Studies on Child Food Insecurity in Lebanon

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Contributions / Authors work

This thesis is result of the author (Carla Yardemian Hage)'s work in terms of design, data collection, data analyses, interpretation of the findings, and writing of the manuscript.

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ABBREVIATIONS

ACFI	Arab Child Food Insecurity
AFS	Adult Food Security
AFFSS	Arab Family Food Security Scale
AFIQ	Arab Food Insecurity Questionnaire
AFS	Applied Food Sciences
AHFIAS	Arabic Household Food Insecurity Acess Scale
AHFSM	Arabic Household Food Security Module
AUB	American University of Beirut
BMI	Body Mass Index
CAS	Central Administration Statistics of Lebanon
CCHIP	Community Childhood Hunger Identification Project
CDC	Centers for Disease Control and Prevention
CFI	Child Food Insecurity
CFS	Child Food Security
CFSS	Child Food Security Scale
CG	Control group
CPI	Consumer Price Index
CPS	Current Population Survey
CS-Pro	Census and Survey Processing System (Program statistics)
CV	Cardiovascular
DD	Dietary Diversity
ED	Emergency Department
ESCWA	Economic and Social Commission for Western Asia
FANTA	Food and Nutrition Technical Assistance Project
FAO	Food and Agriculture Technical Assistance Project
FAO	Food and Agriculture Organization
FCS	Food Consumer Score
FI	Food Insecurity
FKS	Food Knowledge Score
FPS	Food Pyramid Score
FPI	Food Price Index
FS	Food Security
FSP	Food Stamp Program
FSS	Food Security Scale

GDP	Gross Domestic Production
HDL	High Density Lipoprotein
HAZ	Hip circumference
HC	Hip Circumference
HFFSM	Household Food Security Survey Module
HFB	Healthy Food Basket
HFI	Household Food Insecurity
HFIAS	Household Food Insecurity Access
HFS	Household Food Security
HFSSM	Household Food Security Survey Module
HS	High socio-economic status
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IDA	Iron deficient Anemic
IDNA	Iron deficient Non Anemic
IG	Intervention Group
IRT	Item Response Theory
Kcal	Kilo Calories
LS	Low socio-economic status
LMIC	Low-Middle Income Countries
LSRO	Life Science Research Office
MAC	Mid-arm circumference
MDG	Millennium Development Goals
MENA	Middle East
MET	Metabolic Equivalent Task
MOSA	Ministry of Social Affaires
MS	Metabolic Syndrome
NGOs	Non Governmental Organizations
NHANES	National Health and Nutrition Examination Survey
NIH	National Institute of health
NS	Nutritional Status
PDPAR	Previous Day Physical Activity Recall
PI	Principal Investigator
RDA	Recommended Dietary Allowance
SD	Standard Deviation

SEH	Socio-Economic Health questionnaire
SES	Socio-Economic Status
SKF	Skinfold measurements
SNAP	Supplemental Nutrition Assistance Program (US Department of Agriculture)
SPSS	Statistical Package for the Social Sciences
TG	Triglycerides
UN	United Nations
UNDP	United Nations Development Program
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations
UREC	University Research Ethics Committee
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
W/H	Waist -to-Hip Radio
WAZ	Waist Circumference
WC	Waist circumference
WFP	World Food Program
WFS	World Food Summit
WHO	World Health Organization
WHR	Waist-to-hip-ratio

Chapter 1 : General introduction and study background

1.1 General introduction

"Starvation is the characteristic of some people *not* having enough food to eat. It is not the characteristic of there *being* not enough food to eat. While the latter can be a cause of the former, it is but one of the many *possible* causes." (Sen, 1983).

Since early times, food insecurity (FI) and hunger have been issues of concern, especially during periods of drought and natural disasters. Throughout history there has been worry that human population growth will outpace the earth's ability to produce sufficient food supplies. This concern about food shortage was expressed by Thomas R. Malthus in 1778 and it still is a major concern two centuries later (Rutherford, 2007).

Due to population growth and the globalization of the food industry during the last century, the world food systems, including agricultural yields and human diet quality, have undergone major transformations. High yield agricultural productions have increased the affordability and availability of refined foods such as sugar, refined oils**,** and rice. This change in diet quality, accompanied by the westernization of diets in Low and Medium Income Countries **(**LMIC**)**, has resulted in lack of diet diversity that may eventually affect the health and food security (FS) of the population (Lee et al., 2011)**.**

The concern about FS can be traced back to 1948, to the Universal Declaration of Human Rights, which recognized the right to food as a crucial component for an adequate standard of living (United Nations, 2014). Furthermore, the concern about FS increased during the 1972-74 global food crises. In the 1980's, the topic of FS developed, emphasizing on the individual and household FS, specifically focusing on food access, vulnerability, and entitlement.

Today, the most commonly accepted definition of FS is the one given at the World Food Summit: “FS exists when all people at all times have access to sufficient, safe, nutritious food to maintain a health and active life” (World Bank, 1986). This definition covers the multi-dimensional aspect of FS that includes food availability, food access and use, and stability over time.

Food availability entails consistent availability of sufficient food to the person, but it does not ensure adequate access to food. In LMIC, in the last two decades food supplies have increased faster than the population increase, resulting in better food availability per person and better quality diets (National Research Council, 2006).

Food access dependent on two factors: economic and physical access. Economic: access is affected by food prices and purchasing power. Physical access is affected by the quality and availability of transportation and storage of foodstuff that facilitate the functioning of markets (National Research Council, 2006).

Food use could be measured by anthropometric values, such as weight-for-age and weight-for-height for children, indicators of food quality and food intake, water sanitation and general health (National Research Council, 2006).

Food stability consists of two facets: food price stability and food supply over time (Jones, 2013).

Essentially, FI is a reality faced on a daily basis by 842 million individuals worldwide, of which 827 million live in LMIC, constituting 14.3% of the global population (FAO, 2013a). A child dies every five seconds due to malnutrition-related diseases; therefore, international aid agencies focus mainly on extreme cases of child malnutrition that are hazardous to life. However, the more invisible forms of under-nutrition, such as FI and persistent poverty, should equally be treated (Chilton et al., 2007).

1.2 Research hypotheses

The research studies presented in this thesis initially investigated the prevalence of FI in school-aged children and their families in Lebanon. This was followed by an assessment of the nutritional status of school-aged children and the severity of child food insecurity (CFI) in Lebanon. The following research hypotheses were proposed:

1. Poor households' experiences of low FS are comparable whether measured by the household food security survey module (HFSSM) or the household food insecurity acess scale (HFIAS).
2. Children of households with incomes close to or below the national minimal wage or that do not own the house of residence could experience a ceratin degree of CFI (child food insecurity).
3. There is a difference in CFI between private (from high socio-economic status "HS") and public (from low socio-economic status "LS") school aged children, and subsequent differences in health outcome and children's body measurements.
4. There is a large variation in the impact of CFI on children's nutritional status between children from low income urban and rural backgrounds.
5. "Low socio-economic status" families with children experiencing different severities of CFI, could improve the overall development and wellbeing of children with professional nutritional reinforcement at the parent and child levels.

1.3 Study Background

Lebanon is small middle-income country, located on the Eastern shore of the Mediterranean Sea, between Israel and Syria. It covers a total area of 10,432 sq km and its official language is Arabic, but French and English are commonly used. Lebanon's climate is moderate with four distinct seasons. Lebanon is divided into six administrative governorates or *mohafazat* (singular - *mohafazah*): Beqaa, Beirut, North Lebanon, South Lebanon, Mount Lebanon, and Nabatieh (Fig. 1.1). The country is characterized by high rate of urbanization 81% (FAO, 2007). The Beirut governorate is entirely urban, but the other governorates are basically composed of mixed rural and urban regions.

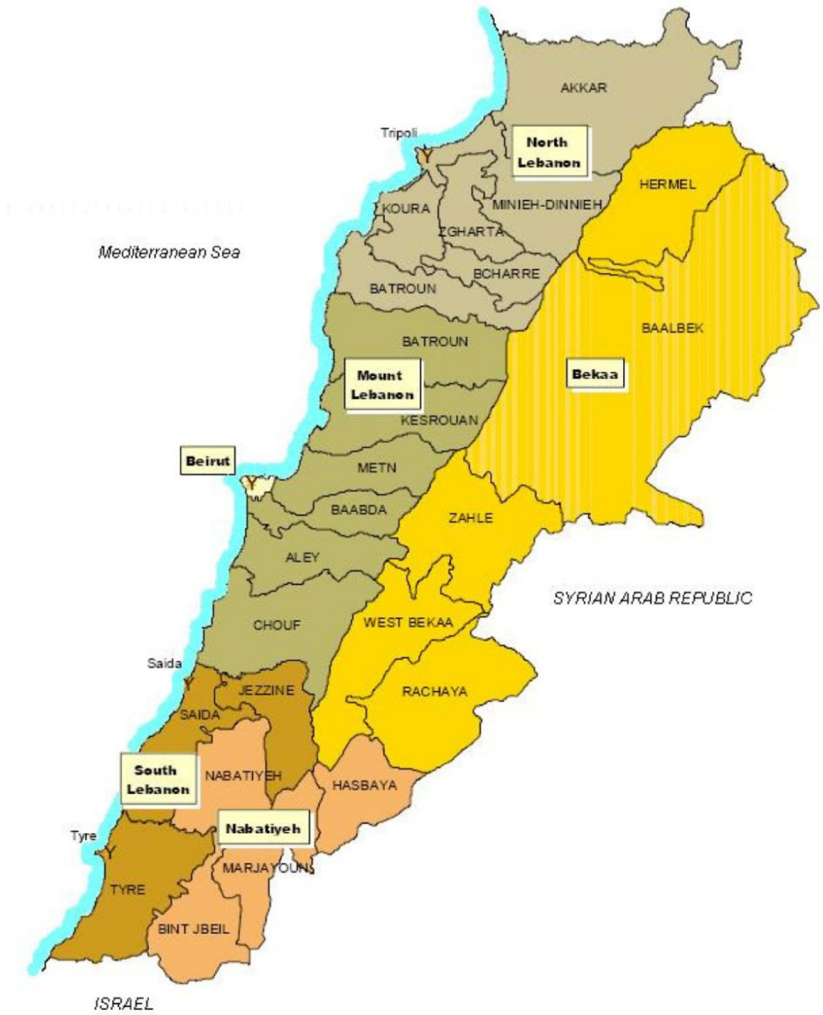


Figure 1.1: Map of Lebanon with administrative distribution (Moe, 2001)

1.3.1 Demographic data

The Lebanese population is estimated to be 4.2 million (ESCWA, 2010) with a 1.6% annual growth rate and life expectancy of 77.2 years. The average household size varies between 3.8 in Beirut and 4.7 in the North. The adult literacy rate in Lebanon is 91% (92% male and 90% female) of the population. Children (aged 0-14 years) constitute 26% of the population with a school life expectancy of 13 years (UNICEF, 2012).

1.3.2 Economic background

Lebanon is a middle-income country with a gross domestic product (GDP) of 45.73 billion dollars in 2014 (World Bank, 2014a). According to statistics (UNDP, 2008), 28.5% of the population live below the poverty line of $4/person per day 8% of those live at less than $ 2.4 and thus “unable to meet their basic needs”.

