to a gym at the conclusion of the interview. This is compensation for your time, discomfort and inconvenience. In addition,you will be reimbursed for any travel expenses they incur. Furthermore, you still have right regarding free to leave out any questions or any parts of the study or even to withdraw completely from this study at any time you wish without giving an explanation without losing your payment.

10. Participant responsibilities

Your participation in this study is voluntary. If you choose to participate, the responsibilities to which you will commit are as follows:

- You must currently works as a healthcare professional, community leader or both.,

- You will be asked to sign the Informed Consent Form (ICF)

- You will be asked to participate in a semi-structured interview, lasting approximately one hour, at a location identified in agreement with the researcher.

Thank you for taking the time to consider participating in this study. If you wish to be involved, please sign the attached consent form. This information sheet is for you to keep for your personal records.

Contact details

If there are any issues regarding this research that you would like to discuss further, please do not hesitate to contact one of the members of the research team listed below.

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Dated: 1 October 2014

Appendix 8.20 Informed Consent Form (ICF) for Qualitative Study.

University of Bedfordshire

Participant Identification Number:

Informed Consent Form (ICF) for Qualitative Study

Title of study: Exploring the risk and protective factors associated with obesity amongst adults aged 20 to 65 years: A case study in Benghazi, Libya.

Please tick the box

• I confirm that I have read and understood the Information Sheet regarding the above study.

• I have been informed of and understand the purposes of the study. Questions about my participation in this study have been answered satisfactorily and I understand that the interview will last approximately one hour.

• I understand that my participation is voluntary and that I can refuse to answer certain questions. Moreover, I am free to withdraw from the study at any time without giving any reason and my care or legal rights will not be affected.

• I am aware that in order to facilitate the research, the interview will be recorded using a digital voice recorder, transcribed by the researcher and subsequently translated by certified Libyan translators.

• I understand that all information in connection with the interview will be stored in a password protected file on the researcher's password protected computer.

• I understand that all the information gathered from the interview will be destroyed at the earliest opportunity, following the completion of the study.

• I am informed that completely interview data will be dealt with securely in order to protect participant confidentiality. I understand that anonymity will be ensured in the thesis by disguising my identity; no names will be mentioned and the data will be coded.

• I understand that disguised extracts from my interview may be quoted in the thesis and any subsequent publications.

• I understand that the researcher, Hamdi Lemamsha, and his supervisory team: **Professor Gurch Randhawa and Dr Chris Papadopoulos,** from the University of Bedfordshire and certified Libyan translators from will have access to the data I provide.
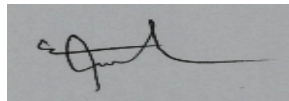
• By signing below, I agree to participate voluntarily in this research study (without coercion).

Signature of Participant Date

_____

• I confirm that the participant has not been coerced into giving consent and that consent has been given freely and voluntarily. A copy of the Informed Consent Form and the Information Sheet has been provided to the participant.

Name of Researcher Signature of Researcher Date

Hamdi Lemamsha

Dated: 1 October 2014

Appendix 8.21 Ethical considerations for Qualitative Study.

8.7 Ethical considerations

8.7.1 Understanding

All participants were given an opportunity to raise any queries they had about my study. Once I had addressed their queries, they gave their final consent to participate in the interviews. Both the PIS and the ICF were written in lay language, without any technical jargon, in order to convey the information as clearly and straightforwardly as possible.

8.7.2 Volunteering

All participants were informed that their participation in the study is voluntary and free of any coercion. Any information pertaining to their identity was obscured and treated as confidential. Interviewees were also given the right to skip questions, to refuse to respond to any questions they found disturbing, and to withdraw from the study at any time without explanation and without any consequences.

8.7.3 Competence

All of the potential interviewees were employed by governmental institutions in Benghazi and affiliated to the Social People's Leadership headquarters see Chapter 8, Section8.3.2. Accordingly they had pre-employment and periodic medical screening reports, which is one of the requirements for being selected as a member of Social People's Leadership institution. These medical screening reports are extant in their personal files and retained at the headquarters according to internal regulations. The director of the Social People's Leadership headquarters is entitled to access them and confirmed to me that all selected participants had the ability to engage in interviews and possessed their capacity to acquire, retain and evaluate information. All the research participants signed the ICF.

8.7.4 Consent

Prior to the interview, each research participant indicated his or her assent by signing two copies of ICF. One signed copy was given to the participant, while the other was retained by the researcher (myself). All participants were informed that their consent was not necessarily permanent and they could withdraw it at any time (see Appendix 8.20). To comply with ethics regulations, I obtained specific consent from all participants to audio-record their interviews. This was one of the aspects covered in the ICF of which community leaders and healthcare professionals were informed.

8.7.5 Confidentiality and anonymity

All information collected from participants remained confidential. No one will have access to information about or the records of the participants without participants' express permission. All participants were assured of the privacy, confidentiality and secure storage of their recording (the computer, files and folders were password-protected). Each interview was anonymised (unidentifiable by name) by allocating initials in place of their name (Brayman, 2012). NVivo software version 10 was used to manage, organise and analyse all transcripts; this was also password-secured. All 21 voice recordings of the interviews were downloaded on a password-protected computer, while the digital voice recorder, included all recording interviews, the participants 'demographic data and the interview transcripts were carefully protected in a secure storage cabinet at my house, as well as all data will be destroyed once the study is completed.

8.7.6 Ethical considerations in translation process

To comply with ethics regulations, all participants were informed through the ICF, which they signed prior to their interview, that three accredited Libyan translators had been appointed to translate their transcripts and that all precautions would be taken to protect their identity, such as anonymising their names (using their initials). All interviewees were reassured that the translators were prohibited from sharing any information about the interview transcripts with any unauthorised individuals. Furthermore, all correspondence relevant to the translation process between myself and the translators was conducted by email in password protected files and folders, to uphold their confidentiality. Similarly, I requested that the three translators return all correspondence in password protected files and folders throughout the period of our communication. Finally, all the translators were asked to destroy any electrical copy or hard-copy of the transcription in their possession upon completion of the translation process.

8.7.7 Compensation and reimbursement

No clear guidance or consensus exists on the issue of compensating or paying research participants. Alderson and Morrow (2004) argue that incentive payments in research can appear to be coercive, particularly towards potential participants who are impoverished and who may comply out of financial need, regardless of whether or not they truly wish to participate. This is problematic because it means that their consent has not been 'freely given' and is therefore a breach of the law in relation to ethical considerations.

All 21 interviewees were informed upfront in the PIS about compensation and reimbursement (see Appendix 8.19), specifically that they would be reimbursed for their travel expenses if their interview was conducted outside their workplace and that they would be compensated for their time in the form of a voucher for a free three-day pass to a gym (see Appendix 8.22). They were also informed that they would not forfeit their reimbursement if they omitted some questions, or even if they opted out completely and were no longer a participant.

Conducting the interview at the participants' place of work means that their work schedule or other commitments might be inconvenienced, hence a voucher was offered as a token of appreciation for their time. Given that all my participants were prominent people in their communities, in terms of their social, economic and/or political position, it was unlikely that any of them were presently experiencing financial hardship. Thus they were unlikely to be motivated to participate because of the vouchers or travel reimbursements offered. As their decisions were not based on financial need, this study met ethical requirements regarding the financial compensation of participants.

Appendix 8.22 A compensation method: A free three-day gym pass.

🗺: **Northern Al Fwayhat, Benghazi, Libya**

☎ : **+218 61-4737172**

مركز الفصول الاربعة، نادي صحي رياضي بنغازي – ليبي

Four Seasons Centre Gym, Benghazi

Appendix 8.23 A summary characteristics of the interviewees of a pilot interview.

Table 8.23.1 A summary characteristics of the interviewees. of a pilot interview.

S.N.	Name of participant	Age	Gender	Participant qualification	Occupation	Place of interview	Religion	Institutional affiliation
1.	TK	45	Male	PhD in Biomedical Science	Biochemist	Sheffield Hallam University	Muslim	Libyan higher education sector
2.	HB	57	Female	MA Sociology	Social worker	Interviewee's home based in Sheffield	Muslim	Libyan Educational Sector
3.	SM	54	Male	BSc Business Management	Administrator	Sheffield University	Muslim	Libyan Economic Sector
4.	KZ	44	Female	MA in Biology	Teacher	Interviewee's home based in Sheffield	Muslim	Libyan Educational Sector

Appendix 8.24 A summary characteristics of the interviewees.

