ANTHROPOMETRIC STATUS AND DIETARY HABITS OF REGISTERED NURSES, ENROLLED NURSES AND ENROLLED NURSING AUXILLIARIES WORKING AT A PRIVATE HOSPITAL IN PIETERMARITZBURG, KWAZULU-NATAL

by

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ABSTRACT

Introduction: The prevalence of overweight and obesity has been increasing over the years, particularly in South Africa (SA). A major contributor to this is poor lifestyle choices such as unhealthy diets and sedentary lifestyles. The rise in overweight and obesity is alarming as both are major risk factors for non-communicable diseases (NCDs). Overweight and obesity are also becoming more prevalent among healthcare professionals, specifically nurses. However, nurses are expected to lead by example and should be role models to the patients they care for. Nurses are the backbone of healthcare facilities and being overweight or obese impacts both on themselves and on their patients. Factors contributing to overweight and obesity among nurses include consuming meals late, eating during stressful periods, low physical activity levels and working shifts.

Aim: This study aimed to investigate the anthropometric status and dietary habits of registered nurses (RNs), enrolled nurses (ENs) and enrolled nursing auxiliaries (ENAs) working at a private hospital in Pietermaritzburg (PMB), KwaZulu-Natal (KZN).

Objectives: (i) to determine the anthropometric status of RNs, ENs and ENAs working at a private hospital in PMB, KZN; (ii) to determine the dietary habits of RNs, ENs and ENAs working at a private hospital in PMB, KZN; (iii) to determine the factors contributing to the anthropometric status and dietary habits of RNs, ENs and ENAs working at a private hospital in PMB, KZN; (iv) to determine the prevalence of NCDs among RNs, ENs and ENAs working at a private hospital in PMB, KZN.

Method: A cross-sectional descriptive study was conducted on RNs, ENs and ENAs working at a private hospital in PMB, KZN. A self-administered questionnaire was developed to obtain data on demographic characteristics, lifestyle factors, body image and weight and eating habits. Anthropometric status was determined using selected anthropometric indices including weight, height, body mass index (BMI) and waist circumference (WC). Dietary habits was assessed using a food frequency questionnaire (FFQ) and a single 24-hour recall. The 24-hour recall was analysed using the Medical Research Council (MRC) Food Finder software programme version 1.0. Data was analysed using the Statistical Package for Social Sciences (SPSS) version 22.

Results: The study sample consisted of 130 nurses; 40.8% (n=53) were RNs, 36.9% (n=48) were ENs, 2.3% (n=3) were midwives, 19.2% (n=25) were ENAs and one was a clinical nurse specialist in the neonatal intensive care unit (NICU). A significant number of the participants were either overweight (25.4%; n=33) or obese class I (29.2%; n=38) ($p<0.0005$). Most participants did not smoke (82.3%; n=107) or consume alcohol (59.2%; n=77). Only 50%

(n=65) of participants exercised. A significant number (63.1%; n=82) indicated that they were not satisfied with their body shape/size and did not feel that they were at a healthy body weight (60%; n=78). The majority of participants underestimated their BMI using the Stunkard figure rating scale (76.9%; n=100).

The majority of participants stated they had tried to lose weight before (64.6%; n=84). The most common weight loss methods were cutting down on fast foods/takeaways (67.9%; n=57) (p=0.001) and exercising (63.1%; n=53). A significant number of nurses agreed that they were role models to their patients (70.8%; n=92) and believed it was important for a nurse to have an ideal body weight (92.3%; n=120). The majority of participants skipped meals (83.8%; n=109) with the only significantly skipped meal being breakfast (63.3%; n=69). A significant number of participants prepared their own meals at home (84.6%; n=110). Participants significantly agreed that time [M (mean)=3.98; p<0.0005], cost (M=3.26; p=0.021), emotions/stress (M=3.61; p<0.0005) and convenience (M=3.38; p<0.0005) were factors that influenced their meal choices. There was significant agreement that a lack of time to prepare meals (M=3.69; p<0.0005), lack of time to eat at work (M=4.04; p<0.0005), emotions/stress (M=3.30; p<0.0010) and healthy food not being available to buy at work (M=3.22; p<0.0036), were factors preventing nurses from eating healthily. The most common food item bought at the hospital cafeteria was pies (21.5%; n=17). Fruit (52.3%; n=68), sweets (34.6%; n=45) and sugar-sweetened soft drinks (32.3%; n=42) were consumed at least once a day.

The mean BMI for females (33.6 kg/m^2) was significantly higher than that for males (28.1 kg/m^2) (p=0.043). Most male participants had a WC above 94 cm (63.6%; n=7), while the majority of females (88.2%; n=105) had a WC above 80 cm. The mean BMI for non-smokers (BMI=33.8 kg/m^2) was significantly higher than that of smokers (29.6 kg/m^2) (p=0.030). A higher BMI was associated with less snacking. The mean BMI for those who skipped supper (36.3 kg/m^2) was significantly higher than for those who ate supper (32.0 kg/m^2) (p=0.013). The mean BMI for those who skipped meals (33.8 kg/m^2) was significantly higher than for those who did not skip meals (29.6 kg/m^2) (p=0.005).

The FFQ showed that the starches most frequently consumed were brown and white bread/rolls, white rice, *phutu* (crumbly maize meal porridge) and potatoes without skin. Sweets, chips (crisps), biscuits and chocolates were also frequently eaten. In the meat, poultry, fish, eggs and meat substitutes group, eggs, processed meats and chicken cuts with skin were frequently

consumed. The fruit and vegetables most frequently consumed were non-starchy vegetables, fresh fruit and fruit juice. Full cream milk, sunflower oil, tub/soft margarine and cheddar cheese were the dairy and fats eaten most often. Tea and water were consumed more often than sugar-sweetened beverages. Overall, the most frequently consumed foods were full cream milk, sunflower oil, tea, white sugar, fresh fruit, brown sugar, brown bread/rolls, tub/soft margarine, sweets and white bread/rolls.

Conclusion: There was a high prevalence of overweight and obesity among the participants. According to WC, the majority of nurses had an increased risk for metabolic complications. However, most participants were not diagnosed with a NCD. Factors associated with a high BMI included being female, not smoking, skipping meals, skipping supper, less snacking and cost of meals. Nurses consumed both healthy and unhealthy foods. Overall, there was a higher intake of carbohydrates and protein and a lower intake of dietary fibre. Despite the many hours that they spend caring for patients, nurses should also pay attention to their own health and well-being. Nurses should be supported in their efforts to achieve and maintain a healthy weight and lead a healthy lifestyle.

PREFACE

This dissertation was written between June 2018 and December 2020 using data collected from a self-administered questionnaire, 24-hour recall and food frequency questionnaire in Pietermaritzburg, KwaZulu-Natal, under the supervision of Dr Kirthee Pillay.

Signed: [redacted] Date: 13 January 2021

Leah Bianca Yegambaram (Candidate)

As the supervisor of this candidate, I agree to the submission of this dissertation.

Signed: [redacted] Date: 13 January 2021

Dr Kirthee Pillay (Supervisor)

DECLARATION OF ORIGINALITY

I, Leah Bianca Yegambaram hereby declare that:

1. The entirety of the work contained in this dissertation is my original work, except where otherwise stated.
2. This dissertation, or any part of it, has not been submitted for any degree or examination at any other university.
3. Where other sources have been used, they have not been copied and properly acknowledged.
4. This dissertation does not contain text, graphics or tables copied and pasted from the internet, unless specifically acknowledged, and the source being detailed in the dissertation and in the relevant reference section.

Signed:  Date: 13 January 2021

Leah Bianca Yegambaram (Candidate)

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LIST OF ABBREVIATIONS

AI	Adequate intake
AIDS	Acquired immunodeficiency syndrome
ARVs	Antiretrovirals
BDNF	Brain-derived neurotrophic factor
BMI	Body mass index
BREC	Biomedical Research Ethics Committee
CDC	Centers for Disease Control and Prevention
CRP	C-reactive protein
CVD	Cardiovascular disease
DOH	Department of Health
DRI	Dietary reference intakes
EAR	Estimated average requirement
ENAs	Enrolled Nursing Auxiliaries
ENs	Enrolled Nurses
FBDGs	Food based dietary guidelines
FFQ	Food frequency questionnaire
FTO	Fat mass and obesity-associated gene
HIV	Human immunodeficiency virus
IBS	Irritable bowel syndrome
IL-6	Interleukin 6
KSR2	Kinase suppressor of ras 2
KZN	KwaZulu-Natal
LDL	Low-density lipoprotein
MC4R	Melanocortin 4 receptor
MRC	Medical Research Council
NCDs	Non-communicable diseases
NHS	National Health Service
NIDDK	National Institute of Diabetes and Digestive and Kidney Diseases
PCOS	Polycystic ovarian syndrome
PMB	Pietermaritzburg
PPARG	Peroxisome proliferator-activated receptor gamma

RDA	Recommended dietary allowance
REE	Resting energy expenditure
RNs	Registered Nurses
SADHS	South African Demographic and Health Survey
SANC	South African Nursing Council
SANHANES-1	South African National Health and Nutrition Examination Survey-1
SPSS	Statistical Package for Social Sciences
T2DM	Type 2 diabetes mellitus
TB	Tuberculosis
TNF-α	Tumor necrosis factor alpha
TSH	Thyroid stimulating hormone
TZDs	Thiazolidinediones
UKZN	University of KwaZulu-Natal
UK	United Kingdom
USA	United States of America
WC	Waist circumference
WHO	World Health Organization

CHAPTER 1
INTRODUCTION, THE PROBLEM AND ITS SETTING

1.1 Importance of the study

Obesity is on the rise globally (Callahan & Roundtable on Obesity Solutions, Food and Nutrition Board, Health and Medicine Division, National Academies of Sciences, Engineering, and Medicine 2019, p5). The prevalence of obesity worldwide has increased two-fold since 1980 [World Health Organization (WHO) 2020b]. The proportion of adult males and females with a body mass index (BMI) greater than 25 kg/m^2 has exceeded the number of males and females in the low BMI category of <20 kg/m^2 (Callahan *et al* 2019, p5). In 2014, over 1.9 billion adults were overweight and of these adults more than 600 million were obese (WHO 2020b). Globally, in 2016, the number of girls, boys, women and men with obesity were 50 million, 74 million, 390 million and 281 million, respectively (Callahan *et al* 2019, p5).

The South African National Health and Nutrition Examination Survey (SANHANES-1) conducted in 2011-2012, found that males had a mean BMI of 23.6 kg/m^2, while females had a higher mean BMI of 28.9 kg/m^2 (Shisana, Labadarios, Rehle, Simbayi, Zuma, Dhansay, Reddy, Parker, Hoosain, Naidoo, Hongoro, Mchiza, Steyn, Dwane, Makoae, Maluleke, Ramlagan, Zungu, Evans, Jacobs, Faber & SANHANES-1 team 2013). The prevalence of overweight in South African men and women was 20.1% and 24.8%, respectively, while the prevalence of obesity was 10.6% and 39.2%, respectively (Shisana *et al* 2013). This shows that obesity is more common among South African women compared to men (Shisana *et al* 2013). Data from the South African Demographic and Health Survey (SADHS) of 2016, reported that in males 16 years and older, the prevalence of overweight and obesity was 20.3% and 11%, respectively [Department of Health (DOH) 2016a]. The prevalence of overweight and obesity in women 16 years and above was 26.6% and 41.0%, respectively (DOH 2016a). Overweight and obesity are linked to a greater risk of premature death in comparison to normal weight individuals (Harvard TH Chan School of Public Health 2016).

Overweight and obesity can be defined as an accumulation of excess fat in the body over time (WHO 2017b). This excess body fat may impair health by increasing the risk of non-communicable diseases (NCDs) (WHO 2017b). BMI is used to classify the degree of overweight and obesity in adults (WHO 2017b). It is calculated using an equation of weight in kilograms divided by height squared and is measured using the unit kg/m^2 (WHO 2017b).

Underweight is classified as a BMI less than 18.5 kg/m^2, while a normal BMI ranges from 18.5 to 24.99 kg/m^2 (WHO 2017b). A BMI greater than or equal to 25 kg/m^2 is considered as overweight and a BMI between 25.00 and 29.99 kg/m^2 is classified as pre-obese (WHO 2017b). A BMI greater than or equal to 30kg/m^2 is considered obese (WHO 2017b). Obesity can be further classified into obese class I (30-34.99 kg/m^2), class II (35-39.99 kg/m^2) and class III (greater than or equal to 40 kg/m^2) (WHO 2017b). According to Wang, Rimm, Stampfer, Willett & Hu (2005), waist circumference (WC) may be a better predictor of visceral fat than BMI alone. Wang *et al* (2005) reported that an increased BMI and WC was associated with a greater risk for type 2 diabetes mellitus (T2DM) due to the increased amount of visceral fat. In men, a WC >94cm indicates an increased risk for metabolic complications, while a WC >102cm indicates a substantially increased risk for metabolic complications (WHO 2011). In women, a WC >80cm indicates an increased risk for metabolic complications, while a WC >88cm indicates a substantially increased risk for metabolic complications (WHO 2011).

NCDs can be defined as a chronic illness that is not contracted via an acute infectious event [Centers for Disease Control and Prevention (CDC) 2013b]. Examples of NCDs include cancer, cardiovascular diseases, neurological disorders, chronic respiratory disease, diabetes and musculoskeletal disorders (CDC 2013b). NCDs have a long course and cannot be spontaneously or fully cured (CDC 2013b). Overweight and obesity are major risk factors for NCDs (WHO 2017a). The main cardiovascular diseases associated with overweight and obesity include heart disease and stroke, while the main musculoskeletal disorder includes osteoarthritis (WHO 2017a). The risk for cancers such as breast cancer, colon cancer and endometrial cancer increase with BMI (WHO 2017a). A high BMI in adults is likely to be associated with higher morbidity and mortality (WHO 2017a).

Overweight and obesity are increasing among South Africans, including healthcare professionals (Phiri, Draper, Lambert & Kolbe-Alexander 2014). However, healthcare professionals are expected to lead by example and should be role models to the patients they treat (Phiri *et al* 2014). Patients prefer taking advice from healthcare workers who also appear to be healthy, as it gives the impression that these healthcare workers know what they are doing (Simfuke, Van Wyk & Swart 2017). The prevalence of overweight and obesity seems to be increasing among nurses in particular (Phiri *et al* 2014). Nurses are the backbone of healthcare facilities, including clinics and hospitals and their physical health influences both themselves and the patients they care for (Phiri *et al* 2014). Nurses spend a significant time directly

involved in patient care and factors contributing to overweight and obesity include consuming meals late, eating during stressful periods, low physical activity levels and working shifts (Phiri *et al* 2014). Overweight and obesity needs to be targeted among healthcare professionals', especially nursing staff, as they spend a significant time directly involved in patient care (Phiri *et al* 2014). This can be achieved through nutrition education, improving physical activity levels, implementing set lunch times, improving the issue of understaffing, as well as providing healthy balanced meals and snacks at the staff cafeteria (Phiri *et al* 2014).

A study conducted in Ghana by Obirikorang, Obirikorang, Enoch, Acheampong, Tuboseiyefah, Miriam & Emmanuella (2016), investigated the prevalence of obesity among nursing staff. Results showed that the prevalence of obesity among nursing staff was 55.9% (Obirikorang *et al* 2016). There was a higher obesity prevalence among female nurses with a higher professional ranking (Obirikorang *et al* 2016). Aryee, Helegbe, Baah, Sarfo-Asante & Quist-Therson (2013), who conducted a cross-sectional study in Tamale Metropolis of Ghana, reported similar findings of a significant relationship between gender and BMI. Female nurses were more likely to be overweight and obese than male nurses were (Aryee *et al* 2013). The overall prevalence of overweight was 26.4% (18.2% in females and 8.2% in males), while the overall prevalence of obesity was 16.9% (15.5% in females and 1.4% in males) (Aryee *et al* 2013). Other factors associated with a higher BMI included increasing age, increased years of service and skipping meals (Aryee *et al* 2013).

According to Goon, Maputle, Olukoga, Lebese, Khoza & Ayanwu (2013), factors leading to overweight and obesity among South African nurses was a diet high in staples such as maize meal and rice, resulting in an increased energy intake. A high energy intake coupled with poor physical activity levels results in a positive energy balance and overweight and obesity (Goon *et al* 2013). Another contributing factor was a poor knowledge of the health consequences of overweight and obesity (Goon *et al* 2013). Kyle, Willis, Mahoney, Hoyle, Kelly & Atherton (2017), noted that working shifts and disruptive working patterns contributed to the high prevalence of overweight and obesity among allied healthcare workers. The prevalence of obesity was significantly higher among allied healthcare workers who fell into the same socio-economic group; however, they did not work shifts (Kyle *et al* 2017). This suggests a possible link between obesity prevalence and disruptive working patterns such as working shifts (Kyle *et al* 2017). A study conducted by Simfuke *et al* (2017), on 18 health workers in Pietermaritzburg (PMB), KwaZulu-Natal (KZN), South Africa (SA), found that although

nurses had some knowledge on obesity, these participants stated that they continued to consume unhealthy meals, as they were convenient. Nurses also reported that there were not many healthy food options to choose from at the hospital cafeteria (Simfuke *et al* 2017). Other factors contributing to obesity included consuming meals late, eating during stressful periods, low physical activity levels and cultural beliefs regarding a larger body size (Obirikorang *et al* 2016; Chithambo & Huey 2013).

In SA, there is a popular cultural belief that a larger body size is an indication of health, happiness, prosperity, strength, esteem and dignity (Puoane, Fourie, Shapiro, Rosling, Tshaka & Oelefse 2005). However, a smaller body size is linked to illness and disease (Matoti-Mvalo & Puoane 2011). Simfuke *et al* (2017), who found that participants believed that thin people were unhealthy, also reported similar findings. Some participants were afraid of living a healthy lifestyle due to the fear of others thinking that they had human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) (Simfuke *et al* 2017).

There is a lack of published studies conducted in PMB, KZN investigating the prevalence of overweight and obesity in nurses, as well as the contributing factors. This study aimed to investigate the anthropometric status and dietary habits of Registered Nurses (RNs), Enrolled Nurses (ENs) and Enrolled Nursing Auxiliaries (ENAs) working at a private hospital in PMB, KZN. This study provides important baseline data in an area that has not been well researched. It is important to determine the factors contributing to overweight and obesity among nursing staff in order to develop strategies to prevent and treat this important health issue.

1.2 Statement of the problem

This study aimed to investigate the anthropometric status and dietary habits of RNs, ENs and ENAs working at a private hospital in PMB, KZN.

1.3 Research objectives

The following objectives were investigated:

1.3.1 To determine the anthropometric status of RNs, ENs and ENAs working at a private hospital in PMB, KZN.

1.3.2 To determine the dietary habits of RNs, ENs and ENAs working at a private hospital in PMB, KZN.

1.3.3 To determine the factors contributing to the anthropometric status and dietary habits of RNs, ENs and ENAs working at a private hospital in PMB, KZN.

1.3.4 To determine the prevalence of NCDs among RNs, ENs and ENAs working at a private hospital in PMB, KZN.

1.4 Hypotheses

1.4.1 There is a high prevalence of overweight and obesity among RNs, ENs and ENAs working at a private hospital in PMB, KZN.

1.4.2 The energy and macronutrient intake of the RNs, ENs and ENAs is higher than their requirements.

1.4.3 The factors that contribute to overweight and obesity among the RNs, ENs and ENAs include shift times, less time to prepare healthy meals, erratic meal times, low availability of healthy snacks and meal items and low physical activity levels.

1.4.4 There is a high prevalence of NCDs among the RNs, ENs and ENAs.

1.5 Study parameters

1.5.1 Only private hospitals were invited to participate in the study because nurses working at public hospitals benefit from free wellness days and have access to an occupational health doctor, which is not the case in the private sector.

1.5.2 Although four private hospitals were invited to participate in the study, only one private hospital agreed to participate. However, the private hospital requested not to be named in this study.

1.5.3 This study was limited to RNs, ENs and ENAs working at one private hospital in PMB, KZN.

1.5.4 RNs, ENs and ENAs who were pregnant at the time of the study were not included in the study.

1.5.5 Anthropometric status was assessed using weight, height, BMI and WC only.

1.5.6 Dietary habits were assessed using a 24-hour recall and quantitative food frequency questionnaire (FFQ) only.

1.5.7 The intake of energy, macronutrients and micronutrients was compared to the dietary reference intakes (DRIs) only, specifically the estimated average requirement (EAR) or adequate intake (AI). The AI was used when no EAR value was available.

1.6 Assumptions

The following assumptions were made:

1.6.1 Participants understood the questionnaire.

1.6.2 Participants were honest when answering the questionnaire.

1.6.3 Participants were honest when providing the 24-hour recall and answering the FFQ.

1.7 Definitions of terms

Adequate intake (AI): The recommended average daily intake level based on estimates of nutrient intake by a group of healthy people that are expected to be adequate; it is used when the recommended dietary allowance (RDA) cannot be determined (Institute of Medicine 2006, p8).

Anthropometric status: In adults, anthropometric status is determined by BMI, which can indicate underweight normal weight, overweight or obesity (Bhattacharya, Pal, Mukherjee & Roy 2019).

Body mass index (BMI): An index that is used to classify the degree of overweight and obesity in adults. BMI can be calculated using an equation of weight in kilograms divided by height squared and is given in kg/m^2 (WHO 2017b).

Dietary intake: Dietary intake refers to the mean nutrient intake of a group that is obtained using a 24-hour recall, food records or FFQ (Johnson 2002).

Enrolled nurse (EN): Nurses that perform restricted nursing duties and report to registered nurses (Maidment 2018).

Enrolled nursing auxiliary (ENA): Nurses that perform basic nursing tasks and patient care. They also report to registered nurses (Maidment 2018).

Estimated average requirement (EAR): An estimated daily value for a specific nutrient that meets 50% of the requirements of a specific gender and age category (Institute of Medicine 2006, p8).

Non-communicable diseases (NCDs): Diseases that result from lifestyle, genetic, environmental and physiological factors. NCDs include diabetes, hypertension, heart disease, cancer and musculoskeletal disorders (WHO 2017a).

Obesity: A condition where excess fat is stored in the body over time, resulting in a BMI of 30 kg/m^2 or higher (WHO 2017b; CDC 2016).

Overweight: A condition where excess fat is stored in the body over time, resulting in a BMI of 25-30 kg/m^2 (WHO 2017b; CDC 2016).

Prevalence: The proportion of a given population who have a specific condition in a specific period (National Institute of Mental Health 2017).

Private hospital: A hospital run by big corporate companies that aim to make a profit (Heywood, Hassim & Berger 2007, p174). Citizens have access to private healthcare via medical aid schemes, out-of-pocket expenses or work compensation (Heywood *et al* 2007, p174). The services offered are independent of each other and aim to make a profit from the service rendered (Heywood *et al* 2007, p173).

Registered Nurse (RN): Nurses who are in charge of typical nursing duties and supervise ENs and ENAs (Maidment 2018).

Waist circumference: A measurement of the circumference of the waist, taken on the uppermost lateral border of the right ilium of the pelvis (CDC 2007). WC measurements assist with assessing the risk for obesity-related conditions such as hypertension, heart disease and diabetes. Abdominal fat, more specifically visceral fat, is more associated with NCDs than a high BMI (WHO 2015).

1.8 Summary

Overweight and obesity are on the rise globally and in SA. Overweight and obesity increase the risk for NCDs, morbidity and mortality. There is also evidence of a rising prevalence of overweight and obesity among healthcare professionals, including nurses. Factors leading to overweight and obesity in nurses include a high energy intake, poor physical activity levels, poor knowledge of the health consequences of overweight and obesity, working shifts, eating meals late, eating during stressful periods, low physical activity levels and cultural beliefs regarding larger body weights. The issue of overweight and obesity among nurses should be addressed as they are seen as role models to patients and also spend the most time with their patients compared to other healthcare workers. Apart from being role models to their patients, nurses also need to take care of their own well-being and protect themselves from obesity-related diseases. Due to a lack of published data in this area, this study aimed to investigate the anthropometric status and dietary habits of RNs, ENs and ENAs working at a private hospital in PMB, KZN. Chapter 2 will review the related literature on overweight and obesity.

CHAPTER 2
REVIEW OF RELATED LITERATURE

2.1 Introduction

Obesity has been on a rapid rise globally over the last few decades (WHO 2018a). The prevalence of obesity around the world nearly tripled between 1975 and 2016 (WHO 2018a). Unbalanced diets combined with sedentary lifestyles are a major contributor to this alarming trend (DOH 2016b). Overweight and obesity are strong risk factors for NCDs such as diabetes, cardiovascular disease (CVD), musculoskeletal disorders and some cancers (WHO 2018a). The risk for NCDs increases as BMI increases (WHO 2018a). Obesity can reduce life expectancy by three to 10 years depending on its severity [National Health Service (NHS) 2019c].

Health care workers are considered important in fostering the decrease of the obesity burden (Ogunjimi, Ikorok & Olayinka 2010). Nurses in particular, make up a large portion of the healthcare team (Ogunjimi *et al* 2010). They usually spend the most time with patients and therefore have a major role to play in promoting good health and weight management (Aryee *et al* 2013). However, it seems that nurses are also part of the global epidemic of obesity and have become too tired to perform required daily nursing tasks (Aryee *et al* 2013). This chapter reviews the prevalence, causes, complications and management of overweight and obesity in the general population and specifically amongst nurses.

2.2 Overweight and obesity

2.2.1 Prevalence

Globally, obesity has increased three-fold over the past 43 years (WHO 2017b). In 2016, 1.9 billion adults had a BMI $\geq$ 25 kg/m^2 (WHO 2017b). Of the 1.9 billion adults who had a BMI greater than normal (18.5-24.9 kg/m^2), 650 million were classified as obese (BMI $\geq$30 kg/m^2) and 1.25 billion were classified as overweight (BMI= 25-30 kg/m^2) (WHO 2017b). The prevalence of overweight in African countries ranges from 12% to 60%, with a median of 35% (WHO 2015). This reveals that more than 1 in 3 adults in African countries are overweight (WHO 2015). The prevalence of obesity in Africa ranges from 2% to 27% with a median of 12% (WHO 2015). This indicates that more than one tenth of the African population is obese (WHO 2015). Statistics also show that females in Africa are two times more likely to be overweight and seven times more likely to be obese than African males (WHO 2015).

In SA, males have an average BMI of 23.6 kg/m^2, whereas females have a significantly higher average BMI of 28.9 kg/m^2 (Shisana *et al* 2013). The prevalence of overweight and obesity among South African females is 24.8% and 39.2%, respectively and 20.1% and 10.6%, respectively, among males (Shisana *et al* 2013). The SADHS of 2016 reported that in men older than 15 years, the prevalence of overweight and obesity was 20.3% and 11%, respectively, while the prevalence of overweight and obesity in females over 15 years was 26.6% and 41.0%, respectively (DOH 2016a).

Shukla, Kumar & Singh (2014) conducted a study to investigate the link between obesity and morbidities such as diabetes, angina, hypertension, stroke, arthritis and depression. Countries investigated included SA, India, China and Russia (Shukla *et al* 2014). The highest prevalence of obesity was found in SA (35%), followed by Russia (22%), China (5%) and India (3%) (Shukla *et al* 2014). In all four countries, diabetes and high blood pressure was associated with overweight and obesity. In all four countries besides India, obese subjects were more likely to report having arthritis (Shukla *et al* 2014). Depression and stroke were not associated with overweight and obesity in this study (Shukla *et al* 2014). Female subjects had a higher prevalence of obesity and overweight compared to men in all four countries (Shukla *et al* 2014).

2.2.2 Causes

According to the CDC (2017), obesity is a complicated health problem to manage and improve and can have multiple causes. These include behavioural factors, community environment, genetics, age, medical diseases, and medication (CDC 2017). Behavioural factors can be further classified into diet, physical activity, stress and sleep patterns (CDC 2017).

2.2.2.1 Behavioural factors

Behavioural factors that cause obesity include diet, physical activity, and stress and sleep patterns (CDC 2017). According to The Cancer Association of South Africa (2019), the main cause of overweight and obesity is an imbalance between energy intake and energy expenditure. Worldwide, there has been an increase in the intake of high energy foods (The Cancer Association of South Africa 2019). Together with an increase in the intake of high energy foods, there has also been a decrease in physical activity due to jobs being more sedentary, modification of transport options as well as urbanisation (The Cancer Association of South Africa 2019). An excessive energy intake together with a sedentary lifestyle results in a positive energy balance, which leads to weight gain and subsequent overweight and obesity (The Cancer

Association of South Africa 2019). According to Eckel, Bays, Klein & Horn (2016), it has become easier to gain weight in the present modernised environment as there is an abundance of food available, an increase in sedentary lifestyles, effective marketing strategies and labour-saving devices (Eckel *et al* 2016).

Energy balance refers to a state where energy consumed is equal to energy expended. Many factors affect energy balance (European Food Information Council 2019). These factors include diet, physical exercise, body muscle, body fat and genetics (European Food Information Council 2019). According to the British Nutrition Foundation (2018b), for an individual to maintain their body weight, energy intake should be equivalent to energy expenditure. Energy balance can be achieved by regulating energy intake through diet, as well as energy expenditure through physical activity, or both (British Nutrition Foundation 2018b). Weight gain is a result of a positive energy balance, whereby energy intake exceeds energy expenditure (British Nutrition Foundation 2018b). Weight loss results when energy expenditure exceeds energy intake (British Nutrition Foundation 2018b).

2.2.2.2 Genetics

According to the Obesity Medicine Association (2018), multiple genes predispose obese individuals to gain additional weight. One of these genes is the fat mass and obesity-associated gene (FTO), which is found in approximately 43% of individuals (Obesity Medicine Association 2018). When FTO is present, individuals gain weight by decreased satiety coupled with excessive hunger, leading to an excessive caloric intake (Obesity Medicine Association 2018). These individuals have less control over their eating patterns and tend to have lower physical activity levels (Obesity Medicine Association 2018).

Other genes associated with obesity include brain-derived neurotrophic factor (BDNF), melanocortin 4 receptor (MC4R), peroxisome proliferator-activated receptor gamma (PPARG and kinase suppressor of ras 2 (KSR2) (Fairbrother, Kidd, Malagamuwa & Walley 2018). BDNF is associated with excessive eating, severe obesity, hyperactivity and impaired brain function (Fairbrother *et al* 2018). MC4R stimulates appetite when it is bound by alpha-melanocyte stimulating hormone (CDC 2013a). PPARG encourages lipid uptake and stimulates the development of fat tissue (CDC 2013a). KSR2 is associated with excessive eating, uncontrolled desire for food, reduced basal metabolic rate and insulin resistance (Fairbrother *et al* 2018).

According to the National Institute of Health (2019), Prader-Willi syndrome is a rare complicated genetic disorder, which affects one in 10 000 to 30 000 people globally. It affects multiple body functions and results from the reduced function of genes in chromosome 15 or the rearrangement of an individual's chromosomes (National Institute of Health 2019). According to Driscoll, Miller, Schwartz & Cassidy (2017, pp7-8), one of the characteristics of Prader-Willi syndrome is the alteration of appetite and obesity. An abnormality in the hypothalamus, which prevents the individual from reaching satiety is believed to cause excessive eating (Driscoll *et al* 2017, pp7-8). Common traits include stealing food, hoarding food, food-seeking behaviour and eating inedible objects (Driscoll *et al* 2017, p7-8). There is a decreased total energy requirement with Prader-Willi syndrome, which is a result of a lower resting energy expenditure (REE) due to lower activity and lean muscle mass, compared to individuals without the disorder (Driscoll *et al* 2017, pp7-8). Obesity in Prader-Willi syndrome is usually central and affects the abdominal area, buttocks and thighs (Driscoll *et al* 2017, pp7-8). Obesity and the complications of obesity in Prader-Willi syndrome are the main causes of morbidity and mortality (Driscoll *et al* 2017, pp7-8).

2.2.2.3 Medical diseases

Underactive thyroid

The thyroid is an endocrine gland that produces thyroid hormones known as thyroxine (T4) and triiodothyronine (T3) (American Thyroid Association 2016). When there is not enough T4 and T3 being secreted, the pituitary gland releases thyroid stimulating hormone (TSH), which stimulates the thyroid to produce more thyroid hormones (Pirahanchi, Toro & Jialal 2019, pp1-2). Thyroid hormones are involved in important processes for optimal growth and development as well as energy metabolism (Mendoza & Hollenberg 2017). Bjergved, Jorgensen, Perrild, Laurberg, Krejbjerg, Ovesen, Rasmussen & Knudsen (2014), conducted a longitudinal study in Denmark to test the association between TSH and weight. The study concluded that TSH levels did not determine changes in future weight and BMI did not determine TSH changes (Bjergved *et al* 2014). However, changes in the levels of TSH seemed to be positively associated with weight change in both males and females (Bjergved *et al* 2014). For every one unit increase in TSH, weight increased by 0.3 kg in females and 0.8 kg in males (Bjergved *et al* 2014).

Cushing's syndrome

According to the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) (2018), Cushing's syndrome is a disorder in which the body makes too much of the stress hormone cortisol. Cortisol is made by the adrenal glands and regulates blood pressure and blood glucose, decreases inflammation and turns food into energy (NIDDK 2018). Weight gain is a symptom of Cushing's syndrome (NIDDK 2018). According to the National Organisation for Rare Disorders (2017), individuals with this disorder gain a large amount of weight. Fat accumulates around the facial area causing a "moon shaped face" (National Organisation for Rare Disorders 2017). Fat is also deposited in the neck and upper back. Central obesity occurs, while the arms and legs remain thin (National Organisation for Rare Disorders 2017).