There is a huge regional disparity in the distribution of poverty, with higher prevalence being in rural areas, while central Beirut accounts for only 1% of the total poor. The poverty rates are significant in families headed by women, elderly, or unemployed persons. For those in employment, poverty is significant for individuals working in agriculture, construction, and industrial sectors, in addition to unskilled workers in the services sectors (UNDP, 2008).

1.3.3 Education system

Education in Lebanon is accessible to all. The combined enrollment in primary, secondary, and tertiary education stands at 85%. Elementary education for children in Lebanon is grade 1 to 3 (cycle 1) and grades 4 to 6 (cycle 2). The schools are divided into public, private, and private for free. The public schools are financed and managed by the Ministry of Education. Private schools have their own internal organization and are financed by students’ fees, while ‘private for free’ schools are subsidized by institutions. The total number of schools is evenly distributed between public and private sectors; however, the majority of students (66%) are enrolled in private schools (CAS, 2012).

1.3.4 Food habits

Lebanon is ranked as a relatively developed country, but with a heavy dependence on food imports. Almost 70% of food consumed in Lebanon is imported (Ministry of Economy, 2010), as is 92% of cereals, mainly in the form of refined wheat flour. Compared to neighboring countries like Jordan and Syria, Lebanon has more than one quarter of the land under cultivation or pasture and is fairly well endowed with water (Harrigan, 2011).

The Lebanese traditional diet has a subtle cultural heritage prepared from fresh and healthy ingredients, with certain exceptions related to sugar, sweeteners, and cereals (FAO, 2007). The food ingredients exemplify the typical Mediterranean diet, with a combination of minimally processed vegetarian based dishes, in addition to an abundance of fruits, vegetables, cereals, nuts and legumes. As for seasoning, olive oil is a major ingredient, in addition to lemon, garlic, mint, and other edible plants (FAO, 2007).

Over the last sixty years there has been considerable scientific evidence about the health virtues of Mediterranean diet. Following the Mediterranean diet may have a preventive effect on many diseases such as cardiovascular disease, diabetes, obesity, metabolic syndrome and mental health disorders (Esposito et al., 2013). In clinical setting, Mediterranean diet is recommended for patients with cardiovascular disease, since it has been confirmed that such diets reduce elevated blood lipids, high blood glucose, and blood pressure.

In an effort to estimate the nutritional quality of the traditional Lebanese diets, a study was conducted comparing fifty composite Lebanese dishes to fifty French dishes (Issa et al., 2009). The dishes were ranked by nutrient profiling, according to their nutritional composition for reasons related to prevention of diseases or promotion of health. The results proved that the Lebanese dishes had a better nutrient profile than the

French dishes and included more vegetables and unrefined starches and less cheese and dairy foods. Moreover, the Lebanese dishes were richer in vitamin C and contained less quantities of sodium, protein, and saturated fatty acids compared to the French dishes.

Nevertheless, in Lebanon, like in other Middle Eastern and North African (MENA) countries, the traditional diet is fading due to the propagation of Western habits, urbanization and technology motivated culture, globalization of food habits and change in food behavior (Nasreddine et al., 2014 a; Yahia et al., 2008). A study conducted on the food consumption patterns of the adult population living in the capital Beirut showed a high percentage contribution of fat to daily calories 39%, 13% from protein and 47% from carbohydrates, in addition to a low intake of fruits, vegetables, and fatty fish compared to international recommendations (Nasreddine et al, 2006). Nonetheless, there are no pubished studies that assimilate in detail the new trend in food consumption patterns in Lebanon.

The Dietary Energy Supply (DES) is commonly used by the FAO to analyze a population's food availability and eating habits (FAO, 2007). The per caput supply represents the amount of food available for the population as a whole, but does not indicate the actual consumption (Burlingame, B., 2003). The DES in Lebanon has been on an increasing trend ever since the 1970's. The per capita energy requirements were 2118 kcal/day from 2000 to 2002, while the per capita energy supply was 3160 kcal/day (FAO, 2004). The energy supply does not implicate its intake, but it could be one of the factors for the increase in the prevalence of overweight and obesity in the population.

National food balance sheets, undertaken by the FAO, illustrate food consumption patterns of the Lebanese population from 1965 until 2002 (FAO, 2007). The traditional diet is based on staples like cereals and cereal based food products, such as bread and rice. The consumption of cereals has shifted from almost 50% of DES in the

1960's to 33% in 2002 (Table 1.1), followed by fruits and vegetables (11%). Besides, the distribution of energy has moved in favor of increased consumption of oil and starchy vegetables, which may be due to westernization of the diet.

Table 1.1. Share of the main food groups in the DES (FAO, 2007)

Food groups	% of DES					
	1965-67	1972-74	1979-81	1986-68	1993-95	2000-02
Cereals (excl. beer)	49	45	40	38	35	33
Vegetable oils	8	11	11	12	14	13
Sweeteners	11	13	12	11	11	10
Fruits and vegetables	9	10	8	12	14	11
Pulses, nuts, oil crops	6	5	7	8	8	10
Meat and offal	7	6	7	6	6	8
Milk and eggs	6	5	7	5	5	6
Animal fats	3	3	4	4	3	2
Starchy roots	2	2	3	3	4	4
Other	1	1	1	1	2	2

In a study conducted by Naja et al. (2011) about the dietary habits of Lebanese adults (n=2048), the results validated the elevated consumption of fast food, sweets and, soda drinks. Another study focused on the diet of rural adults (n=798), demonstrating poor adherence of the rural individuals to the Mediterranean diet patterns (Issa et al., 2011).

The occurrence of overweight and obesity among the Lebanese population is increasing at a high rate: 17% in 1997 compared to 28% in 2009 (Sibai et al., 2010). Thus, a research was undertaken to study the diet-related cardiovascular disease risk factors in Lebanese adults (Nassreddine et al., 2014b) along with the escalating occurrence of hypertension, hyperlipidemia, metabolic syndrome (MS) and diabetes. The food consumption studies showed an increasing trend in energy intake, specifically from animal food sources and fat, with a parallel decrease in cereal and carbohydrate intake. In consequence, the authors concluded that the Lebanese adult obesity prevalence is expected to approach 40% by the year 2020, in parallel with the increase in prevalence of diabetes and hypertension (Figure 1.2).

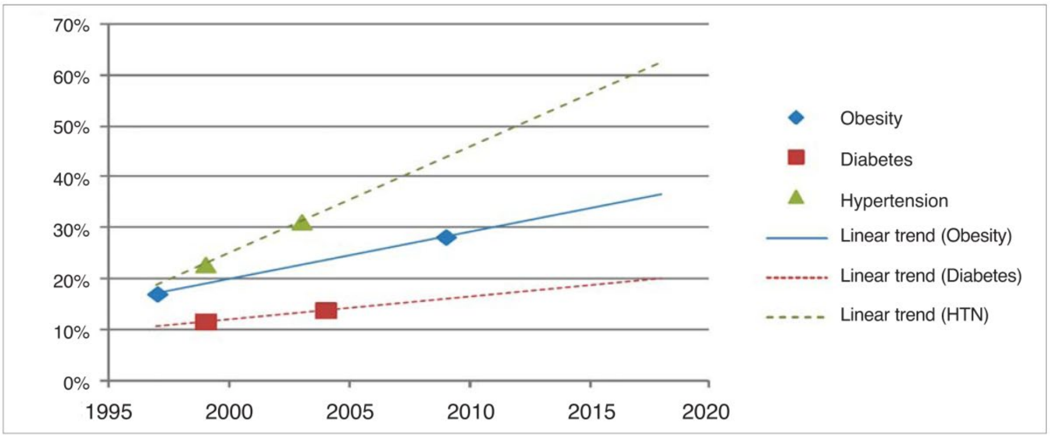


Figure 1.2. Secular linear trends in the prevalence (%) of obesity, diabetes and hypertension in Lebanon (Nassredine et al., 2014 b)

1.4 Summary

The research presented in this thesis was undertaken between February 2008 and May 2011, a time when Lebanon was harshly affected by the international changes in food prices. Subsequently, the economic and security situation worsened with increased local conflicts and the war crisis in neighboring Syria. In order to contribute to the social phenomenon of poverty and help reduce negative nutritional consequences on children, a series of studies were undertaken to validate the measure of FI in households with children in the MENA region and help prevent and manage negative outcomes on their health. In the following chapter, a detailed preview of nutrition and FI studies will be presented to provide an objective basis for the experimental studies that follow.

Chapter 2 : Literature Review

2.1 Introduction

This chapter examines the prevalence and causes of FI of the household and children, in the Middle East and the world. It discusses the characteristics of the diet of the FI family and the factors that might influence their choice, be it food cost, food access**,** or environment. The chapter will also review the healthy food basket and the comparative characteristics of the urban and rural FI populations. Furthermore, the health consequences of FI among children will be examined and the value of nutrition literacy and education of the poor population assessed in order to identify a successful intervention scheme to target the most deprived families with school aged children.

The literature review for the present thesis was conducted through an online database search to identify peer-reviewed journal articles. Ovid Medline, Pub Med, Google Scholar, Web of Science were utilised, in addition to several web sites of international organizations, including the FAO, the International Food Research Institute (IFPRI), the World Food Program (WFP), and the United States Agency for International Development (USAID). Additionally, numerous international non-governmental organization databases were used from the beginning of the project until August 2014. The literature search included a grouping of ten search themes: (1) household food insecurity; (2) child food insecurity; (3) diet quality and diversity; (4) food access and environment; (5) food cost; (6) nutrition knowledge and education; (7) healthy food basket; (8) poverty rural/urban; (9) consequences of food insecurity; and (10) nutrition studies Lebanon. The list of articles was filtered after the reading of the abstracts and the subsequent reading of the articles. A total of 447 papers were included in the literature search. These articles were used as a reference to give support to the validity of the thesis.

2.2 Epidemiology of food insecurity

2.2.1 Global distribution of food insecurity

Food is essential to human welfare, which in turn is vital to achieving FS (Pinstrup-Anderson, 2009). Ever since the last half of the twentieth century, global food production has surpassed the demand for food; however, the latest statistics estimate that there are 842 million people or one in eight people worldwide who are undernourished (FAO, 2013a).

In 1996, heads of state and government delegates from 187 countries gathered in Rome for the first World Food Summit (WFS) to discuss the alarming condition of FI. The summit proposed a commitment and a plan of action to “reduce the number of chronically undernourished people by half by 2015” (FAO, 2011a), known as the Millennium Development Goals (MDG). According to the latest FAO (2014a) statistics, the global number of undernourished has declined by 42% since 1990 from 994 to 791 million. Although progress is clear in certain regions, the MDG target of reducing the number of undernourished by half is not achieved yet. In the case of Western Asia (Figure 2.1.), during the last decade undernourishment has increased from 6.3% to 8.7%, most probably due to the increased conflicts in the region in the same time period (FAO, 2014a).