Name of participant	Age	Gender	Participant qualification	Occupation	Place of interview	Religion	Institutional affiliation	Duration of employment
AA	65	Male	Master of Art Sociology (MA).	Tribal leader	Interviewee's home	Muslim	The Council of Elders and notables Benghazi ,institution	15
AB	50	Male	Doctor of Medicine	Deputy of Medical Department	Arab Medical University, Benghazi	Muslim	Arab Medical University, Benghazi	6
AE	64	Male	BA Principles of Islamic jurisprudence	Imam of a mosque	The Atiq Mosque, Al-Hadaa'iq	Muslim	Civic Leaders Headquarters	15
AL	60	Male	Diploma of Higher Education (DipHE).	Tribal leader	Interviewee's home	Muslim	The Council of Elders and notables Benghazi ,institution	15
EL	53	Male	Master's in Business Management	Municipal Council Member, Benghazi	Benghazi council headquarters	Muslim	Headquarters of Benghazi Council	6
GH	46	Male	Doctor of Medicine	Diabetologist	Benghazi Diabetes Centre	Muslim	Benghazi Diabetes Centre	6
GX	47	Female	Masters of Science in Economics	Municipal Council Member, Benghazi	Benghazi Council Headquarters	Muslim	Headquarters of Benghazi Council	6
HZ	46	Male	Doctor of Public Health	Lecturer	Al-Arab Medical University, Benghazi	Muslim	Al-Arab Medical University, Benghazi	6
KM	61	Male	Diploma of Higher Education in Social Sciences	Tribal leader	Interviewee's home	Muslim	The Council of Elders and notables Benghazi ,institution	15
MA	64	Male	BA Principles of Islamic Jurisprudence	Imam of a mosque	Al Ansar, Mosque, Al-Hawari	Muslim	Civic Leaders Headquarters	15
NH	38	Female	BSc Nursing Studies	Diabetes Specialist Nurse	Benghazi Diabetes Centre	Muslim	Benghazi Diabetes Centre	6
NK	48	Female	Doctor of Medicine	Diabetologist	Benghazi Diabetes Centre	Muslim	Benghazi Diabetes Centre	7
NM	56	Female	Doctor of Medicine	Diabetologist	Benghazi Diabetes Centre	Muslim	Benghazi Diabetes Centre	15
PV	34	Female	BSc Nursing Studies	Diabetes Specialist Nurse	Benghazi Diabetes Centre	Muslim	Benghazi Diabetes Centre	6
RE	44	Female	PhD Epidemiology	Dean of Public Health Department	Al-Arab Medical University, Benghazi	Muslim	Al-Arab Medical University, Benghazi	6
SB	57	Male	Masters in Primary Health Care	Deputy of Municipal Council, Benghazi	Benghazi Council Headquarters	Muslim	Headquarters of Benghazi Council	6
SG	37	Female	BSc Nursing Studies	Diabetes Specialist Nurse	Benghazi Diabetes Centre	Muslim	Benghazi Diabetes Centre	6
TS	62	Male	MA Principles of Islamic jurisprudence	Mufti and a member of a house of fatwa	Omar Bin Khattab Mosque, Al-Fuwayhat	Muslim	Civic Leaders headquarters	30
WQ	36	Female	BSc Dietetics	Dietician	Benghazi Diabetes Centre	Muslim	Benghazi Diabetes Centre	6
YS	37	Female	BSc Dietetics	Dietician	Benghazi Diabetes Centre	Muslim	Benghazi Diabetes Centre	6
ZT	38	Female	BSc Dietetics	Dietician	Benghazi Diabetes Centre	Muslim	Benghazi Diabetes Centre	6

Appendix 8.25 Critique of qualitative data analysis.

8.25.1 Critique of qualitative data analysis

Although qualitative data analysis can suffer from ambiguity and become more problematic to handle than quantitative data (Collis & Hussey, 2009; Johnson et al., 2010; Murphy et al., 1998), the qualitative data analysis method of thematic analysis (TA) is nevertheless extensively used across the social, psychological, behavioural and applied sciences, such as clinical, health and education sciences (Bryman, 2012; Creswell 2012.; Thomas & Harden, 2008).

A possible limitation of TA is its flexibility, as this can make it difficult to recognise what particular aspect of the data to focus on (Bryman 2012; Creswell 2012). Another possible drawback is the absence of clear and concise guidelines on how to conduct thematic analysis transparently; the lack of a clearly identified series of procedures means that this approach is entirely reliant on the researcher's skills and experience (Dixon-Woods, 2011; Furber, 2010; Ward et al., 2013). Due to a wide array of interpretations from researchers' perspectives, reliability is a concern in TA. That no technique has been defined for identifying the themes that are relevant to an under-researched area of study is another disadvantage of TA. Failing to identify and elicit the proper themes means that the outcome of the interviews might be meaningless (Bryman 2012; Creswell 2012).

Although some methodologists argue that the use of tools or guidelines reduces flexibility and constrains the analysis (Swallow et al. 2011; Ward et al., 2013), others argue that viable techniques are needed so that the processes through which the findings were derived are transparent (Braun & Clark, 2006; Dixon-Woods, 2011; Furber, 2010). The criticisms directed against qualitative data analysis in general and thematic analysis (TA) in particular have resulted in researchers' developing Framework Analysis (FA), a qualitative thematic data analysis technique that is increasingly prevalent in healthcare research. The following section discusses the rationale for adopting a FA approach to analyse the qualitative data for this study.

Appendix 8.26 Framework Analysis (FA).

8.26.1 Framework Analysis (FA)

However, the approach has some limitations which are similar to the disadvantages inherent in all thorough qualitative data analysis methods. It can be time-consuming, and, like grounded theory and ethnography, it lacks theoretical foundation (Smith & Bekker, 2011). Some construe the flexibility inherent in the FA approach as a weakness, enabling shortcuts can be taken, which is not the case. Although flexibility is considered to be one of the drawbacks of FA, it is useful in that it enables qualitative data collection and analysis to be undertaken in tandem or consecutively (Lacey & Luff, 2009; Ritchie et al., 2003; Srivastava & Thomson, 2009). Given the short timeframe available to carry out my main fieldwork, it was necessary in my study to undertake these stages of the research consecutively rather than concurrently. The FA approach enabled me to defer all transcribing and analysis until I had returned to the UK. Being able to collect all the data before carrying out the transcribing and conducting the analysis of the digitally-recorded interviews is consistent with my pragmatic approach. Thus, the thematic framework analysis approach is the ideal, workable technique for my qualitative data analysis.

In practice, the Framework Analysis method comprises five key stages of analysis (Gale et al., 2013; Pope et la., 2000; Ritchie & Lewis, 2003): (i) familiarisation – through immersion in the data; (ii) Developing a theoretical framework by identifying recurrent and important themes; (iii) indexing and pilot charting; (iv) charting by summarising the data in an analytical framework; (v) Synthesising data by mapping and interpreting. Details of how these stages were applied in my study are discussed below

8.26.1.1 Familiarisation with the data

Familiarisation with the qualitative data was achieved by performing the following tasks. First, I acted as the interviewer to collect the qualitative data by conducting 21 interviews with 21 Libyan experts. I then transcribed all digitally -recorded interviews verbatim and checked the transcripts for accuracy. I read all the transcripts several times to familiarise myself with their content and to obtain a thorough understanding of their contents. A specific familiarisation exercise was also conducted when I involved myself in the translation process (see Chapter 8, Section 8.9) through frequent communication with the three Libyan translators in order to obtain accurate and meaningful transcripts. This stage was then used to inform the second stage of the analysis.

8.26.1.2 Identifying a thematic framework

The second stage entailed identifying and organising the key themes and sub-themes into a framework from which the data could then be indexed. The primary thematic framework was elicited from a list of key themes and sub-themes derived from the *a priori* issues and themes pertaining to the Socio-Ecological Model (SEM). Constructs from this model include: SES, unhealthy eating habits, physical activities and sedentary lifestyle patterns, and neighbourhood environment factors. A list of key themes and sub-themes was also derived from the emergent themes identified in the familiarisation stage. This list of key themes was modified into a framework by organising the material into a hierarchy of general topics at the top (parent nodes) to more specific topics (sub-themes or sub-nodes or child nodes).

The initial framework was developed and replaced with a provisional framework in the middle in the indexing process.The provisional framework was improved and replaced by an eventual framework once all the interviews had been indexed. The process of enhancing and refining the framework confirmed that the new themes and sub-themes that emerged in later interviews could be included in the analysis.

8.26.1.3 Indexing

The aim of this stage was to thoroughly apply the thematic framework to all the data, using numerical codes to identify specific pieces of data, which correspond to different themes. Decision-making in this stage was based on compare and contrast between the initial themes and the refined themes which emerged and evolved following my sustained immersion in the data. Some of the recurrent themes, sub-themes and other issues that emerged in the initial framework (e.g. SES, unhealthy eating habits, physical activities and sedentary lifestyle, and neighbourhood environment) corresponded to and belonged in the main theme. The indexing process was conducted using NVivo v.10. First a system of "parent nodes" was created to represent individual themes and sub-themes. This was the main basis for refinement of the themes in order to more accurately reflect the data and sub-themes that were emerging. The framework was refined in this stage to ensure that the data pertained to theme only and was not duplicated under several themes.

8.26.1.4 Charting

Once the coding was completed, relevant shortened quotations or snippets selected from the transcripts were charted in a new framework matrix, which created in Nvivo to achieve this task, separate Excel spreadsheets using the actual words as stated by the interviewees. Hence,

designing the charts assisted in extracting, summarising and organising the data relating to a given theme and presenting it in the form of a chart. This facilitated the process of exploring the details, similarities, and differences expressed on a given theme or concept. Initially the themes or constructs from the SEM (e.g. SES, unhealthy eating habits, physical activities and sedentary lifestyle, and neighbourhood environment) were inserted on a new matrix,, while the newly emerging themes and concepts that did not fit into any of the theoretical constructs were grouped as emerged themes. The charts were constructed by assigning a single row denoting a respondent (case) across all the columns, which denoted themes and sub-themes. The first column of each chart was used to identify the respondent (by their initials only), whilst the last column was reserved for the researcher's remarks, observations and points to follow up in the synthesis. This whole process was conducted for all themes separately relating to obesity.

8.26.1.5 Mapping and interpretation

In this stage, I used the thematic charts formatted in the previous stage as a tool to map the range of themes for comparison purposes, checking the themes and sub-themes against the original transcripts, field notes, and audio recordings to identify patterns of association between the themes. The thematic charts were transformed into visual models to help me understand how the contextual and explanatory factors were perceived by the interviewees to relate to risk and protective factors associated with obesity. These models were incorporated in the presentation of the findings to clarify the relationships between the themes and sub-themes (see Chapter 9, Figure 9.12). The interpretation of the themes was supported with original quotations selected to highlight the interesting similarities and differences that occurred between the perspectives the LHCPs and the LCLs on obesity.

To preserve the authenticity of the data, the quotations use the original wording of the informants, with additional words inserted in square brackets where clarification of the subject under discussion was needed. Also included in the text were respondents' allocated initials, gender, age and type of job, to enable the reader to infer similarities and differences within and between the perspectives the LHCPs and the LCLs, the two main groups sampled in this study for their expertise on obesity and community issues.

Appendix 9.1 Socio-demographic and biological factors

9.1 Socio-demographic and biological factors

9.1.1 Age

There was little consensus between the interviewees, belonging to LHCPs and LCLs, on the topic of age and obesity. Three perspectives on this issue were distinguishable in the interviews. One view, held by several the interviewees, belonging to LHCP groups, was that obesity develops at any age without exception. They considered age to be less significant than other socio-demographic factors such as gender and ethnicity.

"I do not think the age is something we should focus on. What I mean is that obesity can develop and occur at any age, from young to old."