2.2.2.4 Medication

Antidiabetic medication such as insulin, meglitinides, sulfonylureas, and thiazolidinediones (TZDs) are known to cause weight gain (University of Rochester Medical Centre 2019). According to Obesity Action Community (2013), these could cause up to 8 kg of weight gain in an intensive 90-day treatment course. According to Wilcox (2005), insulin regulates blood glucose levels by promoting glucose uptake by body cells. This regulates carbohydrate, protein and lipid metabolism in the body (Wilcox 2005). Because insulin helps to move blood glucose into cells to be stored and used for energy, it inherently promotes weight gain (American Diabetes Association 2019). According to the American Diabetes Association (2019), other diabetic medication can cause weight gain mainly by increasing insulin in the body. Insulin, meglitinides and sulfonylureas facilitate weight gain by reducing glucose excretion via the urine (American Diabetes Association 2019). This results in the body reabsorbing the glucose and storing the reabsorbed glucose as fat (American Diabetes Association 2019). According to Wilding (2006), TZDs can cause a mean weight increase of 3-4 kg over the initial six months of treatment. TZDs are associated with fat redistribution, specifically increased peripheral subcutaneous fat and decreased visceral fat (Wilding 2006). Weight gain from TZDs can also be caused by water retention as it causes reabsorption of sodium in the kidney's distal tubules (Wilding 2006).

Corticosteroids such as Prednisone also contribute to weight gain due to fat redistribution, fluid retention and an increased appetite (University of California San Francisco 2019). Prednisone is responsible for fat redistribution of the abdominal area, back of the neck and face. Higher

doses of Prednisone and longer treatment times are associated with significant changes in fat redistribution (University of California San Francisco 2019).

Anti-epileptic drugs such as gabapentin and pregabalin are also responsible for weight gain (Epilepsy Research UK 2014). BDNF is a protein known for its function in appetite suppression (Epilepsy Research UK 2014). If BDNF levels drop, an individual is more prone to consume excess energy, which puts them at risk for obesity (Epilepsy Research UK 2014). The function of BDNF is dependent on a protein called alpha 2 delta 1 (Epilepsy Research UK 2014). Alpha 2 delta 1 is inhibited by certain constituents found in anti-epileptic drugs (Epilepsy Research UK 2014).

2.2.3 Complications

Complications of obesity can affect an individual's quality of life (NHS 2019c). It is important to address obesity as it has many health-related complications. These complications include diabetes, hypertension, CVD and certain cancers (NHS 2019c).

2.2.3.1 Type 2 diabetes mellitus

T2DM is a chronic disease that involves abnormal carbohydrate and fat metabolism in the body (Scheen 2003). Both genetics and environmental factors affect beta-cell function and insulin sensitivity. Most individuals who have T2DM are also obese, with central visceral adiposity. Therefore, adipose tissue plays an important role in the development of T2DM (Scheen 2003). It was found that for each kilogram of weight gained in overweight individuals every year over 10 years, there was a 49% increase in the risk of developing T2DM in the subsequent 10 years (Resnick, Valsania, Halter & Lin 2000). A 33% reduced risk of T2DM was noted for each kilogram of weight lost every year, over 10 years (Resnick *et al* 2000). According to the WHO (2018b), in 2016, diabetes was responsible for 1.6 million deaths worldwide. The number of deaths has increased drastically since 2000, when diabetes was responsible for 1 million deaths (WHO 2018b).

Kengne (2017) investigated the trends in obesity and diabetes across Africa from 1980 to 2014. In 2014, a solid positive association was noted between the mean BMI and prevalence of diabetes in both males and females. Between 1980 and 2014, the age-standardised average BMI for males increased from 21.0 kg/m^2 to 23.0 kg/m^2, and from 21.9 kg/m^2 to 24.9 kg/m^2 for females (Kengne 2017). The age-standardised prevalence of diabetes increased in males from

3.4% to 8.5%, and from 4.1% to 8.9% in females, between 1980 and 2014 (Kengne 2017). Ganz, Wintfeld, Li, Alas, Langer & Hammer (2014), investigated the association of BMI with the risk of T2DM. It was found that individuals classified as overweight or obese were more likely to be diagnosed with T2DM, when compared to those with a normal BMI (Ganz *et al* 2014). For overweight and obese individuals, the risk of developing T2DM was approximately 1.5-5 times greater than for individuals who had a normal BMI (Ganz *et al* 2014). This emphasises the importance of weight management in reducing the burden of disease associated with obesity and possibly avoiding further progression to T2DM (Ganz *et al* 2014).

A study conducted in the United States of America (USA) showed that obesity classified by a high BMI and high WC, indicated a higher risk for T2DM, due to the higher level of visceral fat (Wang *et al* 2005). WC may be a better predictor of visceral fat than BMI alone (Wang *et al* 2005). Subjects with both a high BMI (> 30 kg/m^2) and increased WC (men with WC > 102cm), had more than double the risk of developing T2DM, compared to those who only had a BMI > 30 kg/m^2 (Wang *et al* 2005). The metabolism of insulin is negatively affected by an accumulation of visceral fat, which is due to the release of free fatty acids, which in turn causes hepatic insulin resistance (Ebbert & Jensen 2013). Gluconeogenesis (glucose production) is known to increase when visceral fat increases (Ebbert & Jensen 2013). According to Jung, Ha & Kim (2016), visceral fat is a strong predictor for T2DM.

Tavares, Reis, Dias & Lopes (2010), conducted a descriptive, observational, cross-sectional study to identify the prevalence of T2DM, risk factors, and stress and health-care activities performed by diabetic nurses. The study was conducted in the Clinical Hospital of the Federal University of Triângulo Mineiro in Brazil (Tavares *et al* 2010). Of the 618 nurses who participated, 330 participants were nursing technicians, 204 were nursing auxiliaries and 84 were registered nurses. Just over 3% had diabetes, 75% had a co-morbidity, while 15.4% reported a diabetic complication, the most common being diabetic neuropathy. Results showed that all diabetes risk factors were present in nurses. Just over 60% reported having a sedentary lifestyle, while 45.3% were overweight and 32.9% obese (Tavares *et al* 2010).

2.2.3.2 Hypertension

Hypertension can be defined as blood pressure above 140/90 mmHg. Globally, 4 in 10 individuals have high blood pressure (South African Hypertension Society 2019). Hypertensive individuals are at risk for CVD, strokes, renal failure and sudden death (South African

Hypertension Society 2019). Hypertension accounts for 1 in every 2 strokes as well as 2 in every 5 heart attacks in SA (The Heart and Stroke Foundation South Africa 2017a). More than 1 in 3 adults in SA have hypertension (The Heart and Stroke Foundation South Africa 2017a). Obesity is a risk factor for high blood pressure (NHS 2019c). Muga, Owili, Hsu, Rau & Chao (2017) conducted a cross-sectional study in Taiwan which included 62 965 participants over the age of 40 years (Muga *et al* 2017). The study found that participants who had a systolic blood pressure greater than 120 mmHg or a diastolic blood pressure greater than 80 mmHg, were more likely to be overweight or obese (Muga *et al* 2017).

A cross-sectional, population study in the Eastern Cape Province in SA involving 203 primary health care (PHC) professionals from 41 PHC facilities, found that 52% of the individuals who participated in the study were hypertensive (Monakali, Goon, Seekoe & Owolabi 2018). An alarming 41% of the hypertensive participants were not aware of their condition (Monakali *et al* 2018). This is a concern, as hypertension is known as a "silent killer" due to it being asymptomatic, while silently affecting many organs in the body (Monakali *et al* 2018). Just over 38% of hypertensive participants who were aware of their condition, were controlled (Monakali *et al* 2018). The study showed that obesity, age, alcohol use, income and years of practice amongst professional nurses were associated with the prevalence of hypertension. Approximately 58% of obese participants were also hypertensive (Monakali *et al* 2018).

2.2.3.3 Cardiovascular disease

The heart acts as a pump to ensure that blood is pumped throughout the body (The Heart and Stroke Foundation South Africa 2017e). When blood is pumped throughout the body, it delivers oxygen and nutrients to cells, while removing waste products and carbon dioxide (The Heart and Stroke Foundation South Africa 2017e). Oxygen-rich blood is carried from the heart through the arteries (The Heart and Stroke Foundation of Canada 2018). The veins carry oxygen-poor blood back to the lungs and heart and the process recommences (The Heart and Stroke Foundation of Canada 2018). When the arteries become narrowed or blocked, the heart is deprived of oxygen and this prevents the heart from working properly (The Heart and Stroke Foundation of Canada 2018). This is also known as coronary artery disease (CAD) (The Heart and Stroke Foundation South Africa 2017e).

Ischaemic heart disease and stroke accounted for a combined 15.2 million deaths, making them the world's main killers (WHO 2018b). In SA, CVD is the leading cause of death. One in six

deaths, which equates to 17.3% of deaths are a result of CVD. A total of 215 people die every day in SA from heart disease or strokes (Msemburi, Pillay-van Wyk, Dorrington, Neethling, Nannan, Groenewald, Laubscher, Joubert, Matzopoulos, Nicol, Notilana, Prinsloo, Sithole, Somdyala & Bradshaw 2016; Statistics South Africa 2016). In SA, the underlying causes of death as a result of diseases of the circulatory system increased from 17.4% in 2014 to 18.5% in 2016 (Statistics South Africa 2016).

Risk for cardiac failure is significantly increased in obese individuals due to its negative effects on systolic and diastolic left ventricle dysfunction (Lavie, Alpert, Arena, Mehra, Milani & Ventura 2013). Tumor necrosis factor alpha (TNF-α) is a cell signalling protein that is involved in systemic inflammation (Badawi, Klip, Haddad, Cole, Bailo, El-Sohemy & Karmali 2010). TNF-α is overexpressed when an individual is overweight (Badawi *et al* 2010). Interleukin 6 acts as a pro-inflammatory cytokine as well as an anti-inflammatory myokine (IL-6) (Badawi *et al* 2010). IL-6 is linked more to the obese state of an individual and promotes the synthesis and release of C-reactive protein (CRP), which is a factor of systemic inflammation (Badawi *et al* 2010). This state is linked to a decreased level of adiponectin, which is essential in improving insulin sensitivity, reducing metabolic abnormalities and correcting energy expenditure (Badawi *et al* 2010). Vascular and endothelial dysfunction follow the inflammatory state (Badawi *et al* 2010). This is characterised by reduced nitric oxide and raised reactive oxygen species, which in turn leads to oxidative stress (Badawi *et al* 2010). Oxidative stress together with inflammation initiate atherosclerosis, hypertension, alteration of metabolic markers, and are therefore major negative cardiovascular events (Badawi *et al* 2010).

A cross-sectional study conducted on 453 nurses in East Iran, Birjand educational hospitals, aimed to assess cardiovascular risk factors in nurses (Kazemi, Sharifzadeh, Javadinia & Salehiniya 2015). These risk factors included dyslipidaemia, central obesity, overweight, obesity, hypertension, diabetes and smoking. The study revealed that dyslipidaemia (70%) was the most prevalent cardiovascular risk factor, followed by overweight (40%) and central obesity (37.7%). The lowest prevalence was seen with smoking (3.1%), diabetes (3.1%) and hypertension (9.1%). The study concluded that educational programs should be aimed at nurses and should emphasise decreasing cardiovascular risk factors (Kazemi *et al* 2015). Apart from obesity being a risk factor for CVD, individuals who have CVD are more likely to be overweight or obese (Muga *et al* 2017).

2.2.3.4 Cancer

According to The National Cancer Institute (2019), many factors can contribute to cancer. These factors include lifestyle, environment and genetics. Changes in diet and lifestyle are highlighted as ways to prevent cancer. Modifiable risk factors that may affect cancer risk include obesity, diet, physical activity, alcohol and diabetes. The National Cancer Institute (2019) has indicated that tobacco and cigarette smoking has a strong link with certain cancers. These cancers include cancers of the lung, stomach, kidney, pancreas, oesophagus, oral cavity, cervix and bladder. Alcohol intake is linked to an increased risk for liver cancer, breast cancer, oral cancer, oesophageal cancer and colorectal cancer in both men and women (The National Cancer Institute 2019).

Overweight and obesity are risk factors for some cancers such as colon, endometrial, breast, prostate, ovarian, liver, gallbladder and kidney. Every year in SA, 115 000 individuals are diagnosed with cancer, however, only 60% of individuals with cancer survive. One in seven men are at risk for prostate cancer, colorectal cancer, lung cancer and Karposi's sarcoma, while one in eight women are at risk for breast cancer, cervical cancer, colorectal cancer and cancer of the uterus (The Cancer Association of South Africa 2019; The Cancer Association of South Africa 2014).

In 2012, it was found that 3.6% of all cancers globally were attributable to a high BMI. This equates to 481 000 new cancer cases, with 1.9% (136 000 cases) found in males and 5.4% (345 000 cases) in females (Arnold, Pandeya, Byrnes, Renehan, Stevens, Ezzati, Ferlay, Miranda, Romieu, Dikshit, Forman & Soerjomataram 2015). A large prospective study investigated the risk of cancer in 43 316 nurses in Norway (Lie, Andersen & Kjaerheim 2007). There was a high risk of breast cancer, ovarian cancer, malignant melanoma and skin cancer (Lie *et al* 2007). Results indicated an increased risk between breast cancer and malignant myeloma and working as a nurse (Lie *et al* 2007).

2.4 Management of overweight and obesity

2.4.1 Diet

Following a healthy diet can improve health (Reed 2014). For those who are overweight or obese, the first line of treatment should be lifestyle intervention that includes dietary modification and physical activity (Eckel *et al* 2016). South Africans are encouraged to follow the food based dietary guidelines (FBDGs), which were developed for individuals five years

and older (Food and Agriculture Organization of the United Nations 2019). Eleven statements make up the South African FBDGs (Vorster, Badham & Venter 2013). The FBDGs encourage South Africans to enjoy a variety of foods, be active, make starchy foods part of most meals, as well as eat dry beans, split peas, lentils and soya regularly (Vorster *et al* 2013). South Africans are advised to have milk, *maas* or yoghurt every day and are advised that fish, chicken, lean meat or eggs can be eaten daily (Vorster *et al* 2013). The Heart and Stroke Foundation South Africa (2017c) advises South Africans to cut down on foods with added sugar, salt, saturated fats, *trans* fats and alcohol. When choosing fats, South Africans are also encouraged to choose healthy fats such as olive oil, canola oil, nuts, seeds and avocados (The Heart and Stroke Foundation South Africa 2017c). Individuals who consume larger amounts of meat and processed foods are more likely to be overweight or obese as well as individuals who smoke and consume alcohol (Muga *et al* 2017).

One of the FBDGs states that South Africans should eat plenty of vegetables and fruit daily (Vorster *et al* 2013). This specific FBDG aims to improve fruit and vegetable consumption among South Africans, which in turn may decrease the burden of NCDs (Naude 2013). This is because South Africans do not consume enough fruit and vegetables on a daily basis (Naude 2013). A cross-sectional study investigating dietary patterns, gender, and weight status among middle-aged and older adults in Taiwan, found that individuals who had a higher intake of fruit and vegetables, were less likely to be underweight, overweight or obese (Muga *et al* 2017).

Individuals should drink lots of clean, safe water as part of a healthy diet (Vorster *et al* 2013). Water has many notable functions in the body (Harvard Health Publishing 2018). These functions include aiding digestion, preventing constipation, blood pressure and heartbeat stabilisation, regulating body temperature, maintaining sodium balance in the body, flushing out bladder bacteria, protecting organs and tissues as well as transporting nutrients and oxygen to cells (Harvard Health Publishing 2018). Water is recommended over sugar-sweetened beverages as water contains no sugar and kilojoules. Sugar-sweetened beverages can contain up to 15 teaspoons of sugar (1 275 kJ) per 500 ml (Diabetes South Africa 2017). In adults, the daily consumption of a sugar-sweetened beverage increases the risk of overweight by 27% (Diabetes South Africa 2017).

It is suggested that individuals should adhere to basic nutrition principles such as portion control, variety and consistency (Reed 2014). A simple way to stick to healthy portions is to

use the plate model (The Heart and Stroke Foundation South Africa 2017c). South Africans are encouraged to enjoy a variety of foods in healthy portion sizes (The Heart and Stroke Foundation South Africa 2017c). It is advised that at meal times, individuals should fill half of their plate with non-starchy vegetables, a quarter with high fibre carbohydrates and a quarter with lean protein (The Heart and Stroke Foundation South Africa 2017c).

2.4.2 Physical activity

The Heart and Stroke Foundation of South Africa (2017b) recommends that adults should participate in 150 minutes of moderate intensity exercises or 75 minutes of intense aerobic activities every week. This can be divided over five days with 30 minutes of exercise on each day (WHO 2019). This should be done in bouts of at least ten minutes at a time (WHO 2019). It is suggested that a minimum of two days a week should be spent doing muscle-strengthening exercises as it has additional health benefits (The Heart and Stroke Foundation of South Africa 2017b). Exercise can assist in maintaining energy balance or creating an energy deficit, which could result in maintaining or losing weight (British Nutrition Foundation 2018b). It can also assist an individual to maintain a healthier body composition (WHO 2019). Apart from the weight management effects of exercise, exercise can also reduce the risk of NCDs (such as hypertension, T2DM, stroke, heart disease, metabolic syndrome, colon cancer and breast cancer), improve cardiovascular health, enhance muscular fitness, improve bone health (by lowering the risk of fracturing the hips or vertebra) as well as depression (WHO 2019).

2.4.3 Control of advertising

Although most studies on obesity and food advertising are conducted in children, Zimmerman & Shimoga (2014) highlighted the effects of food advertising on the food choices of the adult population. A total of 351 University of California, Los Angeles students 18 years and older participated in the study and were divided into four experimental groups. These groups included exposure to food advertising and exposure to non-food advertising. The two groups were each further divided into high cognitive load and low cognitive load. Snack tables were provided and participants were observed (Zimmerman & Shimoga 2014). It was found that the food-advertising group, compared to the non-food advertising group, consumed a larger amount of food. There was a significant difference in energy consumed in the group exposed to food advertising, compared to the group exposed to non-food advertising. Participants exposed to food advertising took a set of snacks that contained 65 calories more than the non-food advertising group. When compared to the non-food advertising group, the food-advertising

group chose 28% more unhealthy snacks. The study showed that participants of low socio-economic status were more vulnerable to food advertising. In the high-cognitive load group, participants in the food-advertising group chose a set of snacks that had 94 calories more than the non-food advertising group. In addition to this, their unhealthy snack choices had 107 calories more than the non-food advertising group. The extra energy related to food advertising came from unhealthy food choices. It was concluded that food marketing also affects adults in addition to children. Results showed that food advertising could affect diet and have health-related consequences (Zimmerman & Shimoga 2014).

2.4.4 Improving nutrition knowledge and support

According to Grosso, Mistretta, Turconi, Cena, Roggi & Galvano (2013), nutrition knowledge has the potential to improve diet and lifestyle behaviours. Health education should largely target nutrition knowledge. This would not only encourage healthy dietary and lifestyle behaviours, but also assist in the prevention of overweight and obesity (Grosso *et al* 2013). Ostovan, Zibaeenezhad, Keshmiri & Shekarforoush (2013), conducted a study in Iran to investigate the impact of education on weight loss in overweight and obese adults in Shiraz Healthy Heart House. One hundred and forty subjects with a BMI greater than 25kg/m^2 completed the study's half-year program, which consisted of participants being educated on weight loss related behaviour change and being taught how to record them. A dietitian, exercise specialist and physician gave individual sessions of educational lifestyle counselling (Ostovan *et al* 2013). Subjects were given educational pamphlets about diet and improving physical activity to assist them in remembering what they were taught (Ostovan *et al* 2013). The main finding of this study was that more than two thirds (78.5%) of participants who received intensive lifestyle counselling with two-week follow-ups, reduced their starting weight by 5% or more within three months (Ostovan *et al* 2013).

Effective nutrition interventions in adults include intensive lifestyle counselling (Ostovan *et al* 2013). Lifestyle counselling was shown to be effective in achieving significant weight loss in overweight and obese adults (Ostovan *et al* 2013). This counselling should be conducted by healthcare professionals and should be accompanied by materials such as pamphlets as well as two-week follow-up visits, in order for the intervention to be more effective (Ostovan *et al* 2013).

2.5 Overweight and obesity amongst nurses

2.5.1 Prevalence

Overweight and obesity is on the rise in SA and is becoming more prevalent in occupational and professional groups (Goon *et al* 2013). In England, it was found that nurses had the highest prevalence of obesity when compared to other healthcare workers such as allied professionals, but a lower prevalence when compared to unregistered care workers (Kyle *et al* 2017). Overweight and obesity was also found to be more prevalent in nurse managers or supervisors in a study conducted on actively licensed nurses in the State of California, USA (Chin, Nam & Lee 2016).

Many studies have investigated the prevalence of overweight and obesity in nurses (Kyle *et al* 2017; Chin *et al* 2016; Obirikorang *et al* 2016; Goon *et al* 2013). Goon *et al* (2013) investigated the prevalence of overweight, obesity and underweight among 153 male and female nurses in Limpopo, SA. Participants were divided into four age groups, i.e. 19-29 years, 30-39 years, 40-49 years and 50 years and over. Results showed that the prevalence of underweight, overweight and obesity was 2%, 27.5% and 51.6% (44.2% obesity and 7.2% extreme obesity), respectively. A study conducted in Ghana by Obirikorang *et al* (2016), found a 55.9% prevalence of obesity among nursing staff.

Kyle *et al* (2017) conducted a study to estimate the prevalence of obesity among healthcare workers in England. It was found that the prevalence of obesity was 25.12% among nurses. Nurses in England had a lower prevalence of obesity (25.1%) when compared to nurses in SA, who had an obesity prevalence of 51.6% (44.2% obesity and 7.2% extreme obesity) (Kyle *et al* 2017; Goon *et al* 2013). Chin *et al* (2016) conducted a cross-sectional study to investigate occupational factors associated with obesity and leisure-time physical activity among nurses. Of the randomly selected 394 nurses, 31% of participants were overweight and 18% were obese (Chin *et al* 2016).

Goon *et al* (2013) found that the prevalence of overweight and obesity increased as age increased. Overweight was found to peak in the 30-39 year group (32.6%), while obesity peaked at 50 years and older (68%) (Goon *et al* 2013). Lower rates of literacy were also linked to higher rates of obesity (Kyle *et al* 2017). A higher prevalence of overweight and obesity was also seen among female nurses with a higher professional ranking (Obirikorang *et al* 2016).

According to Chin *et al* (2016), overweight and obesity was more common amongst nurses who worked full-time or more than 40 hours a week.

2.5.2 Risk factors

According to Miller, Alpert & Cross (2008), nurses have a vital role to play in the fight against obesity and obesity-related health risks. Compared to the general population, nurses may have a higher prevalence of obesity due to many underlying factors (Miller *et al* 2008). Nurses are exposed to various stressful conditions in the workplace (Gupta & Guar 2016). This includes lengthy hours of work, working shifts, high levels of physical and emotional stress; sleep deprivation, exposure to infectious diseases and dealing with suffering, grief and death. Factors contributing to obesity among nurses included consuming meals late, eating during stressful periods and low physical activity levels (Obirikorang *et al* 2016). Nurses often take care of patients at the cost of their own health and well-being. Due to the large number of stressful factors at work, nurses usually have poor eating and lifestyle practices, which may contribute to overweight and obesity in the nursing profession. This in turn puts nurses at risk for nutrition-related health problems (Gupta & Guar 2016). Part of the problem may be that nurses do not fully understand the health consequences of obesity (Miller *et al* 2008).

2.5.2.1 Unhealthy diets

Albert, Butler & Sorrell (2014) conducted a study to investigate factors related to a healthy diet and physical activity among hospital-based clinical nurses in a quaternary care medical centre in Northeast Ohio, USA (Albert *et al* 2014). When it came to dietary patterns, 66.3% of nurses had a fairly healthy diet, 16.7% had a mostly healthy diet and 17% had an unhealthy diet (Albert *et al* 2014). Savoury snacks were commonly consumed and snacking most commonly occurred when nurses were bored. More than 60% of nurses consumed sugar-sweetened beverages. Nurses also reported that they felt responsible for their own diet choices (Albert *et al* 2014).

Participants who were more likely to have a healthy eating pattern, had less barriers to healthy eating, understood that healthy meal choices can have more positive outcomes and had greater self-efficacy for consuming healthy foods in different situations (Albert *et al* 2014) . They were also more likely to eat five portions of fruits and vegetables daily and maintain a healthy weight. Neither an internal or external locus of control were linked to having a healthy diet. However, those nurses whose locus of control was motivated by chance were more likely to follow an unhealthy diet (Albert *et al* 2014).

2.5.2.2 Working hours, shift times and night shift

Kyle *et al* (2017) noted that working shifts and disruptive working patterns might also contribute to the high prevalence of overweight and obesity amongst nurses. The prevalence of obesity was significantly higher among allied healthcare workers who fell into the same socioeconomic group; however, they did not work shifts (Kyle *et al* 2017). This suggests a link between obesity prevalence and disruptive working patterns such as working shifts (Kyle *et al* 2017).

Torquatia, Alexander, Pavey, Persson & Leveritta (2016), conducted a study involving 17 nurses from the Brisbane metropolitan area in Australia to understand diet and physical activity behaviour in nurses. Nurses in the study were aged 25-59 years and were from three different hospitals. Four focus group discussions revealed that one of the main factors preventing nurses from adhering to a healthy diet and doing physical activity was working the night shift. Not being able to take proper breaks and having irregular eating patterns resulted in poor food selection at mealtimes. This was more common during the night shift (Torquatia *et al* 2016). Seychelle & Reeves (2016), who investigated the effect of shift work on the diet of accident and emergency nurses at the main general hospital in Malta, Europe, reported similar findings. It was found that the average BMI of day shift workers and night shift workers was 25.6 kg/m^2 and 27 kg/m^2, respectively, which was classified as pre-obese (Seychelle & Reeves 2016). The average WC of day shift nurses and night shift nurses were 82.4 cm and 91.6 cm, respectively (Seychelle & Reeves 2016). Day shift female nurses and night shift female nurses had an average WC of 80.2 cm and 91.7 cm, respectively (Seychelle & Reeves 2016). This exceeded the normal WC of less than 80 cm in women, indicating an increased risk for metabolic complications (WHO 2011). Day shift male nurses and night shift male nurses had an average WC of 87.3 cm and 92.2 cm, respectively (Seychelle & Reeves 2016), which was classified as normal (WHO 2011).

Barriers that prevented nurses from eating healthily and participating in physical activity included working long shifts together with insufficient time for breaks (Torquatia *et al* 2016). This was due to the demanding nature of work during a long shift. Nurses would then turn to unhealthy meal choices and over indulge due to uncertainty about whether they would have time to eat again during their shift (Torquatia *et al* 2016). Nurses also reported that they ate even when they were not hungry (Torquatia *et al* 2016). Seychelle & Reeves (2016) stated that night shift workers also had significantly higher intakes of total energy, protein, fat and fibre,

when compared to day shift workers. According to Torquatia *et al* (2016), nurses also reported that they regularly consumed energy-dense snacks to help them stay awake at night during the night shift. These energy-dense snacks included chocolate, sugar-sweetened beverages and chips. Working long shifts also led to fatigue (Torquatia *et al* 2016).

2.5.2.3 Stress in the work place

In the study conducted by Torquatia *et al* (2016), subjects stated that stress in the workplace directly affected their eating patterns. Stress and fatigue led to participants eating in response to emotion and losing self-control concerning their diet (Torquatia *et al* 2016). Stress was also linked to craving unhealthy energy-dense food items such as sweets, chocolates and takeaways high in fat and sugar (Torquatia *et al* 2016). Nurses reported that a low mood was a barrier to healthy eating as it influenced them to consume junk food, in order to comfort themselves (Power, Kiezebrink, Allan & Campbell 2017).

Ross, Bevans, Brooks, Gibbons & Wallen (2017) suggest that nurse leaders (nursing managers) should create a positive work environment for nurses, where employees can feel free to discuss workplace stressors as well as challenges that they face in following a healthy lifestyle (Ross *et al* 2017). When decisions are made involving staff, nurse leaders should advocate for supporting nurses who want to switch off their cell phones during meal times or breaks taken for relaxing (Ross *et al* 2017). Nurse leaders should also motivate for outdoor spaces and quiet rooms for meditation, if they do not already have one in the hospital for nursing staff (Ross *et al* 2017).

2.5.2.4 Access to healthy food

Meals offered at the hospital cafeteria are not necessarily healthy (Torquatia *et al* 2016). Nurses stated that it would help them to make better meal choices if healthy meal options were available to them (Torquatia *et al* 2016). It was reported that the quality of meals chosen by nurses was largely influenced by what food was available to them in the hospital (Torquatia *et al* 2016). Nurses also reported that sweets and chocolates were always freely available in the wards (Torquatia *et al* 2016).

Power *et al* (2017) conducted a study to understand the perceived determinants of nurses' eating and physical activity behaviour. While interviewing nurses, it became clear that unhealthy food choices in the workplace triggered over eating. Participants stated that the availability of

healthy food was limited and healthier food choices were a distance away. One of the participants stated that because healthy food choices were limited, they resorted to consuming a packet of potato crisps. Participants also raised the point of financial constraints and the cost of food sold at the canteen. This also affected whether nurses consumed healthy foods or not (Power *et al* 2017).

2.5.2.5 Low physical activity levels

Reed, Prince, Pipe, Attallah, Adamo, Tullocha, Manuel, Mullen, Fodor & Reid (2018), conducted a cross-sectional study involving 140 nurses to investigate the influence of the workplace on physical activity and cardiometabolic health among Canadian nurses. Physical activity levels were divided into four categories and included sedentary, light physical activity, moderate physical activity and vigorous physical activity. Only 23% of nurses met the required physical activity levels of more than 150 minutes per week in bouts of 10 minutes. Nurses who worked eight-hour shifts or fixed shifts accumulated greater moderate to vigorous physical activity levels. It was likely that moderate to vigorous physical activity among nurses took place out of working hours. It was assumed that these nurses had more time to participate in physical activity as their work hours and schedules were more flexible. Nurses, who were tired due to working shifts and long hours, were less likely to participate in physical activity. The average proportion of time nurses spent being sedentary and doing light; moderate and vigorous physical activity was 49.5%, 45.8%, 4.3% and 0.4%, respectively (Reed *et al* 2018).

Albert *et al* (2014) found that although 54% of nurses were active, the level was inadequate. Results showed that 30% of nurses were active and 16% were inactive. Brisk walking was common among nurses in the work place as well as out of the workplace. The most common type of physical activity done by nurses was aerobic exercise. Those subjects who walked at a brisk pace in the workplace and out of the workplace were more physically active. Nurses who walked briskly for at least 10 minutes at a time, had a lower BMI, did not smoke and were confident about their body (Albert *et al* 2014).

In a study conducted by Goon *et al* (2013), more than half (51.5%) of the nurses indicated that they did not participate in physical activity, whereas 48.7% of nurses stated that they participated in physical activity. Another study conducted by Chin *et al* (2016) found that most nurses did inadequate amounts of physical activity. Only 41.3% of nurses met the recommendation for aerobic physical activity (a minimum of 150 minutes a week of aerobic

physical activity), while 56.6% met the recommendation for muscle strengthening physical activity. Just over 32% of nurses did not meet the recommendation for both aerobic and muscle-strengthening physical activity. This poses a major health problem as nurses are expected to encourage patients to live a healthy lifestyle (Chin *et al* 2016).

2.5.2.6 Perception of body image

Another factor contributing to the burden of overweight and obesity in SA includes cultural beliefs regarding a larger body size. A fuller figure is preferred amongst African females as they associate a larger body weight with attractiveness (Chithambo & Huey 2013). African males prefer females with a larger body size (Puoane *et al* 2005). It is believed that a larger body weight and BMI is associated with health, strength, wealth, happiness, respect and dignity (Puoane *et al* 2005). On the other hand, a thin figure is associated with illnesses such as HIV/AIDS (Matoti-Mvalo & Puoane 2011). Skaal & Pengpid (2011) conducted a study with 200 African healthcare workers at a selected tertiary hospital in Pretoria, including both medical and non-medical staff. Just over 73% of healthcare workers were overweight, obese or severely obese (Skaal & Pengpid 2011). Despite this result, 56% of medical staff and 61% of non-medical staff reported that they were satisfied with their weight (Skaal & Pengpid 2011).

2.5.2.7 Nutrition knowledge

Abdollahi, Houshiarrad, Abtahi, Esmaeli, Pouraram, Khoshfetrat, Shakori & Keshel (2013), conducted a study to determine the nutrition knowledge of doctors, nurses and nutritionists in nine teaching hospitals associated with the Shahid Beheshti University of Medical Sciences (SBMU) in Tehran, Iran. A total of 81 nurses, 89 physicians and 28 nutritionists participated in the study. Nurses answered a multiple-choice questionnaire that consisted of 59 questions, grouped as nine different sections. The questionnaire included questions on protein, saturated fat, fibre, salt, calcium and clinical nutrition questions on obesity, gastrointestinal diseases, diabetes, heart disease and cancer. The study concluded that the nutritional knowledge levels of physicians, nutritionists and nurses of SBMU was unsatisfactory. In nurses specifically, 32.1% had weak nutrition knowledge, 24.7% had average nutrition knowledge, 22.2% had good nutrition knowledge and 21.0% had very good nutrition knowledge. Physicians and nurses had incorrect knowledge on nutrition in a quarter of the questions answered and one in three nurses had poor nutrition knowledge (Abdollahi *et al* 2013).

These findings correlate with findings from the study conducted by Miller *et al* (2008), who conducted a study to assess nurses' knowledge of obesity and associated health risks. A total of 760 nurses from the Northeast, East Coast, Midwest, South, Southwest, and Western United States (USA) were asked questions relating to their knowledge of overweight and obesity, how to define obesity, to identify health risks that are related to obesity and their thoughts on weight loss (Miller *et al* 2008). Only 26% of nurses could identify the difference between overweight and obesity (Miller *et al* 2008). Participants were asked to list three to five health risks of obesity. About 4% did not answer the question, while only 41% could list five health risks (Miller *et al* 2008).

Studies by Abdollahi *et al* (2013) and Miller *et al* (2008) concluded that nutrition education is important for nurses. It was suggested that nutrition education and continuous nutrition training should be conducted for health care professionals such as nurses (Abdollahi *et al* 2013). Educating nurses on nutrition would not only assist in patient care for obesity, but also more importantly assist with their own health (Miller *et al* 2008).