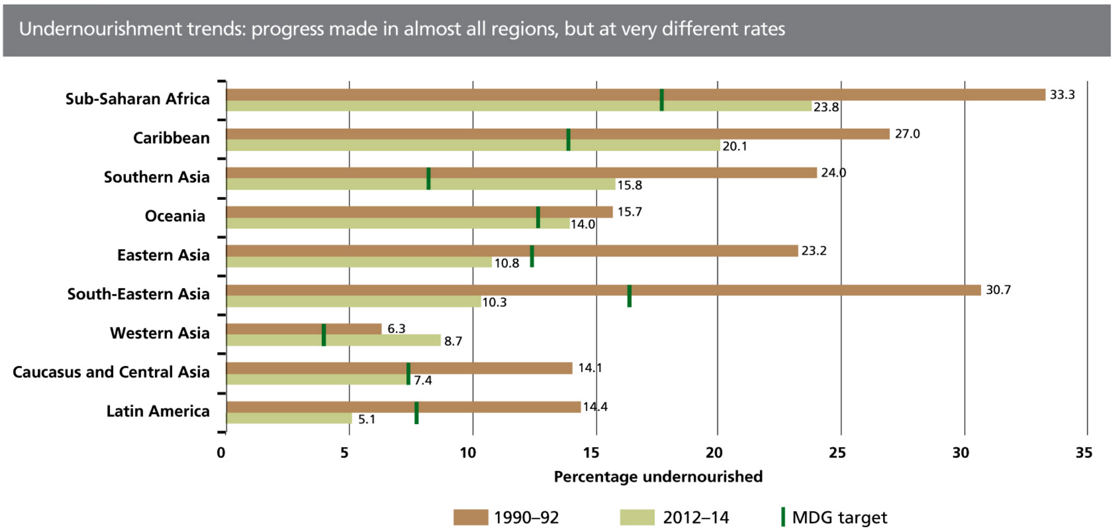


Figure 2.1. Undernourishment in the developing world (FAO, 2014a)

Even at the child level, there is a slight progress in figures showing a decline of 37% stunting in children under the age of 5 years (UNICEF, 2014a). Nevertheless, worldwide a total of 162 million children less than 5 years of age remain stunted. The number of stunted children is unevenly distributed in the world as 56% live in Asia and 36% in Africa (WHO, 2012), and approximately 18,000 children aged 5 years or under die every day because of poverty or geography. According to UNICEF (2014a), a good percentage of these children could be saved with little effort and financing.

In 2008, the Copenhagen Consensus Group, an expert committee of economists who meet to focus on global debates and publicize the solutions for governments and philanthropists, focused on hunger (Hoddinott et al., 2012). The Group asserted that the most effective investment to help undernourished children in the world, for an insignificant price label, was to provide micronutrient supplementation and fortification designed to increase nutrient intake. The authors noted that as low as $100 spent on micronutrient supplementation improved the diet quality and reduced chronic under-nutrition by 36% in LMIC countries (Hoddinott et al., 2012). The Group's predictive speculation was that each dollar spent to reduce chronic under-nutrition has a 30$ payoff.

In LMIC with pervasive poverty and a high dependence on food imports, the political power is perceived to have a role in FS of their population. When the ability of the political organization to provide security breaks down, its popular support fades and uprisings ensue (Lagi, 2011). Historically, high global food prices were a precipitating factor for social unrest and food riots. The most famous food riot noted in history was during the French revolution, when the hungry masses were revolting, and Marie Antoinette, Queen Consort of Louis XVI, suggested that the people of France replace bread with cake (Wilde, 2014).

While many causes of social unrest have been identified, persistently high food prices and food scarcity often trigger popular uprising. "Let them eat baklava" was suggested by many researchers upon the surge of protests in North Africa and the Middle East, which started in 2011 and continues to shake the Arab World. These uprisings are interwoven with increased global prices and chronic food insecurity (Mendel, 2011). Globally, the upsurge of international food prices that began in 2006 burst price inflation worldwide, increasing the incidence of FI, leading to violent remonstration and raising the fear of worldwide security (World Bank, 2010).

2.2.2 Causes of food insecurity in the world

FI is highly associated with poverty (Sarlio-Lahteenkorva & Lahlema, 2001) and it occurs when households face financial restraints (Wunderlich & Norwood, 2006). Furthermore, FI is strongly correlated to household monthly income level, low income per capita, or adult unemployment (Nord & Parker, 2010). In developed countries, at the micro level numerous studies have determined socioeconomic and demographic factors associated with FI at the household level, such as family headed by a single parent, a minority status such as African American or Hispanic, a younger person, a less educated individual compared to respective counterparts (Gunderson et al., 2011) and the smoking status of adults in the household (Cutler-Triggs et al., 2008). Moreover, vulnerable household memebers such as children are particularly at risk, as the incidence of FI tends to be elevated in households with children compared to families with no children (Coleman-Jensen et al., 2013).

Additionally, research on housing hardship such as large family size, household overcrowding (Kennedy et al, 1992), housing instability, meager housing circumstances have proved to have negative effect on the children's physical health (Wood, 2003). These children, compared to children in better housing conditions, were more prone to have accidents (Shenassa et al., 2004), to be in poor health, to experience infectious diseases and lead poisoning (Kim et al., 2002). Finally, studies on housing insecurity and homeless families demonstrated that the children are FI and have poor health compared to children who live in secure homes (Sharfstein et al., 2001; Beker Cutts et al., 2011).

It is well known that socio-political factors play a key role in the existence of global FI. In the last few years, worldwide FS is facing increased food demand and supply pressures. Key reasons for this are population growth, climate change and natural disasters, agricultural infrastructure, environmental overexploitation, globalization, urbanization, diseases, war and refugees (Misselhorn et al., 2012). At the consumer level, all of these aforementioned factors add up to obstruct individuals' access to adequate and nutritious food, primarily troubling their employment, earnings, and food prices. Also, hunger causes poor health and reduced levels of energy that results in low capacity to work. In short, the poor are hungry and their hunger traps them in poverty that will result in another generation in poverty (Chilton et al., 2007).

2.2.2.1 Agricultural Infrastructure and environmental overexploitation

Most LMIC lack the agricultural infrastructure: roads, warehouses, irrigation systems, and storage facilities. According to the World Bank (2007), 80% of the worlds chronically undernourished are in the rural sector, more than 50% being smallholders. “Small” may denote the number of workers, capital invested, but most frequently it refers to the magnitude of land operated. In a large fraction of LMIC, small farms supply 80% of the food (IFAD, 2013). Thus, smallholders compared to large scale commercial ones are the backbone of worldwide FS (Horlings & Marsden, 2011). According to Keating et al., (2010), small rural farmers are mostly under-equipped, doing conventional farming work with basic hand tools, no selected seeds or fertilizers, with heavy dependence on pesticides. In consequence, poor farming practices, deforestation, over cropping and overgrazing exhaust the fertility of the soil and reduce the yields. For durable and productive smallholder farming systems, FS policies should focus on increasing environmentally friendly and sustainable techniques, administering highly diversified crops, introducing new farming technology, and avoiding pesticides while integrating soil fertility approaches ; finally, allowing better access to market information to be competitive in the global market (De Schutter, 2014).

2.2.2.2 Displaced individuals and Refugees

Despite efforts of repatriation of displaced individuals, there has been a significant increase in their number globally. The number of displaced individuals reached 50 million for the first time after World War II (UNHCR, 2014). Displaced individuals and refugee families are susceptible to nutritional deficiencies, especially micronutrient shortage, due to the refugee’s circumstances of origin, current residential situation and reliance on food rations (UNHCR, 2014). Incidentally, refugee relief food is typically poor in many micronutrients such as iron. The inability to supplement rations of refugees with micronutrients eventually will result in major deficiency disease outbreaks (Henry &Seaman, 1992). Few investigations have been conducted on the nutritional quality of refugees; however, these studies have observed limited food access of refugees that produce micronutrient deficiencies and poor diet diversity (Lee et al., 2014). A study undertaken in Lebanon, Jordan, Syria & the West Bank on the nutritional status of Palestinian refugee children 6-35 months concluded that the occurrence of anemia was 67% (Hassan et al., 1997). Additionally, children <24 months had a higher risk of anemia and boys compared to girls had a higher prevalence of anemia.

In the case of displaced families due to long periods of conflict, a study conducted on 2474 Afghan children less than 5 years of age displayed a total of 12% in emaciated state and 40% suffered linear growth retardation (Mashal et al., 2008). Moreover, 33% of the children under the age of five years suffered from diarrhea and 42% from acute respiratory infection. An independent and negative correlation was discovered between child nutritional health status and lack of maternal autonomy, maternal illiteracy, marriage at young age, lack of basic material needs and the magnitude of internal displacements of refugee families.

More recent information on Syrian refugees (Coutts et al., 2013) caused by the Syrian conflict since March 2011, the number of registered refugees residing in Lebanon is estimated to be 1.3 million, with another 150,000 residing without any proper registration. The daily number of unofficial border crossings is at 2,000-3,000. The World Food Program estimated the average food cost per person per month to be 27 $ to provide 2100 calories per day. However, as the conflict is prolonged, starting July 2015, the WFP will apply food cuts for 13.5$ / person (WFP, 2015).

According to a WFP (2013) and UNICEF nutrition assessment of Syrian children aged 6 to 59 months, the Global acute malnutrition was estimated at less than 5 per cent, while the severe acute malnutrition was recorded at less than 1%. However, the recent budgetary cuts, aggravating environmental factors such as high risk of disease, increasing numbers of new refugees and climate extremes will deteriorate the nutritional status of the children even more (WFP, 2013).

2.2.2.3 Climate Change

Global and regional weather conditions are expected to become variable with increases in the severity of extreme events such as disparity in precipitations, acute and erratic climate events, rising sea levels and endangered ecosystems. Related research (Tirado et al, 2013) has proven that the outcome of climatic disasters will eventually result in poor nutritional status of the individuals due to a myriad of conditions such as lack of water and food, meager hygiene and healthcare performance (Figure 2.2.).

Therefore, climate change may augment the threat of FS through direct effect on food availability, quality, access and food utilization in a number of ways (Costello et al, 2009). Global crop production is expected to lessen due to estimated decrease of staple food yield, leading to a negative impact on food availability and farmers' income. Thus the resulting rise in price of staple foods may constrain food access to the poor and thus the food supply chain (Lake et al., 2012).

Moreover, climatic disaster may threaten the water cycle, influencing water sanitation and water access, particularly in the urban context. The variation in temperature, precipitation patterns and humidity may influence vector-borne diseases that may influence negatively the nutritional status of individuals. Further, the changes in the water infrastructure systems may have wide-ranging consequences on human communities, geopolitics and ecosystems (Stanke et al, 2013).