(NM, Female, 56, Diabetologist, Doctor of Medicine)

"We know that obesity rates have increased for all age groups over the past decades in Libya. If we know that obesity occurs in all age groups, it is ridiculous to me if I see people trying to identify which age group has the highest obesity rate."

(NH, Female, 38, Diabetes Specialist Nurse, BSc Nursing Studies)

Other the interviewees, belonging to LHCP groups, argued that obesity is most prevalent in the adult age-groups compared to the other age-groups, and attributed this to hormonal changes.

"Obesity can happen at any age: in adults, in old people and even in young children. As you age, hormonal changes coupled with a less active lifestyle lead to an increased risk of obesity."

(GH, Male, 46, Diabetologist, Doctor of Medicine)

"Obesity appears to develop more often in adulthood than in other age groups because of the massive hormonal changes occurring in our bodies."

(SG, Female, 37, Diabetes Specialist Nurse, BSc Nursing Studies)

On other hand, academic staff, belonging to the LCL groups, was the only group among the LCLs to raise the issue of age. They mentioned that the association between age and obesity is a complicated issue and that a variety of criteria need to be taken into account before comparing the prevalence of obesity among the different age-groups.

"It is difficult to compare obesity across age groups because published studies use different population age structures and different tools to measure obesity."

(RE, Female, 44, Dean of Public Health Department, PhD Epidemiology)

9.1.2 Ethnicity

Interestingly, of the interviewees, belonging to LCLs, only the academic staff mentioned obesity in relation to ethnicity. They asserted that obesity in the Arab Libyans and Berbers is higher than in any other majority group in Libya, due to most of them living in big cities and being influenced by new lifestyles linked to modernisation and urbanisation. In contrast, the academic staff maintained that other ethnic minority groups, such as the Toubou, Tuareg and Bedouin tribes who live in the Sahara desert, are less prone to being overweight or obese, unless they migrate to the big cities and engage in a new environment whereupon their body-weight might change.

"... let us talk about ethnicity in Libya. It is clear that most of the Arab Libyans and Berbers live in Libyan cities and villages [where they are susceptible to obesity], but other tribes living in the Sahara and in the mountains never suffer from obesity due to the nature of their food consumption."

(HZ, Male, 46, Lecturer, DrPH)

"I am sure all tribes, [such as the] Toubou and Tuareg in the Sahara desert, are neither overweight nor obese because they are not exposed to fast food and a sedentary lifestyle, but I think when those people move to the cities they become acculturated and will gain weight."

(RE, Female, 44, Dean of Public Health Department, PhD Epidemiology)

9.1.3 Biological factors: Genetic

As for the above two factors, gender and ethnicity, genetic and biological factors were mentioned by the interviewees, belonging to LHCP groups, and the academic members, belonging to the LCLs. On the one hand, LHCPs acknowledged that genetic factors are an important contributor to obesity.

"I believe that there is a genetic link to obesity. If our biological parents are obese, there is a high probability that we will be obese. Despite this, most obese people fight weight issues all their life. Some succeed, and others fail, but many keep trying."

(GH, Male, 46, Diabetologist, Doctor of Medicine)

"I know that susceptibility to obesity is in part genetic. I believe that certain people are genetically prone to obesity."

(NM, Female, 56, Diabetologist, Doctor of Medicine)

On the other hand, the academic staff (LCLs) contended that genetic factors constitute an inescapable fate that runs in families, causing obesity.

"Many Libyans claim there is no point in trying to keep weight at a normal level because "it runs in my family" or "it's in our ancestors". That's why some people contend that it's an inescapable fate."

(HZ, Male, 46, Lecturer, DrPH)

In addition, the interviewees, belonging to LHCP groups, argued that the causes of obesity should not be narrowed down to a single, common cause because there are other health problems or medications that can cause people to gain weight. They mentioned the crucial hormone leptin that is recognised as having a significant influence on weight-gain.

"We should not narrow our thinking by considering that risk factors of obesity are restricted to a sedentary lifestyle and overeating. Obesity can go beyond that and include other health problems such as a thyroid malfunction, or taking antidepressant medication."

(GH, Male, 46, Diabetologist, Doctor of Medicine)

"[The hormone] leptin is crucial in obesity. It plays a crucial role in appetite and weight control, so being resistant to this hormone's effects – called leptin resistance –is now believed to be the main cause, leading to weight-gain."

(NK, Female, 48, Diabetologist, Doctor of Medicine)

9.2 Social-cultural influences on obesity

9.2.1 Marital status

The interviewees expressed two different views about how marital status influences obesity. From the perspective of interviewees, belonging to LHCP groups, married people are more susceptible to being overweight and obese, particularly in Libya and Arab regions. They attributed this to spouses' encouraging each other to eat and indulge in a sedentary lifestyle.

"We are completely convinced that getting married leads to weight-gain, because both partners encourage each other to eat, and engage in a sedentary lifestyle. This is a scientific fact here in Libya and in Arab countries as whole, but I do not know if this is true in developed countries."

(GH, Male, 46, Diabetologist)

However, the interviewees, belonging to LCL groups, viewed married women to be more prone to gaining weight than married men due to social and cultural norms.

"I believe married women are more obese than married men because our culture enforces women to stay at home, but married men must seek a livelihood for their families. I believe married men engage in physical activity more than married women do. Although I am talking about Libyan people, I think this scenario occurs in all Arab countries."

9.2.2 Acculturation

It was only the three academic staff (LCLs), who raised the topic of adjusting to a new culture, and they expressed diverse views on this topic. Some of academic staff considered that Libyans who migrate from rural areas to urban environments undergo processes of urbanisation, modernisation and acculturation, and they may accordingly be vulnerable to gaining weight.

"Benghazi as a big, multicultural city that attracts many Libyan citizens from different zones to live in it. I think people who come from rural areas are prone to gaining weight when they adopt and adjust the new modern urban [lifestyle] due to the change in their lifestyle from physically active to sedentary."

(RE, Female, 44, Dean of Public Health Department)

However, others academic staff offered the unusual view that the influence of Rural-to-Urban Migration on obesity is still ambiguous, thereby they perceived that obesity occurs in every area as long as the factors that contribute to it are present.

"To me, I do not think there is a difference in the occurrence of overweight and obesity between cities and villages or even in the Sahara. Wherever Libyans live, they can access the modern lifestyle such as high-technology machines at work and at home, which in the end leads to weight-gain."

(HZ, Male, 46, Lecturer)

9.3 The effect of neighbourhood environment on physical activity

9.3.1 Street connectivity

The most interviewees ,belonging to LHCP groups, mentioned that Benghazi has a well-connected, efficient network of streets that encourage the residents to use public transport or walk to use these roads.

"We know Benghazi has well-designed street connectivity, which promotes cycling or walking among the residents, which reduces the risk of obesity."

(ZT, Female, 38, Dietician)

"Many types of roads exist around Benghazi. Most of them are modern roads, which are normally smooth, paved, and enable easy travel. I think the residents use them substantially."

(NM, Female, 56, Diabetologist)

While, other interviewees, belonging to LCL groups, stated that the high level of street connectivity in Benghazi encourages reckless driving. They also attributed reckless driving to the lack of effective law enforcement and safety regulations. These factors impact negatively on the residents' use of these roads and deter Libyans from engaging in physical activities.

"I personally believe a well-designed network of streets discourage the residents from using the roads because they may be prone to the risk of road traffic accidents due to ineffective traffic regulations resulting from ineffective performance of Libyan government."

(EL, Male , 53, Municipal Council Member)

9.3.2 Mixed land use

The vast majority of interviewees, belonging to the two groups, explicitly acknowledged that Benghazi is a metropolitan area, with a high level of mixed-use development. The interviewees, belonging to LHCP groups, were optimistic about the recovery of most of districts in Benghazi, following the conflict, arguing that these areas would become inhabited again and more conducive to walking and using public transport.

"In most districts in Benghazi, except in the areas affected by the war, daily life activity is normal and all institutions and organisations and markets work effectively."

(YS, Female, 37, Dietician, BSc Dietetics)

"Life is recovering in Benghazi and all key buildings, institutions and shops are open normally during the day. The residents attend them to obtain services or buy goods."

(SG, Female , 37, Diabetes Specialist Nurse)

However, the interviewees, belonging to LCL groups, were more pessimistic. They stated that, despite the existence of mixed land-use in Benghazi, many of the conflict-affected districts have not recovered; such areas are unattractive and unusable due to many key buildings having been significantly damaged or destroyed, and this discourages Libyans from walking and using public transport.

"I know the affected zones in Benghazi have still not recovered yet because some of the key buildings have been destroyed and need to be rebuilt again so as to restore the life for the residents and revive the economy."

(EL, Male , 53, Municipal Council Member)

9.3.3 Unsafe environment and crime

The vast majority of interviewees, belonging to the two groups, were in agreement about the lack of safety in several districts of Benghazi having a profound impact on residents' daily lives. However, the interviewees ,belonging to LHCP groups, argued that, despite most of districts being freed from Islamic State militants 'Daesh', those localities remain risky and under curfew. Imposed by the Libyan government in most parts of Benghazi, the curfew restricts the opening hours of most supermarkets. Consequently, Libyans are unable to access healthy food from supermarkets.

"Even some districts in Benghazi were released from militias. It is still miserable to live in due to lack of basic services such as electricity and energy, and a lack of access to healthy foods due to some supermarkets closing due to the curfew forced by Libyan government"

(NM, Female, 56, Diabetologist, Doctor of Medicine)

Considering the unsafe environment from different angles, the interviewees, belonging to LCL groups, perceived that the conflict hinders Libyans from engaging in any kind of outdoor activity; instead, they engage in sedentary activities at home such as watching TV and probably consuming staple food commodities to excess as a form of coping with their stresses.

"Due to instabilities in Benghazi, most Libyans spend their days at homes, and this may impact on their daily activities. They just eat what the government provides them with, which is staple food. They will be under pressure to overcome their fear and concerns, as the old Libyan saying goes "Put your concerns in your morsels."