2.5.3 Management of overweight and obesity in nurses

2.5.3.1 Improving diet in nurses

Nurses can improve their health by following a healthy diet (Reed 2014). This could also reduce nurses' daily stressors, have a good influence on their health status as well as improve their happiness of work and life. Reed (2014) suggests tips for nurses to encourage them to eat healthily. These tips include taking a packed lunch to work, consuming healthy portion sizes of meals and reducing the consumption of sugar-sweetened beverages. Nurses working long shifts usually consume meals from the cafeteria or fast food restaurants. It is essential to plan meals and pack food for the day. Nurse should pack most meals eaten during the day themselves. This would assist nurses to have more control over what they eat. Treats are acceptable in moderation and should rather be shared among colleagues at work in small portion sizes; however, this should not become a regular routine as it may result in excessive energy intake. Drinking additional calories mindlessly can also contribute to weight gain. Nurses often consume sugar-sweetened beverages, including sports drinks and hot beverages. Therefore, it is advisable that nurses consume water instead of sugar-sweetened beverages, as water contains no energy (Reed 2014).

2.5.3.2 Improving physical activity in nurses

Lin, Huang, Chuang, Tsai & Wang (2018) conducted a cross-sectional study on 172 nurses from public health centres in Kaohsiung, Taiwan. The study investigated physical activity and influencing factors among public health nurses (Lin *et al* 2018). The study found that nurses in the public sector remained sedentary for a period longer than eight hours a day (Lin *et al* 2018). Nurses also participated in less than 30 minutes of moderate physical activity or vigorous physical activity weekly (Lin *et al* 2018). The study concluded that the physical activity levels of nurses in Taiwan were insufficient, thus increasing their health risk (Lin *et al* 2018). The study suggests that emphasising positive attitudes towards physical activity can increase the likelihood of nurses participating in physical activity (Lin *et al* 2018). Nurses should be supported with physical activity courses or programmes to help them increase their physical activity levels (Lin *et al* 2018). Policy makers in government as well as health agencies should tackle this issue (Lin *et al* 2018).

2.5.3.3 Improving nutrition knowledge and support in nurses

According to Reed (2014), although there is a wealth of nutrition knowledge available to the public, it is difficult to tell which of these are evidence-based. In order for nurses to reap the benefits of healthy eating, they need to incorporate the basic nutrition principles, which include variety, portion size and consistency (Reed 2014). According to Ross *et al* (2017), although nurses may have sufficient knowledge of health behaviours, it does not necessarily mean that they apply this knowledge in their own lives. Being unhealthy can have negative effects on the self-confidence of nurses, their productivity and ability to care for patients (Ross *et al* 2017). Nurses should be encouraged to eat well, participate in physical activity and minimise stress (Ross *et al* 2017).

Ross *et al* (2017) highlights the role of nurse leaders (such as nurse managers and shift leaders) as advocates for positive change through means of social support. This would help to minimise workplace barriers to living a healthy lifestyle. Nurse leaders can support and promote positive health behaviours such as heathy eating and being physically active. It was suggested that nurse leaders should conduct a needs assessment for eating patterns and physical activity levels or hold focus group discussions for nurse employees. This could help find the best way to assist employees to lead a healthy lifestyle. Nurse leaders can motivate for healthier food choices at the cafeteria as well as an outside area to consume meals. In addition to this, nurses can motivate for exercise facilities at the workplace (Ross *et al* 2017).

Ross *et al* (2017) states that nurse leaders should lead by example. Leaders should serve as role models of healthy behaviour to their colleagues. Nurses should assess their own patterns of eating, sleeping, exercise, stress and work-life balance (Ross *et al* 2017). They should not contradict themselves but rather encourage other staff members by maintaining their own health and well-being (Ross *et al* 2017). Focus should be placed on providing nurses with in-service nutrition training (Sunguya, Poudel, Mlunde, Urassa, Yasuoka & Jimba 2013). In-service training can take place as workshops, nutrition seminars and continuous professional development. Nutrition education can improve the health and quality of life of healthcare workers (Sunguya *et al* 2013). Nutrition education and improved health would make them more confident and knowledgeable in this area, contributing to positive changes in the nutritional status of the population (Sunguya *et al* 2013).

2.6 Conclusion

Healthcare professionals need to lead by example and act as role models to the patients they treat. Nurses, specifically, are the backbone of the healthcare system. Although nurses may be resilient, they are not immune to sickness and disease. The nature of their work and the environment they work in are risks to their health and well-being. Overweight and obesity needs to be targeted among healthcare professionals, especially nursing staff as they spend a significant time directly involved in patient care. This can be done through nutrition education, improving physical activity levels, implementing set lunch times, improving the issue of understaffing, as well as providing healthy balanced meals and snacks at the staff cafeteria.

CHAPTER 3
METHODS

Chapter 3 discusses the type of study, study population and sample selection, methods and materials used and content and face validity. The process of data collection, data analysis, reduction of bias, data quality control and ethical considerations are also discussed.

3.1 Type of study

This was a cross-sectional descriptive study. A cross-sectional study can be defined as a study that describes a group of individuals at a specific point in time (Machin, Campbell & Walters 2007, p222).

3.2 Study population and sample selection

3.2.1 Study population

The study population consisted of RNs, ENs and ENAs employed at a private hospital in PMB, KZN, SA. The private hospital is not identified in this dissertation as the private hospital agreed to participate in the study on condition that they remained anonymous. Four private hospitals in PMB were invited to participate in the study, however, only one hospital responded positively. Private hospitals were chosen over public hospitals as nurses in public hospitals benefit from free wellness days and have access to an occupational health doctor, which is not the case in private hospitals, as these services carry a cost. Nurses were selected as the study population as they usually spend the most time with patients and have an important role to play in promoting good health. In addition, they are regarded as role models for their patients. However, they are at a high risk for overweight and obesity due to unhealthy diets, working shifts, long working hours, stress in the workplace, poor access to healthy food and low physical activity levels (Gupta & Guar 2016).

3.2.2 Sample selection

A convenience sample was used as the sample was selected from the population based on ease of access (Mishra & Alok 2017, p9). All nurses who met the selection criteria and who were on duty on the days of data collection were invited to participate in the study. Only RNs, ENs and ENs working at the private hospital in PMB were eligible to participate in the study. Pregnant nurses were excluded as the study involved assessment of BMI, which may be inaccurate in pregnant women (NHS 2020). This is because most pregnant women gain between 10-12.5 kg during pregnancy (NHS 2017c). The total number of nurses employed at

the private hospital at the time of the study was 265. Seven of these nurses were pregnant at the time of the study and were excluded, leaving a total population of 258 nurses. Using Cochrane's formula, the statistician determined that the minimum sample size required to represent the population was 171 nurses. The statistician further suggested that the sample should consist of 99 RNs, 43 ENs and 28 ENAs to ensure that the sample was representative of the population in terms of rank.

3.3 Study methods and materials

3.3.1 Self-administered questionnaire

A self-administered questionnaire was developed in English by the researcher to obtain data on demographic characteristics, lifestyle factors, body image and weight, eating habits and anthropometry (Appendix A). The self-administered questionnaire consisted of four sections. Section A collected demographic data such as age, gender, race, nursing rank, shift, working hours, number of days on and off duty, number of years qualified, number of years working as a nurse as well as the number of children being cared for. Section B collected data on lifestyle factors such as chronic conditions, chronic medication, smoking, alcohol consumption and physical activity levels. Section C focused on the participants' perception of their body image as well as their attempts to lose weight. Section D focused on eating habits such as the amount of meals eaten daily, meal times, skipping meals, meal choices, person preparing meals, snacking, factors influencing meal choices and barriers to healthy eating.

The self-administered questionnaire consisted mainly of close-ended questions. A closed-ended question is a question that can be answered with one word or a short phrase, whereas an open-ended question requires a longer answer (Hyman & Sierra 2016). Advantages of closed-ended questions are that participants do not struggle to answer questions as there are set responses to choose from, participants respond quicker, an interviewer is not required and data is coded and easier to analyse compared to open-ended questions (Hyman & Sierra 2016). A limitation of closed-ended questions is that they do not allow for a detailed response and may not fully represent the participant's view (Hyman & Sierra 2016). Open-ended questions allow the participant to provide a wide variety of answers, which is an advantage (Hyman & Sierra 2016). The limitations of open-ended questions include difficulty in recording answers and additional time and effort being required to code responses. In addition, open-ended questions usually require a live interviewer as opposed to a self-administered questionnaire, which does not (Hyman & Sierra 2016).

Two questions in the self-administered questionnaire used a Likert scale. The Likert scale is commonly used in medical research and allows participants to report how much they agree or disagree with a specific statement, using five or seven points (Sullivan & Artino 2013). A strength of the Likert scale is that information can be gathered quickly from a large group of participants (Nemoto & Beglar 2014). A limitation of the Likert scale is that the data obtained from the Likert scale cannot provide a full picture of the facts. Therefore, it should be combined with open-ended questions and interviews (Nemoto & Beglar 2014).

3.4 Content and face validity

The self-administered questionnaire was validated by conducting a pilot study before the main study. This is discussed next in section 3.4.1. The study supervisor and statistician also validated the self-administered questionnaire by checking that the questionnaire met the objectives of the study, that there was a logical flow to the questions and that there were no leading, ambiguous or confusing questions.

3.4.1 Pilot study

A pilot study was conducted before the main study. The purpose of a pilot study is to test the feasibility of the main study (Leon, Davis & Kraemer 2011). It aimed to identify possible problems with the self-administered questionnaire, the FFQ and the 24-hour recall. The pilot study also aimed to determine the time required to collect data from each participant. The pilot study was conducted on 10 RNs from the same private hospital in PMB. These 10 nurses were conveniently sampled on the day of the pilot study and were excluded from the main study. The researcher ensured that the participants from the pilot study did not participate in the main study by keeping a record of names, surnames and ranks. This information was not associated with any specific responses or results and was not revealed at any stage in the study or in the final dissertation. The researcher explained the pilot study protocol and objectives to the participants. Participants who agreed to participate in the pilot study were given an information document and consent form to sign (Appendix B). After the participants completed the self-administered questionnaire, the researcher interviewed the participants to obtain a 24-hour recall and complete the FFQ. Weight, height and WC measurements were also taken from pilot study participants. Data was collected from one participant at a time in the unit manager's office to ensure privacy. The participants did not have any problems with understanding the self-administered questionnaire and reported that the wording was simple and easy to

understand. The average time taken to complete the self-administered questionnaire, the FFQ, the 24-hour recall and the anthropometric measurements was 45 minutes per participant. No changes were made to the self-administered questionnaire, FFQ or the 24-hour recall.

3.5 Data collection

Data was collected in February 2020. The researcher liaised with the hospital matron, who is the head nurse and is in charge of all nurses and nursing activities in the hospital. The matron arranged for a meeting between the researcher and the nursing manager of each ward. This provided a platform to inform the nursing managers about the study. This also assisted with increasing awareness of the study amongst the nursing managers. The researcher visited the unit manager of each ward to set two dates for data collection. The researcher was allowed to collect data from nurses working both the day (7am to 7pm) and night shifts (7pm to 7am). Data collection took place on the premises of the private hospital group in PMB and the researcher collected all the data. The ward unit managers requested that the data be collected in the ward in which the participating nurses worked. The equipment room in each ward was used for data collection as this provided a quiet and private environment to collect data. This also allowed the participants to be closer to the ward, which was more convenient for them. Only one participant was in the room with the researcher at a time.

Upon arriving at the ward on the days of data collection, the study was explained to the nurses on duty and they were invited to participate in the study. Those nurses who agreed to participate were provided with an information document and a consent form (Appendix B) to sign. The consent form provided participants with more information about the study. The researcher also explained that the study was voluntary and anonymous, that there were no risks associated with the study, that there was no remuneration for participation and the details of ethical approval received. Only once the informed consent form was signed and consent obtained, was the participant given the self-administered questionnaire (Appendix A) to complete. The researcher provided the participants with a chair and table in the data collection room to answer the self-administered questionnaire. After the questionnaire was answered, the researcher took the selected anthropometric measurements (weight, height and WC) from each participant.

3.5.1 Anthropometric assessment

3.5.1.1 Weight

Weight was measured using a SECA 813 digital scale (GmbH & Co. KG., Hamburg, Germany). The digital scale was calibrated before use, which ensured the reliability of the anthropometric data collected. The scale was placed on a flat hard surface in the data collection room. Participants were asked to remove heavy objects such as jackets, shoes, keys, belts, cellphones and wallets prior to stepping onto the scale. The researcher asked each participant to stand still with each foot on each side of the scale and with hands to the side and looking forward (WHO 2017c). Weight was measured three times to the nearest 0.1 kg and a mean weight measurement was calculated.

3.5.1.2 Height

A Seca 213 portable stadiometer (GmbH & Co. KG., Hamburg, Germany) with a vertical backboard and adjustable headboard was used to take height measurements. The researcher asked each participant to stand upright with hands straight down the side. Feet were positioned together with the participants weight evenly distributed. Head, back, heels and buttocks touched the vertical backboard of the stadiometer. The participant's head was aligned in the Frankfort horizontal plane, which is an imaginary horizontal line from the ear canal to the lower eye orbit that is perpendicular to the backboard and parallel to the floor. The researcher asked each participant to take a deep breath and hold it while taking the measurement. The adjustable headboard was gently moved down onto the participants head and height was recorded to the nearest 0.1 cm. Height was measured three times and a mean height measurement was calculated (WHO 2017c; Lytvyak, Olstad, Schopflocher, Plotnikoff, Storey, Nykiforuk & Raine 2016; CDC 2007).

3.5.1.3 Body mass index

BMI was calculated using the equation of weight in kilograms divided by height in metres squared. The researcher used the mean weight and height measurements from each participant to calculate the BMI. BMI was calculated to the nearest 0.1 kg/m^2 and classified using the BMI classification in Table 3.1 (WHO 2017b; WHO 2006).

Table 3.1: BMI classification table (WHO 2017b; WHO 2006)

Classification	BMI (kg/m^2)
Underweight	<18.5
Normal	18.5-24.99
Obese	≥30
Obese class I	30-34.99
Obese class II	35-39.99
Obese III	≥40

3.5.1.4 Waist circumference

Although it is ideal that the abdominal area be free from clothing when taking the WC measurement, for practical reasons the WC measurements were taken with light clothing on. Subjects were asked to remove all bulky clothing such as jackets and jerseys, however, uniforms were kept on (WHO 2017c). The researcher asked each participant to stand upright and cross their arms on opposite shoulders. The researcher palpated the participants' hip to look for the right ilium of the pelvis. The uppermost lateral border of the right ilium was marked with a marker. Another line was drawn vertically using the mid-axillary line, which extends from the armpit to the torso. A Seca 201 fibreglass non-stretch measuring tape (GmbH & Co. KG., Hamburg, Germany) was used to take the WC measurements. The measuring tape was placed horizontally at the measurement mark. The tape was placed parallel to the floor and sat snug but not tight. The researcher asked participants to breathe normally prior to taking the measurements. WC was measured to the nearest 0.1 cm. The measurements were taken three times and a mean WC measurement was calculated (CDC 2007). A WC of >94cm in men and >80cm in women indicate an increased risk for metabolic complications, while a WC of >102cm in men and >88cm in women, indicate a substantially increased risk for metabolic complications (WHO 2011).

3.5.2 Assessment of dietary habits

3.5.2.1 24-hour recall

The researcher obtained a quantitative 24-hour recall from each participant, which was recorded on a 24-hour recall template (Appendix C). The 24-hour recall method is one of the most widely used methods to assess dietary intake in cross-sectional studies, clinical trials, nutrition surveys, cohort studies and the assessment of individual diets (Castell, Serra-Majem, & Ribas-Barba

2015). The 24-hour recall is a method where the interviewee is required to recall their dietary intake over the previous day (24-hour period) (Fagúndez, Torres, Sánchez, De Torres Aured, Rodrigo & Rocamora 2015). This method was chosen as it includes details about different foods consumed at each meal and can be used with literate or illiterate individuals (Fagúndez *et al* 2015). The 24-hour recall is a valid method used for assessing the energy and nutrient intake of subjects (Castell *et al* 2015). The participant's usual dietary intake is not altered, as it is a retrospective method (Castell *et al* 2015). The researcher asked the participant to recall their food and beverage intake over the previous 24 hours. Subjects answered with the type and quantity of each food item consumed. Standard household measures were used to help participants estimate portion sizes. These household measures included a teaspoon, tablespoon, dessertspoon, ladle and cup. The researcher also used food models to assist participants to estimate portion sizes. Due to time constraints and nurses not being able to leave their nursing duties to give repeated 24-hour recalls, only one 24-hour recall was obtained.

3.5.2.2 Qualitative food frequency questionnaire

A qualitative FFQ (Appendix D) was used to obtain data on the frequency of consumption of food items. The questionnaire consisted of 115 food items. The FFQ has been used to evaluate the relationship between dietary intake and disease or risk factors since the 1990s (Rodrigo, Aranceta, Salvador & Varela-Moreiras 2015). The FFQ was chosen as it is inexpensive for large studies, imposes only a modest burden on the participant and gives a better idea of usual eating patterns instead of using the 24-hour recall alone (Rodrigo *et al* 2015). A limitation of the FFQ is that participants answer based on their current dietary patterns instead of basing it on past memory (Rodrigo *et al* 2015). Another limitation is that the responses regarding frequency of food consumption and food portions may not be a true representation of the participant's usual intake (Rodrigo *et al* 2015). Therefore, in the current study, the FFQ was used together with the 24-hour recall. The food items in the FFQ were grouped into seven different groups. These groups included bread, cereals and starches; baked goods, snacks and sweets; meat, poultry, fish, eggs and meat substitutes; fruit and vegetables; dairy and fats; sugar and beverages and other (participants could add foods that were not included in the questionnaire)

The researcher asked the participants how often they consumed the listed food items. There were five options for the frequency of intake. The options included every day, 4-6 days a week, 1-3 days a week, seldom (less than once a week) and never (Faber & Kruger 2005).

3.6 Data analysis

3.6.1 Statistical analysis

Data was analysed using the Statistical Package for Social Sciences (SPSS) version 22. Descriptive statistics included means and standard deviations where applicable, while frequencies were represented in tables or graphs. The Chi-square goodness-of-fit-test was used on a categorical variable to test whether any of the response options were selected significantly more/less often than the others. Under the null hypothesis, it was assumed that all responses were equally selected. The Chi-square test of independence was used on cross-tabulations to determine whether a significant relationship existed between the two variables represented in the cross-tabulation. The Binomial test was used to test whether a significant proportion of respondents selected one of the two possible responses. This was extended when data with more than two response options was split into two distinct groups. Spearman's correlations measured how ordinal variables or rank orders were related. Pearson's correlation coefficient was a measure of linear association. The One sample t-test tested whether the mean score was significantly different from a scalar value, while the Independent samples t-test compared two independent groups of cases.

3.6.2 Dietary analysis

3.6.2.1 Nutritional analysis

The Medical Research Council (MRC) Food Finder software programme version 1.0 was used to analyse the 24-hour recall (South African Medical Research Council 2020). The data obtained from the Food Finder software programme version 1.0 was exported to a Microsoft Excel spreadsheet. The mean nutrient intake values obtained from MRC Food Finder were compared to the DRIs, specifically the EAR and AI values for specific gender and age groups. The EAR was selected as it is used to assess the nutritional adequacy of the estimated nutrient intake of groups of people (Institute of Medicine 2006, pp10). The AI is used when there is a lack of scientific evidence to calculate the EAR (Institute of Medicine 2006, pp10-11). Mean nutrient intake and standard deviations were calculated. The mean nutrient intake was compared to the EAR to determine if the mean nutrient intake was significantly lower or higher than the EAR. The mean dietary fibre, total sugars, calcium, potassium, sodium, pantothenate, biotin and vitamin D intake values were compared to the AI values, as there is no EAR value available for these nutrients. Total sugars were calculated as 25% of the average total energy intake across all males and females in each age category (Institute of Medicine 2003, p44). Saturated fat was calculated as 10% of the average total energy intake across all males and

females in each age category (Institute of Medicine 2003, p174). Significant p values indicated differences from the EAR value at a 95% level. The FFQ responses were analysed to determine how many participants consumed each food item and how often (never, seldom, 1-3 days a week, 4-6 days a week or every day). The FFQ was used to identify the most frequently consumed food items.

3.7 Reduction of bias

To avoid introducing bias, the researcher strictly adhered to the referenced procedures for taking weight, height and WC measurements. The same equipment was used to take each of the anthropometric measurements. The digital scale was calibrated before use, which ensured the reliability of the anthropometric data collected. The scale was placed on a flat hard surface and the stadiometer was placed against the wall to make sure it was steady and stable to use. The researcher ensured that each participant completed the questionnaire on their own without discussing or sharing their answers with anyone. Participants were also encouraged to answer the questionnaires honestly and accurately. The researcher ensured that each participant only participated once by keeping a list with the name, surname, ward and shift of each participant. However, these names were not associated with any specific responses or results. The names were not revealed at any stage in the study or in the final dissertation.

3.8 Data quality control

The researcher captured the data onto a Microsoft Excel spreadsheet. The researcher together with a research assistant checked that all the data was entered correctly. All errors were corrected before being sent to the statistician, who also checked the data for errors before analysing it.

3.9 Ethical considerations

Full ethics approval was obtained from the University of KwaZulu-Natal (UKZN) Biomedical Research Ethics Committee (BREC) (Ref: BE431/19) (Appendix E). The private hospital group gave approval to conduct the study on condition that the hospital remained anonymous (Appendix F). Participants were required to sign an informed consent form prior to participating (Appendix B). The consent form introduced the researcher, described the study protocol as well as guaranteed the confidentiality of the participants. Participants were also informed that participation in the study was voluntary and that they could withdraw from the study at any time. The study supervisor will securely store all the completed study questionnaires in the

Dietetics Department at UKZN in PMB for five years. All electronic data obtained from the study will be password protected and kept by the study supervisor.

CHAPTER 4

RESULTS

This chapter presents the results of the study.

4.1 Demographic characteristics of participants

Table 4.1 shows the demographic characteristics of the participants.

Table 4.1: Demographic characteristics of participants (n=130)

Characteristic	Category	n (%)
Age (years) (n=130)	19-29	30 (23.1)
	30-39	49 (37.7)
	40-49	37 (28.5)
	50-59	10 (7.7)
	≥ 60	4 (3.1)
Gender (n=130)	Male	11 (8.5)
	Female	119 (91.5)
Race (n=130)	African	93 (71.5)
	White	10 (7.7)
	Indian	21 (16.2)
	Coloured	6 (4.6)
Number of dependants (n=127)*	0	24 (18.5)
	1	43 (33.1)
	2	36 (27.7)
	3	14 (10.8)
	4	8 (6.2)
	5	1 (0.8)
	15	1 (0.8)
Single parent (n=130)	Yes	51 (39.2)
	No	79 (60.8)

*Some participants did not answer therefore the number of participants does not add up to 130

Out of the 258 nurses who met the inclusion criteria for the study, the statistician advised the sample size should include 171 participants. In the current study 130 nurses participated. This resulted in a response rate of 76%. Most participants were 30 to 39 years old (37.7%; n=49), female (91.5%; n=119) and African (71.5%; n=93). One third of participants (33.1%; n=43) stated that they were caring for one child, while 39.2% (n=51) were single parents (Table 4.1).

4.2 Work-related characteristics of participants

Table 4.2 shows work-related characteristics of participants. Of the 130 who participated, 53 (40.8%) were RNs, 48 (36.9%) were ENs, three (2.3%) were midwives, 25 (19.2%) were ENAs and one participant (0.8%) was a clinical nurse specialist in neonatal intensive care unit (NICU). Seventy-four participants (56.9%) worked the day shift, while 56 (43.1%) worked the night shift. Specifically, 69 participants (53.1%) worked the day shift from 7am-7pm, five (3.8%) worked the day shift from 7am-4pm and 56 (43.1%) worked the night shift from 7pm-7am. The majority of nurses were on duty for an average of five days a week (53.1%; n=69) and were off duty on two days in the week (36.9%; n=48). Most participants were qualified for 6- <11 years (35.4%; n=46) and 32.3% (n=42) had been working as a nurse for 1- <6 years (Table 4.2).

Table 4.2: Work-related characteristics of participants (n=130)

Characteristic	Category	n (%)
Nursing rank (n=130)	Registered nurse (RN)	53 (40.8)
	Enrolled nurse (EN)	48 (36.9)
	Midwife	3 (2.3)
	Enrolled nursing auxiliary (ENA)	25 (19.2)
	Clinical nurse specialist (ICU)	1 (0.8)
Number of years qualified (n=130)	<1	2 (1.5)
	1- <6	42 (32.3)
	6- <11	46 (35.4)
	11- <16	12 (9.2)
	16-20	7 (5.4)
	>20	21 (16.2)
Number of years working as a nurse or nursing auxiliary (n=130)	<1	6 (4.6)
	1- <6	48 (36.9)
	6- <11	37 (28.5)
	11- <16	11 (8.5)
	16-20	8 (6.2)
	>20	20 (15.4)
Shift worked (n=130)	Day	74 (56.9)
	Night	56 (43.1)
Working hours (n=130)	7am-7pm	69 (53.1)
	7pm-7am	56 (43.1)
	7am-4pm	5 (3.8)
Average number of days on duty per week (n=130)	1	2 (1.5)
	2	12 (9.2)
	3	21 (16.2)
	4	26 (20.0)
	5	69 (53.1)
Average number of days off duty per week (n=130)	2	48 (36.9)
	3	47 (36.2)
	4	16 (12.3)
	5	17 (13.1)
	6	2 (1.5)

4.3 Lifestyle factors

4.3.1 Medical conditions

Table 4.3 shows the medical history of the participants.

Table 4.3: Medical history of participants (n=130)

Characteristic	Category	n (%)
Diagnosed by a medical doctor with a chronic medical condition (n=130)	Yes	46 (35.4)
	No	84 (64.6)
Medical condition (n=130)	Diabetes	13 (10.0)
	High blood pressure	15 (11.5)
	Heart disease	2 (1.5)
	High cholesterol	4 (3.1)
	Renal failure	0
	Cancer	1 (0.8)
	Other	23 (17.7)
Participants who took chronic medication daily (n=130)	Yes	35 (26.9)
	No	11 (8.5)

Just over 35% (n=46) of participants indicated that a medical doctor had diagnosed them with a medical condition. The most common medical condition diagnosed was high blood pressure (11.5%; n=15), followed by diabetes (10%; n=13) (Table 4.3). Other diagnosed medical conditions included anaemia, asthma, diverticulitis, epilepsy, HIV, hyperthyroidism, insulin resistance, depression, hypothyroidism, polycystic ovarian syndrome (PCOS), irritable bowel syndrome (IBS), Meniere's disease, migraines, psoriasis, reflux, sinusitis and tachycardia. About 27% (n=35) of participants reported that they took chronic medication daily. The chronic medication taken included Amloc, Anostrazole, Irbewin, Antagolin, Insulin, Carloc, Antiretrovirals (ARVs), Aspavor, Bilicor, Neomercazole, Crestor, Disprin Cardiocare, Epillum, Glipizide, Metformin, Amlodipine, Cozaar, Glucophage, Eltroxin, Simvastatin, Keysel, Nexiam, Lorien, Stilnox, Lyrica, Mengen, Pharmapress, Ridaq, pumps, steroids, Symbicort, Laura, Avamys and Twynsta.

4.3.2 Smoking and alcohol consumption

Table 4.4 shows smoking and alcohol consumption of participants.

Table 4.4: Smoking and alcohol consumption

Characteristic	Category	n (%)	P value*
Smoking (n=130)	Yes	23 (17.7)	**<0.0005**
	No	107 (82.3)	
Number of cigarettes participants smoked in a day (n=23)	1-5	11 (47.8)	**0.010**
	6-10	5 (21.7)	
	11-15	4 (17.4)	
	16-20	2 (8.7)	
	>20	1 (4.3)	
Alcohol consumption (n=130)	Yes	53 (40.8)	**0.035**
	No	77 (59.2)	
Number of drinks consumed in the week (n=53)	<1	34 (64.2)	**<0.0005**
	1-2	11 (20.8)	
	3-4	6 (11.3)	
	9-10	1 (1.9)	
	>14	1 (1.9)	
Type of alcohol consumed (n=53)	Beer	9 (17.0)	**<0.0005**
	Wine	23 (43.4)	0.336
	Whiskey/ Brandy	10 (18.9)	**<0.0005**
	Cocktails	5 (9.4)	**<0.0005**
	Spirits	4 (7.5)	**<0.0005**
	Ciders	28 (52.8)	0.680
	Other	2 (3.8)	**<0.0005**

* Chi-square goodness-of-fit test, p values in bold are statistically significant

A chi-square goodness-of-fit test showed that a significant number of the participants reported that they did not smoke (82.3%; n=107) ($p<0.0005$), while 23 participants indicated that they smoked (17.7%). A chi-square goodness-of-fit test showed that of the participants who smoked, a significant number (47.8%; n=11) smoked 1-5 cigarettes a day ($p=0.010$). Fifty-three participants (40.8%) indicated that they consumed alcohol, while 77 participants (59.2%) did not. A significant number of participants did not consume alcohol (59.2%; n=77) ($p=0.035$). Of the 77 (59.2%) participants who consumed alcohol, a significant number of participants consumed <1 drink a week (64.2%; n=34) ($p<0.0005$). Ciders (52.8%; n=28) and wine (43.4%; n=23) were the most popular types of alcohol consumed (Table 4.4).

4.3.3 Exercise

Table 4.5 shows exercise patterns of the participants. There was an even split with regards to exercise. Sixty-five participants indicated that they exercised (50%), while 65 participants indicated that they did not exercise (50%). A chi-square goodness-of-fit test showed that a significant number of participants exercised one (20.0%; n=13), two (29.2%; n=19) and three times a week (33.8%; n=22) ($p<0.0005$). Results showed that most participants exercised for 16-30 minutes (41.5%; n=27) and 31-45 minutes (23.1%; n=15), per session ($p<0.0005$). A significant number of participants did not do aerobics (10.8%; n=7), cycling (3.1%; n=2), dancing (12.3%; n=8), exercise routine from a cell phone application (9.2%; n=6), gardening (18.5%; n=12), gymnastics (1.5%; n=1), jogging/ running (27.7%; n=18), sport (6.2%; n=4); swimming (7.7%; n=5), yoga (4.6%; n=3), skipping and boxing (1.5%; n=1) ($p<0.0005$) and gym (29.2%; n=19) ($p=0.001$).

Table 4.5: Exercise patterns of participants

Exercise patterns	Category	n (%)	P value
Participants did intentional exercise (n=130)	Yes	65	1.000
	No	65	
Types of exercise (n=65)	Aerobics	7 (10.8)	**<0.0005**
	Cycling	2 (3.1)	**<0.0005**
	Dancing	8 (12.3)	**<0.0005**
	Exercise routine from a cell phone application	6 (9.2)	**<0.0005**
	Gardening	12 (18.5)	**<0.0005**
	Gym (at home/at gym)	19 (29.2)	**0.001**
	Gymnastics	1 (1.5)	**<0.0005**
	Jogging/ running	18 (27.7)	**<0.0005**
	Sport (soccer, netball, volleyball, cricket)	4 (6.2)	**<0.0005**
	Swimming	5 (7.7)	**<0.0005**
	Walking	29 (44.6)	0.385
	Yoga	3 (4.6)	**<0.0005**
	Other (skipping and boxing)	1 (1.5)	**<0.0005**
Number of days in the week that participants exercised (n=65)	1	13 (20.0)	**<0.0005**
	2	19 (29.2)	
	3	22 (33.8)	
	4	3 (4.6)	
	5	6 (9.2)	
	7	2 (3.1)	
Average length of each exercise session (n=65)	0-15 minutes	5 (7.7)	**<0.0005**
	16-30 minutes	27 (41.5)	
	31-45 minutes	15 (23.1)	
	46-60 minutes	10 (15.4)	
	>60 minutes	8 (12.3)	

*Chi-square goodness-of-fit test, p values in bold are statistically significant

4.4 Body image and weight

4.4.1 Satisfaction with body shape/size

A binomial test showed that a significant number of participants (63.1%; n=82) indicated that they were not satisfied with their body shape/size, while 36.9% (n=48) were satisfied with their body shape/size (p=0.004) (Table 4.6).

Table 4.6: Satisfaction with body shape/size (n=130)

Characteristic	Category	n (%)	P value*
Are you satisfied with your body shape/size?	Yes	48 (36.9)	**0.004**
	No	82 (63.1)	

*Binomial test, p values in bold are statistically significant

Table 4.7 shows the reasons why participants were not satisfied with their body shape/size.

Table 4.7: Reasons why participants were not satisfied with their body shape/size (n=130)

Reasons for not being satisfied with body shape/size	n (%)
Participants felt they were obese/overweight/ too fat/too big	21 (16.2)
Participants felt they looked shapeless/ unattractive	2 (1.5)
Participants felt they wanted to be healthier	1 (0.8)
Participants felt they didn't want their shape/size to affect them when they are older	1 (0.8)
Unhappy with their stomach/stomach too big	24 (18.5)
Unhappy with their breast/breast too big	1 (0.8)
Unhappy with their butt or hips/too big	4 (3.1)
Unhappy with their waist	2 (1.5)
Clothes didn't fit well	5 (3.8)
Difficulty breathing	1 (0.8)
Could not do things quickly	1 (0.8)
Gained weight	10 (7.7)
Health hazards	1 (0.8)
Got tired easily	4 (3.1)
Sweats a lot	2 (1.5)
Wanted to lose weight	7 (5.4)
Did not feel good/uncomfortable	2 (1.5)
Too tall	1 (0.8)
Too thin/ wanted to gain weight	5 (3.8)

Just over 18% (n=24) of participants were not satisfied with their body shape/size as they were unhappy with their stomach or felt their stomach was too big. The second most common reason was that participants felt that they were obese, overweight, too fat or too big (16.2%; n=21).

Table 4.8 shows if participants felt that they were at a healthy body weight or not.