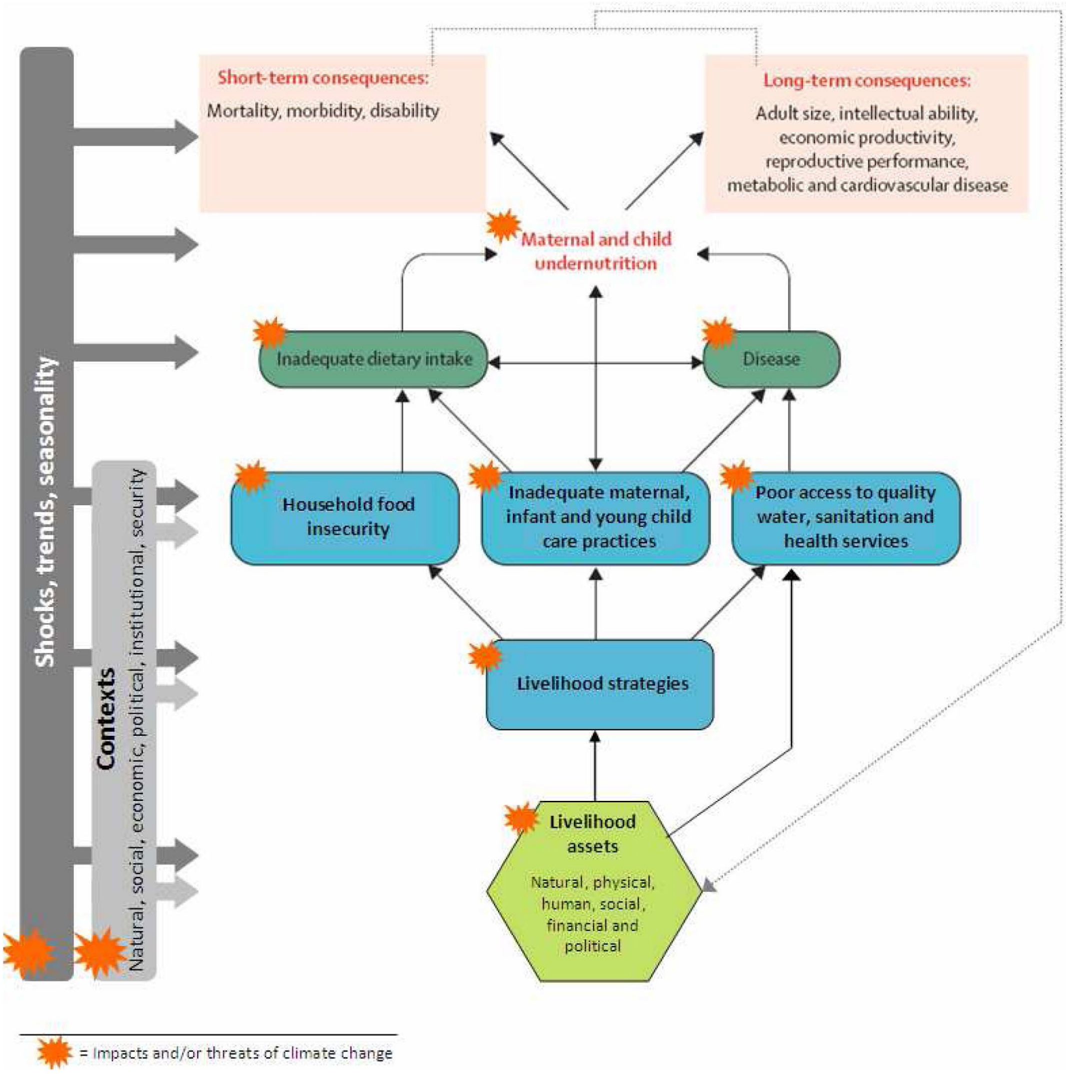


Figure 2.2. Adapted framework on the causes of malnutrition (Crahay et al, 2010)

According to Sheffiled & Landringan (2010), climate change is the biggest health threat of the 21st century, especially to the vulnerable populations who are the children, elderly and the poor. The consequent phenomena of climate change are a number of diseases, premature death, and an extra workload on women in rural areas that will lessen the care to infants and young children, thus amplifying the threat of under-nutrition.

2.3 Studies in Lebanon

2.3.1 Studies on Nutrition Status of Lebanese children

One of the public health challenges of the 21st century is the worldwide increase in the overweight and obesity epidemic (Musaiger, 2011). The Eastern Mediterranean region, Arabian Peninsula and northern Africa are no exceptions, since the obesity rate has reached alarming levels for both children and adults (Badran & Laher, 2011).

In the last few decades few studies have focused on the nutritional status of Lebanese children, although due to rapid development and urbanization some studies have analyzed the epidemiologic impact of this social phenomenon on children and adolescents (Chakar &Salameh, 2006) Nasreddine et al., 2014a). A comparative study was undertaken by Nasreddine et al. (2012a) looking at two previous national cross-sectional obesity surveys conducted in Lebanon during two different time phases (1997 and 2009). Both studies used similar procedures for sampling, data collection and analysis, and the subjects of the research. The study sample was chosen randomly: one adult from each household and one child/adolescent, aged 6 to 19 years, from every other household. Different lifestyle properties including socioeconomic, demographic, and lifestyle characteristic in addition to body measurements were compared.

The results showed increases in weight and height values for both the children and adolescent samples in the 12 year interval. Height increase for children and adolescents was (+16.39 cm in boys and +12.33 cm in girls), and weight (+19 kg in boys and +12.91 kg in girls). Accordingly, findings of BMI were higher in 2009 in all sex and age groups, except for 6-9 year olds. Figure 2.10 depicts the rising trend in BMI according to age group: there was an increase in the 95th percentile or obesity values up to 3.77 kg/ m² for boys and 2.63 kg/m² for girls in the 6-19 years age group (Nassredine et al., 2012a). The researchers also noted a steady increase in the 85th and the 95th

percentile BMI values in different age and sex groups, with the most notable increase (4kg/m²) attained among 6-19 years old boys and adult females. Sex-based differences were obvious in children since obesity was less amongst 6-9 years old girls compared to boys (+2.6% *vs.* 6%); however, in the adolescent sample the relative increase was almost double in girls compared to boys (+8.9% *vs*. 4.5%).

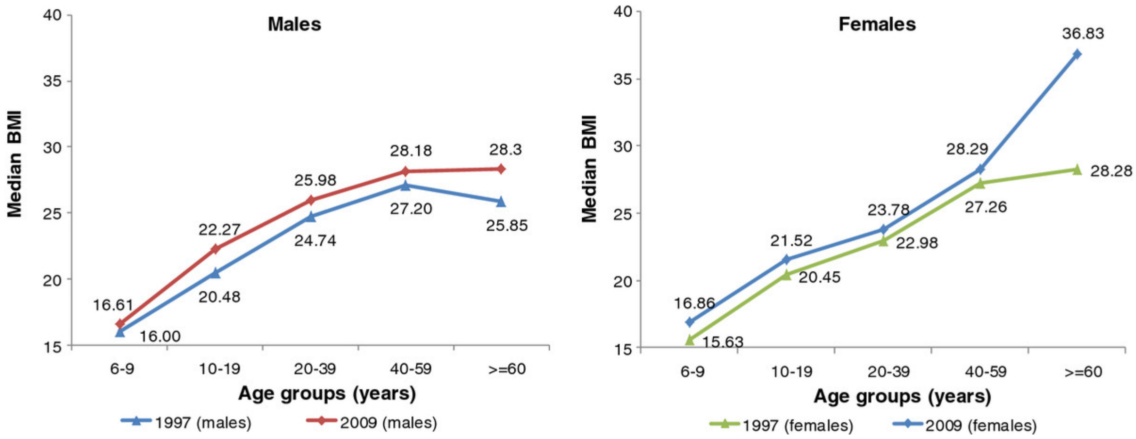


Figure 2.3. Median body mass index of study subjects by sex, age group and survey year in the study population, Lebanon 1997-2009 (Nasreddine et al., 2012a)

In industrialized countries, substantial evidence has linked childhood obesity to changes in the household and school environments, socio-economic changes and level of physical activity (Wang & Lobstein, 2006). Similarly, Nasreddine et al. (2012a) observed that sedentary behavior (defined as 10 hours or more of sitting or inactivity per day) increased in children and adolescent (6 to 19 years) populations from 20% in 1997 to 61% in 2009. This rise in inactivity of the young generation could be explained by the extra hours dedicated to playing electronic games, using computers, and telecommunication technology or watching television. Finally, the study concluded that the frequency of overweight was steady over the study period (1997-2009) with a higher level of obesity amongst pediatric and adult populations.

The escalation prevalence of global childhood obesity is associated with the rise in the incidence of childhood metabolic syndrome (MS) and the increased occurrence of a number of cardiovascular (CV) risk factors (Weiss et al., 2004). A comparable study was undertaken in Lebanon on preadolescent children aged 9-10 years to evaluate the prevalence of MS (Nasreddine et al., 2010). The results showed 26% of obese and 4% of overweight children were diagnosed as MS with a higher occurrence amongst females (Nasreddine et al., 2010). This high prevalence of obesity amongst Lebanese children and adolescents is alarming, considering its short and long term complications on health. In conclusion, the increasing prevalence of the number of obese within the Lebanese child and adolescent populations and their associated cardio-metabolic risk factors on health demand prompt screening and intercession at an early stage. It is documented that intervention at early stage and treatment of co-morbidities early in life, may reverse the negative health outcomes (Battista et al., 2009).

2.3.2 Studies on Food insecurity in Lebanon

Lebanon is a resource-free, middle-income country with high dependency on food imports, in addition to heavy fiscal and trade deficits (SNAP, 2013). The economy of Lebanon has been growing steadily since the end of the civil war in 1990; moreover, in recent years, due to continuous political instability in the area, the economy has been facing major challenges. As demonstrated by Table 2.1, the soaring global food price increase in the past years has impacted the local market, amplifying inflation rates and raising the prices of staple food items (Ministry of Agriculture, 2015).

The food price index (FPI) has increased by 42% in the last seven years, with the heightening of the prices of sugars, meats, oils, dairy foods and cereals by 4%, 31%, 47%, 59%, and 60%, respectively (FAO, 2013b).

Table 2.1. Percent changes in consumption of selected food items as result of the food-price inflation (Ministry of Agriculture, 2015)

Food Item	Price 2003	Price 2009	Change
Orange	1,088	1,177	8%
Apple	1,285	1,602	25%
Banana	1,360	1,349	-1%
Dates	1,675	3,174	90%
Prunes Red	1,975	3,200	62%
Lettuce (Piece)	820	1,050	28%
Cabbage	530	680	28%
Tomato	915	1,136	24%
Cucumber	1,050	1,475	41%
Potato	619	924	49%
Carrots	736	1,127	53%
Fresh Chicken Meat	3,100	4,445	43%
Fresh Beef Meat	8,200	10,168	24%
Fresh Milk	980	1,10	12%
Yogurt	2,120	3,120	47%
Soft White Cheese	5,100	7,600	49%
Rice	3,000	4,000	33%
Arabic Bread	990	1,440	46%

Lebanon is considered a middle income country with an average wage of $750 per month and a minimum wage of $450 (World Bank, 2013). Around 29% of the general population in Lebanon lives below the upper poverty line of $4 per day; this estimate also includes the population who live below the lower poverty line of $2 per day which total around 8% (UNDP, 2013). Therefore, with a susceptible economy Lebanese consumers are influenced from the international and local fluctuations in food prices. As a result of the overall situation in Lebanon, in 2009 the World Bank rated the country as vulnerable to FI (World Bank, 2013).