(HZ, Male , 46, Lecturer)

"The situation in some areas in Benghazi is very dangerous and is not suitable for civilians. The government should urgently evacuate these areas of residents, because people are forced to stay in their homes and just eat like sheep, and this has an impact on their physical and mental condition."

(KM, Male , 61, Tribal leader)

9.3.4 Road traffic safety

The majority of the interviewees,belonging to the two groups, contended that Benghazi has good road-traffic infrastructure, including traffic-calming speed humps and strict speed limits. They perceived the pavements to be of a suitable width for pedestrian and cyclist safety. They also noted that there are plenty of zebra crossings throughout the city, designed for pedestrians and cyclists. However, the interviewees from two groups differed in certain respects. The interviewees, belonging to LHCP groups, perceived that the road infrastructure is lacking in certain deprived and conflict-affected areas, where infrastructural restoration is desperately needed. They argued that these factors likely influence extensively on the everyday life activities of Libyan citizens.

"To be fair, the road infrastructure is well-designed in Benghazi, but in the deprived and the affected areas the road infrastructure is lacking or damaged and needs to be rebuilt."

(AA, Male , 65, Tribal leader)

In contrast, the interviewees, belonging to LCL groups, argued that the residents rarely use the roads due to the lack of traffic law enforcement and the ineffectualness of the fragile government in curbing criminal behaviour, such as drivers breaking the speed-limit. They argued that lack of governance results in Libyans' being disinclined to engage in physical activities.

"I think the situation is dangerous for pedestrians despite good pedestrian safety infrastructure. Some drivers exceed the speed limit and cause accidents but no one arrests them due to the fragility of the government in protecting civilians."

(TS, Male , 62, Mufti and a member of a house of fatwa)

"Pedestrian safety infrastructure is well designed in Benghazi such as traffic lights, pedestrian crossings, yellow road markings and road signs, and subways. But the residents hardly use them due to the unsafe environment."

(GX, Male , 57, Deputy of Municipal Council)

9.3.5 Access to recreational facilities

The most interviewees, belonging to the two groups, admitted that public amenities, such as open spaces and sport and recreation facilities, exist in all districts of Benghazi. However, interviewees, belonging to LHCP groups, perceived that Libyans are unwilling to use these recreational facilities due to the deteriorating political situation in Benghazi. Also deterring physical activity is the fact that hardly any of the sports facilities provide professional trainers, and the membership fees of leisure and sports centres have increased.

"The modern leisure and sports centres are spread across each district rather than just within the city, but some of the sports centres have been destroyed due to the war and need to be rebuilt, and some suffer from a lack of professional trainers."

<div align="right">(GH, Male, 46, Diabetologist)</div>

In contrast, the interviewees, belonging to LCL groups, argued that many leisure centres and other facilities have been closed or destroyed during the fighting in the city and that they need to be rebuilt. In addition, Imams and tribal chiefs asserted that most of these sport centres have disregarded gender segregation, which Libyan culture and Islamic religion desperately needs.

"... to be honest there is a fair amount of leisure centres in Benghazi, but some of them need to develop to meet the requirements of Libyan culture. Apart from this, some of them ignore the allocation of separate sections for women."

<div align="right">*(AL, Male , 56, Tribal leader)*</div>

"I think Benghazi is like any modern city in the world; it has all the modern facilities, including extensive parks and leisure and sports centres. However, the current situation has led to the leisure centres being shut down; the wars imposed on the residents reduce their access to these centres due to some centres' increasing the annual or monthly fitness membership payments."

<div align="right">(AE, Male , 64, Imam of a mosque)</div>

9.3.6 Household vehicle ownership

There was a strong consensus among the vast majority of interviewee, belonging to the two groups, that the majority of Libyan families possess more than one automobile. They also mentioned that Libyans in general over-use their vehicles due to the low cost of modern cars and fuel in Libya, and that Libyans most likely prefer to use their own cars rather than use public transportation, which reduces the level of physical activity among Libyans.

"In Libya, car fuel is cheap so that I assume most households have two or more cars. They also rely on their own cars to run even the smallest errands, rather than walking or cycling."

<div align="right">(ZT, Female, 38, Dietician)</div>

"It does seem like every household has at least one automobile, but I know the majority of households have more than one car."

<div align="right">(AE, Male , 64, Imam of a mosque)</div>

"Today, almost every household in Libya owns at least one car or has a van available to them. Don't be surprised if I say some Libyan households have a car for every member of the household."

<div align="right">(AA, Male , 65, Tribal leader)</div>

9.4 The effect of neighbourhood environment on food

9.4.1 Access to supermarkets

The vast majority of interviewees belonging to the two groups , raised the issue of food availability mentioned the large and small supermarkets chains that are spread across Benghazi. They perceived that these supermarkets sell a huge variety of healthy and unhealthy food and other household products, and that residents can access them either by walking or using their cars. However, there were two distinguishable views on this issue. Both interviewees, belonging to LHCP groups, and the academic staff (LCLs) contended that many of the supermarkets in the conflict-affected areas in Benghazi have reduced their working hours due to the unsafe environment, and this probably reduces the public's access to healthy foods.

"We have huge supermarkets in all zones across Benghazi but opening times have been reduced for some of these supermarkets, especially in the conflict-affected areas. This to me probably limits access to healthy food choices and can lead to poor diets."
(GH, Male, 46, Diabetologist)

"Limited access to fresh foods primarily affects the conflict-affected areas communities due to the curfew enforced by the government and the evening power outages that have made several supermarkets reduce their opening hours during the day."
(AB, Male , 46, Deputy of Medical Department)

On the contrary, other interviewees, belonging to other LCL groups, argued that there is no obstacles hinder Libyans to access fresh and healthy food in all parts in Benghazi from these supermarkets regardless whether the localities are risky or not.

"In Benghazi we do not have any problems with accessing supermarkets of all sizes and at all times and places. It is no problem for the residents to access fresh, healthy food at these supermarkets."
(GX, Male, 57, Deputy of Municipal Council)

9.4.2 Access to groceries and fast food outlets

The majority of interviewees, belonging to the two groups, acknowledged that various fast-food restaurants and grocery stores exist throughout each district in Benghazi, including in the most deprived areas. They also perceived that these restaurants and grocery stores remain open until late at night, enabling Libyans to access them at all hours. However, interviewees, belonging to LHCP groups, asserted that both fast-food outlets and grocery stores stock unhealthy foods, and most of the residents rely on them due to the limited choices available during the current situation, although grocery stores do offer some healthy foods. However, the

fruit and vegetables supplied by grocery stores are often wilted due to the lack of demand for these foods.

"… many fast-food restaurants and small grocery stores are open until late at night despite the current situation, so the residents shop at these outlets, which supply unhealthy foods."
(WQ, Female , 36, Dietician)

"No one can deny that the quality of fresh food sold in groceries stores is often so low compared to the foods sold by supermarkets; the owners are always unwilling to throw away spoiled fruits and vegetables until they lose hope of its ever being sold."
(YS, Female , 37, Dietician)

In contrast, , other interviewees, belonging to LCL groups contended that both grocery stores and convenience stores supply healthy foods like the supermarkets and, like fast-food restaurants, are open until late at night.

"The grocery store and convenience store in most districts of Benghazi sell healthy foods until late at night so there is no problem of healthy foods being inaccessible here in Libya."
(EL, Male, 53, Municipal Council Member)

9.5 Libyan food-subsidy policy

9.5.1 Food prices and affordability

All interviewees, belonging to the two groups, agreed that both healthy and unhealthy food is affordable for all socio-economic classes in Libya. However, interviewees, belonging to LHCP groups, perceived that most Libyans failed to make healthy food choices due to the lack public awareness and campaigns to encourage healthy eating.

"In terms of food price, I think there is no big change in food price despite the deteriorating situation in Benghazi. It is still reasonable for all social classes, but most Libyans think they can't make healthier food choices due to lack of Health Awareness Campaigns.."
(AL, Male , 56, Tribal leader, Diploma of Higher Education)

"... the issue in Libya is not the price of food, as Libyan food is cheaper than that in any other country, but rather the problem is with the Libyans who still are unable to make healthy food choices."
(ZT, Female , 38, Dietician)

In contrast, the interviewees ,belonging to LCL groups, mentioned only the enormous variety of subsidised food sold throughout Benghazi at affordable prices; however, they neglected to associate this issue with eating habits or even with the key issue of obesity in Libya.

"The Libyan government still subsidises staple foods, and a loaf of bread is very cheap. Libya is an agricultural county so fresh food, such as vegetables and fruit, are very cheap."
(GX, Female , 47, Municipal Council Member, Benghazi)

9.5.2 Media and advertising

The issue of the media and advertising was raised only by the interviewees, belonging to LHCP groups, and academic staff (LCLs). Expressing similar views, they contended that Libyans are exposed intensively to advertising for fast-food restaurants, as well as for pre-prepared, convenience foods, takeaways and eating out – particularly on television, although advertising also takes place via leaflets, flyers, pamphlets and menu cards distributed to homes and on the streets. They argued that all this advertising have an adverse impact on Libyans' purchasing decisions and promotes unhealthy eating habits.

"We become vulnerable not only to TV fast-food advertisements but also to outdoor advertisements promoting fast food and soft drinks. We are a susceptible people, thus most of Libya orders fast food or eats out."
(YS, Female , 37, Dietician, BSc Dietetics)

"Since we are compelled to stay at home due to the curfew, we can't deny that we always watch TV and every single hour see a massive variety of advertisements on all channels that encourage us to purchase a variety of food at fast-foods restaurants and supermarkets."

(ZT, Female, 38, Dietician)

"We can see exterior advertising for fast-food restaurants and many products sold in markets, including any signs, posters, banners, flags or stickers on public buildings and properties. This impacts not only adults' but also our children's food choices."