Table 4.8: Participants feelings of whether they were at a healthy body weight or not (n=130)

Characteristic	Category	n (%)	P value
Do you feel that you are at a healthy body weight?	Yes	52 (40.0)	**p=0.028**
	No	78 (60.0)	

*Binomial test, p values in bold are statistically significant

Fifty-two participants (40%) felt that they were at a healthy body weight. A binomial test showed that a significant number (60%; n=78) did not feel that they were at a healthy body weight (p=0.028).

Reasons why participants did not feel that they were at a healthy body weight are presented in Table 4.9. The majority of participants did not feel that they were at a healthy body weight because they felt that they were big, fat, overweight or obese (27.7%; n=36).

Table 4.9: Reasons why participants felt that they were not at a healthy body weight (n=130)

Reasons why participants felt that they were not at a healthy body weight	n (%)
Risk of chronic diseases	2 (1.5)
Body aches/pains	3 (2.3)
I am big/fat/overweight/obese	36 (27.7)
Not losing weight	1 (0.8)
Gaining weight	8 (6.2)
Have been at a better weight	1 (0.8)
Too thin/ have to gain weight	5 (3.8)
Bad eating patterns/eats junk/does not eat healthy	8 (6.2)
Gets tired easily	4 (3.1)
Sweats a lot	1 (0.8)
Unhappy with figure	3 (2.3)
Wants to lose weight	5 (3.8)
No time to gym/cannot exercise	2 (1.5)
Tummy too big	3 (2.3)
Breasts too big	1 (0.8)
Unhappy with hips	1 (0.8)
Fluctuating weight	1 (0.8)
Trying to eat healthy	1 (0.8)

4.4.2 Perception of body shape using images

Participants were asked to select a figure from the Stunkard figure rating scale that they felt best matched their actual body shape. Figure 4.1 shows the Stunkard figure rating scale.

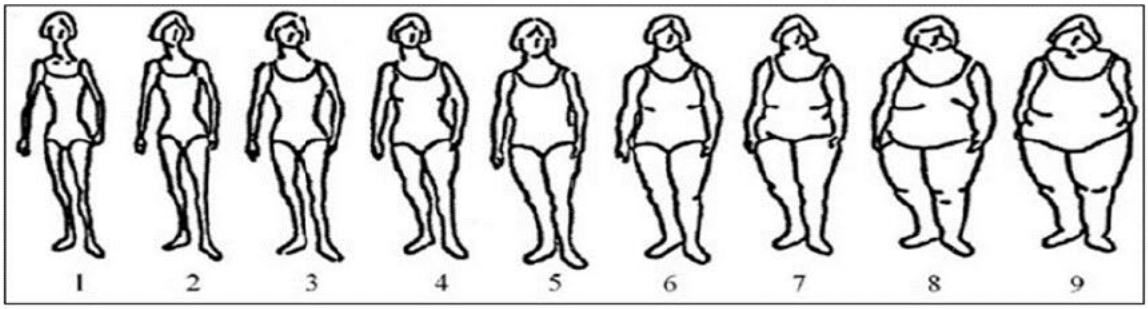


Figure 4.1: Stunkard figure rating scale (Stunkard, Sorensen & Schulsinger 1983)

Table 4.10 shows the number of participants who overestimated, underestimated and accurately estimated their body shape. A chi-square goodness-of-fit test showed that a significant number of participants selected figure 3 (13.8%; n=18), figure 4 (20.0%; n=26), figure 5 (18.5%; n=24) and figure 6 (18.5%; n=24) (p=0.0005) (Table 4.10).

Table 4.10: Number of participants who overestimated, underestimated and accurately estimated their body shape (n=130)

	Actual BMI category of participants					
Figure number chosen by participants	**Underweight n (%)**	**Normal n (%)**	**Overweight n (%)**	**Obese I n (%)**	**Obese II n (%)**	**Obese III n (%)**
1 (Underweight)	1 (0.8)	4 (3.1)	0	0	0	0
2 (Normal)	1 (0.8)	6 (4.6)	4 (3.1)	2 (1.5)	0	0
3 (Normal)	0	3 (2.3)	9 (6.9)	5 (3.8)	1 (0.8)	0
4 (Normal)	0	1 (0.8)	10 (7.7)	10 (7.7)	4 (3.1)	1 (0.8)
5 (Overweight)	0	1 (0.8)	6 (4.6)	8 (6.2)	4 (3.1)	5 (3.8)
6 (Overweight)	0	1 (0.8)	4 (3.1)	10 (7.7)	3 (2.3)	6 (4.6)
7 (Obese I)	0	0	0	3 (2.3)	4 (3.1)	7 (5.4)
8 (Obese II)	0	0	0	0	1 (0.8)	3 (2.3)
9 (Obese III)	0	0	0	0	0	2 (1.5)

*Chi-square goodness-of-fit test

Overestimated Accurately estimated Underestimated

Table 4.11 shows results of how participants estimated their body shape. The majority of participants underestimated their BMI (76.9%; n=100). Twenty-seven participants (20.8%) accurately estimated their BMI by choosing the figure that correctly represented their BMI. Three participants (2.3%) overestimated their BMI by choosing a figure larger than their actual body shape. A chi-square test of independence showed there was a significant relationship between BMI and the figure selected from the Stunkard figure rating scale ($p<0.0005$).

Table 4.11: Participant's estimation of their body shape (n=130)

Estimation of body shape	**n (%)**	**P value***
Underestimated	100 (76.9)	**p<0.0005**
Accurately estimated	27 (20.8)	
Overestimated	3 (2.3)	

*Chi-square test of independence, p values in bold are statistically significant

4.4.3 Attempts at weight loss

Table 4.12 shows participant's weight loss attempts, success and maintenance.

Table 4.12: Participant's weight loss attempts, success and maintenance

Characteristic	**Category**	**n (%)**	**P value**
Have you ever tried to lose weight before? (n=130)	Yes	84 (64.6)	**0.001***
	No	46 (35.4)	
Were you successful in losing weight? (n=84)	Yes	61 (72.6)	**<0.0005****
	No	23 (27.4)	
Were you successful in maintaining your weight loss? (n=61)	Yes	31 (50.8)	1.000**
	No	30 (49.2)	

*Chi-square goodness-of-fit test, p values in bold are statistically significant
**Binomial test, p values in bold are statistically significant

A chi-square goodness-of-fit test showed that a significant number of participants stated that they had tried to lose weight before (64.6%; n=84) ($p=0.001$). Of those participants who tried to lose weight before, a significant number reported they were successful in losing weight (72.6%; n=61) ($p<0.0005$), while 23 participants were unsuccessful (27.4%). Of the 61 participants who were successful in losing weight, 31 participants (50.8%) were successful in maintaining their weight loss, while 30 participants (49.2%) were unsuccessful in maintaining their weight loss.

Table 4.13 shows the weight loss methods used by participants. According to the binomial test, a significant proportion indicated that they cut down on fast foods/takeaways (67.9%; n=57) (p=0.001) and exercised (63.1%; n=53) (p=0.021) in order to achieve weight loss. A significant proportion did not try weight loss methods such as detox juice diet (86.9%; n=73), diet pills (76.2%; n=64), diet shakes (79.8%; n=67), fasting (86.9%; n=73), following a diet by a registered dietitian (89.3%; n=75), gastric surgery (97.6%; n=82), liposuction (98.8%; n=83), liquid diets (89.3%; n=75), portion control (79.8%; n=67), spa treatments (100%; n=84), Atkins diet (98.8%; n=83), Banting diet (86.9%; n=73), Paleo diet (97.6%; n=82) and "other" (95.2%; n=80) ($p<0.0005$).

Table 4.13: Weight loss methods used by participants (n=84)

Weight loss method	Response	n (%)	P value*
Cutting down on fast foods/takeaways	Yes	57 (67.9)	**0.001**
	No	27 (32.1)	
Cutting down on high fat and processed foods	Yes	33 (39.3)	0.063
	No	51 (60.7)	
Cutting down on sugar, sugary treats and sugar sweetened soft drinks	Yes	41 (48.8)	0.913
	No	43 (51.2)	
Detox juice diet	Yes	11 (13.1)	**<0.0005**
	No	73 (86.9)	
Diet pills/weight loss pills/appetite suppressants	Yes	20 (23.8)	**<0.0005**
	No	64 (76.2)	
Diet shakes	Yes	17 (20.2)	**<0.0005**
	No	67 (79.8)	
Exercise	Yes	53 (63.1)	**0.021**
	No	31 (36.9)	
Fasting	Yes	11 (13.1)	**<0.0005**
	No	73 (86.9)	
Following a diet planned by a Registered Dietitian	Yes	9 (10.7)	**<0.0005**
	No	75 (89.3)	
Gastric surgery	Yes	2 (2.4)	**<0.0005**
	No	82 (97.6)	
Liposuction	Yes	1 (1.2)	**<0.0005**
	No	83 (98.8)	
Liquid diets	Yes	9 (10.7)	**<0.0005**
	No	75 (89.3)	
Portion control	Yes	17 (20.2)	**<0.0005**
	No	67 (79.8)	
Spa treatments (body wraps)	Yes	0	**<0.0005**
	No	84 (100.0)	
The Atkins diet	Yes	1 (1.2)	**<0.0005**
	No	83 (98.8)	
The Banting diet	Yes	11 (13.1)	**<0.0005**
	No	73 (86.9)	
The Paleo diet	Yes	2 (2.4)	**<0.0005**
	No	82 (97.6)	
Other: ▪ Calorie counting ▪ Herbal life ▪ Weigh less	Yes	4 (4.8) 1 (1.2) 1 (1.2) 2 (2.4)	**<0.0005**
	No	80 (95.2) 83 (98.8) 83 (98.8) 82 (97.6)	

*Binomial test, p values in bold are statistically significant

Table 4.14 shows participants' perceptions of being a role model to patients and importance of having an ideal body weight. A significant number of participants felt that they were a role model to their patients (70.8%; n=92) (p<0.0005), while 29.2% (n=38) felt that they were not. The majority of participants (92.3%; n=120) felt that it was important to have an ideal body weight (p<0.0005), while 10 (7.7%) participants felt that it was not important to have an ideal body weight (Table 4.14).

Table 4.14: Participant's perceptions of being a role model to patients and importance of having an ideal body weight (n=130)

Questions	Category	n (%)	P value*
As a nurse, do you feel that you are a role model to your patients?	Yes	92 (70.8)	**<0.0005**
	No	38 (29.2)	
As a nurse, do you feel that it is important to have an ideal body weight?	Yes	120 (92.3)	**<0.0005**
	No	10 (7.7)	

*Binomial test, p values in bold are statistically significant

4.5 Eating patterns

Table 4.15 presents the number of meals and snacks eaten by participants on days on and off duty. A chi-square goodness-of-fit test showed that a significant number of participants had two (40.8%; n=53) or three meals (39.2%; n=51) a day on days on duty (p<0.0005). Results showed that a significant number of participants had zero (26.9%; n=35), one (33.8%; n=44) or two (29.2%; n=38) snacks a day on days on duty (p <0.0005). A significant number of participants had two (26.9%; n=35) or three (53.8%; n=70) meals a day on days off duty (p<0.0005). A chi-square goodness-of-fit test showed that a significant number of participants had one (27.7%; n=36), two (27.7%; n=36) or three (17.7%; n=23) snacks a day when off duty (p<0.0005).

Table 4.15: The number of meals and snacks eaten by participants on days on and off duty (n=130)

Characteristic	Number	n (%)	P value*
Meals eaten on days on duty	0	2 (1.5)	**<0.0005**
	1	16 (12.3)	
	2	53 (40.8)	
	3	51 (39.2)	
	4	8 (6.2)	
Snacks eaten on days on duty	0	35 (26.9)	**<0.0005**
	1	44 (33.8)	
	2	38 (29.2)	
	3	8 (6.2)	
	4	3 (2.3)	
	5	1 (0.8)	
	8	1 (0.8)	
Meals eaten on days off duty	1	9 (6.9)	**<0.0005**
	2	35 (26.9)	
	3	70 (53.8)	
	4	13 (10.0)	
	5	2 (1.5)	
	6	1 (0.8)	
Snacks eaten on days off duty	0	19 (14.6)	**<0.0005**
	1	36 (27.7)	
	2	36 (27.7)	
	3	23 (17.7)	
	4	11 (8.5)	
	5	1 (0.8)	
	6	4 (3.1)	

* Chi-square goodness-of-fit test, p values in bold are statistically significant

The total number of participants who ate the different meals and snacks on days on and off duty are shown in Table 4.16. A significant number of participants consumed breakfast (75.4%; n=98), lunch (73.8%; n=96) and supper (74.6%; n=97) on days on duty ($p<0.0005$). On days off duty, a significant number of participants consumed breakfast (76.9%; n=100), lunch (75.4%; n=98) and supper (90%; 117) ($p<0.0005$). A significant number of participants did not consume a morning snack (74.6%; n=97) ($p<0.0005$), afternoon snack (64.6%; n=84) ($p=0.001$) and evening snack (75.4%; n=98) ($p<0.0005$) on days on duty. A significant number of participants did not consume a morning snack (64.6%; n=84) ($p=0.001$) and evening snack (63.8%; n=83) ($p=0.002$) on days off duty.

Table 4.16: Meals and snacks consumed on days on and off duty

Characteristic	Meal	Response	n (%)	P value*
Meal consumed on days on duty	Breakfast	Yes	98 (75.4)	**<0.0005**
		No	32 (24.6)	
	Morning snack	Yes	33 (25.4)	**<0.0005**
		No	97 (74.6)	
	Lunch	Yes	96 (73.8)	**<0.0005**
		No	34 (26.2)	
	Afternoon snack	Yes	46 (35.4)	**0.001**
		No	84 (64.6)	
	Supper	Yes	97 (74.6)	**<0.0005**
		No	33 (25.4)	
	Evening snack	Yes	32 (24.6)	**<0.0005**
		No	98 (75.4)	
Meal consumed on days off duty	Breakfast	Yes	100 (76.9)	**<0.0005**
		No	30 (23.1)	
	Morning snack	Yes	46 (35.4)	**0.001**
		No	84 (64.6)	
	Lunch	Yes	98 (75.4)	**<0.0005**
		No	32 (24.6)	
	Afternoon snack	Yes	73 (56.2)	1.88
		No	57 (43.8)	
	Supper	Yes	117 (90)	**<0.0005**
		No	13 (10.0)	
	Evening snack	Yes	47 (36.2)	**0.002**
		No	83 (63.8)	

*Binomial test, p values in bold are statistically significant

4.5.1 Skipping meals

Results on meal skipping are presented in Table 4.17. The majority of participants stated that they skipped meals (83.8%; n=109) ($p<0.0005$), while 21 participants (16.2%) did not skip meals (Table 4.17). Breakfast was also the only meal that was significantly skipped (63.3%; n=69) ($p=0.007$). A significant number of participants did not skip the morning snack (73.4%; n=80), afternoon snack (80.7%; n=88), supper (89.0%; n=97), and evening snack (77.1%; n=84) ($p<0.0005$).

Table 4.17: Meals skipped by participants (n=130)

Characteristic	Category	n (%)	P value*
Meals skipped	Yes	109 (83.8)	**<0.0005**
	No	21 (16.2)	
Meal skipped	**Response**	**n (%)**	**P value***
Breakfast	Yes	69 (63.3)	**0.007**
	No	40 (36.7)	
Morning snack	Yes	29 (26.6)	**<0.0005**
	No	80 (73.4)	
Lunch	Yes	52 (47.7)	0.702
	No	57 (52.3)	
Afternoon snack	Yes	21 (19.3)	**<0.0005**
	No	88 (80.7)	
Supper	Yes	12 (11.0)	**<0.0005**
	No	97 (89.0)	
Evening snack	Yes	25 (22.9)	**<0.0005**
	No	84 (77.1)	

*Bionomial test, p values in bold are statistically significant

Table 4.18 presents the times of the first and last main meal of the day on days on and off duty.

Table 4.18: Times of the first and last main meal of the day on days on and off duty

	On duty n (%)		Off duty n (%)	
Times	**First meal (n=129)***	**Last meal (n=127)***	**First meal (n=129)***	**Last meal (n=127)***
01h00-02h59	3 (2.3)	0	0	0
03h00-04h59	0	0	0	0
05h00-06h59	22 (17.1)	0	4 (3.1)	0
07h00-08h59	19 (14.7)	1 (0.8)	39 (30.2)	1 (0.8)
09h00-10h59	66 (51.2)	2 (1.6)	47 (36.4)	0
11h00-12h59	8 (6.2)	0	27 (20.9)	0
13h00-14h59	9 (7.0)	6 (4.7)	6 (4.7)	3 (2.4)
15h00-16h59	0	6 (4.7)	2 (1.6)	5 (3.9)
17h00-18h59	1 (0.8)	14 (11.0)	1 (0.8)	48 (37.8)
19h00-20h59	0	54 (42.5)	1 (0.8)	56 (44.1)
21h00-22h59	0	35 (27.6)	2 (1.6)	11 (8.7)
23h00-00h59	1 (0.8)	9 (7.1)	0	3 (2.4)

*Some participants did not answer, therefore the number of participants does not add up to 130.

Just over 51% (n=66) had their first main meal of the day when on duty between 09h00-10h59, while 42.5% (n=54) had their last meal between 19h00-20h59. The majority (36.4%; n=47) had their first main meal of the day when off duty between 09h00-10h59, while 44.1% (n=56) had their last meal between 19h00-20h59 (Table 4.18).

4.5.2 Person preparing meals at home

Table 4.19 shows that a significant number of participants prepared their own meals at home (84.6%; n=110) (p<0.0005), while 20 (15.4%) did not. Out of the 20 participants who did not prepare their own meals, five (25%) and six (30%) participants reported that their parent and siblings prepared their meals, respectively.

Table 4.19: Meal preparation at home (n=130)

Characteristic	Category	n (%)	P value
Do you prepare your own meals at home? (n=130)	Yes	110 (84.6)	**<0.0005***
	No	20 (15.4)	
Person who prepares meals at home (n=20)	Child	4 (20.0)	0.326**
	Girlfriend/boyfriend	1 (5.0)	
	Parent	5 (25.0)	
	Sibling	6 (30.0)	
	Spouse	2 (10.0)	
	Other	2 (10.0)	

*Binomial test, p values in bold are statistically significant
**Chi-square goodness-of-fit test

4.5.3 Factors influencing meal choices

Table 4.20 shows the factors that influenced meal choices. There was significant agreement that time [M (mean) =3.98; p<0.0005], cost (M=3.26; p=0.021), emotions/stress (M=3.61; p<0.0005) and convenience (M=3.38; p<0.0005) were all factors that influenced meal choices.

Table 4.20: Factors that influenced meal choices (n=130)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	P value*
	n (%)					
Time	10 (7.7)	7 (5.4)	7 (5.4)	57 (43.8)	49 (37.7)	**<0.0005**
Cost	13 (10.0)	30 (23.1)	21 (16.2)	42 (32.3)	24 (18.5)	**0.021**
Emotions/ stress	13 (10.0)	18 (13.8)	14 (10.8)	47 (36.2)	38 (29.2)	**<0.0005**
Convenience	12 (9.2)	18 (13.8)	27 (20.8)	54 (41.5)	19 (14.6)	**<0.0005**
Nutritional content of meals	10 (7.7)	30 (23.1)	36 (27.7)	42 (32.3)	12 (9.2)	0.207
Media and advertising	18 (13.8)	43 (33.1)	21 (16.2)	31 (23.8)	17 (13.1)	0.341

*One sample t-test, p values in bold are statistically significant

4.5.4 Factors preventing participants from eating healthily

There was significant agreement that a lack of time to prepare meals (M=3.69; p<0.0005), lack of time to eat at work (M=4.04; p<0.0005), emotions/stress (M=3.30; p=0.010) and healthy food not being available to buy at work (M=3.22; p=0.036), were all factors that prevented participants from eating healthily. There was a significant disagreement that a lack of knowledge of healthy eating (M=2.69; p=0.003) and healthy food not appealing to the participant (M=2.48; p<0.0005) were factors that prevented participants from eating healthily (Table 4.21).

Table 4.21: Factors that prevented participants from eating healthily (n=130)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	P value*
	n (%)					
Finances	17 (13.1)	37 (28.5)	26 (20.0)	32 (24.6)	18 (13.8)	0.837
Lack of time to prepare meals	7 (5.4)	20 (15.4)	11 (8.5)	60 (46.2)	32 (24.6)	**<0.0005**
Lack of time to eat at work (too busy)	6 (4.6)	7 (5.4)	12 (9.2)	56 (43.1)	49 (37.7)	**<0.0005**
Emotions/stress	14 (10.8)	27 (20.8)	22 (16.9)	40 (30.8)	27 (20.8)	**0.010**
Lack of knowledge of healthy eating	17 (13.1)	53 (40.8)	22 (16.9)	29 (22.3)	9 (6.9)	**0.003**
Healthy food not available to buy at work	11 (8.5)	33 (25.4)	18 (13.8)	52 (40.0)	16 (12.3)	**0.036**
Healthy food does not appeal to me	19 (14.6)	60 (46.2)	26 (20.0)	19 (14.6)	6 (4.6)	**<0.0005**

*One sample t-test, p values in bold are statistically significant

4.5.5 Meal purchasing from the hospital cafeteria

Table 4.22 shows how often participants purchased meals from the hospital cafeteria and the most commonly purchased food items. A chi-square goodness-of-fit test showed that a significant number of participants never purchased meals from the hospital cafeteria (39.2%; n=51), while 23.1% (n=30) purchased on one day a week and 17.7% (n=23) purchased on two days a week ($p<0.0005$) (Table 4.22). Pies (21.5%; n=17) were most commonly purchased from the hospital cafeteria. This was followed by biryani (traditional Indian dish made with spiced rice, meat, fish or vegetables) (10.1%; n=8), grilled meat with chips/rolls (10.1%; n=8), and 'other'. The 'other' items purchased were muffins, butter chicken pie, pap and wors, slice of chocolate cake and whatever was available on the menu, sweets, samoosas (10.1%; n=8), fried chips (8.9%; n=7) and curry and rice (7.6%; n=6) ($p=0.0005$).

Table 4.22: Meal purchasing from the hospital cafeteria (n=130)

Characteristic	Frequency	n (%)	P value*
How often do you purchase meals at the hospital cafeteria in the week? (n=130)	Never	51 (39.2)	**<0.0005**
	1 day	30 (23.1)	**<0.0005**
	2 days	23 (17.7)	
	3 days	12 (9.2)	
	4 days	2 (1.5)	
	5 days	3 (2.3)	
	Everyday	7 (5.4)	
	More than once a day	2 (1.5)	
Meal most commonly purchased from the cafeteria (n=79)	**Meals**	**n (%)**	**P value**
	Biryani	8 (10.1)	**<0.0005**
	Brown bread rolls	1 (1.3)	
	Brown bread sandwiches	3 (3.8)	
	Burgers	3 (3.8)	
	Cottage pie	2 (2.5)	
	Curry and rice	6 (7.6)	
	Fried chips	7 (8.9)	
	Fried/deep fried meat	1 (1.3)	
	Grilled chicken/meat with chips/roll	8 (10.1)	
	Health rolls	1 (1.3)	
	Hot dogs	1 (1.3)	
	Pasta	3 (3.8)	
	Phutu and beans	1 (1.3)	
	Phutu and curry	1 (1.3)	
	Pies	17 (21.5)	
	Roti roll with curry	1 (1.3)	
	Salad with meat	4 (5.1)	
	Samp and beans	1 (1.3)	
	Stew and rice	1 (1.3)	
	White bread sandwiches	1 (1.3)	
	Other	8 (10.1)	

*Chi-square goodness-of-fit test, p values in bold are statistically significant

4.5.6 Frequency of snack consumption

Table 4.23 shows the statistically significant results on the frequency of snack consumption by participants obtained from the self-administered questionnaire.

Table 4.23: Frequency of snack consumption (n=130)

Snack	Frequency	n (%)	P value
Biscuits	At least once a week	51 (39.2)	**<0.0005**
Cakes	At least once a week	43 (33.1)	**<0.0005**
Sugar-sweetened soft drinks	At least once a week	44 (33.8)	**<0.0005**
	At least once a day	42 (32.3)	
Fruit	At least once a week	43 (33.1)	**<0.0005**
	At least once a day	68 (52.3)	
Salted nuts/seeds/corn	Never	50 (38.5)	**<0.0005**
	At least once a week	34 (26.2)	
Popcorn	Never	53 (40.8)	**<0.0005**
Potato/ maize crisps or chips	At least once a week	55 (42.3)	**<0.0005**
Raw nuts/seeds	Never	79 (60.8)	**<0.0005**
Sweets	At least once a week	36 (27.7)	**<0.0005**
	At least once a day	45 (34.6)	
Yoghurt	At least once a week	63 (48.5)	**<0.0005**

* Chi-square goodness-of-fit test, p values in bold are statistically significant

Fruit, sweets and sugar-sweetened soft drinks were eaten at least once a day by 52.3% (n=68), 34.6% (n=45) and 32.3% (n=42) of participants, respectively ($p<0.0005$). About 61% (n=79), 40.8% (n=53) and 38.5% (n=50) of participants never snacked on raw nuts/seeds, popcorn and salted nuts/seeds/corn, respectively ($p<0.0005$).

4.6 Prevalence of overweight and obesity according to BMI

According to Table 4.24, the majority of participants (86.2%; n=112) were overweight or obese, according to their BMI. Specifically, 29.2% (n=38) were classified as obese class I, 13.1% (n=17) as obese class II and 18.5% (n=24) as obese class III. A significant number of the participants were either overweight (25.4%; n=33) or obese class I (29.2%; n=38) ($p<0.0005$).

Only 12.3% (n=16) had a normal body weight (Table 4.24). Females had a significantly higher mean BMI (33.6 kg/m^2) compared to males (28.1 kg/m^2) (p=0.043).

Table 4.24: BMI classification of participants (n=130)

Characteristics	**Total (n=130) Mean (SD)**	**Male (n=11) Mean (SD)**	**Female (n=119) Mean (SD)**	**P value**
Weight (kg)	84.7 (23.1)	80.6 (12.2)	85.1 (23.9)	**p=0.043***
Height (m)	1.6 (0.1)	1.7 (0.1)	1.6 (0.1)	
BMI (kg/m^2)	33.1 (8.6)	28.1 (5.2)	33.6 (8.7)	
BMI classification	**n (%)**	**n (%)**	**n (%)**	**P value**
Underweight	2 (1.5)	0	2 (1.7)	**<0.0005****
Normal weight	16 (12.3)	3 (27.3)	13 (10.9)	
Overweight	33 (25.4)	3 (27.3)	30 (25.2)	
Obese Class I	38 (29.2)	4 (36.4)	34 (28.6)	
Obese Class II	17 (13.1)	1 (9.1)	16 (13.4)	
Obese Class III	24 (18.5)	0	24 (20.2)	

*Independent sample test, p values in bold are statistically significant

**Chi-square goodness-of-fit test, p values in bold are statistically significant

4.7 Factors contributing to a high BMI

An independent samples t-test showed that the mean BMI for females (33.6 kg/m^2) was significantly higher than that of males (28.1 kg/m^2) (p=0.043). It also showed that the mean BMI for non-smokers (33.8 kg/m^2) was significantly higher than that of smokers (29.6 kg/m^2) (p=0.030). There was a significant negative correlation between BMI and snacking, both for days on duty (rho = -0.245; p=0.005) and days off duty (rho = -0.197; p=0.024). A higher BMI was associated with less snacking, in each case. An independent samples t-test showed that the mean BMI for those who skipped supper (36.3 kg/m^2) was significantly higher than for those who ate supper (32.0 kg/m^2) (p=0.013). Participants who skipped meals had a higher mean BMI (33.8 kg/m^2) than those who did not skip meals (29.6 kg/m^2) (p=0.005). There was a significant positive correlation between BMI and cost as a factor in meal choices (rho = 0.216; p=0.014). Those who agreed that cost influenced meal choices had a higher BMI. There was a significant negative correlation between BMI and lack of time to eat at work (too busy) as a factor preventing healthy eating. There was an agreement that a lack of time to eat at work (too busy) was a factor associated with a lower BMI (rho= -0.210; p=0.016).

4.8 Waist circumference

Table 4.25 presents the results on WC. Most males had a WC above 94 cm (63.6%; n=7), indicating an increased risk for metabolic complications. Out of these seven participants, three participants (27.3%) had a WC greater than 102 cm, indicating a substantially increased risk for metabolic complications. The majority of females (88.2%; n=105) had a WC above 80 cm. Out of these 105 participants, 86 participants (72.3%) had a WC greater than 88 cm, indicating a substantially increased risk for metabolic complications. There were no significant differences between gender and WC.

Table 4.25: Waist circumference measurements of participants

Waist circumference	n (%)
Males	
< 94 cm	4 (36.4)
> 94 cm	7 (63.6)
>102 cm	3 (27.3)
Females	
< 80 cm	14 (11.8)
> 80 cm	105 (88.2)
> 88 cm	86 (72.3)

4.9 Dietary assessment

4.9.1 24-hour recall

Tables 4.26 to 4.28 show the comparison of mean nutrient intakes from the 24-hour recall to the EAR for male and female participants according to the DRI age categories (19-30 years, 31-50 years and 51-70 years). The AI was used when there was insufficient scientific evidence to calculate the EAR (Institute of Medicine 2006, pp10-11). Tables 4.26 to 4.28 show the mean nutrient intakes and standard deviation for macronutrients and micronutrients. There were no participants older than 70 years of age.

4.9.1.1 24-hour recall analysis for participants 19-30 years

Table 4.26 shows the mean nutrient intake for males and females 19-30 years of age compared to the EAR or AI.

Table 4.26: Comparison of mean nutrient intake with the EAR or AI from the 24-hour recall for female adults aged 19-30 years (n=26) and male adults aged 19-30 years (n=4)

Nutrient	Females				Males			
	Mean intake (SD)	**EAR** [a-c]	**AI** [a-c]	**P value***	**Mean intake (SD)**	**EAR** [a-c]	**AI** [a-c]	**P value***
Energy (kCal)	1891.9 (1137.1)	<1800	-	0.684	1724.7 (952.7)	<2200	-	0.392
Total fat (g)	68.8 (75.3)	ND	-		81 (53.7)	ND	-	
Saturated fat (g)[d]	17.3 (12.4)	<10% of total energy 20.8 g	-	0.158	33.3 (25.1)	<10% of total energy 19.0 g	-	0.338
Cholesterol (mg)	239.1 (211.2)	-	<300	0.154	213.3 (157.2)	-	<300	0.350
Total protein (g)	71.5 (37.6)	38	-	**<0.0005**	82.6 (51.1)	46	-	0.247
Carbohydrates (g)	244 (143.9)	<100	-	**<0.0005**	160.1 (104.0)	<100	-	0.332
Total sugars (g)[e]	60.8 (42.1)	-	<25% of total energy 116.3 g	**<0.0005**	42.1 (50.2)	-	<25% of total energy	0.084
Dietary fibre (g)	16.6 (11.9)	-	25	**0.001**	6.4 (4.3)	-	106.0 g	**0.001**
Vitamin A (µg)	964.7 (3373.0)	500	-	0.489	12.3 (19.5)	625	38	**<0.0005**
Vitamin D (µg)	3.3 (3.6)	-	5	**0.022**	2.2 (1.0)	-	-	**0.011**
Vitamin E (mg)	11.3 (21.3)	12	-	0.877	3.6 (3.3)	12	5	**0.015**
Vitamin K (µg)	43.4 (54.8)	90	-	**<0.0005**	10.5 (6.2)	120	-	**<0.0005**
Vitamin C (mg)	60.2 (60.1)	60	-	0.990	13.3 (22.6)	75	-	**0.012**
Thiamin (mg)	1.6 (1.1)	0.9	-	**0.007**	1.3 (0.8)	1.0	-	0.467
Riboflavin (mg)	1.4 (1.7)	0.9	-	0.112	1.1 (0.5)	1.1	-	0.868
Niacin (mg)	25.4 (15.9)	11	-	**<0.0005**	22.1 (10.9)	12	-	0.161
Vitamin B_6 (mg)	3.3 (2.4)	1.1	-	**<0.0005**	2.8 (1.6)	1.1	-	0.119
Folate (µg)	101.3 (156.0)	320	-	**<0.0005**	161.5 (210.6)	320	-	0.229
Vitamin B_{12} (µg)	12.8 (36.8)	2.0	-	0.147	4.6 (4.0)	2.0	-	0.285
Biotin (µg)	16.4 (12.2)	-	30	**<0.0005**	10.5 (4.3)	-	-	**0.003**
Pantothenate (mg)	5.4 (4.5)	-	5.0	0.658	2.7 (1.8)	-	30	0.078
Sodium (mg)	2248 (1945.4)	-	1500	0.061	2002.8 (1943.7)	-	5.0	0.641
Potassium (mg)	1968.7 (1085.1)	-	4700	**<0.0005**	1257.8 (355.9)	-	4700	**<0.0005**

Table 4.26: Comparison of mean nutrient intake with the EAR or AI from the 24-hour recall for female adults aged 19-30 years (n=26) and male adults aged 19-30 years (n=4) continued

Nutrient	Females				Males			
	Mean intake (SD)	**EAR** [a-c]	**AI** [a-c]	**P value***	**Mean intake (SD)**	**EAR** [a-c]	**AI** [a-c]	**P value***
Calcium (mg)	324.6 (211.3)	-	1000	**<0.0005**	343 (155.4)	-	1000	**0.003**
Phosphorus (mg)	919.7 (490.5)	580	-	**0.002**	757.8 (398.5)	580	-	0.438
Magnesium (mg)	232.2 (152.2)	255	-	0.451	152.8 (79.4)	330	-	**0.021**
Iron (mg)	13.3 (9.1)	8.1	-	**0.007**	10.9 (5.9)	6	-	0.201
Zinc (mg)	11 (6.6)	6.8	-	**0.003**	12.6 (9.5)	9.4	-	0.553

*P values in bold indicate a significant difference from the EAR value (P<0.05); [a]Institute of Medicine (2003, pp282-285), [b]Institute of Medicine (2005a, pp278-1331), [c]Institute of Medicine (2005b, pp606-617). [d]Saturated fat was calculated as 10% of the average total energy (Institute of Medicine 2003, p174); [e]Total sugars were calculated as 25% of the average total energy (Institute of Medicine 2003, p44).