To assess the purchasing power in the Middle East and North Africa Region (MENA), Haffez (2014) created the "Falafel Index" indicator to generate a connection between the price value of a falafel sandwich and the purchasing power of the consumer from different Arab speaking countries. The falafel sandwich is an affordable staple which consists of crispy golden chickpea balls (falafel), wrapped in pita bread with condiments such as tomato, pickles, and tahini paste. Comparing the minimum wages in the MENA region with Iraq $103, Jordan $259 and Lebanon $ 439 (World Bank , 2014b), the local purchasing power was relatively high but still very low compared to wages in industrialized countries such as Great Britain where the average income was $3465 per month (World Bank, 2013). As shown in Figure 2.4, the Lebanese consumer pays a relatively high price for the purchase of food commodities compared to other neighboring countries: Beirut, the capital, is considered the third most expensive city, and, Jbeil, a small city in the North of Lebanon, is sixth expensive in the ranking.

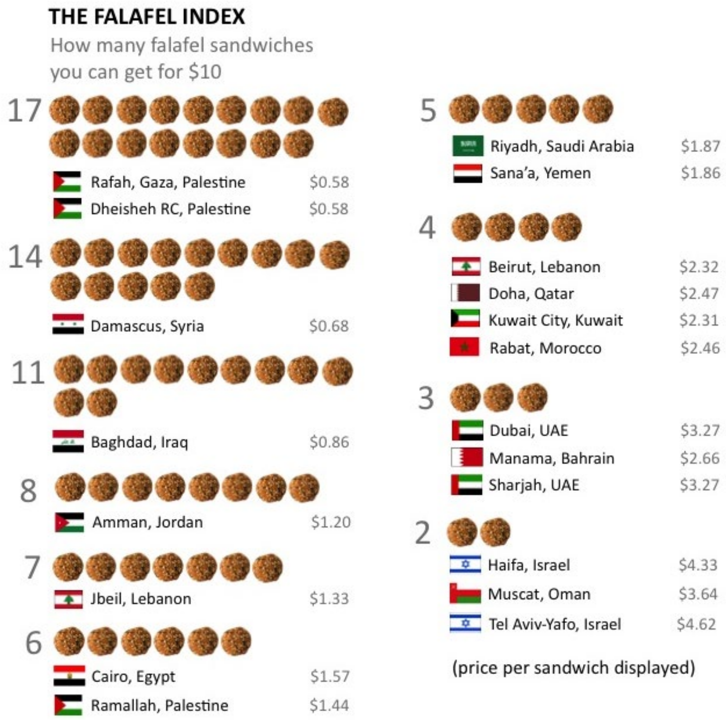


Figure 2.4. The Falafel Index (Haffez, 2014)

Moreover, at the household level economic inflation has diminished the purchasing power of the Lebanese household, since they are net buyers of food and spend an average 20% and more of their income on food commodities (CAS, 2005). In a study conducted to evaluate the impact of the global food price inflation on FI and malnutrition in Lebanon (Abou Zaki et al., 2014), data for the research was drawn from the only published survey undertaken in 2004 about the household living conditions (CAS, 2005) for 7431 households from different geographical regions.

To determine the typical Lebanese food basket, Abou Zaki et al. made recourse to the study by Nassredine et al. (2006), which is based on a sample of urban adults (aged 24 to 54) limited to Beirut and its suburbs. Thus the food basket of the latter study characterizes the food habits of the Lebanes urban population and is not representative of the food habits of the total population.

The adopted food basket included 17 food items from five food groups: commonly consumed in Lebanon: dairy products, meats, fruits & vegetables, bread and rice. To obtain the consumption per individual the total amount of nutrients was divided by 4.2, which is the calculated average number of household memebers in a Lebanese family (Abou Zaki, 2014).

A model of food expenditure shares was generated for the different food groups. Based on this model, compensated price elasticities were developed and applied for estimation of percentage change in the intake of macronutrient and micronutrient in Lebanese households due to food price inflation. Change in the nutrient intake was calculated by governorates to detect the most price sensitive regions in the country.

Furthermore, the researchers focused on certain nutrients (potassium, zinc, vitamin C, vitamin A, calcium, iron, folate and protein) to estimate the nutritional changes of the Lebanese adult consumer over time. The choice of these nutrients was based on two main criteria: first, the nutrients are considered indispensable for growth and activity and overall well functioning of the body; second, their intake was reported to be of borderline or deficient quantities in studies applied in Lebanon (Hwalla et al., 2004; Salamoun et al., 2005; Sibai et al., 2003).

Table 2.2 Percent changes in intakes of selected nutrients as a result of the 2008 food-price shock in six Lebanese Governorates (Abou Zaki et al., 2014)

Nutrient	Overall	Beirut	Mt. Lebanon	North	Bekaa	South	Nabatieh
Protein	−11.7%	−12.5%	−13.1%	−12.1%	−9.4%	−11.0%	−10.8%
Potassium	−8.1%	−9.6%	−9.8%	−7.7%	−4.4%	−7.8%	−8.2%
Vitamin A	−5.8%	−10.4%	−8.5%	−5.2%	−1.1%	−4.9%	−6.3%
Vitamin C	−2.8%	−3.0%	−3.2%	−3.7%	−0.6%	−2.9%	−4.0%
Calcium	−16.3%	−20.3%	−18.7%	−14.7%	−9.9%	−17.2%	−16.9%
Iron	−3.2%	−4.5%	−4.0%	−4.0%	−0.5%	−2.6%	−4.0%
Folate	−14.5%	−13.3%	−15.4%	−15.0%	−13.1%	−14.6%	−13.7%
Zinc	−11.3%	−11.8%	−12.4%	−11.5%	−9.2%	−10.8%	−10.9%

As shown in Table 2.2, the consumption of the eight selected nutrients decreased as a result of the food price shock. The average decrease was in all the regions and it varied between 2.8% for vitamin C to 16.3% for calcium. The highest nutrient reductions occurred in Beirut and Mount Lebanon, the urban regions, compared to the smallest reduction in the Bekaa, which is predominantly a rural region. Still, as the dietary intake of the Lebanese population are crude approximations, they are not exact indicators of the issue of FI in the country. The authors concluded that poor urban families may be more susceptible to FI and malnutrition due to price spikes, given that members of rural families practice farming and have the possibility to save part of their output for personal consumption (Abou Zaki et al., 2014). Finally, the study projected that progressive nutritional adjustments will increase gradually the risk of FI and nutrient deficiencies in the population.

Published data by the World Bank (2012) on the nutritional status of the Lebanese population estimated 5% of the population to be malnourished with a food deficiency of 160 kcal/person/day. At the pediatric level, 12% of children were stunted and 17% were overweight. In addition, the Lebanon country profile featured by FAO in 2004 demonstrated the prevalence of several micronutrient deficiencies of which iron deficiency anemia was the most common. This latter was confirmed by Hwalla in 2004, who demonstrated anemia prevalence of 21% in 15-50 year olds and iron deficiency percentage of 34% (Hwalla et al., 2004).

A comparative study was undertaken in the Bekaa between two nomadic (Bedouin) settlements (Ghattas et al., 2013b) to investigate the outcome of increased food prices on a marginalized community in Lebanon. One settlement had access to land, thus depended more on livestock and grazing, while the second settlement depended on the service sector for employment, where food was purchased rather than produced.

The families were interviewed for the FI questionnaire, adapted to the Lebanese context, and the anthropometric measures of all the family members evaluated. FI was prevalent in 55% of families with less access to land and in 29% of families with greater land access. Overall frequency of consumption of fresh foods, such as meat, chicken, fish, fruits and vegetables, was low and less frequent in the Bedouin FI households. As for nutritional status, 35% of households had one stunted child, 12% had one overweight child, 86% households had one overweight adult, and 54% households had at least one obese adult (Ghattas et al., 2013).

Refugees residing in Lebanon have no legal rights and are considered vulnerable since Lebanon has not signed the 1951 Refugee Convention (UNHCR, 2011). A survey was undertaken by Ghattas et al. (2012) on 2575 households of Palestinian refugees living in camps and gatherings between July and August 2010. The questionnaire included an adapted version of the US Household Food Security Scale to the Lebanese context in addition to socio-economic, demographic, and health information. Almost 59% of households lived below the national poverty line of $6 per person, 63% reported some form of FI, and 13% severe FI. Ghattas et al. (2013) also conducted a socio-economic survey on 630 Iraqi households, ten years after the Iraqi invasion. The information collected included socio-demographic, economic, health, diet and FS status. The results showed that about 20% were FS, 36% moderately FI, and 44% severely FI. The severely FI group of refugees was correlated to very poor housing quality and reduced diet diversity. Further, 85 children less than 5 years old were tested for hemoglobin level: 41% were anemic, independent of the FS status of the household.

In Lebanon, thus far a study by Sahyoun et al (2014) developed a FS tool in Arabic, based on the HFSSM (Bickel et al., 2000) and Yemeni National food Security survey (Kabbani, et al., 2004). The two scales underwent construct and face validity, in addition to a psychometric assessment that proved only 7 items of the questionnaires to have good internal validity and reliability (Sahyoun et al., 2014). The questionnaire was tested with two underprivileged communities in Lebanon: a community in the south (Tyre), and the second one of Palestinian refugees, and socio demographic and food consumption information was collected from the participating families. According to the authors, the higher the educational level of the head of household, the higher average monthly income and the less risk of FI. Conversely, the higher the FI level the less was the expenditure on food and fewer the food categories except legumes, which was highly consumed among Lebanese FI households. The authors concluded that the seven item scale is a valid tool for assessment and monitoring of food insecurity in the MENA region covering a wide range of FI severity.

In a survey undertaken by UNDP in 2007 about poverty rate across governorates in Lebanon, the highest concentration of poverty was found to be in the Bekaa with 29% of the population, the South 42%, and the North 53% (Figure 2.5).

From the limited publications about FI in Lebanon, it may be concluded that the intensity of FI in the region is on the rise, especially in vulnerable communities such as the refugees and Bedouin settlers. The only data on FI of Lebanese residents is in the last survey by Sahyoun et al. (2014), who found that 42% of southern residents were FI. Thus, there is an urgent need for programs to address the FS situation of Lebanese underpriviledged households and children, in addition to the nutrition education and health situation of the whole population.