(HZ, Male , 46, Lecturer)

Appendix 10 My diary for the main

Date		Take	Remark
29-11-2014 Saturday		To minimise the effort that I faced when beginning the phone calls to recruit the research participants, the researcher employed four employees; two males and two females affiliated to a reliable communication agency, employed by the Libyan general postal services. This was to help the researcher make the initial contact with the research participants, whether by phone (landline or mobile). Thus, if this was unsuccessful, letters were used instead. In the correspondence, I invited them to participate in the forthcoming survey and subsequently arranged the timetable to visit their homes, in order to conduct the fieldwork. .	An extensive effort is often made to reduce non-response by making multiple attempts at contact through repeated calling. Participants are presented with a selection of time slots and asked to indicate their available times. Achieved satisfactory results (See enclosed report).
		Lunch time	
30-11-2014 Saturday		The researcher and the four allocated employees made the initial contact with prospective participants by phone.	Achieved satisfactory results (See enclosed report).
		The researcher and the four allocated employees continued to recruit the prospective participants in the study by phone.	
		Lunch time	
		The researcher and the four allocated employees persisted with attempting to make the initial contact with prospective participants by phone.	Accomplished satisfactory results (See enclosed report).
1-12-2014 Monday		Interview with Physician NE (Female) at Diabetes Hospital.	Accomplished satisfactorily
		The researcher and the four allocated employees continued to try and to make the initial contact with prospective participants by phone.	Accomplished satisfactory results (See enclosed report).
		Lunch time	
		Interview with nurse GR (Female) at Diabetes Hospital.	Accomplished satisfactorily
		The researcher and the four allocated employees persisted with attempting to make the initial contact with prospective participants by phone.	Accomplished satisfactory results (See enclosed report).
2-12		Interview with Physician NE (Male) at Diabetes Hospital.	Accomplished satisfactorily

		Producers previews to the interviews: Personally contacted the directors of the five-targeted institutions and requested their permission to allow me to contact the affiliated employees, who wished to participate. I undertook this for two reasons: the first was to confirm that they had been provided with all the relevant documents related to the study. The second task was to emphasize or reschedule interviews, due to any unexpected circumstances that might have occurred since the primary schedule was formulated a month ago.	As a result, this helped to promote further reassurance and to remove any confusion that the informants might be confronted with.
	Lunch time		
		Persisted with attempting to implement this task and meet the other institutional directors, whom I was unable to contact earlier, so as to establish the correct schedule for all the interviews with the potential informants, prior to conducting the fieldwork.	Having conducted all these steps, several interviews were rescheduled and others cancelled due to various circumstances, such as an interruption in the electricity supply. Hence, I finalised and designed the final timetable for the interviews.
		Nurse	Has been cancelled due to the blackout & therefore, we reschedule the interview on Sunday 14/12/2014 at 14:00:15:00.

Date	Time	Participant's Number	Gender	Meeting place	Remark
03-12-2014 Wednesday	8:00-9:00	Interview with Physician –AB (Male) Diabetes Hospital			Accomplished satisfactorily
	9:00-9:17	4554	F	Home	She was cooperative and we managed the visit very quickly.
	9:23-9:40	4102	F	Home	She was cooperative and we managed the visit very quickly.
	9:47-10:04	2294	F	PCT-F	She came to the clinic and participated in the study.
	10:05-10:20	2746	F	PCT-F	She came to the clinic and participated in the study.
	10:27-10:44	3085	M	Home	Despite making an appointment beforehand, we could not contact him as he lives in a very secure building and he did not answer our phone calls any longer.
	10:50-11:07	1503	F	PCT-F	She came to the clinic and participated in the study.
	11:08-11:28	2859	M	PCT-F	He came to the clinic and participated in the study.
	11:30-11:47	2972	M	PCT-F	He came to the clinic and participated in the study.
	11:48-12:07	2068	M	PCT-F	He came to the clinic and participated in the study.
	12:07-13:00	Lunch time			
	13:00-13:18	2181	M	PCT-F	He came to the clinic and participated in the study.
	13:20-13:35	6249	F	PCT-F	She came to the clinic and participated in the study.
	13:36-13:53	5797	M	PCT-F	He came to the clinic and participated in the study.
	13:55-14:12	5232	F	PCT-F	She came to the clinic and participated in the study.
	14:15-14:20	1955	M	Home	We excluded this particular case because he did not meet the eligibility criteria as he was chair bound.
	14:26-14:30	3537	M	Home	We excluded this case because he did not meet the eligibility criteria, as he has lived in Benghazi for less than five years.
	14:36-14:54	4215	F	Home	She was cooperative and we managed the visit very quickly.
	16:00-16:20	4780	F	Home	She was cooperative and we managed the visit very quickly.
	16:27-16:32	4441	F	Home	Despite making an appointment beforehand, we could not contact him, as he lives in a very secure building and he did not answer our phone calls any longer.
	16:40-17:00	5006	F	Polyclinics F	She came to the clinic and participated in the study.
	19:00- 20:00	Interview with a nurse			Has been cancelled due to the blackout & therefore, we reschedule the interview on Tuesday **09/12/2014 at 14:15**

Date	Time	Participant's Number	Gender	Meeting place	Remark
	8:00-8:45	Clinical nutritionists TA (Male)Diabetes Hospital			Clinical nutritionists TA (Male)Diabetes Hospital
	9:00-9:19	5910	M	Home	He was cooperative and we managed the visit very quickly.
	9:26-9:5:45	5119	M	Home	He was cooperative and we managed the visit very quickly.
	10:00-10:25	3876	M	Polyclinics F	She came to the clinic and participated in the study.
	10:30-10:55	3311	M	Polyclinics F	He came to the clinic and participated in the study.
	11:00-11:25	1842	M	Polyclinics F	She did not attend the clinic despite promising to come. When calling her again we discovered that her phone was out of service
	11:30-11:55	2520	F	Polyclinics F	She came to the clinic and participated in the study.
	12:00-12:25	3198	M	Polyclinics F	He came to the clinic and participated in the study.
	12:30-12:55	5458	F	Polyclinics F	She came to the clinic and participated in the study.
	13:00-14:00	**Lunch time**			
04-02-2014 Thursday	13:00-14:00	6136	M	Home	He admitted that he got a phobia when he saw a medical staff, so he opted out from this research and he was a polite man when he did apologies for us.
	14:00-14:10	5571	F	Home	She was cooperative and we managed the visit very quickly. I left the Questionnaire with the participant and Returned to Collected it later.
	14:20-14:30	6023	F	Home	She was cooperative and we managed the visit very quickly.
	14:37-14:56	2407	F	Home	She was cooperative and we managed the visit very quickly.
	15:05-15:23	3763	F	Home	Despite making appointment beforehand, we could not approach her due to the head of the household refusing our request.
	15:33-15:40	3650	F	Home	Despite making an appointment beforehand, we could not approach her due to a family social occasion.
	15:50-15: 57	4667	F	Home	She was cooperative and we managed the visit very quickly. I left the Questionnaire with the participant and Returned to Collected it later.
	16:07-16:17	4328	F	Home	She was cooperative and we managed the visit very quickly. I left the Questionnaire with the participant and Returned to Collected it later.
	16:26-16:36	2633	F	Home	Despite making an appointment beforehand, we could not approach her due to the absence of her family members for the home visit. Therefore, we were not allowed to see her.
	16:45-16:55	Clinical nutritionists			Has been cancelled due to the blackout & therefore, we reschedule the interview on **Sunday 21/12/2014 at 14:15**

Date	Time	Participant's Number	Gender		Meeting place	Remark
05-12-2014 Friday	9:00-13:00	*Holiday: It was not possible to recruit any participants due to prayer time*				
	13:00-14:00	**Lunch time**				
	14:00-14:25	5345	M		Home	He was cooperative and we managed the visit very quickly.
	14:31-14:53	5684	F		Home	She was cooperative and we managed the visit very quickly.
	15:00-15:10	1729	M		Home	When we met him, he was embarrassed and he opted out form this study without giving a reasonable excuse.
	15:22-15:40	3424	F		Home	She was cooperative and we managed the visit very quickly.
	15:53-16:11	3650	F		Home	She was cooperative and we managed the visit very quickly.
	16:20-16:38	4893	F		Home	We excluded this case because she did not meet the eligibility criteria as she was pregnant
	16:50-17:10	3989	F		Home	We excluded this case because she did not meet the eligibility criteria due to a physical deformity. (A problem with her back).

Date	Time	Number of Participant	Gender	Meeting place	Outcome
06-12-2014 Saturday	11:00-11:15	6683	F	PCT-K	She came to the clinic and participated in the study.
	11:15-11:30	7135	F	PCT-K	She came to the clinic and participated in the study.
	11:30-11:45	6570	M	PCT-K	She did not attend the clinic despite promising to come. When calling her again we discovered that her phone was out of service
	11:45-12:00	6909	F	PCT-K	She came to the clinic and participated in the study.
	12:10-12:26	6796	F	Home	She was cooperative and we managed the visit very quick
	12:29-12:34	7022	M	Home	He was cooperative and we managed the visit very quick
	12:40-12:48	7474	M	Home	He was cooperative and we managed the visit very quick
	13:00-14:00			Lunch time	
	14:00-14:15	7361	F	Polyclinics-K	She came to the clinic and participated in the study
	14:15-14:30	7248	F	Polyclinics-K	She came to the clinic and participated in the study
	14:30-14:45	8039	M	Polyclinics-K	Since the instrument failed to give the reading of the participant who had amputated arm, however despite getting his weight and height and the nurse computed his BMI, the participants opted out without giving any reason. Therefore, we destroyed his questionnaire.
	14:45-15:00	7813	M	Polyclinics-K	He came to the clinic and participated in the study
	15:00-15:15	7587	F	Polyclinics-K	She came to the clinic and participated in the study
	15:15-15:30	8265	F	Polyclinics-K	She came to the clinic and participated in the study
	15:30-15:45	8604	M	Polyclinics-K	He came to the clinic and participated in the study
	15:45-16:00	8152	M	Polyclinics-K	She did not attend the clinic despite promising to come. When calling her again we discovered that her phone was out of service
Date	Time	Number of Participant	Gender	Meeting place	Outcome
07-12-2014 Sunday	9:00-9:15	8717	M	Polyclinics-K	He came to the clinic and participated in the study
	9:15-9:30	9169	F	Polyclinics-K	She came to the clinic and participated in the study
	9:30-9:45	8830	M	Polyclinics-K	He came to the clinic and participated in the study