The mean nutrient intake of protein, carbohydrates, phosphorus, iron, zinc, thiamin, niacin and vitamin B_6 were significantly higher than the EAR or AI for females 19-30 years old. The mean nutrient intake of total sugar, dietary fibre, vitamin D, vitamin K, folate, biotin, potassium and calcium were significantly lower than the EAR or AI for females 19-30 years old. The mean nutrient intake of dietary fibre, vitamin A, vitamin D, vitamin E, vitamin K, vitamin C, biotin, potassium, calcium and magnesium was significantly lower than the EAR or AI for males 19-30 years old.

4.9.1.2 24-hour recall analysis for participants 31-50 years

Table 4.27 shows the mean nutrient intake for males and females 31-50 years of age compared to the EAR or AI.

Table 4.27: Comparison of mean nutrient intake with the EAR or AI from a 24-hour recall for female adults aged 31-50 years (n=80) and male adults aged 31-50 years (n=6)

Nutrient	Females				Males			
	Mean intake (SD)	**EAR** [a-c]	**AI** [a-c]	**P value***	**Mean intake (SD)**	**EAR** [a-c]	**AI** [a-c]	**P value***
Energy (kCal)	1803.4(829.1)	<1800	-	0.971	2420.1(585.3)	<2200	-	0.399
Total fat (g)	60.9 (39.5)	ND	-		79.1 (48.3)	ND	-	-
Saturated fat (g)[d]	17.8 (11.8)	<10% of total energy 19.8 g	-	0.137	20.6 (11.3)	<10% of total energy 26.6 g	-	0.251
Cholesterol (mg)	220.2 (391.2)	-	<300	0.072	363.5 (187.1)	-	<300	0.444
Total protein (g)	67.8 (32)	38	-	**<0.0005**	94.1 (40.0)	46	-	**0.032**
Carbohydrates (g)	240.1 (130.5)	<100	-	**<0.0005**	328.8 (63.9)	<100	-	**<0.0005**
Total sugars (g)[e]	68.3 (48.7)	-	<25% of total energy 110.9 g	**<0.0005**	76.4 (58.3)	-	<25% of total energy 148.8 g	**0.036**
Dietary fibre (g)	17.1 (11.3)	-	25	**<0.0005**	21.3 (5.6)	-	38	**0.001**
Vitamin A (µg)	404.6 (2327.2)	500	-	0.986	2 (2.8)	625	-	**<0.0005**
Vitamin D (µg)	3 (5.1)	5	-	**0.001**	4.7 (3.7)	5	-	0.872
Vitamin E (mg)	9.6 (9.4)	12	-	**0.023**	14.4 (15.6)	12	-	0.727
Vitamin K (µg)	76.6 (201.7)	90	-	0.554	167 (266.4)	120	-	0.683
Vitamin C (mg)	55.4 (58.9)	60	-	0.482	48.2 (34.5)	75	-	0.115
Thiamin (mg)	1.4 (0.9)	0.9	-	**<0.0005**	1.7 (0.3)	1.0	-	**0.005**
Riboflavin (mg)	1.3 (1.2)	0.9	-	**0.004**	1.3 (0.4)	1.1	-	0.375
Niacin (mg)	24.6 (11.2)	11	-	**<0.0005**	37.3 (15.0)	12	-	**0.009**
Vitamin B_6 (mg)	2.8 (1.8)	1.1	-	**<0.0005**	4.8 (1.5)	1.1	-	**0.002**
Folate (µg)	96.6 (343.2)	320	-	**<0.0005**	28 (31.7)	320	-	**<0.0005**
Vitamin B_{12} (µg)	4.8 (11.7)	2.0	-	**0.036**	3.6 (2.6)	2.0	-	0.203
Biotin (µg)	23.7 (17.4)	-	30	**0.002**	38.1 (15.0)	-	30	0.243
Pantothenate (mg)	5.6 (4.5)	-	5.0	0.231	8.4 (5.1)	-	5.0	0.164
Sodium (mg)	1865.4(1333.2)	-	1500	**0.016**	3108.3 (1462.4)	-	1500	**0.043**

Table 4.27: Comparison of mean nutrient intake with the EAR or AI from a 24-hour recall for female adults aged 31-50 years (n=80) and male adults aged 31-50 years (n=6) continued

Nutrient	Females				Males			
	Mean intake (SD)	**EAR** [a-c]	**AI** [a-c]	**P value***	**Mean intake (SD)**	**EAR** [a-c]	**AI** [a-c]	**P value***
Potassium (mg)	1899.8 (795.4)	-	4700	**<0.0005**	2448.3 (783.7)	-	4700	**0.001**
Calcium (mg)	439.1 (279.3)	-	1000	**<0.0005**	287 (200.1)	-	1000	**<0.0005**
Phosphorus (mg)	883 (430.3)	580	-	**<0.0005**	1041.5 (465.0)	580	-	0.059
Magnesium (mg)	230.7 (129.3)	265	-	**0.020**	277.2 (91.6)	350	-	0.109
Iron (mg	13.7 (9.1)	8.1	-	**<0.0005**	14.7 (2.1)	6	-	**<0.0005**
Zinc (mg)	10 (5.5)	6.8	-	**<0.0005**	14.5 (3.5)	9.4	-	**0.015**

*P values in bold indicate a significant difference from the EAR value (P<0.05); [a]Institute of Medicine (2003, pp282-285), [b]Institute of Medicine (2005a, pp278-1331), [c]Institute of Medicine (2005b, pp606-617). [d]Saturated fat was calculated as 10% of the average total energy (Institute of Medicine 2003, p174); [e]Total sugars were calculated as 25% of the average total energy (Institute of Medicine 2003, p44).

In the age category of 31-50 years, the mean nutrient intake of females was significantly higher than the EAR or AI for protein, carbohydrates, thiamin, riboflavin, niacin, vitamin B_6, vitamin $B_{12,}$ sodium, phosphorus and zinc. The mean nutrient intake was significantly lower than the EAR or AI for total sugars, dietary fibre, vitamin D, vitamin E, folate, biotin, potassium, calcium, and magnesium for females aged 30-51 years. In males, 31-50 years of age, the mean nutrient intake for protein, carbohydrates, thiamin, niacin, vitamin B_6, sodium, iron, and zinc were significantly higher than the EAR or AI. The mean nutrient intake for total sugars, dietary fibre, vitamin A, folate, potassium and calcium was significantly lower than the EAR or AI.

4.9.1.3 24-hour recall analysis for participants 51-70 years

Table 4.28 shows the mean nutrient intake for males and females 51-70 years of age, compared to the EAR or AI.

Table 4.28: Comparison of mean nutrient intake with the EAR or AI from a 24-hour recall for female adults aged 51-70 years (n=13) and male adults aged 51-70 years (n=1)

Nutrient	Females				Males			
	Mean intake (SD)	EAR [a-c]	AI [a-c]	P value*	Mean intake	EAR [a-c]	AI [a-c]	P value*[f]
Energy (kCal)	1482.9 (565.9)	<1800	-	0.066	1393.8	<2200	-	-
Total lipid (g)	55.2 (34.3)	ND	-		23.4	ND	-	-
Saturated fat (g)[d]	17.4 (13.0)	<10% of total energy 16.3 g	-	0.763	8.7	<10% of total energy 26.6 g	-	-
Cholesterol (mg)	204.6 (180.3)	-	<300	0.081	94.0	-	<300	-
Total protein (g)	59 (24.8)	38	-	**0.010**	47.5	46	-	-
Carbohydrates (g)	184.4 (72.5)	<100	-	**0.001**	244.7	<100	-	-
Total sugars (g)[e]	51.1 (41.8)	-	<25% of total energy 91.2 g	**0.005**	100.7	-	<25% of total energy 148.8 g	-
Dietary fibre (g)	15.7 (5.1)	-	25	**<0.0005**	11.1	-	38	-
Vitamin A (µg)	26.7 (64.4)	500	-	**<0.0005**	0.0	625	-	-
Vitamin D (µg)	3.7 (5.1)	10	-	**0.001**	0.7	10	-	-
Vitamin E (mg)	7.6 (3.9)	12	-	**0.002**	2.9	12	-	-
Vitamin K (µg)	71.4 (78.9)	90	-	0.412	3.5	120	-	-
Vitamin C (mg)	57.7 (54.3)	60	-	0.881	2.0	75	-	-
Thiamin (mg)	1.1 (0.4)	0.9	-	0.107	1.3	1.0	-	-
Riboflavin (mg)	0.9 (0.4)	0.9	-	0.914	0.8	1.1	-	-
Niacin (mg)	22.9 (9.6)	11	-	**0.001**	12.2	12	-	-
Vitamin B_6 (mg)	2.7 (1.4)	1.1	-	**0.002**	1.7	1.1	-	-
Folate (µg)	39.9 (34.5)	320	-	**<0.0005**	51.0	320	-	-
Vitamin B_{12} (µg)	2.1 (1.9)	2.0	-	0.872	2.4	2.0	-	-
Biotin (µg)	25.7 (11.5)	-	30	0.206	13.7	30	30	-
Pantothenate (mg)	5.2 (3.0)	-	5.0	0.849	1.3	5.0	5.0	-
Sodium (mg)	1378.8 (831.4)	-	1300	0.738	159.0	-	1300	-
Potassium (mg)	1856.8 (626.5)	-	4700	**<0.0005**	1191.0	-	4700	-

Table 4.28: Comparison of mean nutrient intake with the EAR or AI from a 24-hour recall for female adults aged 51-70 years (n=13) and male adults aged 51-70 years (n=1) continued

Nutrient	Females				Males			
	Mean intake (SD)	EAR [a-c]	AI [a-c]	P value*	Mean intake (SD)	EAR [a-c]	AI [a-c]	P value*
Calcium (mg)	352.7 (147.0)	-	1000	**<.0005**	150.0	-	1000	-
Phosphorus (mg)	724.8 (251.5)	580	-	0.060	605.0	580	-	-
Magnesium (mg)	195.2 (63.1)	255	-	**0.005**	229.0	330	-	-
Iron (mg)	10.2 (4.3)	8.1	-	0.103	8.6	6	-	-
Zinc (mg)	8.3 (4.3)	6.8	-	0.225	10.5	9.4	-	-

*P values in bold indicate a significant difference from the EAR value (P<0.05); [a]Institute of Medicine (2003, pp282-285), [b]Institute of Medicine (2005a, pp278-1331), [c]Institute of Medicine (2005b, pp606-617). [d]Saturated fat was calculated as 10% of the average total energy (Institute of Medicine 2003, p174); [e]Total sugars were calculated as 25% of the average total energy (Institute of Medicine 2003, p44).

4.9.2 Food frequency questionnaire

4.9.2.1 Breads, cereals and starches

Table 4.29 shows the frequency of consumption of breads, cereals and starches. Brown and white bread/rolls were consumed everyday by 28.5% (n=37) and 26.9% (n=35) of participants, respectively. The following food items in this group were consumed 4-6 days a week: white rice (22.3%; n=29), *phutu* (crumbly maize meal porridge) (18.5%; n=24) and potato without skin (17.7%; n=23).

Table 4.29: Frequency of consumption of breads, cereals and starches

FOOD ITEM	FREQUENCY OF CONSUMPTION IN THE PREVIOUS MONTH									
	Never		Seldom (less than once a week)		1-3 days a week		4-6 days a week		Everyday	
	n	%	n	%	n	%	n	%	n	%
BREADS, CEREALS AND STARCHES										
Cereals and grains										
All Bran Flakes	74	56.9	20	15.4	18	13.8	12	9.2	6	4.6
Corn Flakes	77	59.2	15	11.5	23	17.7	8	6.2	7	5.4
Future Life	102	78.5	9	6.9	13	10.0	3	2.3	3	2.3
Mageu	113	86.9	11	8.5	5	3.8	0	0	1	0.8
Maize meal, soft	69	53.1	20	15.4	30	23.1	5	3.8	6	4.6
Maize meal, stiff	67	51.5	21	16.2	31	23.8	10	7.7	1	0.8
Maltabella porridge	118	90.8	8	6.2	3	2.3	0	0	1	0.8
Oats, cooked	71	54.6	13	10.0	37	28.5	6	4.6	3	2.3
Pasta, white	54	41.5	29	22.3	41	31.5	6	4.6	0	0
Pasta, whole-wheat	122	93.8	7	5.4	1	0.8	0	0	0	0
Phutu	30	23.1	14	10.8	57	43.8	24	18.5	5	3.8
Pronutro	120	92.3	3	2.3	6	4.6	1	0.8	0	0
Refined cereal (Coco Pops, Fruit Loops, Milo cereal, Frosties)	109	83.8	7	5.4	11	8.5	0	0	3	2.3
Rice, basmati	108	83.1	11	8.5	9	6.9	2	1.5	0	0
Rice, brown	112	86.2	9	6.9	9	6.9	0	0	0	0
Rice Crispies	115	88.5	7	5.4	7	5.4	1	0.8	0	0
Rice, white	16	12.3	11	8.5	61	46.9	29	22.3	13	10.0
Samp and beans	42	32.3	54	41.5	26	20.0	8	6.2	0	0
Weetbix	59	45.4	12	9.2	39	30.0	9	6.9	11	8.5
Breads										
Bread/ roll, brown	43	33.1	12	9.2	23	17.7	15	11.5	37	28.5
Bread/roll, white	37	28.5	12	9.2	31	23.8	15	11.5	35	26.9
Steam bread	77	59.2	27	20.8	20	15.4	6	4.6	0	0
Starchy vegetables										
Amadumbe	93	71.5	30	23.1	6	4.6	1	0.8	0	0
Mealie/corn	65	50.0	65	50.0	19	14.6	2	1.5	0	0
Peas, green	55	42.3	19	14.6	43	33.1	11	8.5	2	1.5
Potato, with skin	83	63.8	22	16.9	22	16.9	2	1.5	1	0.8
Potato, without skin	17	13.1	16	12.3	62	47.7	23	17.7	12	9.2
Squash, butternut, pumpkin	28	21.5	13	10.0	65	50.0	15	11.5	9	6.9
Sweet potato	70	53.8	29	22.3	23	17.7	6	4.6	2	1.5
Starchy food prepared with fat										
Crumpets	117	90.0	8	6.2	4	3.1	1	0.8	0	0
Fried chips	24	18.5	40	30.8	50	38.5	14	10.8	2	1.5
Instant noodles	86	66.2	23	17.7	12	9.2	6	4.6	3	2.3
Pancakes	100	76.9	19	14.6	10	7.7	1	0.8	0	0
Popcorn with oil	84	64.6	23	17.7	16	12.3	7	5.4	0	0
Scones	60	46.2	30	23.1	31	23.8	8	6.2	1	0.8
Vetkoek	88	67.7	33	25.4	7	5.4	2	1.5	0	0

4.9.2.2 Baked goods, snacks and sweets

Table 4.30 shows the frequency of consumption of baked goods, snacks and sweets. In this group, 35 participants (26.9%) consumed sweets every day, while 27 participants (20.8%) consumed chips (crisps) every day. The following food items in this group were consumed 4-6 days a week: biscuits with filling (14.6%; n=19), sweets (13.1%; n=17), chips (crisps) (11.5%; n=15) and chocolates (11.5%; n=15).

Table 4.30: Frequency of consumption of baked goods, snacks and sweets

FOOD ITEM	FREQUENCY OF CONSUMPTION IN THE PREVIOUS MONTH									
	Never		Seldom (less than once a week)		1-3 days a week		4-6 days a week		Everyday	
	n	%	n	%	n	%	n	%	n	%
BAKED GOODS, SNACKS AND SWEETS										
Biscuits with filling (Romany Creams, Lemon Creams, Toppers, Oreo)	32	24.6	24	18.5	40	30.8	19	14.6	15	11.5
Biscuits without filling (Marie, Eat Sum More)	36	27.7	27	20.8	37	28.5	14	10.8	16	12.3
Cakes, with icing	66	50.8	38	29.2	21	16.2	3	2.3	2	1.5
Cakes, without icing	65	50.0	31	23.8	27	20.8	6	4.6	1	0.8
Chips (crisps)	18	13.8	25	19.2	45	34.6	15	11.5	27	20.8
Chocolates	28	21.5	34	26.2	38	29.2	15	11.5	15	11.5
Fibre biscuits (Provita, Ryvita)	81	62.3	25	19.2	15	11.5	3	2.3	6	4.6
Nuts, salted	63	48.5	25	19.2	31	23.8	8	6.2	3	2.3
Nuts, unsalted	107	82.3	13	10.0	5	3.8	2	1.5	3	2.3
Savoury biscuits, plain (Cream Crackers, Salty Crax)	81	62.3	27	20.8	16	12.3	3	2.3	3	2.3
Sweets	22	16.9	28	21.5	28	21.5	17	13.1	35	26.9

4.9.2.3 Meat, poultry, fish, eggs and meat substitutes

Table 4.31 shows the frequency of consumption of meat, poultry, fish, eggs and meat substitutes. Eggs and processed meats were consumed every day by 20.0% (n=26) and 10.8% (n=14) of participants, respectively. Just over 26% (n=34), 20.0% (n=26) and 17.7% (n=23) of participants consumed eggs, chicken cuts with skin and processed meats 4-6 days a week, respectively.

Table 4.31: Frequency of consumption of meat, poultry, fish, eggs and meat substitutes

FOOD ITEM	FREQUENCY OF CONSUMPTION IN THE PREVIOUS MONTH									
	Never		Seldom (less than once a week)		1-3 days a week		4-6 days a week		Everyday	
	n	%	n	%	n	%	n	%	n	%
MEAT, POULTRY, FISH, EGGS AND MEAT SUBSTITUTES										
Baked beans	15	11.5	41	31.5	60	46.2	12	9.2	2	1.5
Beans, lentils, chickpeas	52	40.0	28	21.5	45	34.6	4	3.1	1	0.8
Bean salad, no oil	91	70.0	24	18.5	15	11.5	0	0	0	0
Beef, cuts	23	17.7	25	19.2	57	43.8	20	15.4	5	3.8
Beef, mince	43	33.1	21	16.2	55	42.3	9	6.9	2	1.5
Beef, patty	69	53.1	30	23.1	23	17.7	7	5.4	1	0.8
Beef, sausage	48	36.9	27	20.8	38	29.2	14	10.8	3	2.3
Chicken, cuts with skin	40	30.8	7	5.4	49	37.7	26	20.0	8	6.2
Chicken, cuts without skin (thigh, breast, wing drumstick)	49	37.7	17	13.1	45	34.6	13	10.0	6	4.6
Chicken, feet	66	50.8	28	21.5	31	23.8	5	3.8	0	0
Chicken, fillet	57	43.8	26	20.0	37	28.5	10	7.7	0	0
Chicken, mince	106	81.5	13	10.0	9	6.9	2	1.5	0	0
Chicken, sausage	77	59.2	24	18.5	24	18.5	4	3.1	1	0.8
Eggs	7	5.4	16	12.3	47	36.2	34	26.2	26	20.0
Fish, fillet crumbed	72	55.4	24	18.5	24	18.5	9	6.9	1	0.8
Fish, fillet not crumbed	87	66.9	18	13.8	18	13.8	6	4.6	1	0.8
Fish, tinned (sardines/pilchards/tuna)	47	36.2	40	30.8	34	26.2	9	6.9	0	0
Lamb/ Mutton	31	23.8	41	31.5	47	36.2	10	7.7	1	0.8
Organ meat (liver, kidney, heart)	53	40.8	38	29.2	29	22.3	9	6.9	1	0.8
Pork, bacon	49	37.7	28	21.5	39	30.0	11	8.5	3	2.3
Pork, cuts	75	57.7	26	20.0	24	18.5	4	3.1	1	0.8
Pork, ham	85	65.4	22	16.9	18	13.8	4	3.1	1	0.8
Pork, sausage	71	54.6	26	20.0	26	20.0	5	3.8	2	1.5
Processed meat (sausage, vienna, polony, cold meat, fish fingers, burger patty)	18	13.8	26	20.0	49	37.7	23	17.7	14	10.8

4.9.2.4 Fruit and vegetables

Table 4.32 shows the frequency of consumption of fruit and vegetables. Just over 36% (n=47) of participants consumed fresh fruit every day. Non-starchy vegetables and fruit juice were consumed everyday by 16.2% (n=21) and 14.6% (n=19) of participants, respectively and 4-6 days a week by 16.9% (n=22) and 11.5% (n=15) of participants, respectively.

Table 4.32: Frequency of consumption of fruit and vegetables

FOOD ITEM										
	Never		**Seldom (less than once a week)**		**1-3 days a week**		**4-6 days a week**		**Everyday**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
FRUIT AND VEGETABLES										
Vegetable (non-starchy)	8	6.2	18	13.8	61	46.9	22	16.9	21	16.2
Fresh fruit	9	6.9	9	6.9	47	36.2	18	13.8	47	36.2
Fruit juice	28	21.5	22	16.9	46	35.4	15	11.5	19	14.6
Fruit salad	61	46.9	33	25.4	29	22.3	6	4.6	1	0.8
Dried fruit	85	65.4	27	20.8	13	10.0	3	2.3	2	1.5
Tinned fruit	93	71.5	23	17.7	9	6.9	4	3.1	1	0.8

4.9.2.5 Dairy and fats

Table 4.33 shows the frequency of consumption of dairy and fats. Full cream milk and sunflower oil were both consumed every day by 46.2% (n=60) of participants, followed by tub/soft margarine (28.5%; n=37). The following food items were consumed 4-6 days a week: cheddar cheese (16.9%; n=22), full cream flavoured yoghurt (12.3%; n=16), ice cream (12.3%; n=16) and tub/soft margarine (11.5%; n=15).

Table 4.33: Frequency of consumption of dairy and fats

FOOD ITEM	FREQUENCY OF CONSUMPTION IN THE PREVIOUS MONTH									
	Never		Seldom (less than once a week)		1-3 days a week		4-6 days a week		Everyday	
	n	%	n	%	n	%	n	%	n	%
DAIRY AND FATS										
Avocado	48	36.9	39	30.0	28	21.5	8	6.2	7	5.4
Butter (brick)	91	70.0	14	10.8	7	5.4	5	3.8	13	10.0
Butter (tub, soft)	97	74.6	8	6.2	9	6.9	6	4.6	10	7.7
Cheese, cheddar	38	29.2	17	13.1	49	37.7	22	16.9	4	3.1
Cheese, gouda	71	54.6	19	14.6	28	21.5	10	7.7	2	1.5
Cheese, low fat	101	77.7	11	8.5	13	10.0	3	2.3	2	1.5
Coffee creamers (e.g. Cremora, Ellis Brown)	79	60.8	13	10.0	21	16.2	4	3.1	13	10.0
Custard	54	41.5	39	30.0	24	18.5	12	9.2	1	0.8
Ghee	120	92.3	7	5.4	2	1.5	1	0.8	0	0
Ice cream	24	18.5	45	34.6	35	26.9	16	12.3	10	7.7
Maas, full cream	61	46.9	27	20.8	33	25.4	7	5.4	2	1.5
Maas, low fat	105	80.8	13	10.0	10	7.7	1	0.8	1	0.8
Margarine (brick)	94	72.3	9	6.9	13	10.0	7	5.4	7	5.4
Margarine (tub, soft)	54	41.5	8	6.2	16	12.3	15	11.5	37	28.5
Milk, fat free	111	85.4	4	3.1	5	3.8	1	0.8	9	6.9
Milk, full cream	38	29.2	7	5.4	17	13.1	8	6.2	60	46.2
Milk, low fat	73	56.2	9	6.9	19	14.6	6	4.6	23	17.7
Oil, canola	86	66.2	6	4.6	2	1.5	3	2.3	33	25.4
Oil, olive	95	73.1	11	8.5	7	5.4	4	3.1	13	10.0
Oil, sunflower	45	34.6	8	6.2	10	7.7	7	5.4	60	46.2
Yoghurt flavoured full cream	69	53.1	12	9.2	28	21.5	16	12.3	5	3.8
Yoghurt, flavoured low fat	74	56.9	14	10.8	32	24.6	6	4.6	4	3.1
Yoghurt plain, full cream	114	87.7	7	5.4	5	3.8	3	2.3	1	0.8
Yoghurt plain, low fat	106	81.5	6	4.6	13	10.0	2	1.5	3	2.3

4.9.2.6 Frequency of consumption of sugar and beverages

Table 4.34 shows the frequency of consumption of sugar and beverages. Water was consumed every day by 82.3% (n=107) of participants followed by tea (42.3%; n=55), white sugar (38.5%; n=50) and brown sugar (31.5%; n=41). Sugar-sweetened soft drinks, tea and coffee were consumed 4-6 days a week by 13.8% (n=18), 11.5% (n=15) and 10.0% (n=13) of participants, respectively.

Table 4.34: Frequency of consumption of sugar and beverages

FOOD ITEM	FREQUENCY OF CONSUMPTION IN THE PREVIOUS MONTH									
	Never		Seldom (less than once a week)		1-3 days a week		4-6 days a week		Everyday	
	n	%	n	%	n	%	n	%	n	%
SUGAR AND BEVERAGES										
Alcoholic drinks	75	57.7	31	23.8	19	14.6	4	3.1	1	0.8
Cappuccino	81	62.3	31	23.8	8	6.2	5	3.8	5	3.8
Coffee	57	43.8	21	16.2	19	14.6	13	10.0	20	15.4
Honey	93	71.5	23	17.7	7	5.4	4	3.1	3	2.3
Milo, hot chocolate, Horlicks	77	59.2	26	20.0	16	12.3	6	4.6	5	3.8
Mixes (e.g. Halls, Oros, Jungle Yum, Fiesta)	73	56.2	13	10.0	19	14.6	7	5.4	18	13.8
Soft drinks, light (e.g. Coke Light)	89	68.5	15	11.5	19	14.6	4	3.1	3	2.3
Soft drinks, sugar free (e.g. Coke Zero, Sprite Zero)	98	75.4	15	11.5	13	10.0	1	0.8	3	2.3
Sugar, brown	65	50.0	6	4.6	14	10.8	4	3.1	41	31.5
Sugar, white	54	41.5	12	9.2	9	6.9	9	6.9	50	38.5
Sugar-sweetened soft drinks (e.g. Coke/ Fanta)	40	30.8	20	15.4	32	24.6	18	13.8	20	15.4
Sweeteners (e.g. Canderel)	119	91.5	3	2.3	6	4.6	0	0	2	1.5
Tea	27	20.8	18	13.8	15	11.5	15	11.5	55	42.3
Water	0	0	5	3.8	13	10.0	5	3.8	107	82.3

4.9.2.7 Other foods

Table 4.35 shows the frequency of consumption of other foods mentioned by participants. Coconut oil was consumed by 2.3% (n=3) of participants every day, followed by raw oat bran (0.8%; n=1), herbal life tea (0.8%; n=1) and seeded bread (0.8%; n=1).

Table 4.35: Frequency of consumption of other foods mentioned by participants

FOOD ITEM	FREQUENCY OF CONSUMPTION IN THE PREVIOUS MONTH									
	Never		Seldom (less than once a week)		1-3 days a week		4-6 days a week		Everyday	
	n	%	n	%	n	%	n	%	n	%
OTHER										
Monster sugar free energy drink	0	0	0	0	1	0.8	0	0	0	0
Coconut oil	0	0	0	0	1	0.8	0	0	3	2.3
Cheese, feta	0	0	0	0	1	0.8	0	0	0	0
Flavoured yoghurt, double cream	0	0	0	0	1	0.8	0	0	0	0
Plain yoghurt, double cream	0	0	0	0	3	2.3	0	0	0	0
Black olives	0	0	0	0	1	0.8	0	0	0	0
Flavoured instant oats	0	0	0	0	2	1.5	0	0	0	0
Muesli	0	0	0	0	2	1.5	0	0	0	0
Soya patty/ sausage	0	0	0	0	1	0.8	0	0	0	0
Waffles	0	0	1	0.8	0	0	0	0	0	0
Herbal life chocolate bars	0	0	0	0	1	0.8	0	0	0	0
Oat bran raw	0	0	0	0	0	0	0	0	1	0.8
Herbal life tea	0	0	0	0	0	0	0	0	1	0.8
Seeded bread	0	0	0	0	0	0	0	0	1	0.8
Crumbed chicken	0	0	0	0	0	0	1	0.8	0	0

4.10 Summary of results

Most participants were 30-39 years old (37.7%), female (91.5%), African (71.5%) and RNs (40.8%). Only 35.4% of participants reported having a diagnosed medical condition. Most participants did not smoke or consume alcohol, while 50% exercised. A significant number of participants did not feel they were at a healthy body shape/size (63.1%) and were not satisfied with their body weight (60%). Most participants underestimated their BMI (76.9%). Most participants skipped meals (83.8%) with breakfast being the only significantly skipped meal. There was significant agreement that time; cost, emotions/stress and convenience were all factors that influenced meal choices. Participants also significantly agreed that a lack of time to prepare meals, lack of time to eat at work, emotions/stress and healthy food not being available to buy at work, were all factors that prevented participants from eating healthily. Majority of participants (86.2%) were overweight or obese, according to their BMI. Over 60% of males had a WC above 94 cm and the majority of females (88.2%) had a WC above 80 cm, indicating an increased risk for metabolic complications. The 24-hour recall showed that the mean intakes of carbohydrates, protein, thiamine, niacin and vitamin B_6 were significantly higher than the EAR or AI, while the mean intakes of dietary fibre, potassium and calcium were significantly lower than the EAR or AI. The FFQ revealed that the most frequently consumed foods were full cream milk, sunflower oil, tea, white sugar, fresh fruit, brown sugar, brown bread/rolls, tub/soft margarine, sweets and white bread/rolls.

CHAPTER 5
DISCUSSION

This study aimed to investigate the anthropometric status and dietary habits of RNs, ENs and ENAs working at a private hospital in PMB, KZN. This chapter discusses the results presented in chapter 4.

5.1 Demographic characteristics of participants

One hundred and thirty nurses participated in this study. The response rate was 76%, which was low. One of the reasons for the low response rate was that nurses were not comfortable with being weighed. In addition, some wards were busy with admissions, discharges, doctor's rounds and emergencies on the days of data collection and nurses were not available to participate in the study. According to Weierbach, Glick, Fletcher, Rowlands & Lyder (2010), barriers that prevent nurses from participating in research studies includes time constraints, high workloads as well as daily routines, which was also seen in the current study. The length of questionnaires also influences the response rate of participants (Edwards, Roberts, Clarke, DiGuiseppi, Wentz, Kwan, Cooper, Felix & Pratap 2007). The likelihood of participants responding increased by 75% with shorter questionnaires (Edwards *et al* 2007). The current study involved one self-administered questionnaire, and two interview questionnaires. The approximate time taken for each participant to answer the questionnaires was 45 minutes. The nurses were informed about the number of questionnaires that they were required to complete and the time it would take when they read the informed consent form. This may have negatively influenced the response rate.

Most nurses were between 30 and 39 years old, were female and African. This is in line with the South African Nursing Council (SANC) (2017) statistics, where it was reported that the number of registered female nurses (64 123) in KZN far outweigh the number of male nurses (6 838) (SANC 2017). This distribution has been observed in all provinces in SA (SANC 2017). The total number of female nurses in SA is almost ten times higher than that of male nurses (SANC 2017).

5.2 Work-related characteristics of participants

In the current study, the shift worked did not contribute to a high BMI. This was unexpected as previous studies showed that night shift workers had a higher BMI (27 kg/m^2) compared to day shift workers (25.6 kg/m^2) (Seychelle & Reeves 2016). Peplonska, Bukowska & Sobala (2015), who conducted a study on nurses in Poland, also showed that shift work was associated with a higher BMI. Peplonska *et al* (2015) found that working the night shift contributed to an increased BMI, which contradicts the findings of the current study. For every one thousand night shifts worked, BMI increased by 0.477 kg/m^2 (Peplonska *et al* 2015).

5.3 Lifestyle factors

5.3.1 Medical conditions

The current study found a lower prevalence of diabetes, hypertension and heart disease (10%, 11.5%, and 1.5%, respectively) when compared to the findings of Skaal & Pengpid (2011), who conducted a study in Pretoria on 200 healthcare workers (HCWs). The prevalence of diabetes, hypertension, heart disease and respiratory diseases among medical staff was 12%, 20%, 3% and 6%, respectively (Skaal & Pengpid 2011). Despite the high prevalence of overweight and obesity found in the current study, most participants reported that they had not been diagnosed with any medical condition. This was unexpected as overweight and obesity are strong predictors for NCDs such as diabetes, CVD, musculoskeletal disorders and some cancers (WHO 2018a). Therefore, it was expected that the current study would have found a higher prevalence of NCDs due to the high prevalence of overweight and obesity found in participants. This finding does not correlate with findings of Skaal & Pengpid (2011), where all medical staff (100%) who participated in the study reported that they had been diagnosed with a medical condition.

It is also possible that participants in the current study were not aware of their medical conditions due to nurses not seeking medical attention when they were unwell and not going for regular health checks. Bana, Yakoo, Jivany, Faisal, Jawed & Awan (2016), investigated the healthcare seeking behaviour of healthcare professionals in Pakistan. It was found that the majority of nurses (74%) had not visited a doctor for any reason in over 12 months. Almost all nurses (99.7%) indicated that they self-medicated when they were ill. The most common reason for nurses not seeking healthcare was the high cost of healthcare. This is also a possible reason why nurses were unaware of their medical conditions in the current study. Healthcare

professionals need to be educated on the importance of regular health check-ups, visiting the doctor on time as well as the dangers of self-medicating (Bana *et al* 2016).

In the current study, some nurses were diagnosed with medical conditions that could have contributed to weight gain and the high prevalence of overweight and obesity in the sample. These conditions included insulin resistance (3.1%), PCOS (1.5%) and hypothyroidism (0.8%). Causes of PCOS include genetics, hormone imbalance and insulin resistance. Insulin assists with the transport of glucose from the blood to cells in order for the glucose to be broken down and produce energy (NHS 2019a). With PCOS, insulin resistance causes the pancreas to produce more insulin, which results in increased fat storage therefore promoting weight gain (NHS 2019b). One of the symptoms of PCOS is weight gain, which could be due to insulin resistance (NHS 2019a). Hypothyroidism reduces energy metabolism therefore causing weight gain in patients with hypothyroidism (Northwestern medicine 2020).