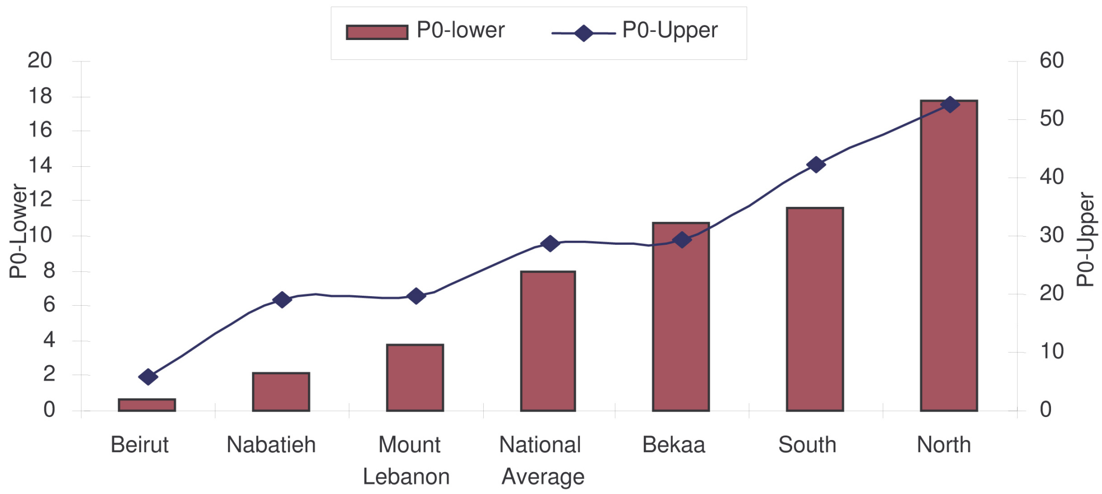


Figure 2.5. Extreme poverty (P0-Lower) and overall poverty (P0-Upper) by governorate (UNDP, 2007)

2.4 Food Security Information systems

Food insecurity is complex multi sectoral and multi disciplinary phenomenon. Over the years multiple indicators for assessment and monitoring of FI were developed (Table 2.3).

2.4.1 Measurement of household food insecurity

"Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food…." Article 25 of the Universal Declaration of Human Rights (General Assembly of the United Nations, 1945).

After World War II, hunger and poverty received little public attention worldwide (Nestle et al., 1992). Measuring malnutrition through clinical and biochemical indices being complex and expensive, FI has been assessed by different complementary procedures such as measurement of energy intake using food frequency and recall or direct child anthropometric measures of nutritional status (Wiehl, 1960); measurement using income and expenditure survey (Smith, 1998); combining national food balance sheets with household consumption surveys (Naiken, 2003). Yet, there is little consensus about which method is most accurate as these methods have not been useful for guiding food security policies.

Early attempts were made to measure FI in the United States in the early 1980's when the demand for food assistance increased from certain communities, particularly families with children (National Research Council, 2006). Thus, community leaders wanted to document this mounting social phenomenon to policymakers who should recognize the severity of the problem. One of the first tools to measure FI was by the Community Childhood Hunger Identification Project (CCHIP) in 1983 (Wehler et al,

1992) intended for application by communities to measure the incidence of hunger among households with children.

In 1984, a report from the Physician's Task Force on Hunger stimulated researchers from the private sector to develop survey instruments to measure hunger. By the early 1990's, attempts to measure FI experiences had focused on direct measures, collecting information directly from individuals about food habits of the household (Nestle et al.,1992). In parallel, Radimer and Cornell developed a method to measure FI that included assessment of the adequacy of food quality and quantity at four levels: household, adult, child, and food anxiety at the household level (Radimer et al, 1992). The validation that pursued established the ability of this latter method to distinguish the individual experience of food insecurity and hunger amongst members of the households (Kendall et al, 1995).

Consequently, FSS (Food Security Supplement) was added to the Current Population Survey (CPS) in 1995 to report national FI prevalence and to monitor effects of food assistance programs on household FS (Bickel et al., 2000). The CPS is a representative national sample investigation of about 60,000 households that are surveyed monthly by the U.S. Census Bureau for the Department of Labor (Bickel et al., 2000). Subsequently, the Federal Interagency Food Security Measurement Project created the U.S. Household Food Security Scale (HFSSM) applying CCHIP as a foundation (Frongillo, E.A., 1999). Ever since the creation of the measure, the questions in HFSSM have remained unchanged over the years while the full supplement includes more than 70 questions about food sufficiency, only a set of 18 items examine the increasing levels of severity of food access or insecurity, followed by nine "frequency of occurrence" questions that are asked as a follow up to each occurrence question to determine how often the condition occurred during the last 12 months or the past 30 days (Wunderlich, 2006).

Table 2.3. Measures of Food Insecurity

Method	Principle	Unit of Measurement	Advantage	Disadvantage
Household Food Security Survey Module(HFSSM)	• **Result**: Household level of FI • Contains algorithm system to convert scale scores into FI categories	• Household with Child	• Captures physical and psych emotional aspects of FI • Low cost in application • HFSSM and translated versions valid across diverse socio-cultural settings	• Reference time period 12 months • "Benefit" bias of participants
Child Food Security Scale (CFSS)	• **Result:** Child level of FI	• Child within a household	• Captures physical and psycho emotional aspects of FI • Low cost in application • CFSS and translated version are valid across diverse socio-cultural settings	• Reference time period 12 months • Child FI as reported by parent or Caretaker • Benefits bias of participant parent or caretaker
Household Food Insecurity Access Scale (HFIAS)	• **Result:** • Access component Household FI • Contains algorithm system to convert scale scores into FI categories	• Household As a group	• Captures anxiety aspects of Food access, food preference, economic access and food quantity • Low cost and easy application • Can detect changes in FI access over time as a group or populations	• Reference time period one month • "Benefit" bias of participants • No justification cause of Food insecurity
FAO Measure	• **Result:** Calories available per capita per day • **Methods:** energy intake coefficient of variation, food balance sheets	• population	• Applied annually worldwide • Low cost in application	• Identification at risk of population level not household or individual levels • No details about dietary quality • Low standardization on data collection methods across countries
Dietary Diversity (DD)	• **Result:** Total amount of different foods consumed over a specified time period(1-15 days)	• Individual • Household	• Easy to train enumerators to undertake an interview • Demonstrates difference in food distribution within household • Tracks seasonal changes in Food Security • Easy to input data	• No reference food group to compare • DD can emphasize use of unhealthy foods

The 18 items of the HFSSM questionnaire are divided as follows:

- Three items ask about the experiences of the whole household;
- Seven items ask about the experiences and behaviors of the adult members of the household;
- Eight items ask about the experiences and conditions of the children in the household as a group.

The questions vary from the least severe (for example, concern about being able to afford food) to the most severe (for example, losing weight because of lack of food). Further, the scoring of the FS questionnaire, item response theory (IRT), or statistical Rasch model is applied to evaluate the FI of households. The Rasch model provides standard statistical methods to estimate the FI of households that vary across a wide range of severity conditions identified by items (Nord, 2014). The variations in the level of FI are detected in the response patterns of studied households. More severe items are less often affirmed than less severe items. Likewise, a household that declines an item at mid-range is expected to decline all items that are more severe. These characteristic reactions are prototype, not collective but they usually prevail in good research data. It is applied to create a range of food problems (Ohls et al., 2001).

Once a household validates an item they are assigned the score 1. The FS scale allocates each household a scale value ranging from 0 to 10, with 0 indicating no verification of FI and scores close to 10 indicating cumulative evidence of the most severe scale of food sufficiency problems (Table 2.4). The FS status of each household lies somewhere along a scale extending from high food security to very low food insecurity. This continuum is divided into four ranges: food secure; food insecure without hunger; and food insecure with hunger; food insecure with severe hunger.

Table 2.4.Categorization of FS status of households (Bickel et al., 2000)

Household without children (based on responses to 10 adult and household items) • Food secure = households that denied all items or affirmed 1 or 2 items • Food insecure without hunger = households that affirmed 3, 4 or 5 items • Food insecure with hunger = households that affirmed 6 or more items
Household with children (based on responses to all 18 items) • Food secure = household that denied all items or affirmed 1 or 2 items • Food insecure without hunger = households affirmed 3 to 7 items • Food insecure with hunger = households that affirmed 8 or more items

Lately many countries have adopted FS measures either by simple translation of the US module or by adaptation of the US module to be culturally, economically and linguistically suited to local settings. The questionnaire adaptation requires focus groups and cognitive testing of the questions and statistics of the surveyed data to check the validity and the applicability of the instrument outside the US. Several recent publications of FS questionnaire adaptation in Bolivia, Burkina Faso, and the Philippines (Melgar-Quinonez et al., 2006); the Caribbean (Gulliford et al, 2006); Iran (Zerafati et al., 2007); Asia and Pacific Islands (Derrickson et al., 2000);Venezuela (Albert, 2000); Costa Rica (Gonzalez, 2008); Colombia (Hackett et al., 2008); Peru (Vargas, 2009);Tanzania (Germana et al, 2008) Campinas, Brazil (Perez-Escamilla et al., 2004) and Lebanon (Sahyoun et al., 2014).

In the United States, some researchers have modified the items of the HFSSM or have reduced the set items of the questionnaire to fit the requirements of their experiment (Radimer, 2002). In 1999, Blumberg and colleagues developed the abbreviated six-item module from the 18 item questionnaire. This short form proved to have optimal sensitivity, specificity, minimal bias and an acceptable substitute of the full module (Blumberg et al., 1999). But even this form does not provide data specific to children and does not measure the more severe levels of hunger, and thus classifies households as FS, FI without hunger and FI with hunger (Economic Research Service, 2012).

The short form of the HFSSM was evaluated in English speaking developing Caribbean community by Gulliford et al. in 2003. The questionnaire was well understood by all participants and proved to give valid and reliable responses in a setting different than the US, with no modifications concerning the cut-off points for the FI classification (Gulliford et al., 2003).

2.4.2 Measurement of Child Food insecurity

The interest to measure child food security (CFS) began in the mid 1980's by the Community Childhood Hunger Identification Project (CCHIP) that developed a sequence of four questions concerning children's food situation as part of a survey module to evaluate household hunger conditions (Wehler, 1992). The survey data analysis concluded that the child-addressed questions measured FI that was associated with, but not one-dimensional with, FI questions addressed to the household and adult members.

2.4.2.1 Development of the Child Food Security Scale (CFSS)

In 1990, Radimer and Cornell developed a method to measure FI that included assessment of the adequacy of food quality and quantity at four levels: household, adult, child, and food anxiety at the household level. The validation that followed proved that the four FI factors related to child, adult, household and quality were interrelated but separately identifiable. The fundamental problem using the HFSSM to assess CFS is that the relation between the FS of the adults and the children depends upon the ages of the children. In general, young children are protected from disordered food patterns and decreased food intake at much greater levels of adult food insecurity compared to older teenaged children (Rose & Bodor, 2006).

The bi-dimensionality (child and adult items) of the HFSSM causes it to underrate the FI of adults in families with only very young children compared to adult FS in households without children. The HFSSM measures adult and child dimensions of FI which are associated but not co-linear. In many LMIC situations, food distribution in a family depends on variable assets and the factors related to family structure, such as duration of marriage, stability of marriage, number of wives and within household organization. Parents are expected to display altruism towards their children; still it depends on whether the children are biological, adopted, foster or stepchildren. In general, low income adults bestow food resources to feed their children adequately (Kuku et al., 2011).

Thus, Nord and Bickel (2002) proposed the eight referenced questions to be used as the Child Food Security Scale (CFSS), which proved to have excellent internal validity. The eight items of this questionnaire are evenly spaced with respect to the severity of the question. Thus, a household that affirms a certain question will assert all the questions that are less severe and household that rejects a specific question will reject all items that are less severe. Subsequently, the CFSS gives precise measurement of the extent to which children are affected by resource-restricted food shortage.