	Time	Number of Participant	Gender	Meeting place	Outcome
	9:50-10:06	8378	F	**Home**	Despite making an appointment beforehand, we could not approach her due to the head of the household refusing our request.
	10:10-10:15	7926	F	**Home**	Despite making an appointment beforehand, we could not approach her due to a family social occasion.
	10:25-10:47	7700	F	**Home**	She was cooperative and we managed the visit very quickly.
	10:52-11:10	1674	M	**Home**	He was cooperative and we managed the visit very quickly.
	11:20-11:40	2126	F	**Home**	She was cooperative and we managed the visit very quickly.
	11:50-11:55	8491	F	**Home**	We excluded this particular case because he did not meet the eligibility criteria, as she was Pregnant.
	12:20-12:20	8943	M	**Home**	He was cooperative and we managed the visit very quickly.
	12:25-12:45	9395	M	**PCT-K**	He came to the clinic and participated in the study
	13:00-14:00			**Lunch time**	
	14:00-14:25	9056	F	**Home**	She was cooperative and we managed the visit very quick
	14:30-14:55	9282	F	**Home**	She was cooperative and we managed the visit very quick
	15:05-15:20	9621	M	**Grocery**	He was cooperative and we managed the visit very quickly.
	15:20-15:35	9847	M	**PCT-K**	He did not attend the clinic despite promising to come. When calling her again we discovered that her phone was out of service.
Date	**Time**	**Number of Participant**	**Gender**	**Meeting place**	**Outcome**
08-12-2014 Monday	9:00-9:15	9734	F	**PCT-K**	She came to the clinic and participated in the study
	9:15-9:30	92	F	**PCT-K**	She came to the clinic and participated in the study
	9:30-9:45	544	M	**PCT-K**	He came to the clinic and participated in the study
	9:50-10:00	883	F	**PCT-K**	She came to the clinic and participated in the study
	10:00-10:15	1109	M	**PCT-K**	He came to the clinic and participated in the study
	10:30-10:45	657	M	**PCT-K**	He did not attend the clinic despite promising to come. When calling her again we discovered that her phone was out of service.
	10:45-11:00	205	F	**PCT-K**	She came to the clinic and participated in the study
	11:00-11:15	431	M	**PCT-K**	She came to the clinic and participated in the study

Date	Time	Number of Participant	Gender	Meeting place	Outcome
	10:15-11:30	996	F	**PCT-K**	She came to the clinic and participated in the study
	11:30-11:45	2352	M	**PCT-K**	He came to the clinic and participated in the study
	11:45-12:00	2239	F	**PCT-K**	He did not attend the clinic despite promising to come. When calling her again we discovered that her phone was out of service.
	12:00-12:15	1787	F	**Social Service Institute**	She was cooperative and we managed the visit very quick
	12:15-12:30	2013	F	**Social Service Institute**	She was cooperative and we managed the visit very quick
Date	**Time**	**Number of Participant**	**Gender**	**Meeting place**	**Outcome**
09-12-2014 Tuesday	9:00-9:15	1448	M	**Clinic**	He was cooperative and we managed the visit very quick
	9:15-9:30	10186	M	**Clinic**	He was cooperative and we managed the visit very quick
	9:30-9:45	10412	F	**Clinic**	She was cooperative and we managed the visit very quick
	10:05-10:26	9508	F	**Home**	She was cooperative and we managed the visit very quick
	10:36-10:52	10299	M	**Home**	He was cooperative and we managed the visit very quick
	11:00-11:20	318	F	**Home**	She was cooperative and we managed the visit very quick
	11:30-11:55	770	F	**Home**	We excluded this particular case because he did not meet the eligibility criteria as she had Leg injury.
	12:00-12:20	1222	F	**Home**	She was cooperative and we managed the visit very quick
	12:25-12:45	2126	F	**Clinic**	She was cooperative and we managed the visit very quick
	13:00-14:00			**Lunch time**	
	14:30-14:52	9960	F	**Home**	She was cooperative and we managed the visit very quick
	15:10-15:35	1335	F	**Home**	She was cooperative and we managed the visit very quick

Date	Time	Number of Participant	Gender	Meeting place	Outcome
10-12-2014 Wednesday	9:00-9:15	22	F	**Walk-in Clinic R**	She came to the clinic and participated in the study.
	9:17-9:32	926	F	**Walk-in Clinic R**	She came to the clinic and participated in the study.
	9:35-9:48	1152	M	**Walk-in Clinic R**	He came to the clinic and participated in the study.
	9:49-9:55	1717	F	**Walk-in Clinic R**	He did not attend the clinic despite promising to come. When calling her again we discovered that her phone was out of service.
	11:00-10:15	1943	F	**Walk-in Clinic R**	She came to the clinic and participated in the study
	10:17-10:34	2395	M	**Walk-in Clinic R**	He came to the clinic and participated in the study.
	10:35-10:40	2734	M	**Walk-in Clinic R**	He did not attend the clinic despite promising to come. When calling her again we discovered that her phone was out of service.
	10:43-11:00	3186	F	**Walk-in Clinic R**	She came to the clinic and participated in the study.
	11:09-11:28	1604	F	**Home**	She was cooperative and we managed the visit very quickly.
	11:45 12:02	3299	F	**Home**	She was cooperative and we managed the visit very quickly.
	12:10-12:15	2508	F	**Home**	We excluded this particular case because he did not meet the eligibility criteria as she had Leg injury.
	12:25-12:40	2847	F	**Home**	She was cooperative and we managed the visit very quickly.
	12:49-13:56	2169	F	**Home**	We excluded this particular case because he did not meet the eligibility criteria, as she was chair bound.
	13:00-14:00	**Lunch time**			

		Nurse MB (Female) at Diabetes Hospital.			Accomplished satisfactorily
	14:00 - 15:00				
	16:00-17:00	Member Benghazi Municipal Council GM (Male) at Benghazi Municipal Council Headquarters			Accomplished satisfactorily

Date	Time	Number of Participant	Gender	Meeting place	Remark
11-12-2014 Thursday	9:00-9:15	361	M	**Polyclinic R**	He came to the clinic and participated in the study
	9:17-9:30	1378	M	**Polyclinic R**	He came to the clinic and participated in the study
	9:33-9: 43	248	F	**Polyclinic R**	She came to the clinic and participated in the study
	9:45-10:00	813	M	**Polyclinic R**	He came to the clinic and participated in the study
	10:03-10:18	4768	M	**Polyclinic R**	He came to the clinic and participated in the study
	10:20-10:33	2056	F	**Polyclinic R**	She came to the clinic and participated in the study
	10:40-10:47	474	F	**Home**	No body at home and the chaperon emphasize that they fled from conflict
	10:57-11:15	135	F	**Home**	She was cooperative and we managed the visit very quickly.
	11:23-11:40	700	F	**Home**	She was cooperative and we managed the visit very quickly.
	11:50-12:08	1265	F	**Home**	She was cooperative and we managed the visit very quickly.
	12:15-12:22	1491	M	**Home**	No body at home and the chaperon emphasize that they fled from conflict.
	13:00-14:00	**Lunch time**			

Date	Time	Participant's Number	Gender	Meeting place	Outcome
	14:00-14:14	587	F	**Health care setting R**	She came to the clinic and participated in the study
	14:16-14:30	2282	M	**Health care setting R**	He came to the clinic and participated in the study
	14:35-14:48	2960	F	**Health care setting R**	She came to the clinic and participated in the study
	14:51-14:57	4542	F	**Health care setting R**	He did not attend the clinic despite promising to come. When calling her again we discovered that her phone was out of service.
	15:00-15:16	3638	F	**Health care setting R**	She came to the clinic and participated in the study
	16:20-16:39	4316	M	**Health care setting R**	He came to the clinic and participated in the study
Date	**Time**	**Participant's Number**	**Gender**	**Meeting place**	**Outcome**
12-12-2014 Friday	9:00-12:00	**Holiday: It was imposable to recruit any participants due to the prayer Time**			
	12:00-13:00	**Lunch time**			
	13:00-13:20	3977	M	**Home**	He was cooperative and we managed the visit very quickly.
	13:25-13:43	4203	F	**Home**	She was cooperative and we managed the visit very quickly.
	13:50-14:10	4429	M	**Home**	No body at home and the chaperon emphasize that they fled from conflict.
	14:15-14:35	4655	F	**Home**	She was cooperative and we managed the visit very quickly.
	14:40-15:00	4881	F	**Home**	She was cooperative and we managed the visit very quickly.
	15:10-15:27	2621	F	**Home**	We excluded this particular case because she did not meet the eligibility criteria, as he was Pregnant.

Date	Time	Participant's Number	Gender	Meeting place	Remark
	15:33-15:50	3073	F	**Home**	She was cooperative and we managed the visit very quickly.
	16:00-16:20	3525	M	**Home**	We excluded this particular case because he did not meet the eligibility criteria, as he was Limp.
	16:32:16:50	3751	F	**Home**	She was cooperative and we managed the visit very quickly.
Date	**Time**	**Participant's Number**	**Gender**	**Meeting place**	**Remark**
	9:00-11:00	**Holiday: some participants accepted to meet after 11 am**			
13-12-2014 Saturday	11:00-11:20	8276	M	**Polyclinic R**	He came to the clinic and participated in the study
	11:25-11:43	3412	F	**Polyclinic R**	She came to the clinic and participated in the study
	11:50-12:10	3864	M	**Polyclinic R**	He came to the clinic and participated in the study
	12:15-12:35	4090	M	**Polyclinic R**	He came to the clinic and participated in the study
		Lunch time			
	13:00-13:22	8389	F	**Home**	We excluded this case because she did not meet the eligibility criteria due to a physical deformity. (A problem with her back).
	13:30-13:50	1039	F	**Home**	She was cooperative and we managed the visit very quickly.
	14:10-14:36	1830	F	**Home**	Despite making appointment beforehand, we could not approach her due to the head of the household refusing our request.