Medications used by nurses in the current study that could possibly have caused weight gain as a side-effect included insulin (0.8%), Glipizide (0.8%) and steroids (0.8%). It is unlikely that these medications could have made a large contribution to the prevalence of overweight and obesity in the current study, as only a small percentage of participants used these medications. According to the American Diabetes Association (2019), weight gain caused by sulfonylureas (such as Glipizide) and insulin is caused by reduced glucose excretion via the urine; therefore, glucose is reabsorbed and stored as fat. Weight gain from corticosteroids is due to an increased appetite, fluid retention as well as fat redistribution (University of California San Francisco 2019). A study in the USA by Lee, Kaminski, McPherson, Feese & Cutter (2018), investigated the adverse effects of prednisone between genders in patients with myasthenia gravis (MG). Adverse effects of prednisone such as increased appetite and weight gain were reported more in females than males. More than half of the female participants and 39.4% of males reported an increased appetite. Weight gain was reported by 68.8% of females and 56.2% of males (Lee *et al* 2018).

Therefore, the hypothesis that there would be a high prevalence of NCDs among RNs, ENs and ENAs in the current study, is rejected.

5.3.2 Smoking and alcohol consumption

Majority of participants in the current study did not smoke (82.3%), while only 17.7% of participants smoked. This was similar to the 17% prevalence of smoking among adults in SA, as reported by Reddy, Zuma, Shisana, Jonas & Sewpaul (2015). Low rates of smoking were also found in the study conducted by Monakali, Goon, Seekoe & Owolabi (2019), who investigated health-promoting lifestyle behaviours in professional nurses in the Eastern Cape, SA. Monakali *et al* (2019) also found a low prevalence of smoking among nurses, whereby only 3% of participants smoked at the time of the study. The current study found that the mean BMI for smokers (29.6 kg/m^2) was significantly lower than the BMI for non-smokers (33.8 kg/m^2). The balance of energy intake and energy expenditure influence weight (McGovern & Benowitz 2011). Physical activity, thermic effects of food as well as resting metabolic rate determine daily energy expenditure (McGovern & Benowitz 2011). Smoking cigarettes containing nicotine decreases body weight by increasing resting metabolic rate together with a reduced intake of food (McGovern & Benowitz 2011). The decreased food intake could be due to cigarettes being a behavioural alternative to eating (McGovern & Benowitz 2011). These findings disagreed with Muga *et al* (2017), who found that individuals who smoked and consumed alcohol were more likely to be overweight or obese.

Results of the current study showed that the majority of nurses did not consume alcohol (59.2%), while 40.8% of participants did. The prevalence of alcohol consumption in the current study was higher than the prevalence of alcohol consumption found in nurses in the Eastern Cape, SA (18%) (Monakali *et al* 2019). Maigari, Mosaku, Umar, Kever, Dalhatu & Dathini (2014) conducted a study in Nigerian nurses to determine their knowledge and attitude towards care of clients with substance abuse. The study found that the majority of nurses passed a knowledge test on the management and prevention of substance abuse, suggesting that nurses had a good knowledge of substance abuse (Maigari *et al* 2014). In contrast to the current study, a much higher prevalence of alcohol consumption was found among healthcare workers in KZN, SA (53.6%), with 22% of participants admitting to having a problem with alcohol (Okeke, Ross, Esterhuizen & Van Wyk 2012).

5.3.3 Exercise

Exactly half of the participants in the current study indicated that they exercised, with the most common form of exercise being walking. Goon *et al* (2013) reported similar findings in Limpopo, whereby 48.7% of nurses stated that they participated in physical activity. The Heart

and Stroke Foundation of South Africa (2017b) recommends that adults should participate in 150 minutes of moderate intensity exercises weekly or 75 minutes of intense aerobic activities weekly. In the current study, the majority of participants exercised for three days a week and for 16-30 minutes in each session, which falls below the weekly amount of exercise recommended by the Heart and Stroke Foundation of South Africa (2017b). Exercise can assist with weight management and the prevention of NCDs (WHO 2019). However, nurses face barriers when it comes to physical activity such as working long shifts together with insufficient time for breaks (Torquatia *et al* 2016). Reed *et al* (2018) reported that nurses, who were tired due to working shifts and long hours, were less likely to participate in physical activity.

5.4 Body image and weight

5.4.1 Satisfaction with body shape/size

Despite the high prevalence of overweight and obesity found in the current study, the majority of participants were satisfied with their body shape/size. Skaal & Pengpid (2011) similarly reported that although 73.5% of healthcare workers were overweight, obese or severely obese, over half of the healthcare workers stated that they were satisfied with their weight (Skaal & Pengpid 2011). In some cultures, it is acceptable to have a bigger body size as it represents health, strength, wealth, attractiveness happiness, respect and dignity (Chithambo & Huey 2013; Puoane *et al* 2005), while a smaller figure is associated with HIV and AIDS (Matoti-Mvalo & Puoane 2011). This may explain why the majority of participants in the current study were satisfied with their body shape/size, despite being overweight or obese.

The two most common reasons why participants were not satisfied with their body shape/size in the current study were that participants felt unhappy with their stomach or felt that their stomach was too big. The high prevalence of central obesity (measured using WC) found in males and females in the current study, supports this finding. Despite feeling satisfied with their body shape/size, the majority of participants felt that they were not at a healthy body weight (60%). The most common reason for participants not feeling that they were at a healthy body weight was because they felt that they were big, fat, overweight or obese. This statement is supported by the high prevalence of overweight and obesity found in the current study. A similar study by Ramgolam (2018) conducted on African female nurses in Durban, KZN, SA, to investigate the prevalence of overweight, obesity and body image, found that the majority of nurses were unhappy with their body shape and showed a significant desire to lose weight.

More than half of the participants in the study wanted to be thinner by one or two body shapes on the Stunkard figure rating scale (Ramgolam 2018).

5.4.2 Perception of body shape using images

Although the majority of participants in the current study were overweight or obese, results showed that nurses perceived themselves to be thinner than they actually were. Over three quarters of participants underestimated their body shape, while just under a quarter of participants accurately assessed their body shape and only a small percentage of participants over estimated their body shape. This suggests that nurses have a problem with accurately judging their own body shape, which could be a barrier in nurses identifying the need to lose weight and achieve a healthier body shape. Ramgolam (2018) found a similar trend to the current study, whereby 69.6% of participants underestimated, 28.3% accurately estimated and 6.6% overestimated their body shape (Ramgolam 2018). The findings of the current study are similar to the findings of Okop, Levitt & Puoane (2019), who conducted a study in Cape Town, Western Cape, SA to investigate weight underestimation and body size dissatisfaction among obese African adults. The study found that 85% of obese participants and 79% of overweight participants underestimated their weight (Okop *et al* 2019). Less than 20% of participants who were overweight or obese were accurately able to estimate their body weight (Okop *et al* 2019).

Okop, Mukumbang, Mathole, Levitt & Puoane (2016), conducted a descriptive qualitative study, whereby purposive sampling was used to select participants from an existing Prospective Urban and Rural Epidemiology (PURE) cohort study done on participants from Cape Town. Okop *et al* (2016) used validated sex specific body image silhouettes for participants to assess body size perception. Majority of obese and overweight women chose the silhouette figures that were smaller than the one that represented their actual weight. Participants believed that they were thinner than they actually were (Okop *et al* 2016). These findings were similar to the current study. A reason for underestimating body shape is possibly due to the high prevalence of overweight and obesity, globally and locally, which has caused a decreased sensitivity in individuals being able to recognise overweight and obesity (Johnson, Cooke, Croker & Wardle 2008).

The results of the current study agree with those of Skaal & Pengpid (2011), who found that 73.6% of participants perceived themselves to be of normal weight when they were actually overweight, while 57.3% perceived themselves to be of normal weight when they were actually

obese and 40% of them perceived themselves to be overweight when they were obese. In addition to this, 66.8% of participants who were severely obese viewed themselves as overweight and 10% of severely obese participants viewed themselves as being normal. A reason for this could be due to cultural norms promoting bigger body sizes as attractive, which resulted in overweight and obese healthcare workers viewing their weight as normal and healthy (Skaal & Pengpid 2011).

The underestimation of body size could be due to norms in society as well as positive associations with having a larger body size (Okop *et al* 2019). Okop *et al* (2016) also found a common trend whereby a popular opinion of participants was that thin people are viewed as being unhealthy or having diseases such as HIV, AIDS, tuberculosis (TB), cancer, depression or emotional stress. HIV is viewed as being socially unacceptable and individuals with HIV are judged negatively or discriminated against (CDC 2020). This may result in individuals aiming to achieve a state of overweight or obesity to avoid the stigma associated with HIV.

5.4.3 Attempts at weight loss

Over 60% of participants in the current study had tried to lose weight before. Of those participants who tried to lose weight before, almost three quarters of participants were successful in losing weight. Of those participants who were successful in losing weight, just over half maintained their weight loss. This could be due to the majority of participants using sustainable weight loss methods such as cutting down on fast foods/takeaways and exercising. According to Ndlovu, Day, Sartorius, Aargaard-Hansen & Hofman (2018), the nutrition transition in sub-Saharan African countries has played a role in increasing the prevalence of major health risks such as overweight and obesity. Fast foods, which contain high amounts of fat, sugar and salt, are easily accessible (Ndlovu *et al* 2018). According to the CDC (2015), exercise is essential for weight loss and weight maintenance. In a study conducted by Chin *et al* (2016), 41% of participants did regular aerobic physical activity for more than 150 minutes weekly and 57% performed regular muscles strengthening exercises for more than two days weekly. The study also found that decreased levels of aerobic and muscle-strengthening physical activities were strongly associated with obesity. It is evident that nurses need assistance to achieve regular exercise (Chin *et al* 2016). The reduced physical activity levels of nurses impact significantly on public health, as nurses should be in the frontline when it comes to providing health and lifestyle education to patients (Chin *et al* 2016).

Only 10.7% of participants in the current study visited a registered dietitian for weight loss. One would have expected more participants to have consulted a registered dietitian for weight loss as dietitians are the experts on weight loss (Academy of Nutrition and Dietetics 2020). Dietitians are trained to formulate personalised weight loss plans and set personalised goals. They are also trained to obtain a thorough history about health, eating patterns, physical activity levels and favourite foods (Academy of Nutrition and Dietetics 2020). Dietitians also teach individuals how to read nutrition labels on food, how to prepare healthy, cost effective meals, how to make healthy choices when eating out and how to avoid cravings (Academy of Nutrition and Dietetics 2020). The private hospital group in the current study is associated with dietetic private practices who see patients on a referral basis. Nurses in the current study can consult with these private practicing dietitians to assist with weight loss.

5.4.4 Participants' perceptions of being a role model to patients and importance of having an ideal body weight

Majority of nurses in the current study felt they were role models to their patients and felt that it was important to have an ideal body weight. This was encouraging as nurses may be urged to take more responsibility for their own body image to be a good role model to the patients they treat. According to the Nursing & Midwifery Counsel (2014), "all nurses must take every opportunity to encourage health promoting behaviour through education, role modelling and effective communication". The current study agrees with the findings of Blake & Harrison (2013), who conducted a study on 540 pre-registered nurses at a teaching hospital in the United Kingdom (UK), to investigate health behaviours and attitudes towards being role models. The study found that over 60% of participants felt that being at a healthy weight was essential for certain nurse duties, and more than half of the participants who felt this way were overweight or obese (Blake & Harrison 2013). Overweight or obese participants were less likely to agree that being at a healthy weight was essential to being a nurse, when compared to underweight and normal weight participants (Blake & Harrison 2013). Blake & Harrison (2013) reported that the majority of participants agreed that nurses should be role models when it comes to health behaviours, similar to the findings of the current study. Overweight or obese participants were less likely to agree that nurses should be role models when it comes to health behaviours, when compared to underweight and healthy weight participants (Blake & Harrison 2013).

Blake & Harrison (2013) found that most participants believed that their physical appearance may affect how other people see them as a nurse. Participants who were overweight or obese were less likely to agree that their physical appearance may affect how other people see them as a nurse, compared to participants who were normal weight or underweight (Blake & Harrison 2013). Nurses spend the most time with patients and play a significant role in health promotion and weight management education (Aryee *et al* 2013). The public prefer to take advice from healthcare professionals who appear healthy themselves as it motivates the public to achieve the same healthy appearance (Simfukwe *et al* 2017). It is assumed that healthcare professionals who have a healthy physical appearance know what they are doing (Simfukwe *et al* 2017). This was also reported in the study by Blake & Harrison (2013), where the majority of the sample indicated that patients would be more inclined to follow health advice given by a nurse who appeared to follow the advice themselves (Blake & Harrison 2013). Participants who were overweight and obese were less likely to agree with this compared to participants who were at a normal weight or underweight, however, this was not a statistically significant finding (Blake & Harrison 2013). More than half of the sample reported that they would find it harder to encourage others to follow positive health behaviours if they did not follow good heath practices themselves (Blake & Harrison 2013).

5.5 Eating patterns and skipping meals

Participants in the current study indicated that they skipped meals with breakfast being the only meal that was significantly skipped. A possible reason for participants skipping breakfast could be due to a lack of time, as they needed to be at work before the 7am shift for handover procedures. It is possible that nurses who work the night shift sleep after their shift and usually eat their first meal later in the day. A study conducted by Akhlaghi & Behrouz (2015) investigated skipping meals and frequency of snack consumption among hospital employees in Iran. Results of the study revealed that more females skipped meals than males. In agreement with the current study, breakfast was the most skipped meal. Skipping meals was linked to a higher obesity risk in females (Akhlaghi & Behrouz 2015). Eating breakfast has some advantages over skipping breakfast (Schlundt, Hill, Sbrocco, Pope-Cordle & Sharp 1992). Participants who consumed breakfast had a lower fat and higher carbohydrate consumption, which showed a better nutrient density and dietary adequacy (Schlundt *et al* 1992). Consuming breakfast has a positive effect on preventing unexpected impulsive snacking, which can result from a long time interval between meals (Schlundt *et al* 1992). In the current study, the mean BMI of participants who skipped supper was significantly higher than those who ate supper.

This finding could be due to participants consuming high-energy sweet snacks that are easily accessible, as they may be hungry but too tired to prepare supper after a long shift. Akhlaghi & Behrouz (2015) also similarly reported that skipping meals was linked to a higher obesity risk in females. A study by Agustina, Nadiya, Andini, Setianingsih, Sadariskar, Prafiantini, Wirawan, Karyadi & Raut (2020) on adolescent females in Indonesia, found that participants who did not consume supper on weekdays were more likely to be overweight or obese.

In the current study, the mean BMI of participants who skipped meals was significantly higher than the BMI of those participants who did not skip meals. This was similar to the findings of Akhlaghi & Behrouz (2015), who reported that frequent snacking was significantly linked to a decreased risk of overweight and obesity in the sample. Speechly, Rogers & Buffenstein (1999), who conducted a study among obese males in Johannesburg, SA, found that an inverse relationship existed between meal frequency and the amount of food consumed at the next meal. Speechly *et al* (1999) found that eating smaller amounts of food more regularly resulted in fewer fluctuations in insulin and blood glucose. Eating frequent meals reduced appetite at the next meal as well as perceived feelings of hunger (Speechly *et al* 1999). However, it is also important to note that the quality of snacks plays an important role in weight management. Barnes, French, Harnack, Mitchell, & Wolfson (2015) who conducted a study on adults in Minnesota, USA, found that the energy intake from healthy snacks such as vegetables was significantly linked to a lower BMI, while the energy intake from sweet snacks such as sweets and desserts was significantly linked to a higher BMI (Barnes *et al* 2015).

5.6 Person preparing meals at home and factors influencing meal choices

A significant number of participants in the current study prepared their own meals. This could be the reason for less healthy meals being prepared as nurses usually look for the quickest and most convenient foods to eat after a long shift. Convenience foods are often high in fat, salt and calories (energy). As healthcare professionals, nurses are expected to make healthy meal choices, however, despite having some nutrition knowledge; nurses do not necessarily use their knowledge to lead a healthier lifestyle. More extensive nutrition training would not only benefit nurses with helping their patients, but will also help them to lead healthier lifestyles themselves. This is in line with findings of the current study, which found that a lack of time was a significant factor that prevented participants from eating healthily. In the study by Phiri *et al* (2014), nurses regularly stated that they did not have enough time to prepare healthy meals and bought unhealthy fast foods due to convenience. A lack of time to prepare healthy meals was

a result of working long hours and being fatigued after their shift. This was seen as a major barrier to leading a healthy lifestyle (Phiri *et al* 2014). These findings of Phiri *et al* (2014) are similar to the current study, which found a significant agreement that time and convenience were factors that influenced meal choices of participants.

There was a significant agreement in the current study that cost was a factor affecting the meal choices of nurses. Similarly, Phiri *et al* (2014) also found that nurses did not choose healthy foods due to cost. Healthy foods such as salads and fruit were more expensive at the cafeteria (Phiri *et al* 2014). A study conducted by Power *et al* (2017) in Scotland, also reported that financial aspects influenced whether or not nurses chose healthy meals (Power *et al* 2017). Nurses in Nigeria reported that fruits and vegetables were more expensive compared to foods high in sugar, fat and carbohydrate (Uchendu, Windle & Blake 2020). Nurses reported that high household expenses make it difficult to afford the requirements for leading a healthy lifestyle, including healthy eating and exercising (Uchendu *et al* 2020).

Emotions/stress was another significant factor that influenced meal choices in the current study. Torquatia *et al* (2016) similarly reported that stress was a driving factor for emotional eating, where nurses craved fast food, chocolates and sweets high in sugar and fat. Rothmann, Van der Colff & Rothmann (2006), conducted a study to investigate the occupational stress of 980 professional nurses and 800 ENs and ENAs from the Eastern Cape, Free State, Gauteng, KZN, Mpumalanga, North West and Western Cape in SA. The most severe stress experienced by professional nurses was caused by colleagues not performing their tasks, being short staffed, not having enough time to do their tasks, lack of motivation, poor recognition for performing tasks well, watching patients suffer, demands from patients, health risks while caring for patients and stock control at ward level (Rothmann *et al* 2006). The most severe stressors for ENs and ENAs were health risks while caring for patients, being short staffed and poor recognition for performing tasks well (Rothmann *et al* 2006). Professional nurses had higher stress levels compared to ENs and ENAs, due to the risk of making a mistake while treating patients, as well as possible conflict with other healthcare professionals about patient treatment (Rothmann *et al* 2006).

5.7 Factors preventing participants from eating healthily

The current study found that a lack of time to prepare meals, a lack of time to eat at work, emotions/stress and healthy food not being available to buy at work were factors that prevented

participants from eating healthily. Simfukwe *et al* (2017), who conducted a study on healthcare workers in PMB, also reported similar results as nurses reported a lack of time as a barrier to preparing healthy meals at home. The lack of time was due to working long hours, which resulted in employees getting home late and being too tired to prepare healthy meals (Simfukwe *et al* 2017). Chain restaurants such as McDonalds and KFC would still be open and participants would usually purchase these fast foods (Simfukwe *et al* 2017). Nurses in the study conducted by Power *et al* (2017), reported that work stress is often a result of not taking their breaks and having busy shifts. This stress is a barrier to healthy eating as they usually reach for something sweet, "junk food" or "comfort food" (Power *et al* 2017). Nurses also reported that adequate breaks were essential to achieving healthy eating (Power *et al* 2017). Results from the study conducted by Phiri *et al* (2014) revealed that nurses of all ranks reported that there were mostly unhealthy meal options to choose from at the hospital cafeteria. Healthier meal options at the hospital cafeteria were reported to be more expensive (Power *et al* 2017; Phiri *et al* 2014). Another factor contributing to unhealthy meal choices at work is patients giving sweet treats to nurses (Power *et al* 2017).

5.8 Snacking and meal purchasing from the hospital cafeteria

In the current study, the food items that were purchased at least once a day from the hospital cafeteria were fruit and sugar-sweetened soft drinks. It was encouraging that nurses consumed fruit daily, as fruit is high in fibre and nutrients. However, it is of concern that sugar-sweetened beverages were consumed daily. Sugar-sweetened beverages are high in sugar and calories (energy) but provide little nutritional value (WHO 2020c). In addition, they do not contribute to satiety (WHO 2020c). This could lead to an increase in daily energy intake and contribute to a high prevalence of overweight and obesity (WHO 2020c), as seen in the current study. In the current study, pies were the most common food item purchased from the hospital cafeteria. Pies are high in saturated fat and carbohydrates and a high intake of pies on a regular basis could contribute to weight gain. Torquatia *et al* (2016) reported that chocolates and treats were easily accessible snacks to nurses as they were always available in the ward. Participants felt was that this was a key cause of overweight (Torquatia *et al* 2016). Nurses working the night shift stated that they regularly ate snacks such as chips and chocolates, which are high in energy, to help them stay awake during their shift (Torquatia *et al* 2016). Nurses reported that they would feel more motivated to avoid unhealthy snacks if their peers showed more commitment to avoiding unhealthy snacks (Torquatia *et al* 2016). Albert *et al* (2014) who investigated factors related to a healthy diet and physical activity among hospital-based clinical nurses in

Ohio, USA, found that most participants snacked on savoury snacks such as chips, nuts or crackers. Almost half of the sample snacked on ice cream, sweets and cookies, followed by fast foods like fries and pizza (Albert *et al* 2014).

Snacks can be part of a healthy diet if the snacks are chosen wisely and eaten in moderation (The Association of UK Dietitians 2020). A healthy snack should have less than 3g fat, less than 5g sugar and less than 0.3g of salt per 100g (The Association of UK Dietitians 2020). Eating healthy snacks that contain whole grains can encourage satiety and appetite control, which could help to decrease obesity (Njike, Smith, Shuval, Shuval, Edshteyn, Kalantari & Yaroch 2016). Nurse Managers and supervisors should be advocates for change in hospitals (Ross *et al* 2017). A practical example of this is to support the serving of healthier options such as fruit trays instead of energy dense, high sugar and high fat snacks during times of celebration (Ross *et al* 2017). It is suggested that the hospital cafeteria stock healthy snacks such as fruit, low fat yoghurt, whole-wheat sandwiches or crackers, unsalted nuts and popcorn (The Heart and Stroke Foundation of South Africa 2017d).

5.9 Anthropometric status

The current study found that just over 60% of the participants were obese, while 25.4% were overweight. Female participants had a significantly higher mean BMI compared to males. This is in line with findings of the SANHANES-1 conducted on South African individuals, which found that South African females had a higher mean BMI than males (Shisana *et al* 2013). However, the mean BMI for females and males in the current study were higher than that reported in the SANHANES-1. The prevalence of obesity among females in the current study (62.2%) is also higher than that reported for South African females in SANHANES-1 (39.2%) (Shisana *et al* 2013). The high prevalence of obesity among females in the current study is a cause for concern and requires urgent attention. The hypothesis that there would be a high prevalence of overweight and obesity among RNs, ENs and ENAs working at a private hospital in PMB, KZN, is accepted.

The current study results are in line with a study by Goon *et al* (2013), which found a 27.5% and 51.6% prevalence of overweight and obesity among nurses, respectively. However, a lower prevalence of obesity was found in nurses in other countries. In a study conducted on Californian nurses in the USA, the prevalence of overweight and obesity was 31% and 18%, respectively. Kyle *et al* (2017) found an obesity prevalence of 25.12% among nurses in

England. This indicates that nurses in SA are facing a higher burden of obesity compared to nurses internationally.

In the current study, there were no significant differences between gender and WC. Most males (63.6%) and females (88.2%) in the study exceeded the cut-off points for WC of > 94 cm and > 88 cm, respectively. This is of concern as it indicates that the majority of participants are at increased risk for metabolic complications. Furthermore, 27.3% of males had a WC greater than 102cm and 72.3% of females had a WC greater than 88cm, which indicates central obesity as well as a substantially increased risk for metabolic complications. Findings of the current study were similar to the SANHANES-1 (2013) and 2016 SADHS study which was conducted on South Africans, in that a higher number of females (50.5% and 45%, respectively) had a WC ≥ 88cm compared to males with a WC ≥ 102cm (9.9% and 10%, respectively). However, in the current study a higher percentage of participants exceeded the WC cut-off points, when compared to the SANHANES-1 and SADHS studies (DOH 2016a; Shisana *et al* 2013). This finding is of concern, as a high WC is associated with an increased risk for diabetes, heart disease and hypertension (National Heart, Lung and Blood Institute 2000).

5.10 Dietary habits

5.10.1 24-hour recall

The mean intakes of carbohydrates, protein, thiamine, niacin and vitamin B_6 were significantly higher than the EAR or AI in the current study. Despite the mean nutrient intake of carbohydrates being significantly higher than the EAR, the mean intake of dietary fibre was significantly lower than the AI in the current study. This suggests that most of the carbohydrates consumed were refined and lower in fibre. This finding is a cause for concern, as an intake of carbohydrates in excess of the body's requirements can be detrimental to health (Heart Research Institute 2020). This could lead to a constant increase in blood glucose levels causing an increased risk for cardiac disease, poor metabolic health and weight gain (Heart Research Institute 2020). In addition to this, nurses should be encouraged to consume complex carbohydrates that are higher in fibre as they promote satiety and fullness, which can lead to a reduced energy intake and assist with weight management (Institute of Medicine 2006, p112). Other benefits of dietary fibre include reducing the risk of heart disease and regulating cholesterol levels by altering cholesterol and fat absorption (Institute of Medicine 2006, pp112-113). It is possible that participants could have underreported their intake during their 24-hour

recall interview. In addition, a single 24-hour recall is not reflective of usual dietary intake (Gibson 2005, p42).

The hypothesis that the intake of energy and macronutrients among RNs, ENs and ENAs would be higher than their requirements was partially accepted, as the mean intake of carbohydrates was significantly higher than the EAR.

Some of the most frequently consumed foods from the FFQ included crisps/chips and processed meats, which are high in sodium. Fried chips were also one of the food items consumed most frequently. Although fried chips are not naturally high in sodium, salt is usually added to fried chips. A high intake of sodium is linked to strokes, high blood pressure, heart disease, and stomach cancer (American Heart Association 2020a). Although salty foods and snacks were frequently consumed in the current study, there was a low prevalence of hypertension and heart disease. This could possibly be due to medical conditions being undiagnosed. In addition, no blood or other medical tests were conducted in the current study to detect any unknown existing medical conditions. Therefore, the low prevalence of these medical conditions reported in the current study, may not be a true representation of the existing medical conditions.

Participants with existing heart disease should be informed about how excess sodium intake could worsen their current condition or even increase the risk of death from these conditions (DOH 2016a). Those without existing heart disease should be informed about how excess sodium intake can increase the risk of stroke, high blood pressure, heart disease, stomach cancer as well as kidney disease, kidney stones, osteoporosis and enlarged heart muscles (American Heart Association 2020a). A study by Okeyo (2009), conducted on nursing students in the Eastern Cape, SA, also found that carbohydrate intake was higher than the RDA for carbohydrate, similar to the current study. Another study conducted on rural South Africans in Empangeni also found similar trends, whereby there was an excessive intake of carbohydrates and sodium (Kolahdooz, Spearing & Sharma 2013). Participants in the current study should be advised to replace the crisps/chips consumed with lower salt options such as lightly salted homemade popcorn (NHS 2017a). Processed meats should be replaced with fresh or frozen unprocessed meat that has a lower sodium content compared to processed meats (Heart Foundation 2018). Salt free herbs, spices and natural flavourings should be used to flavour meals, while cutting down on salt (Heart Foundation 2018).

The current study did not draw blood samples to detect any micronutrient deficiencies. Participants in the current study may be consuming foods with a low nutrient density. Although they could be meeting or exceeding their energy and macronutrient requirements, they may not be meeting their micronutrient requirements. In the current study, the FFQ showed a frequent consumption of foods with low nutrient density such as fried chips, biscuits, chips, chocolates and sweets. This could have contributed to participants meeting or exceeding their energy, carbohydrate and fat requirements, while having an inadequate intake of micronutrients. Other studies on overweight and obese individuals had similar findings to the current study. Horvath, Dias de Castro, Kops, Malinosk & Friedman (2014), conducted a study on obese patients in the Hospital de Clínicas de Porto Alegre (HCPA), Brazil. The study investigated the coexistence of inadequate nutrient intake with obesity. The study found that obese individuals did not meet the RDA for vitamin A, vitamin D, vitamin E and potassium, similar to the current study (Horvath *et al* 2014). In summary, participants should be educated on choosing foods that are lower in sugar, carbohydrates, fat and energy, but high in fibre, vitamins and minerals.

5.10.2 Food consumption patterns

Brown and white bread/rolls, white rice, potatoes with skin and *phutu* were the starches eaten most often by participants in the current study. White bread/rolls, white rice, potatoes without skin and *phutu* are generally lower in fibre. A low fibre intake is associated with stomach cancer and constipation (British Nutrition Foundation 2018a), while diets high in fibre are linked to a decreased risk of diabetes, improved cholesterol levels and prevention of overweight (British Nutrition Foundation 2018a). Gross, Li, Ford & Liu (2004), found an increasing trend of T2DM prevalence, a low fibre intake, and a high intake of refined carbohydrates. Obesity and diabetes prevalence increased with an increased intake of refined carbohydrates (Gross *et al* 2004). Obesogenic foods are those that are high in sugar, salt and saturated fats and promote obesity (Kroll, Swart, Annan, Thow, Neves, Apprey, Aduku, Agyapong, Moubarac, Du Toit, Aidoo & Sanders 2019). Findings of the current study are similar to other studies conducted in SA. Kunene & Taukobong (2017) who conducted a study on healthcare professionals (nurses, doctors, paramedics and allied healthcare professionals) in KZN found that participants rarely consumed whole grains and high fibre foods. In agreement with this, a study conducted in Limpopo, SA by Mbhenyane, Venter, Vorster & Steyn (2005) on college students, found that the five most popular eaten starches were stiff maize-meal porridge, white rice, brown bread, soft maize-meal porridge and white bread. Sheehy, Kolahdooz, Mtshali, Khamis & Sharma (2013), who conducted a study on 81 adults in Empangeni, SA also similarly reported that the

main five foods contributing to macronutrient intake were *phutu*, rice, beans, samp and beans, and stiff maize meal.

In the current study, participants frequently consumed sweets, chips (crisps), biscuits, and chocolates. Confectionery and sweets, which were eaten often by participants in the current study, are considered obesogenic foods (Kroll *et al* 2019). The current study findings are in agreement with Kunene & Taukobong (2017), who reported that half of the sample of healthcare professionals consistently ate unhealthy snacks. Participants consumed sweet, salty, fried and fatty foods as well as fast foods (Kunene & Taukobong 2017). According to The Heart and Stroke Foundation of South Africa (2017d), healthy snacks, include fresh fruit, dried fruit, yoghurt, whole-wheat sandwiches, whole-wheat crackers, unsalted nuts and popcorn. Participants in the current study did not frequently consume any of these healthy snacks. One of the most common barriers preventing healthy snacking is the lack of healthy food options being available at work. Work places should make healthier snacks available at the canteen and vending machines (The Heart and Stroke Foundation of South Africa 2017d). Serving healthier drinks and snacks at meetings should also be encouraged. These include water, 100% fruit juice diluted with water and fruit and vegetable platters accompanied by sides such as low-fat hummus or cottage cheese (The Heart and Stroke Foundation of South Africa 2017d).

Foods most frequently consumed in the category of meat, poultry, fish, eggs and meat substitutes were eggs, chicken cuts with skin and processed meats. Processed meats and chicken with skin are higher in saturated fat, which can increase serum cholesterol and low-density lipoprotein (LDL) cholesterol levels, which can increase the risk of strokes and cardiac disease (American Heart Association 2020b). Nurses should be educated to consume more lean protein and remove all visible fat and skin from meat to reduce the saturated fat and energy content of the meal (Schonfeldt, Pretorius & Hall 2013). Eating larger quantities of meat and processed foods, which are considered obesogenic foods, are more likely to be associated with overweight or obesity (Kroll *et al* 2019; Muga *et al* 2017). The most commonly consumed dairy and fats were full cream milk, sunflower oil, full cream flavoured yoghurt, tub/soft margarine and cheddar cheese. Full cream milk and cheddar cheese are higher in saturated fats than low fat dairy products. A study by van den Berg, Okeyo, Dannhauser & Nel (2012) on nursing students in the Eastern Cape, SA, reported that very few participants consumed dairy daily. The majority of participants did not consume skim milk or low-fat milk. The most commonly consumed fruit and vegetables in the current study were fresh fruit, non-starch

vegetables and fruit juice. It was encouraging to see that participants frequently consumed non-starchy vegetables and fruit as consumption of these two food groups are associated with a low risk for obesity (Kroll *et al* 2019).

Participants in the current study consumed tea and water every day. It was encouraging to see that participants did not have an issue with consuming water, which does not contain any added sugar. Consuming adequate amounts of water allows for nutrient transportation and removal of waste products through urination and prevents dehydration (NHS 2017b). Kunene & Taukobong (2017) found conflicting results where participants regularly consumed carbonated beverages with sugar, coffee and alcohol, with a low consumption of water.

CHAPTER 6

CONCLUSIONS, STUDY LIMITATIONS AND RECOMMENDATIONS

The current study aimed to investigate the anthropometric status and dietary habits of RNs, ENs and ENAs working at a private hospital in PMB, KZN. The objectives were as follows: (i) to determine the anthropometric status of RNs, ENs and ENAs working at a private hospital in PMB, KZN; (ii) to determine the dietary habits of RNs, ENs and ENAs working at a private hospital in PMB, KZN; (iii) to determine the factors contributing to the anthropometric status and dietary habits of RNs, ENs and ENAs working at a private hospital in PMB, KZN; (iv) to determine the prevalence of NCDs among RNs, ENs and ENAs working at a private hospital in PMB, KZN.