2.4.2.2 Scoring of the CFSS

In the US there are different survey vehicles that include measuring FI and hunger and tracking changes over time. The NHANES is a sequence of national examination studies conducted in the US ever since 1971. The findings from these surveys are used to determine occurrence of major diseases. Since 1999, every two years FI data has been collected from a representative sample of US population. For 2001-02 the NHANES documented public use data, identified ranges based on CFSS (Table 2.5) (Nord & Hopwood, 2007). Similar to the household FI scoring, the statistical Rasch model is used for the CFSS scale scoring.

Table 2.5. Ranges for CFSS (Nord & Hopwood, 2007)

Raw Score	*Child Food Security Status*
Raw Score 0	Child Food Quantity and quality unaffected
Raw Score 1	Child Marginally Food Secure
Raw Score 2-4	Child reduced quality and quantity of food
Raw Score 5-8	Child food insecure with hunger

Further, in 2006 the USDA (Coleman- Jensen et al., 2013) introduced new labels for survey results (Table 2.6). The term hunger was removed because "hunger" describes an individual experience while "FI" describes a household experience. The two terms that describe children as FS are: "High FS" for children that did not answer "yes" to any question, and "marginal FS" to children who answer "yes" to 1 or 2 questions. Furthermore, the two terms that describe FI are:

- "Low child FS" replaced the term "FI with no hunger". In general, children in this category have had to make changes in quality or quantity to deal with economic changes;
- "Very Low child FS" replaces the term "FI with hunger" individuals in this group struggle to have enough food, including cutting back or skipping meals on a frequent basis.

Table 2.6. USDA label ranges for CFSS (Coleman- Jensen et al., 2013)

Raw Score	*Child Food Security Status*
Raw Score 0-1	High or Marginal Child Food Security
Raw Score 2-4	Low Child Food Security
Raw Score 5-8	Very Low Child Food Security

2.4.2.3 CFSS Reported by children

Many studies have investigated the behavior and reaction of individuals facing conditions of FI using the HFSSM which determines FI at the aggregate level, the FS of the household members as a group and the children as a different group. Most previous research has measured child FS using the parental information of children's food experiences (Matheston et al., 2002; Casey et al., 2005; Jyoti et al., 2005); more specifically they have focused on the perceptions of women (Radimer et al., 1992; Hamelin, 1999; Nord, 2002). There is discordance in studies on children in the US, confirming that children in FI households are protected from FI and yet substantial findings have shown negative developmental outcomes on children at academic, social or behavioral levels (Yoo, 2009). A study undertaken by Nord & Hanson (2012) concluded that reports by adults and adolescents concerning the adolescents' own food security status did not concur; the FI experience of children was different from adults both in content and context. Therefore, the need to develop a measuring tool of CFS as reported by children and adolescents is essential.

Several attempts to measure CFS directly among children, by adapting quantitative methods used for adults, have been accomplished. In the US, in an effort to develop a child reported FI questionnaire, Connell et al (2004) adapted nine items from the HFSSM in a child-appropriate wording. The pilot study proved that the set of questions had sufficient reliability to measure CFI especially for children less than 12 years old. Although Connell et al. (2004) encouraged children to report their FI experiences, this study demonstrated that the adult-generated concept of FI state of the child was also valid. Furthermore, Connell in 2005 investigated 32 children aged 11-16 years who were asked about "kids they know" whose families almost "ran out of food". The findings of this study add a new perception about children's cognizance of the quality, severity, social and psychological aspects of HFI. The limitation of the study, though, was that children were asked to report the FI experience of others rather than their own (Connell, 2005).

A study conducted by Sharkey et al. (2012) in the US on Hispanic children aged 6 to 11 years from low SES assessed the relationship between FI experience and nutrient intake. Fifty mothers and children were interviewed for demographics and dietary intake. The children were interviewed for the CFSS and their anthropometric measurements taken. From the sample, two thirds reported low or very low FS. None of the participants met the dietary recommendations for potassium and vitamin D, but few met the daily needs for sodium, calcium, and dietary fiber. Very low FS was associated with greater intakes of total energy, calcium and percentage of calories from sugar and fat. Thus, child-reported CFSS could serve as an efficient screen for potential metabolic and health related consequences for children.

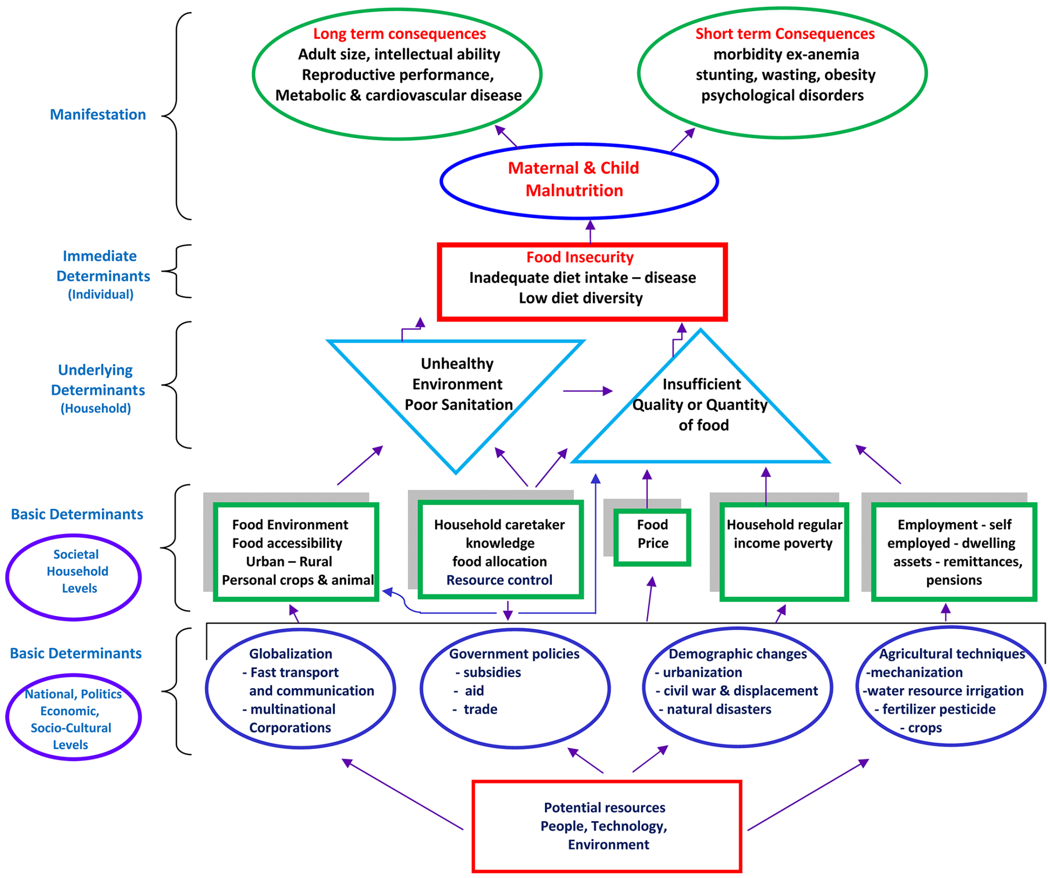
In 2008 Hadley et al. surveyed Ethiopian adolescents aged 13 to 17 years about their understanding of FI: the results revealed that this age group were able to attest well their FI experience and self-reports were associated with their health outcome. More recently, in the US, as an effort to create questionnaire directly administered to children, cognitive testing and analysis were undertaken for internal validity and reliability of a newly developed FS scale (Fram et al., 2011). The sample consisted of 26 families from rural (n=14) and non-rural (n=12) homes in South Carolina with children aged 9 to 16 years. The members interviewed included children, mothers, fathers, and other household adults. Once again the children proved to be reliable reporters of their FI experience, especially being aware of their FI and taking the initiative to manage food resources.

Finally, in a study conducted by Bernal et al. (2012) in an urban Venezuelan setting, children aged 10 to 17 years were interviewed through focus groups. Their behavior while facing FI was distinct and different from experiences of adults. The sampled children successfully reported their emotional experiences of FI, feelings of concern, sadness, agony, and manifestations like crying. The children's description of physical manifestations of FI were feelings of hunger, reduction of quality and quantity of food, child labor, consumption of food from waste, and asking support from family members. The children were not always protected from FI since they came up with strategies to acquire and prepare food, especially when the head of the family was unemployed, was a drug or alcohol addict, or was extremely poor. Thus, these studies open up a new dimension concerning FI of minors that needs to be taken into consideration.

2.5 Health and Nutrition consequences of FI on children

Although extreme FI is uncommon in developed countries, many households still experience FI and less severe forms of hunger. Numerous studies have investigated the short-term consequences of FI that lead to a plethora of medical problems to children, be it developmental or of well being (Alaimo et al., 2001a). As demonstrated in Figure 2.6, children living in households experiencing FI are more prone to have poor health and chronic illnesses (Cook et al., 2006), increased odds of being hospitalized (Cook et al., 2006), frequent headaches and stomach aches (Alaimo et al., 2001a), impaired cognitive and mental skills (Zaslow et al., 2009), mental symptoms such as hyperactivity and inattention (Melchior et al., 2012), depressive disorders and suicide symptoms in adolescents (Alaimo et al., 2002), aggression and anxiety (Whitaker et al., 2006), psychosocial problems (Weinreb et al., 2002), behavioral and emotional skills (Huang el al., 2010), greater predisposition to see a psychologist (Slack & Yoo, 2005; Belsky et al., 2010), academic and social developmental delays in children (Ashiabi, 2005), higher prospect of asthma occurrence (Kirkpatrick et al., 2010), higher prevalence of inadequate intake of key nutrients (Lee & Frongillo, 2001; Matheston et al., 2002), higher levels of iron deficiency anemia (Skalicky et al., 2006; Park et al., 2009), and increased occurrence of dental caries (Chi et al., 2014). Obviously, there is a growing body of evidence indicating that children and adults from marginally FS households (affirm 1-2 items of the food security scale) are extensively associated with many of the health consequences as severe FI individuals (Lee et al., 2012).

A long list of published literature document that poor health in childhood has extended consequences throughout adulthood (WHO, 2006). Thus, a review of studies involving maternal and child malnutrition from LMIC such as Brazil, India, Guatemala, the Philippines and South Africa was undertaken to assess the long term consequences of malnutrition on adult health (Victoria et al., 2008). The markers of maternal and child under-nutrition studies were: maternal height, intrauterine growth limitations, birth weight in addition to weight, height and BMI at 2 years. The study demonstrated that child under-nutrition was strongly correlated to future adult outcomes, namely shorter adult height, less schooling, reduced economic output, lower SES in adulthood and low offspring birth weight for women; whereas maternal under-nutrition contributed to fetal growth restriction, which increases the risk of neonatal death or for surviving children stunting by two years (Blacke et al., 2013). In the same assessment Blacke et al. concluded that for the first 1000 days from conception to a child's second birthday, optimal nutrition is vital for long-lasting benefits throughout life.



Source: Adapted from Unicef 1998

Figure 2.6. Conceptual Framework of Child Food Insecurity

Along the same line, it is documented that maternal and postnatal malnutrition influence motor and cognitive development, with the prime outcome of stunting before the age of 3 years (Christian et al., 2010a). Deficiencies in vitamin A and zinc may lead to death, while iodine deficiency and iron deficiency coupled with stunting will restrict children's developmental potential (Grantham McGregor et al., 1999; Villalpando et al., 2003). Consequently, if low birth weight babies who are stunted and underweight in infancy gain weight rapidly in childhood or adulthood due to adoption of westernized diets, they may become susceptible to future increased BMI, elevated blood pressure and glucose, cardiovascular and metabolic non-communicable diseases (Prentice et al., 2005).