Date	Time	Number of Participant	Gender	Meeting place	Remark
14-12-2014 Sunday	9:00-9:17	7102	F	Polyclinics L	She came to the clinic and participated in the study.
	9:19-9:35	6650	F	Polyclinics L	She came to the clinic and participated in the study.
	9:36-9:40	6763	M	Polyclinics L	He did not attend the clinic despite promising to come. When calling her again we discovered that her phone was out of service.
	9:42-9:56	7893	M	Polyclinics L	He came to the clinic and participated in the study.
	10:03-10:15	8119	F	Polyclinics L	She came to the clinic and participated in the study.
	10:25-10:47	8458	F	Polyclinics L	She came to the clinic and participated in the study.
	10:52-11:10	8345	F	Home	She was cooperative and we managed the visit very quickly.
	11:20-11:40	8684	M	Home	He was cooperative and we managed the visit very quickly.
	11:50-11:55	7554	F	Home	She was cooperative and we managed the visit very quickly.
	12:00-12:20	7328	F	Home	She was cooperative and we managed the visit very quickly.
	12:27-12:52	9249	M	Home	He was cooperative and we managed the visit very quickly.
	13:00-14:00	**Lunch time**			
	14:00-14:17	10605	F	Polyclinics L	She came to the clinic and participated in the study.
	14:25-14:35	6876	F	Home	She was cooperative and we managed the visit very quickly.
	14:42-15:00	6989	M	Home	He was cooperative and we managed the visit very quickly.
	15:11-15:30	7215	M	Home	He was cooperative and we managed the visit very quickly.
	15:38-15:50	7667	F	A primary care trust (PCT- L)	She came to the clinic and participated in the study.
Date	**Time**	**Number of Participant**	**Gender**	**Meeting place**	Remark
15-12-2014 Monday	9:00-9:15	9588	F	PCT- L	She came to the clinic and participated in the study.
	9:19-9:30	9023	F	PCT- L	She came to the clinic and participated in the study.
	9:33-9:45	10153	M	PCT- L	She came to the clinic and participated in the study.
	9:54-10:00	9927	F	Home	We excluded this particular case because he did not meet the eligibility criteria, as she was chair bound.
	10:06-10:11	9475	F	Home	Despite making appointment beforehand, we could not approach her due to the head of the household refusing our request.
	10:18-10:23	9814	F	Home	She was cooperative and we managed the visit very quickly.
	10:30-11:38	10379	M	Home	He was cooperative and we managed the visit very quickly.
	11:45-11:52	8232	F	Home	He was cooperative and we managed the visit very quickly.

Date	Time	Number of Participant	Gender	Meeting place	Remark
	12:00-12:05	8571	F	**Home**	We excluded this particular case because she did not meet the eligibility criteria, as she was pregnant.
	12:15-12:38	9136	F	**Home**	She came to the clinic and participated in the study.
	12:45-13:07	10944	F	**PCT- L**	She came to the clinic and participated in the study.
	13:00-14:00			**Lunch time**	
	14:00-14:25	10831	F	**Home**	She was cooperative and we managed the visit very quickly.
	14:30-14:55	11396	F	**Home**	She was cooperative and we managed the visit very quickly.
	15:05-15:20	103	M	**PCT- L**	She came to the clinic and participated in the study.
	15:20-15:35	329	M	**PCT- L**	He did not attend the clinic despite promising to come. When calling her again we discovered that her phone was out of service.
	15:35-15:50	10266	F	**Home**	She was cooperative and we managed the visit very quickly.
Date	**Time**	**Number of Participant**	**Gender**	**Meeting place**	Remark
16-12-2014 Tuesday	9:00-9:15	11283	F	**Walk-in Clinic L**	She came to the clinic and participated in the study.
	9:16-9:30	11735	F	**Walk-in Clinic L**	She came to the clinic and participated in the study.
	9:33-9:47	1685	M	**Walk-in Clinic L**	He came to the clinic and participated in the study.
	9:50-10:00	1459	F	**Walk-in Clinic L**	She came to the clinic and participated in the study.
	10:03-10:18	1233	M	**Walk-in Clinic L**	He came to the clinic and participated in the study.
	10:20-10:25	1007	M	**PCT- L**	He did not attend the clinic despite promising to come. When calling her again we discovered that her phone was out of service.
	10:35-10:42	668	F	**PCT- L**	She came to the clinic and participated in the study.
	10:45-11:00	1911	F	**PCT- L**	She came to the clinic and participated in the study.
	11:03-11:30	894	F	**PCT- L**	She came to the clinic and participated in the study.
	11:38-11:43	8910	F	**Home**	Despite making appointment beforehand, we could not approach her due to the head of the household refusing our request.
	11:54-12:15	9362	F	**Home**	She was cooperative and we managed the visit very quickly.
	12:22-12:43	9701	F	**Home**	She was cooperative and we managed the visit very quickly.
	13:00-14:00			**Lunch time**	
	14:00-15:00	**Nurse MM (Male) Diabetes Hospital**		**Accomplished satisfactorily**	
	16:00-17:00	**Lecturer Dr RZ Female Al-Arab Medical University**		**Accomplished satisfactorily**	
Date	Time	Number of Participant	Gender	Meeting place	Remark

	8:00-8:00	Lecturer Dr HZ Male Interviewee's office			Accomplished satisfactorily
	9:00-9:12	11057	F	Home	She was cooperative and we managed the visit very quickly.
	9:15-9:30	11509	F	Home	She was cooperative and we managed the visit very quickly.
	9:30-9:45	10040	M	Home	His wife informed us he went to refill a gas cylinder, so we decided to revisit him tomorrow.
	9:50-10:06	442	F	Home	She was cooperative and we managed the visit very quickly.
	10:10-10:15	216	F	Home	She was cooperative and we managed the visit very quickly.
	10:25-10:47	11848	F	Home	She was cooperative and we managed the visit very quickly.
	10:52-11:10	11622	F	Home	She was cooperative and we managed the visit very quickly.
	11:20-11:40	1572	F	Home	She was cooperative and we managed the visit very quickly.
	11:50-11:55	1798	M	Home	He opted out to participate immediately over the phone.
17-12-2014 Wednesday	12:20-12:20	1346	M	Home	He moved to another area.
	12:25-12:45	781	M	Home	We informed us he went to refill a gas cylinder, so we decided to revisit him tomorrow.
	13:00-14:00	Lunch time			
	14:00-15:00	Lecturer Dr AG Male Interview's office			Accomplished satisfactorily
	15:07-15:12	7441	M	Home	He was drunk and it was difficult to talk with him about the study.
	15:20-15:26	8006	M	Home	We informed us he went to refill a gas cylinder, so we decided to revisit him tomorrow.
	15:35-15:41	7780	M	Home	He excluded to involve because he was not able to stand upright due to suffering from (hemiplegia).
	15:48-15:54	10492	M	Home	We informed us he went to refill a gas cylinder, so we decided to revisit him tomorrow.
	16:02-16:07	1120	M	Home	No body at home and the chaperon emphasize that they fled from conflict.
	16:14-16:20	555	M	Home	We informed us he went to refill a gas cylinder, so we decided to revisit him tomorrow.
	16:27-16:32	11170	M	Home	He moved to another area.
	16:38-16:44	8797	F	Home	She opted out to participate immediately over the phone.
	16:51-17:00	10718	M	Home	We got an incorrect address.

I revisited the last potential participants in the next day in order to improve the response rate due to the reason went the most of them to 'Refill gases cylinders

Date	Time	Number of Participant	Gender	Meeting place	Remark
18-12-2014	9:00-9:20	781	M	Home	He was cooperative and we managed the visit very quickly.
	9:27-9:43	10040	M	Home	He was cooperative and we managed the visit very quickly.
	9:50-10:08	10492	M	Home	He was cooperative and we managed the visit very quickly.

	10:19-10:30	555	M	Home	Despite revisiting again, nobody was at his home
	10:40-10:58	7441	M	Home	Having recognised this case as if a drunk, we decided to leave him in order to revisit him next day but unfortunately, he was not at his house during the second visit.
	11:10-11:30	8006	M	Home	Despite revisiting again, nobody was at his home
	13:00-14:00	Lunch time			
	14:00-15:00	Imams (Sheikhs)TB Male Mosque		Accomplished satisfactorily	

Date	Time	Number of Participant	Gen der	Meeting place	Remark
19-12-2014 Friday	9:00-13:00	Holiday: It was imposable to recruit any participants due to the prayer Time			
	14:00-14:18	14945	F	Home	She was cooperative and we managed the visit very quickly.
	14:27-14:44	15043	F	Home	She was cooperative and we managed the visit very quickly.
	14:52-15:10	14847	M	Home	He was cooperative and we managed the visit very quickly.
	15:17-15:22	14553	F	Home	We excluded this particular case because she did not meet the eligibility criteria as she was pregnant.
	15:29-15:47	14651	F	Home	She was cooperative and we managed the visit very quickly.
	15:56-16:00	15631	M	Home	No body at home and the chaperon emphasize that they fled from conflict.
	16:10:16:27	14749	F	Home	She was cooperative and we managed the visit very quickly.
	16:35:16:40	15141	M	Home	No body at home and the chaperon emphasize that they fled from conflict.
	16:47:16:52	15239	F	Home	She was cooperative and we managed the visit very quickly.
Date	Time	Number of Participant	Gen der	Meeting place	Remark
20-12-2014 Saturday	11:00-11:18	15337	F	Polyclinic H	She came to the clinic and participated in the study.
	11:23-11:40	15435	F	Polyclinic H	She came to the clinic and participated in the study.
	11:48-12:06	15533	M	Polyclinic H	He came to the clinic and participated in the study.

	12:15-12:33	16317	M	**Polyclinic H**	He came to the clinic and participated in the study.
	13:00-14:00			**Lunch time**	
	13:00-13:18	16415	F	**Home**	She was cooperative and we managed the visit very quickly.
	13:29-13:47	16219	M	**Home**	He was cooperative and we managed the visit very quickly.
	13:55-14:12	16513	F	**Home**	She was cooperative and we managed the visit very quickly.
	14:21-14:38	15827	F	**Home**	She was cooperative and we managed the visit very quickly.
	14:47-14:52	15925	M	**Home**	No body at home and the chaperon emphasize that they fled from conflict.
	15:03-15:22	16611	M	**Home**	He was cooperative and we managed the visit very quickly.
	15:35-15:40	17101	M	**Home**	No body at home and the chaperon emphasize that they fled from conflict.
	15:53-16:12	17885	M	**Home**	He was cooperative and we managed the visit very quickly.
	16:33-16:50	16121	M	**Home**	He was cooperative and we managed the visit very quickly.