6.1 Conclusions

There was a high prevalence of overweight and obesity among participants. Female nurses had a higher BMI than males. Most participants exceeded the cut-off values for WC, indicating an increased risk for metabolic complications. There was a low prevalence of known NCDs and most participants did not consume alcohol or smoke. Most participants were not satisfied with their body shape and felt that they were not at a healthy body weight. Despite the high prevalence of overweight and obesity found, many participants underestimated their body shape/size. Most participants had tried to lose weight before and some were successful in losing weight, which could be due to sustainable weight lost methods such as cutting down on fast foods and exercise. However, a large number of participants were still overweight or obese. Unfortunately, only a small percentage of participants consulted a registered dietitian for weight loss.

Most participants felt that they were a role model to their patients and that it was important for them to be at an ideal body weight. This could be used as motivation for nurses to be serious about achieving an ideal body weight or at least working towards it. Meal skipping was common amongst participants and the most significantly skipped meal was breakfast. Participants significantly agreed that time, cost, emotions/stress and convenience were factors that influenced their meal choices. A lack of time to prepare meals, lack of time to eat at work, emotions/stress and healthy food not being available to buy at work prevented participants from eating healthily.

Non-smokers had a higher BMI than smokers, while less snacking was associated with a higher BMI. In addition, those who skipped meals had a higher BMI than those who did not. Participants who skipped supper had a higher mean BMI than those who did not skip supper. Those who agreed that cost influenced meal choices had a higher BMI than those who did not. Those who agreed that a lack of time to eat at work (too busy) was a factor preventing healthy eating had a lower BMI than those who did not.

Overall, there was a higher intake of carbohydrates and protein and a lower intake of dietary fibre. The FFQ revealed that both healthy and unhealthy foods were eaten on a regular basis. The FFQ revealed that the most frequently consumed foods were full cream milk, sunflower oil, tea, white sugar, fresh fruit, brown sugar, brown bread/rolls, tub/soft margarine, sweets and white bread/rolls. Ongoing nutrition education can assist nurses to make choices that are more informed when it comes to healthy meal choices. Encouraging participants to lead a healthy lifestyle and eat a healthy balanced diet will ensure that they meet their micronutrient requirements, without exceeding their macronutrient requirements. This will also motivate them to lose weight and feel that they have the right support to make better choices to lose weight.

6.2 Study limitations

6.2.1 Although all private hospitals in PMB were invited to participate in the study, only one private hospital agreed to participate. Therefore, the study was limited to one private hospital in PMB. The sample was therefore not a true representation of all nurses working in private hospitals in PMB and this prevents generalised conclusions from being drawn.

6.2.2 No biochemical tests or medical tests were conducted in the study to screen for undiagnosed existing NCDs due to financial constraints.

6.2.3 Body composition analyses were not conducted to determine the contribution of muscle and fat to body weight. Body fat percentage was also not measured in this study.

6.2.4 The current study had a poor response rate due to the busy nature of the hospital wards and the unwillingness of nurses to participate.

6.2.5 The 24-hour recall was obtained for one day only due to time constraints. Therefore, the dietary intake data should be interpreted with caution. Although it would have been ideal to obtain three repeated 24-hour recalls, this was not possible due to the inability of nurses to leave their nursing duties to give repeated 24-hour recalls. The researcher

informed the nurses of the importance of giving accurate and honest information in the 24-hour recall before it was obtained. To ensure that the 24-hour recall was valid, it was compared to the information obtained from the food frequency questionnaire.

6.3 Recommendations

6.3.1 Hospitals should implement wellness days for nurses and a registered dietitian should be part of the occupational health team focusing on weight loss and weight management for nurses who are overweight and obese. Not only would it benefit the nurses, but also the hospital as nurses would be healthier and more productive in the work place.

6.3.2 Because time and cost were factors influencing meal choices, nurses should be educated on quick, healthy cost-effective meals that can be prepared after a long shift to prevent them from skipping meals and relying on convenience foods.

6.3.3 The hospital cafeteria should have more healthy options on the menu and these items should be wholesome, affordable and appealing in terms of presentation and flavour. This will encourage nurses to make healthier meal choices. A registered dietitian should be consulted. The cafeteria environment should be a place of relaxation during break times and also ensure healthy food choices become the default.

6.3.4 Stress was a factor that influenced meal choices and prevented participants from eating healthily. Therefore, the hospital as the employer should provide psychological support to nurses to cope with the stress that they experience.

6.3.5 The hospital should ensure that nurses take their lunch breaks on time, for the full duration and without any disturbances, as a lack of time to eat at work prevented participants from eating healthily. Hospitals should also be adequately staffed to prevent nurses from being overworked and not having enough time to eat snacks or meals.

6.3.6 Nurses should be educated on the benefits of physical activity for health and weight loss. They should also be educated on how much exercise they need to do. Hospitals should have a clean safe space for nurses to exercise before work, after work or during breaks.

6.3.7 Nurses should be educated on what a healthy body size is and the health risks associated with a larger body size.

6.3.8 Nurses should be encouraged to have healthy portion sizes, choose complex carbohydrates, lean proteins, low fat dairy products, fruit and vegetables in order

to meet their micronutrient requirements, without exceeding their macronutrient requirements.

6.4 Recommendations for further research

6.4.1 Future studies should include assessment of muscle mass, fat mass, body fat percentage and visceral fat as body composition provides a more detailed anthropometric assessment than BMI and WC. Visceral fat is also a strong predictor of T2DM.

6.4.2 Studies should also be expanded to include other health care professionals such as doctors and allied health care workers, as they experience similar stresses to nurses and are also role models to their patients.

6.4.3 Nurses working at both private and public hospitals countrywide should be included in future studies.

6.4.4 It would be beneficial to measure the effectiveness of a nutrition education intervention in influencing the dietary habits of nurses by assessing anthropometric status before and after the intervention.

REFERENCES

Abdollahi M, Houshiarrad A, Abtahi M, Esmaeli M, Pouraram H, Khoshfetrat MR, Shakori MM, Keshel SH (2013). The nutrition knowledge level of physicians, nurses and nutritionists in some educational hospitals. **Journal of Paramedical Sciences** 4: 106-114.

Academy of Nutrition and Dietetics (2020). **10 Reasons to Visit an RDN**. [https://www.eatright.org/food/resources/learn-more-about-rdns/10-reasons-to-visit-an-rdn] (Accessed 26 October 2020).

Agustina R, Nadiya K, Andini EA, Setianingsih AA, Sadariskar AA, Prafiantini E, Wirawan F, Karyadi E, Raut MK (2020). Associations of meal patterning, dietary quality and diversity with anemia and overweight-obesity among Indonesian school going adolescent girls in West Java. **PLoS One** 15(4): 1-19.

Akhlaghi M, Behrouz V (2015). Skipping meals and frequency of snack consumption are important eating behaviours related to obesity in hospital employees. **Journal of Paramedical Sciences** 6(2): 44-52.

Albert NM, Butler R, Sorrell J (2014). Factors Related to Healthy Diet and Physical Activity in Hospital-Based Clinical Nurses. **A Scholarly Journal of the American Nurses Association** 19(3): 1-17.

American Diabetes Association (2019). **Diabetes Medications and Their Effect on Weight** [http://www.diabetesforecast.org/2012/oct/diabetes-medications-and-their-effect-on-weight.html] (Accessed 7 October 2019).

American Heart Association (2020a). **Effects of Excess Sodium Infographic** [https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/sodium/effects-of-excess-sodium-infographic] (Accessed 13 December 2020).

American Heart Association (2020b). **Saturated Fat** [https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/fats/saturated-fats] (Accessed 12 November 2020).

American Thyroid Association (2016). **Thyroid & Weight**. [http://www.thyroid.org/wp-content/uploads/patients/brochures/Thyroid_and_Weight.pdf] (Accessed 5 October 2019).

Arnold M, Pandeya N, Byrnes G, Renehan AG, Stevens GA, Ezzati M, Ferlay J, Miranda JJ, Romieu I, Dikshit R, Forman D, Soerjomataram I (2015). Global burden of cancer attributable to high body-mass index in 2012: a population-based study. **Lancet Oncology** 16(1): 36-46.

Aryee PA, Helegbe GK, Baah J, Sarfo-Asante RA, Quist-Therson R (2013). Prevalence and Risk Factors for Overweight and Obesity among Nurses in the Tamale Metropolis of Ghana. **Journal of Medical and Biomedical Sciences** 2(4): 13-23.

Badawi A, Klip A, Haddad P, Cole D, Bailo B, El-Sohemy A, Karmali M (2010). Type 2 diabetes mellitus and inflammation: prospects for biomarkers of risk and nutritional intervention. **Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy** 3: 173-186.

Bana S, Yakoo J, Jivany N, Faisal A, Jawed H, Awan S (2016). Understanding health seeking behaviour of health care professionals in tertiary care hospitals in Pakistan. **Journal of Ayub Medical College Abbottabad** 28(3): 545-549.

Barnes TL, French SA, Harnack LJ, Mitchell NR, Wolfson J (2015). Snacking Behaviors, Diet Quality, and BMI in a Community Sample of Working Adults. **Journal of the Academy of Nutrition and Dietetics** 115(7): 1117-1123.

Bhattacharya A, Pal B, Mukherjee S, Roy SK (2019). Assessment of nutritional status using anthropometric variables by multivariate analysis. **BMC Public Health** 19(1045): 1-9.

Bjergved L, Jorgensen T, Perrild H, Laurberg P, Krejbjerg A, Ovesen L, Rasmussen L, Knudsen N (2014). Thyroid Function and Body Weight: A Community-Based Longitudinal Study. **PLoS One** 9(4): 1-7.

Blake H, Harrison C (2013). Health behaviours and attitudes towards being role models. The University of Nottingham. **British Journal of Nursing** 22(2): 86-94.

British Nutrition Foundation (2018a). **Dietary Fibre**. [https://www.nutrition.org.uk/nutritionscience/nutrients-food-and-ingredients/dietary-fibre.html] (Accessed 28 December 2020).

British Nutrition Foundation (2018b). **Energy intake and expenditure**. [https://www.nutrition.org.uk/nutritionscience/obesityandweightmanagement/energy-intake-and-expenditure.html?start=5] (Accessed 17 October 2019).

Callahan EA, Roundtable on Obesity Solutions, Food and Nutrition Board, Health and Medicine Division, National Academies of Sciences, Engineering, and Medicine (2019). Current Status and Response to the Global Obesity Pandemic: Proceedings of a Workshop (2019). **Current Global Obesity Pandemic**, 1st ed. Washington DC: The National Academy Press.

Castell GS, Serra-Majem L, Ribas-Barba L (2015). What and how much do we eat? 24-hour dietary recall method. **Nutrición Hospitalaria** 31(3): 46-48.

Centers for Disease Control and Prevention (CDC) (2017). **Adult Obesity Causes & Consequences**. [https://www.cdc.gov/obesity/adult/causes.html] (Accessed 23 August 2019).

Centers for Disease Control and Prevention (CDC) (2007). **Anthropometry Procedures Manual**. [https://www.cdc.gov>nhanes.manual_an] (Accessed 19 June 2018).

Centers for Disease Control and Prevention (CDC) (2013a). **Genes and Obesity** [https://www.cdc.gov/genomics/resources/diseases/obesity/obesedit.htm] (Accessed 20 October 2019).

Centers for Disease Control and Prevention (CDC) (2020). **HIV Stigma and Discrimination**. [https://www.cdc.gov/hiv/basics/hiv-stigma/index.html] (Accessed 10 November 2020).

Centers for Disease Control and Prevention (CDC) (2013b). **Overview of Noncommunicable Diseases and Related Risk Factors**. [https://www.cdc.gov/globalhealth/ healthprotection/fetp/training_modules/new-8/Overview-of-NCDs_PPT_QA-RevCom_09112013.pdf] (Accessed 30 September 2020).

Centers for Disease Control and Prevention (CDC) (2016). **Overweight and Obesity**. [https://www.cdc.gov/obesity/adult/defining.html] (Accessed 24 May 2017).

Centers for Disease Control and Prevention (CDC) (2015). **Physical Activity for a Healthy Weight**. [https://www.cdc.gov/healthyweight/physical_activity/index.html] (Accessed 26 October 2020).

Chin DL, Nam S, Lee SJ (2016). Occupational factors associated with obesity and leisure-time physical activity among nurses: A cross sectional study. **International Journal of Nursing Studies** 57: 60-69.

Chithambo TP, Huey SJ (2013). Black/White Differences in Perceived Weight and Attractiveness among Overweight Women. **Journal of Obesity** 2013: 1-4.

Department of Health (2016a). **South Africa Demographic and Health Survey 2016**. [http://www.health.gov.za/index.php/component/phocadownload/category/539-sadhs-south-africa-demographic-and-health-survey-report?download=3325:sadhs-2016-report] (Accessed 2 August 2020).

Department of Health (2016b). **Strategy for the prevention and control of obesity in South Africa 2015-2020**. [http://www.health.gov.za/index.php/2014-03-17-09-09-38/policies-and-guidelines/category/327-2017po?download=1832:strategy-for-the-prevention-and-control-of-obesity-in-south-africa] (Accessed 28 May 2019).

Diabetes South Africa (2017). **Rethink your drink; choose water**. [https://www.diabetessa.org.za/rethink-your-drink/] (Accessed 27 October 2019).

Driscoll DJ, Miller JL, Schwartz S, Cassidy SB (2017). **GeneReviews® Prada-Willi syndrome,** 1st ed. Seattle (WA): University of Washington, Seattle.

Ebbert JO, Jensen MD (2013). Fat Depots, Free Fatty Acids, and Dyslipidemia. **Nutrients** 5: 498-508.

Eckel RH, Bays HE, Klein, Horn DB (2016). Proactive and Progressive Approaches in Managing Obesity. **Postgraduate Medicine** 128(S1): 21-30.

Edwards PJ, Roberts IG, Clarke MJ, DiGuiseppi C, Wentz R, Kwan I, Cooper R, Felix L, Pratap S (2007). Methods to increase response rates to postal questionnaires (Review). **Cochrane Database of Systematic Reviews** 1(2): 1-283

Epilepsy Research UK (2014). **Study Establishes Link Between AEDs and Weight Gain** [https://www.epilepsyresearch.org.uk/study-establishes-link-between-aeds-and-weight-gain/] (Accessed 29 October 2019).

European Food Information Council (2019). **Energy balance** [https://www.eufic.org /en/healthy-living/category/energy-balance/] (Accessed 17 October 2019).

Faber M, Kruger S (2005). Dietary intake, perceptions regarding body weight, and attitudes toward weight control of normal weight, overweight, and obese black females in a rural village in South Africa. **Ethnicity & Disease** 15: 238-245.

Fagúndez LJM, Torres AR, Sánchez MEG, De Torres Aured ML, Rodrigo CP, Rocamora JAI (2015). Dietary history: Method and application. **Nutrición Hospitalaria** 31: 57-61.

Fairbrother U, Kidd E, Malagamuwa T, Walley A (2018). Genetics of Severe Obesity. **Current Diabetes Reports** 18(85): 1-9.

Food and Agriculture Organization of the United Nations (2019). **Food-based Dietary Guidelines - South Africa** [http://www.fao.org/nutrition/education/food-dietary-guidelines/regions/countries/south-africa/en/] (Accessed 1 December 2019).

Ganz ML, Wintfeld N, Li Q, Alas V, Langer J, Hammer M (2014). The association of body mass index with the risk of type 2 diabetes: a case-control study nested in an electronic health records system in the United States. **Diabetology & Metabolic Syndrome** 6(50): 1-8.

Gibson RS (2005). **Principles of Nutritional Assessment**, 2nd ed. New York: Oxford University Press, Inc.

Goon DT, Maputle MS, Olukoga A, Lebese R, Khoza LB, Ayanwu FB (2013). Overweight, obesity and underweight in nurses in Vhembe and Capricorn districts, Limpopo. **South African Journal of Clinical Nutrition** 26(3): 147-149.

Gross LS, Li L, Ford ES, Liu S (2004). Increased consumption of refined carbohydrates and the epidemic of type 2 diabetes in the United States: an ecologic assessment. **American Journal of Clinical Nutrition** 79(5): 774-779.

Grosso G, Mistretta A, Turconi G, Cena H, Roggi C, Galvano F (2013). Nutrition knowledge and other determinants of food intake and lifestyle habits in children and young adolescents living in a rural area of Sicily, South Italy. **Public Health Nutrition** 16(10): 1827-1836.

Gupta S, Guar S (2016). Lifestyle Patterns, Eating Practices and Obesity among Nurses: A Review. **International Journal of Health Sciences and Research** 6(11): 258-266.

Harvard Health Publishing (2018). **How much water should you drink?** [https://www.health.harvard.edu/staying-healthy/how-much-water-should-you-drink] (Accesssed 27 October 2019).

Harvard TH Chan School of Public Health (2016). **As overweight and obesity increase, so does risk of dying prematurely**. [https://www.hsph.harvard.edu/news/press-releases/overweight-obesity-mortality-risk/] (Accessed 30 September 2020).

Heart Foundation (2018). **Salt in everyday foods adds up quickly.** [https://www.heartfoundation.org.nz/about-us/news/blogs/salt-in-everyday-foods] (Accessed 26 November 2020).

Heart Research Institute (2020). **All about carbs**. [https://www.hri.org.au/health/your-health/nutrition/all-aboutcarbs#:~:text=Excess%20carbohydrate%20intake%20places%20a, increased%20risk%20of%20heart%20disease] (Accessed 26 November 2020).

Heywood M, Hassim A, Berger J (2007). **Health and Democracy: A Guide to Human Rights, Health Law and Policy in Post Apartheid South Africa**, 1st ed. Cape Town: Siber Ink.

Horvath JDC, Dias de Castro ML, Kops NL, Malinosk NK, Friedman R (2014). Obesity coexists with malnutrition? adequacy of food consumption by severely obese patients to dietary reference intake recommendations. **Nutricion Hospitalaria** 29(2): 292-299.

Hyman MR, Sierra JJ (2016). Open- versus Close-Ended Survey Questions. **NMSU Business outlook** 4(2): 1-5.

Institute of Medicine (2006). **Dietary Reference Intakes: The Essential Guide to Nutrient Requirements**. Washington DC: National Academy Press.

Institute of Medicine (2005a). **Dietary Reference Intakes for Energy, Carbohydrates, Fiber, Fat, Fatty acids, Cholesterol, Protein and Amino Acids**. Washington DC: National Academy Press.

Institute of Medicine (2005b). **Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate**. Washington DC: National Academy Press.

Institute of Medicine (2003). **Dietary Reference Intakes: Application in Dietary Assessment. Food and Nutrition Board.** Washington DC: National Academy Press.

Johnson F, Cooke L, Croker H, Wardle J (2008). Changing perceptions of weight in Great Britain: comparison of two population surveys. **British Medical Journal** 337 (7664): 1-5.

Johnson RK (2002). Dietary Intake-How Do We Measure What People Are Really Eating? **Obesity Research** 10(11): 63-68.

Jung SH, Ha KH, Kim DJ (2016). Visceral fat mass has stronger associations with diabetes and prediabetes than other anthropometric obesity indicators among Korean Adults. **Yonse Medical Journal** 57(3): 674-680.

Kazemi T, Sharifzadeh G, Javadinia SA, Salehiniya H (2015). Prevalence of Cardiovascular Risk Factors among the Nurse Population in the East of Iran. **International Journal of Travel Medicine and Global Health** 3(4): 133-136.

Kengne AP (2017). Trends in obesity and diabetes across Africa from 1980 to 2014: an analysis of pooled population-based studies. **International Journal of Epidemiology** 46(5):1421-1432.

Kolahdooz F, Spearing K, Sharma S (2013). Dietary Adequacies among South African Adults in Rural KwaZulu-Natal. **PLoS One** 8(6): 1-6.

Kroll F, Swart EC, Annan RA, Thow AM, Neves D, Apprey C, Aduku LNE, Agyapong NAF, Moubarac JC, Du Toit A, Aidoo R, Sanders D (2019). Mapping Obesogenic Food Environments in South Africa and Ghana: Correlations and Contradictions. **Sustainability** 11(14): 1-31.

Kunene SH, Taukobong NP (2017). Dietary habits among health professionals working in a district hospital in KwaZulu-Natal, South Africa. **African Journal of Primary Healthcare & Family Medicine** 28(9): 1-5.

Kyle RG, Willis J, Mahoney C, Hoyle L, Kelly M, Atherton LM (2017). Obesity prevalence among healthcare professional in England: a cross-sectional study using Health Survey for England. **British Medical Journal** 1-7.

Lavie CJ, Alpert MA, Arena R, Mehra MR, Milani RV, Ventura HO (2013). Impact of Obesity and the Obesity Paradox on Prevalence and Prognosis in Heart Failure. **Journal of the American College of Cardiology** 1(2):93-102.

Lee I, Kaminski HJ, McPherson T, Feese M, Cutter G (2018). Gender differences in prednisone adverse effects. **Neurology Neuroimmunology & Neuroinflammation** 5(6): 1-8.

Leon AC, Davis LL, Kraemer HC (2011). The role and interpretation of pilot studies in clinical research. **Journal of Psychiatric Research** 45(5): 626-629.

Lie JAS, Andersen A, Kjaerheim K (2007). Cancer risk among 43 000 Norwegian nurses. **Scandinavian Journal of Work, Environment & Health** 33(1): 66-73.

Lin ML, Huang JJ, Chuang HY, Tsai HM, Wang HH (2018). Physical activities and influencing factors among public health nurses: a cross-sectional study. **British Medical Journal Open** 8:1-7.

Lytvyak E, Olstad DL, Schopflocher DP, Plotnikoff RC, Storey KE, Nykiforuk CIJ, Raine KD (2016). Impact of a 3-year multi-centre community-based intervention on risk factors for chronic disease and obesity among free-living adults: the Healthy Alberta Communities study. **BioMed Central Public Health** 16:344.

Machin D, Campbell MJ, Walters SJ (2007). **Medical Statistics: A textbook for the health Sciences**, 4th ed. Chichester: John Wiley & Sons Ltd.

Maidment H (2018). **Nursing in South Africa**. [https://educonnect.co.za/nursing-in- south-africa/] (Accessed 12 December 2020).

Maigari B, Mosaku SK, Umar NJ, Kever RT, Dalhatu A, Dathini H (2014). Nurses' Knowledge and Attitude towards Care of Clients with Substance Abuse in Borno State, Nigeria. **Journal of Nursing and Health Science** 3(5): 19-24.

Matoti-Mvalo T, Puoane T (2011). Perceptions of body size and its association with HIV/AIDS. **South African Journal of Clinical Nutrition** 24(1):40-45.

Mbhenyane XG, Venter CS, Vorster HH, Steyn HS (2005). Nutrient intake and consumption of indigenous foods among college students in Limpopo Province. **South African Journal of Clinical Nutrition** 18(1): 32-38.

McGovern JA, Benowitz NL (2011). Cigarette Smoking, Nicotine, and Body Weight. **Clinical Pharmacology & Therapeutics** 90(1): 164-168.

Mendoza A, Hollenberg AN (2017). New Insights into Thyroid Hormone Action. **Pharmacology & Therapeutics** 173(1): 135-145.

Miller SK, Alpert PT, Cross CL (2008). Overweight and obesity in nurses, advanced practice nurses, and nurse educators. **Journal of the American Academy of Nurse Practitioners** 20(5):259-265.

Mishra SB, Alok S (2017). **Handbook of Research Methodology: A Compendium for Scholars & Researchers**, 1st ed. New Delhi: Educreation Publishing.

Monakali S, Goon DT, Seekoe E, Owolabi EO (2019). Health-Promoting Lifestyle Behaviours Among Primary Healthcare Professional Nurses in Eastern Cape Province, South Africa. **Global Journal of Health Science** 11(1): 92-102.

Monakali S, Goon DT, Seekoe E, Owolabi EO (2018). Prevalence, awareness, control and determinants of hypertension among primary health care professional nurses in Eastern Cape, South Africa. **African Journal of Primary Health Care & Family Medicine** 10(1): 1-5.

Msemburi W, Pillay-van Wyk V, Dorrington RE, Neethling I, Nannan N, Groenewald P, Laubscher R, Joubert J, Matzopoulos R, Nicol E, Notilana B, Prinsloo M, Sithole N, Somdyala N, Bradshaw D (2016). **Second National Burden of Disease Study for South Africa: Cause-of-death Profile for South Africa, 1997-2012**. Cape Town: South African Medical Research Council.

Muga MA, Owili PO, Hsu CY, Rau HH, Chao JCJ (2017). Dietary patterns, gender, and weight status among middle-aged and older adults in Taiwan: a cross-sectional study. **BMC Geriatrics** 17(268):1-10.

National Heart, Lung and Blood Institute (2000). **The Practical Guide Identification, Evaluation, and Treatment of Overweight and Obesity in Adults** [https://www.nhlbi.nih.gov/files/docs/guidelines/prctgd_c.pdf] (Accessed 17 December 2020).

National Health Service (NHS) (2019a). **Causes polycystic ovary syndrome**. [https://www.nhs.uk/conditions/polycystic-ovary-syndromepcos/causes/#:~:text= Insulin%20resistance%20can%20also%20lead,to%20produce%20even%20more% 20insulin.] (Accessed 9 November 2020).

National Health Service (NHS) (2019b). **Dietary Advice for Polycystic Ovary Syndrome (PCOS)**. [https://www.swft.nhs.uk/application/files/8015/6586/5352/Dietary_ Advice_for_Polycystic_Ovary_Syndrome_A4_2019.pdf] (Accessed 8 November 2020).

National Health Service (NHS) (2017a). **Eat well, look good, lose weight, feel great.** [https://www.nhsggc.org.uk/media/247211/nhsgcc_ph_weight_management_leaflet_2018-04.pdf] (Accessed 26 November 2020).

National Health Service (NHS) (2017b). **Hydration and Nutrition**. [https://www.suttonccg.nhs.uk/vanguard/Resources/PublishingImages/Pages/default/Hydration%20and%20Nutrition%20Guidance%20for%20Care%20homes%20-%20November%202017%20v1.0%20 final.pdf] (Accessed 13 December 2020).

National Health Service (NHS) (2019c). **Obesity**. [https://www.nhs.uk/conditions/obesity/#defining-obesity] (Accessed 24 May 2018).

National Health Service (NHS) (2020). **Overweight and pregnant**. [https://www.nhs.uk/conditions/pregnancy-and-baby/overweight-pregnant/]. (Accessed 27 September 2020).

National Health Service (NHS) (2017c). **Pregnancy and body mass index**. [https://www.ouh.nhs.uk/patient-guide/leaflets/files/11027Pbmi.pdf] (Acessed 17 September 2020).

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) (2018). **Cushing's Syndrome** [https://www.niddk.nih.gov/health-information/endocrine-diseases/cushings-syndrome] (Accessed 5 October 2019)

National Institute of Health (2019). **Your guide to understanding genetic conditions: Prader- Willi syndrome** [https://ghr.nlm.nih.gov/condition/prader-willi-syndrome#genes] (Accessed 30 September 2019).

National Institute of Mental Health (2017). **What is prevalence?** [https://www.nimh.nih.gov/health/statistics/what-is-prevalence.shtml] (Accessed 24 May 2018).

National Organisation for Rare Disorders (2017). **Cushing Syndrome** [https://rarediseases.org/rare-diseases/cushing-syndrome/] (Accessed 6 October 2019).

Naude CE (2013). "Eat plenty of vegetables and fruit every day": a food-based dietary guideline for South Africa. **South African Journal of Clinical Nutrition** 26(3): 46-56.

Ndlovu N, Day C, Sartorius B, Aargaard-Hansen J, Hofman K (2018). Assessment of food environments in obesity reduction: a tool for public health action. **South African Health Review** 2018(1): 115-123.

Nemoto T, Beglar D (2014). Developing Likert-scale questionnaires. **Japan Association for Language Teaching** 1-8.

Njike VY, Smith TM, Shuval O, Shuval K, Edshteyn I, Kalantari V, Yaroch AL (2016). Snack Food, Satiety, and Weight. **Advances in Nutrition** 7(5): 866-878.

Northwestern medicine (2020). **I'm Gaining Weight: Is It My Thyroid?** [https://www.nm.org/healthbeat/healthy-tips/im-gaining-weight-is-it-my-thyroid] (Accessed 13 December 2020).

Nursing and Midwifery Counsel (2014). **Standards for competence for registered nurses**. [https://www.nmc.org.uk/standards/standards-for-nurses/pre-2018-standards/standards-for-competence-for-registered-nurses/](Accessed October 2020).

Obesity Action Community (2013). **Prescription Medications & Weight Gain**. [https://www.obesityaction.org/wp-content/uploads/prescription_medications.pdf] (Accessed 8 October 2019).

Obesity Medicine Association (2018). **Obesity and Genetics: Nature and Nurture**. [https://obesitymedicine.org/obesity-and-genetics/] (Accessed 28 November 2019).

Obirikorang Y, Obirikorang C, Enoch OA, Acheampong E, Tuboseiyefah P, Miriam AA, Emmanuella NB (2016). Prevalence and risk factors of obesity among practicing nurses at three selected hospitals in Kumasi Metropolis, Ghana. **Journal of Medical and Biomedical Sciences** 5(3): 45-55.

Ogunjimi LO, Ikorok MM, Olayinka YO (2010). Prevalence of obesity among Nigeria nurses: The Akwa Ibom State experience. **International NGO Journal** 5(2): 45-49.

Okeke PI, Ross AJ, Esterhuizen T, Van Wyk JM (2012). Tobacco and alcohol use among healthcare workers in three public hospitals in KwaZulu-Natal, South Africa. **South African Family Practice** 5(1): 61-67.

Okeyo AP (2009). **Eating practices, nutritional knowledge and body weight in nursing science students in the University of Fort Hare**. Unpublished dissertation. Nutrition and Dietetics, University of the Free State.

Okop KJ, Levitt N, Puoane T (2019). Weight underestimation and body size dissatisfaction among black African adults with obesity: Implications for health promotion. **African Journal of Primary Health Care & Family Medicine** 11(1): 1-8.

Okop KJ, Mukumbang FC, Mathole T, Levitt N, Puoane T (2016). Perceptions of body size, obesity threat and the willingness to lose weight among black South African adults: a qualitative study. **BMC Public Health** 16 (356): 1-13.

Ostovan MA, Zibaeenezhad MJ, Keshmiri H, Shekarforoush S (2013). The Impact of Education on Weight Loss in Overweight and Obese Adults. **International Cardiovascular Research Journal** 7(3): 79-82.

Peplonska B, Bukowska A, Sobala W (2015). Association of Rotating Night Shift Work with BMI and Abdominal Obesity among Nurses and Midwives. **PLoS One** 10(7): 1-13.

Phiri LP, Draper CE, Lambert EV, Kolbe-Alexander TL (2014). Nurses' lifestyle behaviours, health priorities and barriers to living a healthy lifestyle: a qualitative descriptive study. **BMC Nursing** 13(38): 1-11.

Pirahanchi Y, Toro F, Jialal I (2019). **Physiology, thyroid stimulating hormone (TSH)**. In: StatPearls [Internet]. StatPearls Publishing, Treasure Island.

Power BT, Kiezebrink K, Allan JL, Campbell MK (2017). Understanding perceived determinants of nurses' eating and physical activity behaviour: a theory-informed qualitative interview study. **BMC Obesity** 4(18): 1-12.

Puoane T, Fourie JM, Shapiro M, Rosling L, Tshaka NC, Oelefse A (2005). "Big is beautiful"- an exploration with urban black community health workers in a South African township. **South African Journal of Clinical Nutrition** 18(1): 6-15.

Ramgolam Y (2018). **Prevalence of overweight and obesity and body image perception among black South African female nurses practicing in Durban, KwaZulu-Natal, South Africa**. Unpublished dissertation. Dietetics and Human Nutrition, University of KwaZulu-Natal.

Reed D (2014). Healthy Eating for Healthy Nurses: Nutrition Basics to Promote Health for Nurses and Patients. **The Online Journal of Issues in Nursing** 19(3): 1-8.

Reed JL, Prince SA, Pipe AL, Attallah S, Adamo KB, Tullocha HE, Manuel D, Mullen KA, Fodor G, Reid RD (2018). Influence of the workplace on physical activity and cardiometabolic health:Results of the multi-centre cross-sectional Champlain Nurses' study. **International Journal of Nursing Studies** 81: 49-60.

Reddy P, Zuma K, Shisana O, Jonas K, Sewpaul R (2015). Prevalence of tobacco use among adults in South Africa: Results from the first South African National Health and Nutrition Examination Survey. **South African Medical Journal** 105(8): 648-655.

Resnick HE, Valsania P, Halter JB, Lin X (2000). Relation of weight gain and weight loss on subsequent diabetes risk in overweight adults. **Journal of Epidemiology and Community Health** 54: 596-602.

Rodrigo CP, Aranceta J, Salvador G, Varela-Moreiras G (2015). Food Frequency Questionnaires. **Nutrición Hospitalaria** 31(3): 49-56.

Ross A, Bevans M, Brooks AT, Gibbons S, Wallen GR (2017). Nurses and Health-Promoting Behaviors: Knowledge May Not Translate Into Self-Care. **Association of perioperative Registered Nurses** 105(3): 267-275.

Rothmann S, Van der Colff JJ, Rothmann JC (2006). Occupational stress of nurses in South Africa. **Curationis** 29(2): 22-33.

Scheen AJ (2003). Pathophysiology of type 2 diabetes. **Acta Clinica Belgica** 58(6): 335-341.

Schlundt DG, Hill JO, Sbrocco T, Pope-Cordle J, Sharp T (1992). The role of breakfast in the treatment of obesity: A randomized clinical trial. **American Journal of Clinical Nutrition** 55(3): 645-651.

Schonfeldt HC, Pretorius B, Hall N (2013). "Fish, chicken, lean meat and eggs can be eaten daily": a food-based dietary guideline for South Africa. **South African Journal of Clinical Nutrition** 26(3): 66-76.

Seychelle J, Reeves S (2016). The effect of shift work on the diet of accident and emergency nurses at the main general hospital in Malta. **Nutrition and Food Science** 47(2): 165-174.