Date	Time	Number of Participant	Gender	Meeting place	Remark
21-12-2014 Sunday	9:00-9:17	15729	F	**Polyclinics H**	She came to the clinic and participated in the study.
	9:25-9: 43	16023	M	**Polyclinics H**	He came to the clinic and participated in the study.
	10:00-11:00	Tribal leader SB Male Elders of Benghazi Council headquarters			Accomplished satisfactorily
	11:14-11:31	16905	M	**Polyclinics H**	He came to the clinic and participated in the study.
	11:34-11:50	16807	F	**Polyclinics H**	She came to the clinic and participated in the study.
	11:52-11:00	17199	F	**Polyclinics H**	She came to the clinic and participated in the study.
	12:12-12:28	16709	M	**Polyclinics H**	He came to the clinic and participated in the study.
	12:31-12:50	17983	F	**Polyclinics H**	She came to the clinic and participated in the study.
	13:00-14:00	Lunch time			
	14:00-15:00	Clinical nutritionists TH (Male) Diabetes Hospital			Accomplished satisfactorily
	15:15-15:31	17689	F	**Polyclinics H**	She came to the clinic and participated in the study.
	15:34-15:50	17297	M	**Polyclinics H**	He came to the clinic and participated in the study.
	15:35-16:00	17493	M	**Polyclinics H**	He came to the clinic and participated in the study.
	16:03-16:19	17787	F	**Polyclinics H**	She came to the clinic and participated in the study.
	16:30-16:37	17395	F	**Home**	She refuse to take part when we contacted her by phone.

Date	Time	Number of Participant	Gender	Meeting place	Remark
22-12-2014 Monday	9:00-9:16	18375	F	**PCT-H**	She came to the clinic and participated in the study.
	9:20-9:33	18473	F	**PCT- H**	She came to the clinic and participated in the study.
	9:35-9:40	18571	M	**PCT- H**	We excluded this particular case because she did not meet the eligibility criteria as he was confined bed
	10:00- 11:00	Imams (Sheikhs) RL MaleMosque			Accomplished satisfactorily
	11:18-11:35	18277	F	**Home**	She was cooperative and we managed the visit very quickly.
	11:43-11:48	18081	M	**Home**	We excluded this particular case because she did not meet the eligibility criteria as he was Less than 5 years
	12:00-12:17	19061	F	**Home**	She was cooperative and we managed the visit very quickly.
	12:25-12:43	18767	F	**Home**	She was cooperative and we managed the visit very quickly.
	13:00-14:00	**Lunch time**			
	14:00-15:00	Imams (Sheikhs) NM Male		Mosque	Accomplished satisfactorily
	15:12-15:25	743	F	**PCT-H**	She came to the clinic and participated in the study.
	15:28-15:45	18963	M	**PCT- H**	He came to the clinic and participated in the study.
	15:49-16:07	155	M	**PCT- H**	He came to the clinic and participated in the study.
	16:17-16:35	2507	F	**PCT-H**	She came to the clinic and participated in the study.

Date	Time	Number of Participant	Gender	Meeting place	Remark
	16:37-16:43	547	M	Home	We excluded this particular case because she did not meet the eligibility criteria as he was Hunchback
	16:50-16:55	17591	F	Home	We could not approach her due to the head of the household refuding our request.
Date	**Time**	**Number of Participant**	**Gender**	**Meeting place**	**Remark**
23-12-2014 Tuesday	9:00-9:16	645	F	**PCT-H**	She came to the clinic and participated in the study.
	9:18-9:31	841	F	**PCT-H**	She came to the clinic and participated in the study.
	9:34-9:48	351	M	**PCT-H**	He came to the clinic and participated in the study.
	9:53-10:08	1135	F	**PCT-H**	She came to the clinic and participated in the study.
	10:11-10:26	1233	M	**PCT-H**	He came to the clinic and participated in the study.
	10:40-10:45	939	M	**Walk-in Clinic H**	Despite making appointment beforehand, when he came to clinic he refused to take part in the study
	10:48-11:03	1527	F	**Walk-in Clinic H**	She came to the clinic and participated in the study.
	11:05-11:20	1331	F	**Walk-in Clinic H**	She came to the clinic and participated in the study.
	11:35-11:49	3291	F	**Walk-in Clinic H**	She came to the clinic and participated in the study.
	11:52-11:58	1429	M	**Walk-in Clinic H**	We excluded this particular case because she did not meet the eligibility criteria as he was Limp
	12:02-12:18	2017	F	**Walk-in Clinic H**	She came to the clinic and participated in the study.
	12:21-12:38	1723	M	**Walk-in Clinic H**	He came to the clinic and participated in the study.
	12:41-13:00	1821	F	**Walk-in Clinic H**	She came to the clinic and participated in the study.
	13:00-14:00	**Lunch time**			
	14:00-15:00	Tribal leader	YB Male house	Interviewee's	**Accomplished satisfactorily**
	15:12-15:25	17003	F	**Home**	No body at home and the chaperon emphasize that they fled from conflict.
	15:28-15:45	18669	F	**Home**	She was cooperative and we managed the visit very quickly.
	15:49-16:07	18179	F	**Home**	She was cooperative and we managed the visit very quickly.
	16:17-16:35	18865	F	**Home**	She was cooperative and we managed the visit very quickly.

Date	Time	Number of Participant	Gender	Meeting place	Remark
25-12-2014 Thursday	**9:15-9:32**	**2703**	**M**	**Clinic**	He came to the clinic and participated in the study.
	9:34-9:49	**2311**	**M**	**Clinic**	He came to the clinic and participated in the study.
	9:53-10:08	**2997**	**F**	**Clinic**	She came to the clinic and participated in the study.
	10:18-10:36	**2213**	**F**	**Home**	She came to the clinic and participated in the study.
	10:47-11:05	**3193**	**M**	**Home**	He was cooperative and we managed the visit very quickly.
	11:17-11:34	**4663**	**F**	**Home**	She was cooperative and we managed the visit very quickly.
	11:42-12:00	**3683**	**F**	**Home**	She was cooperative and we managed the visit very quickly.
	12:09-12:27	**5251**	**M**	**Home**	He was cooperative and we managed the visit very quickly.
	12:35-13:03	**4957**	**F**	**Home**	She was cooperative and we managed the visit very quickly.
	13:00-14:00			**Lunch time**	
	14:00-15:00	**Tribal leader HG Male Interviewee's house**			**Accomplished satisfactorily**
	15:07-15:25	**5055**	**M**	**Home**	He was cooperative and we managed the visit very quickly.
	15:32-15:47	**5349**	**M**	**Home**	He was cooperative and we managed the visit very quickly.
	15:53-16:11	**3487**	**M**	**Home**	He was cooperative and we managed the visit very quickly.
	16:21-16:37	**4271**	**M**	**Home**	He was cooperative and we managed the visit very quickly.
	16:44-17:00	**4173**	**M**	**Home**	He was cooperative and we managed the visit very quickly.

Date	Time	Number of Participant		Gender	Meeting place	Remark
26-12-2014 Friday	9:00-13:00	Holiday: It was imposable to recruit any participants due to the prayer Time				
	13:00-14:00	Lunch time				
	14:00-14:18	3977		F	Home	She was cooperative and we managed the visit very quickly.
	14:27-14:44	4467		M	Home	He was cooperative and we managed the visit very quickly.
	14:52-15:10	4075		M	Home	He was cooperative and we managed the visit very quickly.
	15:17-15:22	57		F	Home	We excluded this case because she did not meet the eligibility criteria due to a physical deformity. (A problem with her back).
	15:29-15:47	253		F	Home	She was cooperative and we managed the visit very quickly.
	15:56-16:00	449		M	Home	No body at home and the chaperon emphasize that they fled from conflict.
	16:10:16:27	2605		F	Home	She was cooperative and we managed the visit very quickly.
	16:35:16:40	1037		M	Home	No body at home and the chaperon emphasize that they fled from conflict.
	16:47:16:52	2115		F	Home	She was cooperative and we managed the visit very quickly.
Date	Time	Number of Participant	Gender	Meeting place		Remark
27-12-2014 Saturday	11:00-11:18	1625	F	Home		She was cooperative and we managed the visit very quickly.
	11:23-11:28	2801	F	Home		No body at home and the chaperon emphasize that they fled from conflict.
	11:46-12:03	1919	F	Home		She was cooperative and we managed the visit very quickly.
	12:15-12:34	2899	M	Home		He was cooperative and we managed the visit very quickly.
	13:00-14:00	Lunch time				
	14:00-14:19	3095	F	Home		She was cooperative and we managed the visit very quickly.
	14:27-14:43	2409	F	Home		She was cooperative and we managed the visit very quickly.
	14:55-15:12	3389	F	Home		She was cooperative and we managed the visit very quickly.

	15:21-15:26	3781	F	**Home**	We excluded this particular case because she did not meet the eligibility criteria as she was pregnant.
	15:35-15:52	3879	F	**Home**	She was cooperative and we managed the visit very quickly.
	16:04-16:22	4565	F	**Home**	She was cooperative and we managed the visit very quickly.
	16:34-16:40	3585	F	**Home**	No body at home and the chaperon emphasize that they fled from conflict.

Date	Time	Number of Participant	Gender	Meeting place	Remark
28-12-2014 Sunday	**9:12-9:19**	**4761**	**F**	**Home**	We could not approach her due to the head of the household refusing our request.
	9:30-9:47	**4859**	**F**	**Home**	She was cooperative and we managed the visit very quickly.
	9:53:-10:00	**5153**	**F**	**Home**	She was cooperative and we managed the visit very quickly
	10:12-16:30	**4369**	**F**	**Home**	She was cooperative and we managed the visit very quickly.
	10:37-16:55	**5447**	**F**	**Home**	She was cooperative and we managed the visit very quickly.