Sheehy T Kolahdooz F, Mtshali TL, Khamis T, Sharma S (2013). Development of a quantitative food frequency questionnaire for use among rural South Africans in KwaZulu-Natal. **Journal of Human Nutrition and Dietetics** 27(5): 443-449.

Shisana O, Labadarios D, Rehle T, Simbayi L, Zuma K, Dhansay A, Reddy P, Parker W, Hoosain E, Naidoo P, Hongoro C, Mchiza Z, Steyn NP, Dwane N, Makoae M, Maluleke T, Ramlagan S, Zungu N, Evans MG, Jacobs L, Faber M, SANHANES-1 team (2013). South African National Health and Nutrition Examination Survey (SANHANES-1). Cape Town: HSRC Press.

Shukla A, Kumar K, Singh A (2014). Association between Obesity and Selected Morbidities: Study of BRICS countries. **Public Library of Science** 9(4): 1-9.

Simfuke P, Van Wyk B, Swart C (2017). Perceptions, attitudes and challenges about obesity and adopting a healthy lifestyle among health workers in Pietermaritzburg, KwaZulu-Natal province. **African Journal of Primary Health Care and Family Medicine** 9(1): 1-9.

Skaal L, Pengpid S (2011). Obesity and health problems among South African healthcare workers: do healthcare workers take care of themselves? **South African Family Practice** 53(6): 563-567.

South African Hypertension Society (2019). **About us**. [https://www.hypertension.org.za /pages/about-us] (Accessed 6 June 2019).

South African Medical Research Council (2020). **Food Finder**. [https://foodfinder.samrc.ac.za/Client/ClientOrders.aspx] (Accessed 27 September 2020).

South African Nursing Council (2017). **SANC Provincial Distribution 2016**. [https://www.sanc.co.za/stats/Stat2016/Distribution%202016.htm] (Accessed 4 November 2020).

Speechly DP, Rogers GG, Buffenstein R (1999). Acute appetite reduction associated with an increased frequency of eating in obese males. **International Journal of Obesity** 23(11): 1151-1159.

Statistics South Africa (2016). **Mortality and causes of death in South Africa, 2016: Findings from death notification**. [http://www.statssa.gov.za/publications/P03093 /P030932016.pdf] (Accessed 10 June 2019).

Stunkard AJ, Sorensen T, Schulsinger F (1983). Use of the Danish Adoption Register for the Study of Obesity and Thinness. **Research Publications - Association for Research in nervous & Mental Disease** 60: 115-120.

Sullivan GM, Artino AR (2013). Analyzing and Interpreting Data from Likert-Type Scales. **Journal of Graduate Medical Education** 5(4): 541-542.

Sunguya BF, Poudel KC, Mlunde LB, Urassa DP, Yasuoka J, Jimba M (2013). Nutrition training improves health workers' nutrition knowledge and competence to manage child undernutrition: a systematic review. **Frontiers in Public Health** 1(37): 1-21.

Tavares DMS, Reis NA, Dias FA, Lopes FAM (2010). Diabetes mellitus: occurrence of risk factors and care among nursing workers. **Acta Paul Enferm** 23(5): 671-676.

The Association of UK Dietitians (2020). **Healthy snacks: Food Fact Sheet** [https://www.bda.uk.com/resource/healthy-snacks.html] (Accessed 31 October 2020).

The Cancer Association of South Africa (2019). **Fact Sheet on Obesity and Cancer** [https://www.cansa.org.za/files/2019/02/Fact-Sheet-on-Obesity-and-Cancer-web-Feb-2019.pdf] (Accessed 15 June 2019).

The Cancer Association of South Africa (2014). **Statistics** [https://www.cansa.org.za/south-african-cancer-statistics/] (Accessed 17 June 2019).

The Heart and Stroke Foundation of Canada (2018). **How a healthy heart works**. [https://www.heartandstroke.ca/heart/what-is-heart-disease/how-a-healthy-heart-works] (Accessed 10 June 2016).

The Heart and Stroke Foundation South Africa (2017a). **Blood Pressure**. [http://www.heartfoundation.co.za/blood-pressure/] (Accessed 14 July 2019).

The Heart and Stroke Foundation South Africa (2017b). **Get Active**. [http://www.heartfoundation.co.za/get-active/] (Accessed 4 July 2019).

The Heart and Stroke Foundation South Africa (2017c). **Healthy Eating**. [http://www.heartfoundation.co.za/healthy-eating/] (Accessed 27 July 2019).

The Heart and Stroke Foundation of South Africa (2017d). **Healthy eating at work**. [https://www.heartfoundation.co.za/topical_articles/healthy-eating-at-work/] (Accessed 1 November 2020).

The Heart and Stroke Foundation South Africa (2017e). **Types of heart disease**. [http://www.heartfoundation.co.za/types-of-heart-disease/] (Accessed 10 June 2019).

The National Cancer Institute (2019). **Cancer Prevention Overview**. [https://www.cancer.gov/about-cancer/causes-prevention/patient-prevention-overview-pdq] (Accessed 15 July 2019).

Torquatia L, Alexander TK, Pavey T, Persson C, Leveritta M (2016). Diet and physical activity behaviour in nurses: a qualitative study. **International Journal of Health Promotion and Education** 1-15.

Uchendu C, Windle R, Blake H (2020). Perceived Facilitators and Barriers to Nigerian Nurses' Engagement in Health Promoting Behaviors: A Socio-Ecological Model. **International Journal of Environmental Research and Public Health** 17(4): 1-20.

University of California San Francisco (2019). **ILD Nutrition Manual: Prednisone and Weight Gain**. [https://www.ucsfhealth.org/education/ild_nutrition_manual/prednisone_and_weight_gain/] (Accessed 21 November 2020).

University of Rochester Medical Centre (2019). **When Your Weight Gain Is Caused by Medicine** [https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=56&contented=DM300] (Accessed 8 October 2019).

Van den Berg VL, Okeyo AP, Dannhauser A, Nel M (2012). Body weight, eating practices and nutritional knowledge amongst university nursing students, Eastern Cape, South Africa. **African Journal of Primary Healthcare & Family Medicine** 4(1): 1-9.

Vorster HH, Badham JB, Venter CS (2013). An introduction to the revised food-based dietary guidelines for South Africa. **South African Journal of Clinical Nutrition** 26(3): 5-12.

Wang Y, Rimm EB, Stampfer MJ, Willet WC, Hu FB (2005). Comparison of abdominal adiposity and overall obesity in predicting risk of type 2 diabetes among men. **American Journal of Clinical Nutrition** 81:555-563.

Weierbach FM, Glick DF, Fletcher K, Rowlands A, Lyder CH (2010). Nursing Research and Participant Recruitment: Organizational Challenges and Strategies. **The Journal of Nursing Administration** 40(1): 43-48.

Wilcox G (2005). Insulin and Insulin Resistance. **The Clinical Biochemist Reviews** 26(2): 19-39.

Wilding J (2006). Thiazolidinediones, insulin resistance and obesity: finding a balance. **International Journal of Clinical Practice** 60(10): 1272-1280.

World Health Organization (WHO) (2020a). **Double burden of malnutrition**. [https://www.who.int/nutrition/double-burden-malnutrition/en/] (Accessed 28 November 2020).

World Health Organization (WHO) (2006). **Global Database on Body Mass Index**. [http://apps.who.int/bmi/index.jsp?introPage=intro_3.html] (Accessed 29 October 2018).

World Health Organization (WHO) (2017a). **Noncommunicable Diseases**. [http://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases] (Accessed 24 May 2017).

World Health Organization (WHO) (2020b). **Obesity**. [https://www.afro.who.int/health-topics/obesity] (Accessed 30 September 2020).

World Health Organization (WHO) (2017b). **Obesity and overweight**. [http://www.who.int/mediacentre/factsheets/fs311/en/] (Accessed 8 May 2018).

World Health Organization (WHO) (2018a). **Obesity and overweight**. [https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight] (Accessed 28 May 2019).

World Health Organization (WHO) (2019). **Physical Activity and Adults**. [https://www.who.int/dietphysicalactivity/factsheet_adults/en/] (Accessed 29 October 2019).

World Health Organization (WHO) (2020c). **Reducing consumption of sugar-sweetened beverages to reduce the risk of unhealthy weight gain in adults**. [https://www.who.int/elena/titles/ssbs_adult_weight/en/] (Accessed 12 November 2020).

World Health Organization (WHO) (2015). **Report on the status of major health risk factors for noncommunicable diseases: WHO African Region, 2015**. [https://www.afro.who.int/publications/report-status-major-health-risk-factors-noncommunicable-diseaseswho-african-region] (Accessed 21 July 2018).

World Health Organization (WHO) (2017c). **STEPS Manual: Data Collection**. [http://www.who.int/chp/steps/Part3_Section5.pdf?ua=1] (Accessed 2 October 2018).

World Health Organization (WHO) (2018b). **The top 10 causes of death**. [https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death] (Accessed 21 July 2019).

World Health Organization (WHO) (2011). **Waist Circumference and Waist-Hip Ratio: Report of a WHO Expert Consultation, Geneva, 8-11 December 2008.** Switzerland: WHO Press.

Zimmerman FJ, Shimoga SV (2014). The effects of food advertising and cognitive load on food choices. **BMC Public Health** 14(342): 1-10.

APPENDIX A: SELF-ADMINISTERED QUESTIONNAIRE

Anthropometric status and dietary intake of Registered Nurses, Enrolled Nurses and Enrolled Nursing Auxiliaries working at private hospitals in Pietermaritzburg, KwaZulu-Natal

This is a research project for a Master of Science in Dietetics degree. Anthropometric status and dietary intake of Registered Nurses, Enrolled Nurses and Enrolled Nursing Auxiliaries working at private hospitals in Pietermaritzburg, KwaZulu-Natal is being investigated.

Objectives of the study:

1.1 To determine the anthropometric status of Registered Nurses, Enrolled Nurses and Enrolled Nursing Auxiliaries working at private hospitals in Pietermaritzburg, KwaZulu-Natal.

1.2 To determine the dietary intake of Registered Nurses, Enrolled Nurses and Enrolled Nursing Auxiliaries working at private hospitals in Pietermaritzburg, KwaZulu-Natal.

1.3 To determine the factors contributing to the anthropometric status of Registered Nurses, Enrolled Nurses and Enrolled Nursing Auxiliaries working at private hospitals in Pietermaritzburg, KwaZulu-Natal.

1.4 To determine the prevalence of non-communicable diseases among Registered Nurses, Enrolled Nurses and Enrolled Nursing Auxiliaries working at private hospitals in Pietermaritzburg, KwaZulu-Natal.

Please answer all questions honestly and tick the appropriate column/s or fill in where necessary.

SELF-ADMINISTERED QUESTIONNAIRE **CODE** | |

SECTION A: DEMOGRAPHIC DATA

1. What is your age?

19-29 years	
30-39 years	
40-49 years	
50-59 years	
≥ 60 years	

2. What is your gender?

Male	
Female	
Trans-gender	

3. What is your race?

Black	
White	
Indian	
Coloured	
Other (specify)_____	

4. What is your nursing rank?

Registered Nurse	
Enrolled Nurse	
Midwife	
Enrolled Nursing Auxiliaries	
Other (specify)	

5. Which shift are you currently working?

Day shift	
Night shift	
Other (specify): _____	

6. What are your working hours?

7am-7pm	
7pm-7am	
7am-4pm	
Other (specify)_____	

7. On how many days in the week, on average, are you on duty? (Tick **ONE** option only)

1 day a week	
2 days a week	
3 days a week	
4 days a week	
5 days a week	
6 days a week	
7 days a week	

8. On how many days in the week, on average, are you off duty? (Tick **ONE** option only)

1 day a week	
2 days a week	
3 days a week	
4 days a week	
5 days a week	
6 days a week	
7 days a week	

9. For how many years have you been qualified?

< 1 year	
1 - < 6 years	
6 - < 11 years	
11 - < 16 year	
16 - 20 years	
>20 years	

10. For how many years have you been working as a nurse or nursing auxiliary?

< 1 year	
1 < 6 years	
6- < 11 years	
11 - < 16 year	
16 - 20 years	
>20 years	

11. How many children are you caring for? _____

12. Are you a single parent?

Yes	
No	

SECTION B: LIFESTYLE FACTORS

13. Have you been diagnosed by a medical doctor with a chronic medical condition?

Yes	
No	

If you answered NO to Q13, proceed to Q14:

13.1 Indicate which of the following medical conditions you suffer from (Tick **ALL** that apply)

13.1.1 Diabetes	
13.1.2 High blood pressure	
13.1.3 Heart disease	
13.1.4 High cholesterol	
13.1.5 Renal failure	
13.1.6 Cancer	
13.1.7 Other (specify)_____	

13.2 Do you take any chronic medication (i.e. you take it daily)?

Yes	
No	

13.3 **If you answered yes to Q13.2**, please write down the names of the chronic medication you take daily and for which conditions.

_____
_____
_____
_____
_____
_____
_____
_____

14. Do you smoke?

Yes	
No	

14.1 **If YES to Q14**, how many cigarettes do you smoke a day?

1-5 cigarettes	
6-10 cigarettes	
11-15 cigarettes	
16-20 cigarettes	
>20 cigarettes	

15. Do you consume alcohol?

Yes	
No	

15.1 **If YES to Q15**, how many drinks do you have in the week?

(1 drink = 340ml beer, 120ml wine, 60ml sherry or 30ml spirits)

< 1 drink a week	
1-2 drinks a week	
3-4 drinks a week	
5-6 drinks a week	
7-8 drinks a week	
9-10 drinks a week	
11-12 drinks a week	
13-14 drinks a week	
>14 drinks a week	

15.2 **If YES to Q15**, indicate which of the following you consume. (Tick **ALL** that apply)

15.2.1 Beer	
15.2.2 Wine	
15.2.3 Whiskey/brandy	
15.2.4 Cocktails	
15.2.5 Spirits	
15.2.6.Ciders	
15.2.7 Other(specify)_____	

16. Do you exercise? (This refers to exercise done **intentionally** i.e. walking, jogging, swimming or exercising using gym equipment etc.)

Yes	
No	

If you answered NO to Q16, proceed to Q17:

16.1 Indicate which of the following types of exercise you do. (Tick **ALL** that apply)

16.1.1 Aerobics	
16.1.2 Cycling	
16.1.3 Dancing	
16.1.4 Exercise routine from a cell phone application	
16.1.5 Gardening	
16.1.6 Gym (at home/at gym)	
16.1.7 Gymnastics	
16.1.8 Jogging/ running	
16.1.9 Sport (soccer, netball, volleyball, cricket)	
16.1.10 Swimming	
16.1.11 Walking	
16.1.12 Yoga	
16.1.13 Other_____	

16.2 On how many days in the week, on average, do you exercise? (Tick **ONE** option only)

1 day a week	
2 days a week	
3 days a week	
4 days a week	
5 days a week	
6 days a week	
7 days a week	

16.3 How long does each exercise session last, on average?

0-15 minutes	
16-30 minutes	
31-45 minutes	
46-60 minutes	
>60 minutes	

SECTION C: BODY IMAGE AND WEIGHT

17. Are you satisfied with your body shape/size?

Yes	
No	

17.1 **If not,** why are you dissatisfied with your body shape/size?

_____

_____

_____

18. Do you feel that you are at a healthy body weight?

Yes	
No	

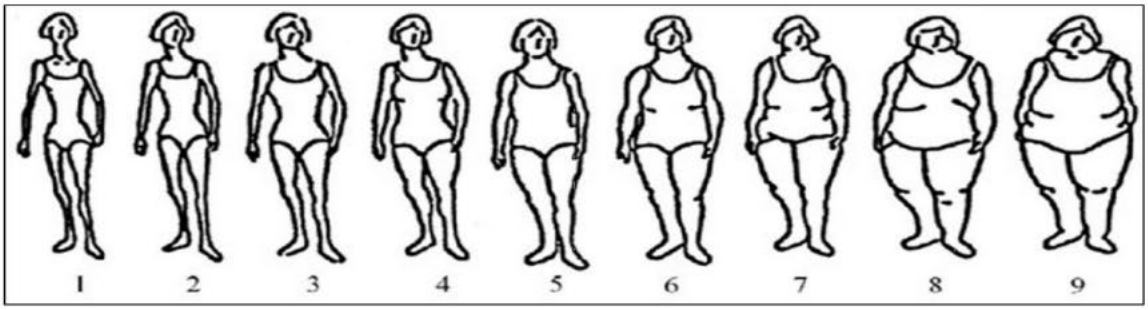
18.1 **If no**, why not?

_____

_____

19. From the pictures below, which **ONE** image do you feel best matches your body shape? (Select the number that corresponds to your chosen image and select **ONE** option only) _____

(See pictures 1-9 below).



20. Have you ever tried to lose weight before?

Yes	
No	

If you answered NO to Q20, proceed to Q21:

20.1 Indicate which of the following methods you have used (Tick ALL that apply).

20.1.1 Cutting down on fast foods/ takeaways		20.1.10 Gastric surgery	
20.1.2 Cutting down on high fat and processed foods		20.1.11 Liposuction	
20.1 3 Cutting down on sugar, sugary treats and sugar sweetened soft drinks		20.1.12 Liquid diets	
20.1.4 Detox juice diet		20.1.13 Portion control	
20.1.5 Diet pills/weight loss pills/appetite suppressants		20.1.14 Spa treatments (body wraps)	
20.1.6 Diet shakes		20.1.15 The Atkins diet	
20.1.7 Exercise		20.1.16 The Banting diet	
20.1.8 Fasting		20.1.17 The Paleo diet	
20.1.9 Following a diet planned by a Registered Dietitian		20.1.18 Other (specify)	

20.2 Were you successful in losing weight?

Yes	
No	

20.3 **If YES to Q20.2**, were you successful in maintaining your weight loss?

Yes	
No	

21. As a nurse, do you feel that you are a role model to your patients?

Yes	
No	

22. As a nurse, do you feel that it is important to have an ideal body weight?

Yes	
No	

SECTION D: EATING HABITS

23. How many meals and snacks (small amount of food eaten between meals) do you eat in a day?

	Number of meals	Number of snacks
23.1 Working days		
23.2 Off days		

24. On the days that you work, which of the following meals or snacks do you eat? (Tick **ALL** that apply.)

24.1 Breakfast	
24.2 Morning snack	
24.3 Lunch	
24.4 Afternoon snack	
24.5 Supper	
24.6 Evening snack	

25. On days that you do not work, which of the following meals or snacks do you eat? (Tick **ALL** that apply.)

25.1 Breakfast	
25.2 Morning snack	
25.3 Lunch	
25.4 Afternoon snack	
25.5 Supper	
25.6 Evening snack	

26. Do you ever skip meals?

Yes	
No	

26.1 **If you answered YES to Q26**, which meal(s) do you skip? (Tick **ALL** that apply)

26.1.1 Breakfast	
26.1.2 Morning snack	
26.1.3 Lunch	
26.1.4 Afternoon snack	
26.1.5 Supper	
26.1.6 Evening snack	

27. At what time is your first and last main meal of the day, when you are working and when you are off?

	Time eaten (working)	Time eaten (off)
27.1 First meal of the day		
27.2 Last meal of the day		

28. Do you prepare your own meals at home?

Yes	
No	

28.1 **If you answered NO to Q28**, who **usually** prepares your meals? (Select ONE option only)

Aunt/uncle	
Child (daughter/son)	
Girlfriend/ boyfriend	
Grandchild	
Grandparent	
Nephew/niece	
Parent (mother/father)	
Sibling (brother/sister)	
Spouse (husband/wife)	
Other_____	

29. Indicate your agreement that the following factors influence your meal choices.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
29.1 Time					
29.2 Cost					
29.3 Emotions/stress					
29.4 Convenience					
29.5 Nutritional content of meals					
29.6 Media and advertising					

30. Indicate your agreement that the following factors prevent you from eating healthily.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
30.1 Finances					
30.2 Lack of time to prepare meals					
30.3 Lack of time to eat at work (too busy)					
30.4 Emotions/stress					
30.5 Lack of knowledge of healthy eating					
30.6 Healthy food not available to buy at work					
30.7 Healthy food does not appeal to me					

31. How often do you purchase meals at the hospital cafeteria?

I do not purchase meals at the cafeteria	
1 day a week	
2 days a week	
3 days a week	
4 days a week	
5 days a week	
6 days a week	
Everyday	
More than once a day	

32. **If you buy food from the hospital cafeteria**, choose the **ONE** meal that you most commonly purchase from the cafeteria. (Select **ONE** option only)

Biryani		Pasta	
Brown bread rolls		Phutu and beans	
Brown bread sandwiches		Phutu and curry	
Burgers		Pies	
Cottage pie		Roti roll with curry	
Curry and rice		Salad with meat	
Fried chips		Samp and beans	
Fried/ deep fried meat		Soup	
Grilled chicken/meat with chips/roll		Stew/casserole and rice	
Health rolls		White bread rolls	
Hot dogs		White bread sandwiches	
Other _____			

33. Indicate how often, on average, you eat the following snacks?

	Never	Less than once a month	At least once a month	At least once a week	At least once a day
33.1 Biltong					
33.2 Biscuits					
33.3 Cakes					
33.4 Sugar sweetened soft drinks					
33.5 Fruit					
33.6 Nuts/seeds/corn (salted)					
33.7 Popcorn					
33.8 Potato/maize crisps or chips					
33.9 Raw nuts/ seeds					
33.10 Sweets					
33.11 Yoghurt					
33.12 Other					

Thank you for your time!

Anthropometric data to be filled in by researcher

	Measurement 1	Measurement 2	Measurement 3	Average
Weight				
Height				
Waist circumference				
BMI using average of weight and height: _____ kg/m^2				

APPENDIX B: INFORMATION DOCUMENT AND CONSENT FORM

UKZN BIOMEDICAL RESEARCH ETHICS COMMITTEE

APPLICATION FOR ETHICS APPROVAL
For research with human participants (Biomedical)

INFORMED CONSENT FORM

Information Sheet and Consent to Participate in Research

Date: 31 October 2019

Dear Sir/ Madam

My name is Leah Bianca Yegambaram. I am a Master of Science in Dietetics Student from UKZN, Pietermaritzburg.

You are being invited to consider participating in a study that involves research on Nurses working at Private Hospitals in Pietermaritzburg. The aim and purpose of this research is to determine the anthropometric status and dietary intake of Registered Nurses, Enrolled Nurses and Enrolled Nursing Auxiliaries working at private hospitals in Pietermaritzburg, KwaZulu-Natal.

The study is expected to enroll 265 participants from a private hospital group in Pietermaritzburg. It will involve allowing the researcher to take your weight, height and waist circumference measurements. It will also involve answering a self-administered questionnaire and giving information on dietary intake through a 24-hour recall and food frequency questionnaire. The study is funded by the researcher and supervisor.

The study will also involve asking personal questions about your weight and dietary intake, which will be done privately. It is hoped that the study will provide insight on the prevalence of overweight and obesity among Registered Nurses, Enrolled Nurses and Enrolled Nursing Auxiliaries working at private hospitals in Pietermaritzburg. We also aim to determine what

factors contribute to overweight and obesity among Registered Nurses, Enrolled Nurses and Enrolled Nursing Auxiliaries working at private hospitals in Pietermaritzburg. By being aware of one's nutritional status and factors contributing to this, it is hoped that the participant would be urged to lead a healthier lifestyle.

In the event of any problems or concerns/questions you may contact the researcher on leahbianca@gmail.com/ 0670510549 or the UKZN Biomedical Research Ethics Committee, contact details as follows:

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604769 - Fax: 27 31 2604609
Email: BREC@ukzn.ac.za

Please note that participation in this research is voluntary and participants may withdraw from participation at any point. In the event of refusal/withdrawal of participation, the participants will not incur penalty or loss of treatment or other benefit to which they are normally entitled.

There will be no costs incurred by participants as a result of participation in the study. There will be no incentives for participating in the study.

To protect participant confidentiality, the results of the measurements and answers to the questionnaires will be entered into a database using a code and not names and surnames. Once the data is entered, the questionnaires and forms will be destroyed, and the data will remain confidential to the supervisor and principal investigator. Every effort will be made to keep personal information confidential. However, absolute confidentiality cannot be guaranteed. Personal information may be disclosed if required by law.

Organizations that may inspect and/or copy research records for quality assurance and data analysis include groups such as the Research Ethics Committee. Data collected will be used to obtain a MSc Dietetics qualification and will be published in a scientific journal.

-

CONSENT (Edit as required)

I _____have been informed about the study entitled "Anthropometric status and dietary intake of Registered Nurses, Enrolled Nurses and Enrolled Nursing Auxiliaries working at private hospitals in Pietermaritzburg, KwaZulu-Natal", by Leah Bianca Yegambaram.

I understand the purpose and procedures of the study will involve the following procedures: allowing the researcher to take weight, height and waist circumference measurements. It will also involve answering a self-administered questionnaire and giving dietary data through a 24 hour recall and food frequency questionnaire.

I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any treatment or care that I would usually be entitled to.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher at leahbianca@gmail.com or 0670510549.

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers, then I may contact:

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001

Durban

4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604769 - Fax: 27 31 2604609

Email: BREC@ukzn.ac.za

_____ _____

Signature of Participant **Date**

_____ _____

Signature of Witness **Date**

(Where applicable)

APPENDIX C: 24 HOUR RECALL

24 HOUR RECALL **CODE** ____

Dietary intake of participant to be recorded by the researcher

1. To which day of the week does this record apply? (Tick one only)

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

2. Is this a typical day?

Yes	No

If not typical, what is different about it?

_____

_____

_____

24 HOUR RECALL		
Time	**Quantity (in household measures)**	**Description of food / drink**

24 HOUR RECALL		
Time	**Quantity (in household measures)**	**Description of food / drink**

APPENDIX D: QUALITATIVE FOOD FREQUENCY QUESTIONNAIRE

FOOD FREQUENCY QUESTIONNAIRE **CODE**

FOOD ITEM	**AVERAGE USE IN THE PAST MONTH**				
	Never	**Seldom (less than once a week)**	**1-3 days a week**	**4-6 days a week**	**Everyday**
BREADS, CEREALS AND STARCHES					
Cereals and grains					
All Bran Flakes					
Corn Flakes					
Future Life					
Mageu					
Maize meal, soft					
Maize meal, stiff					
Maltabella porridge					
Oats, cooked					
Pasta, white					
Pasta, whole-wheat					
Phutu					
Pronutro					
Refined cereal (Coco Pops, Fruit Loops, Milo cereal, Frosties)					
Rice, basmati					
Rice, brown					
Rice Crispies					
Rice, white					
Samp and beans					
Weetbix					
Breads					
Bread/ roll, brown					
Bread/roll, white					
Steam bread					
Starchy vegetables					
Amadumbe					
Mealie/corn					
Peas, green					
Potato, with skin					
Potato, without skin					

Squash, butternut, pumpkin					
Sweet potato					
Starchy food prepared with fat					
Crumpets					
FOOD ITEM	**AVERAGE USE IN THE PAST MONTH**				
	Never	**Seldom (less than once a week)**	**1-3 days a week**	**4-6 days a week**	**Everyday**
Fried chips					
Instant noodles					
Pancakes					
Popcorn with oil					
Scones					
Vetkoek					
BAKED GOODS, SNACKS AND SWEETS					
Biscuits with filling (Romany Creams, Lemon Creams, Toppers, Oreo)					
Biscuits without filling (Marie, Eat Sum More)					
Cakes, with icing					
Cakes, without icing					
Chips (crisps)					
Chocolates					
Fibre biscuits (Provita, Ryvita)					
Nuts, salted					
Nuts, unsalted					
Savoury biscuits, plain (Cream Crackers, Salty Crax)					
Sweets					
MEAT, POULTRY, FISH, EGGS AND MEAT SUBSTITUTES					
Baked beans					
Beans, lentils, chickpeas					
Bean salad, no oil					
Beef, cuts					
Beef, mince					
Beef, patty					
Beef, sausage					

Chicken, cuts with skin					
Chicken, cuts without skin (thigh, breast, wing drumstick)					
FOOD ITEM	**AVERAGE USE IN THE PAST MONTH**				
	Never	**Seldom (less than once a week)**	**1-3 days a week**	**4-6 days a week**	**Everyday**
Chicken, feet					
Chicken, fillet					
Chicken, mince					
Chicken, sausage					
Eggs					
Fish, fillet crumbed					
Fish, fillet not crumbed					
Fish, tinned (sardines/pilchards/ tuna)					
Lamb/ Mutton					
Organ meat (liver, kidney, heart)					
Pork, bacon					
Pork, cuts					
Pork, ham					
Pork, sausage					
Processed meat (sausage, vienna, polony, cold meat, fish fingers, burger patty)					
FRUIT AND VEGETABLES					
Vegetable (non-starchy)					
Fresh fruit					
Fruit juice					
Fruit salad					
Dried fruit					
Tinned fruit					
DAIRY AND FATS					
Avocado					
Butter (brick)					
Butter (tub, soft)					
Cheese, cheddar					
Cheese, gouda					
Cheese, low fat					

Coffee creamers (e.g. Cremora, Ellis Brown)					
Custard					
Ghee					
Ice cream					
FOOD ITEM	**AVERAGE USE IN THE PAST MONTH**				
	Never	**Seldom (less than once a week)**	**1-3 days a week**	**4-6 days a week**	**Everyday**
Maas, full cream					
Maas, low fat					
Margarine (brick)					
Margarine (tub, soft)					
Milk, fat free					
Milk, full cram					
Milk, low fat					
Oil, canola					
Oil, olive					
Oil, sunflower					
Yoghurt flavoured full cream					
Yoghurt, flavoured low fat					
Yoghurt plain, full cream					
Yoghurt plain, low fat					
SUGAR AND BEVERAGES					
Alcoholic drinks					
Cappuccino					
Coffee					
Honey					
Milo, hot chocolate, Horlicks					
Mixes (e.g. Halls, Oros, Jungle Yum, Fiesta)					
Soft drinks, light (e.g. Coke Light)					
Soft drinks, sugar free (e.g. Coke Zero, Sprite Zero)					
Sugar, brown					
Sugar, white					

Sugar sweetened soft drinks (e.g. Coke/ Fanta)					
Sweeteners (e.g. Canderel)					
Tea					
Water					
Other (if you feel anything has been left out, please fill in below)					
FOOD ITEM	**AVERAGE USE IN THE PAST MONTH**				
	Never	**Seldom (less than once a week)**	**1-3 days a week**	**4-6 days a week**	**Everyday**

APPENDIX E: ETHICS APPROVAL LETTER FROM THE BIOMEDICAL RESEARCH ETHICS COMMITTEE OF THE UNIVERSITY OF KWAZULU-NATAL

UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI
RESEARCH OFFICE
Biomedical Research Ethics Administration
Westville Campus, Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604769 - Fax: 27 31 2604609
Email: BREC@ukzn.ac.za
Website: http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx

05 December 2019

Ms LB Yegambaram (212520803)
School of Agricultural, Earth and Environmental Sciences
leahblanca@gmail.com

Dear Ms Yegambaram

Protocol: Anthropometric status and dietary intake of Registered Nurses, Enrolled Nurses, Enrolled Nursing Auxiliaries working at private hospitals in Pietermaritzburg, KwaZulu-Natal
Degree: MSc
BREC Ref No: BE431/19

We wish to advise you that your correspondence received on 27 November 2019 submitting permission from Hospital (Netcare Hospital Management) has been noted and approved by a subcommittee of the Biomedical Research Ethics Committee.

Yours sincerely

[redacted]

Prof V Rambiritch
Chair: Biomedical Research Ethics Committee

cc: Postgrad Admin: manjoom@ukzn.ac.za Supervisor: PillayK@ukzn.ac.za

APPENDIX F: APPROVAL LETTER FROM THE PRIVATE HOSPITAL

RESEARCH OPERATIONS COMMITTEE FINAL APPROVAL OF RESEARCH

Approval number: UNIV-2019-0058

Ms Leah Bianca Yegambaram

E mail: leahbianca@gmail.com

Dear Ms Yegambaram

RE: ANTHROPOMETRIC STATUS AND DIETARY INTAKE OF REGISTERED NURSES, ENROLLED NURSES AND ENROLLED NURSING AUXILIARIES WORKING AT PRIVATE HOSPITALS IN PIETERMARITZBURG, KWAZULU-NATAL

The above-mentioned research was reviewed by the Research Operations Committee's delegated members and it is with pleasure that we inform you that your application to conduct this research at Private Hospitals, has been approved, subject to the following:

i) Research may now commence with this FINAL APPROVAL from the Committee.

ii) All information regarding the Company will be treated as legally privileged and confidential.

iii) The Company's name will not be mentioned without written consent from the Committee.

iv) All legal requirements with regards to participants' rights and confidentiality will be complied with.

v) All data extracted may only be used in an anonymised, aggregated format and for the purposes of this specific study as specified in the proposal. The data may under no circumstances be used for any other purpose whatsoever.

vi) The Company must be furnished with a STATUS REPORT on the progress of the study at least annually on 30th September irrespective of the date of approval from the Committee as well as a FINAL REPORT with reference to intention to publish and probable journals for publication, on completion of the study.

vii) A copy of the research report will be provided to the Committee once it is finally approved by the relevant private party or tertiary institution, or once complete or if discontinued for any reason whatsoever prior to the expected completion date.

[redacted]

viii) The Company has the right to implement any recommendations from the research.

ix) The Company reserves the right to withdraw the approval for research at any time during the process, should the research prove to be detrimental to the subjects/ Company or should the researcher not comply with the conditions of approval.

x) APPROVAL IS VALID FOR A PERIOD OF 36 MONTHS FROM DATE OF THIS LETTER OR COMPLETION OR DISCONTINUATION OF THE STUDY, WHICHEVER IS THE FIRST.

We wish you success in your research.

Yours faithfully [redacted] 16/10/2019

Prof Dion du Plessis
Full member: Research Operations Committee & Medical Practitioner evaluating research applications as per Management and Governance Policy

[redacted]
Shannon Nell
Chairperson: Research Operations Committee
Date: 18/10/2019

This letter has been anonymised to ensure confidentiality in the research report. The original letter is available with author of research