2.5.1 Health and nutrition consequences of FI on children, as reported by CFSS

Ever since the development and validation of the CFSS (Nord & Bickel, 2002), a few studies focused on CFSS to demonstrate its consequences on child health and well-being (Nord, 2007). In the US, a study was conducted to investigate if CFI increased the risk caused by HFI to children's health, aged 36 months or less (Cook et al., 2006). From 1998 until 2004, 17,158 caregivers of children were interviewed from six urban medical centers in different States. The questionnaires included child health status, HFSSM, demographics, hospitalization history, and participation in Food Stamp Program (FSP). Overall, 22% of the sample population was FI, 10% being only HFI, and 12% HFI and CFI. Children living in FI households had greater risks of hospitalization and fair/poor health compared to children from FS households. The extent of this prospect was greater if the children lived in households with HFI and CFI.

In another study by Skalicky et al. (2006), caregivers of children 6 months to 3 years were interviewed from 1996 until 2001 in a pediatric emergency department (ED). Hematologic data were obtained from the ED center. Results were taken during the last year or 3 months after the interview with the caregiver. Iron status was defined according to CDC norms and iron status groups were created. The overall analysis of the sample demonstrated that 10% were CFI, 8% had reduced diet quality, and 3% suffered child hunger. As for the blood tests, 61% were iron sufficient with no anemia (ISNA), 21% anemic with no iron deficiency, 7% were iron deficient non anemic (IDNA), and 11% were iron deficient anemic (IDA).

It is documented that iron deficiency anemia does not develop immediately but develops through stages, starting with iron depletion, iron deficiency leading to iron deficiency anemia (IDA) (Gratham- McGregor et al., 2001). In the case of anemia due to poverty, Skalicky et al. (2006) proved that iron deficiency anemia was found to be substantially more likely in CFI than in CFS infants and toddlers from low income households due to chronic FI. Finally, both studies conducted on CFSS concluded that participation in food aid programs targeted to poor households with children, such as the FSP (Food Stamp Program) in the US, have been helpful in reducing the adverse outcomes of FI on child health, but are unable to eliminate it (Casey et al., 2005; Cook et al., 2006).

2.5.2 Health and nutrition consequences of FI in children, as reported by HFSSM

2.5.2.1 Malnutrition

Considerable evidence has shown that children living in FI households have adverse consequences, including poor quality diets (Frongillo, et al., 1997) and poor health consequences (Cook et al., 2004; Casey, et al., 2005). Poor diet quality and diversity are major causes of malnutrition and particularly micronutrient deficiency (Steyn. et al., 2006). In LMIC, diets are frequently deficient in macronutrients (protein, carbohydrates and fat), micronutrients (electrolytes, minerals and vitamins) or both (Melchior et al., 2007). As demonstrated in Figure 2.7 in extreme cases, FI children suffer from symptoms of protein-energy malnutrition, corresponding to measurements that fall below 2 standard deviations under the standard weight-for-age (underweight), weight-for-height (wasting) and height-for-age (stunting) (Muller et al., 2005).

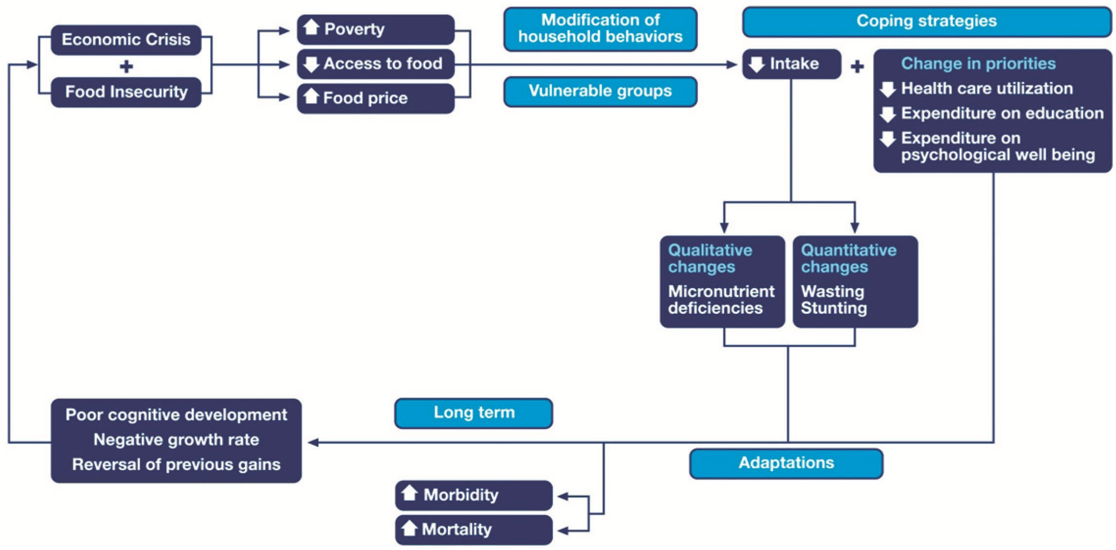


Figure 2.7. The vicious cycle of economic crisis (Bhutta et al., 2009)

In cross-sectional studies undertaken on children in non-industrial countries, HFI was related to underweight, wasting and stunting in Africa (Kruger et al., 2006) and Pakistan (Baig-Ansari et al., 2006). However, in Colombia (Hackett et al., 2009) and Malaysia (Ali Nasser et al., 2014) HFI was significantly correlated to underweight and stunting, but not to wasting. The latter research demonstrated that children from low income households who suffered HFI had 2.15 times more risk to be underweight and three times more risk to be stunted compared to children from the same background, but living in HFS households. Further, Abuya et al. (2012) proved that additional factors affect child stunting such as maternal education, child birth weight, and gender. Males had 57% more probability to be stunted compared to girls (Abuya et al., 2012).

Children who are stunted, underweight, or wasted are at an increased risk of death from gastroenteritis, measles, pulmonary tract infections, and other infectious diseases (Caulfield et al., 2004). Height stunting is considered as the main marker of child malnutrition since it results from chronic weight loss and is widespread in LMIC (Blacke et al., 2013). In 2011, the number of global stunted children less than 5 years of age was 165 million, according to WHO standards height-for-age Z score (HAZ) of -2 or lower indicator of stunting, with a 35% reduction in the number of stunted from the 1990 (UNICEF, WHO, World Bank, 2012).

During, economic crises, food prices increase, and consequently HFI deteriorates, food access is reduced, so household food based coping mechanisms are the first line of defense (Darton-Hill et al., 2010). Primarily, households apply food stretching, reducing food varieties, especially expensive food items such as meat, dairy, fruits and vegetables, but the cheap staple foods are consumed. When the situation worsens, food sharing is applied, reducing meal size and frequency, first among adults and then among children. Further, distress will lead to food searching, seeking food in socially unacceptable ways. In such situations, consumers would opt for grass, sawdust, or other choices from forest or fields. Finally, food anxiety would prevail (Norhasmas et al., 2010). FI individuals would also opt for non-food coping strategies such as taking loans, decreasing expenditure on education, health and other expenses, selling assets, taking children out of school to work, collecting food or even trading (Shrimpton, 2008).

In the context of economic difficulties, Dabone et al. (2011) undertook a study in an urban and peri-urban setting of Burkino Faso to assess the prevalence of malnutrition of school-aged children from 4-7 years from public and private schools. The sample consisted of 649 children, whereby the micronutrient malnutrition was prevalent, with 39% of children having low serum retinol and 40% being anemic; stunting was 9% and thinness 14%. Moreover, almost 15% of the children experienced at least two types of nutritional deficiencies.

It has been documented that long-term FI will have a negative impact on child health complications and behavioral problems (Cook et al., 2006). In an effort to explore the aftermath of FI on child health and ambulatory care, a study was undertaken by Chen et al. (2009) in Taiwan. The children were categorized according to the family income into economic groups based on the national poverty line: low, middle, and upper income. The number of ambulatory visits of the child and their cost was calculated. The study discovered that children from FI households were more prone to ambulatory visits for medical conditions such as upper and lower respiratory tract infections, metabolic problems, diabetes, iron deficiency anemia, ill defined symptoms related to nutrition, development, and mental disorders. Furthermore, children born with a low birth weight suffered additional disease symptoms such as endocrine problems, thyroid gland complications, inborn metabolic diseases, anemia, and nutritional deficiencies and developmental complications (Chen et al., 2009). The study concluded that poverty and FI form a vicious circle: while poverty will cause FI, subsequently FI can cause more disease burdens, such as direct health care expenses and indirect expenditure linked to productivity cost. This cycle (Figure 2.8) will leave the poor child in the same social class and pronounce the social injustice (Chen et al., 2009).

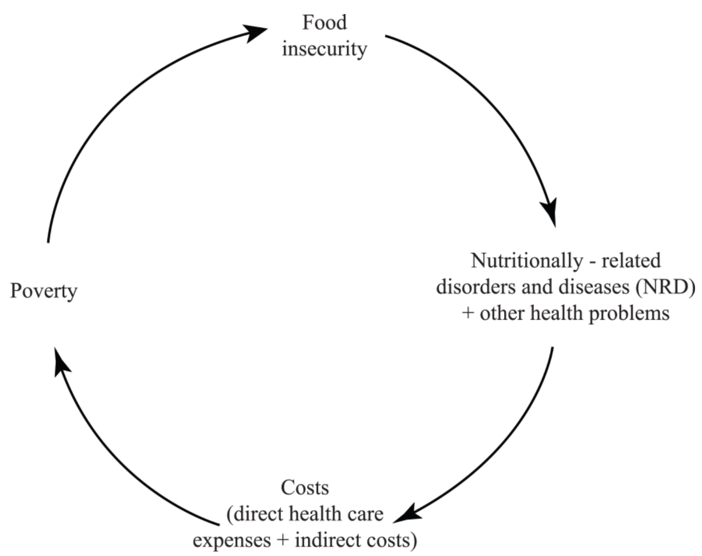


Figure 2.8. The vicious cycle of poverty and food insecurity (Chen et al., 2009)

A review of articles concerning FI in US adults and children, associations between FI and diet quality were tested (Hanson et al., 2014). In general, associations with diet quality of adults were weak, mainly concerning vegetables, fruits and dairy. Regarding FI children, they consumed little fruits compared to FS children. Studies that assessed the nutrient intakes of FI children from different settings came up with different findings. Two studies demonstrated that with a decrease in FS status there was a significant increase in intake of total calories and percent calories from fat and sugars (Sharkey et al., 2012, Rosas et al., 2009). In the UK, Pilgrim et al. (2011) showed that the diet of children from FI households was characterized as poor with a high consumption of white bread, processed meat and chips and low consumption of vegetables. Kilanowski and Moore (2010) found that FI children did not meet dietary guidelines of minimum daily servings for fruit, vegetable, and grain groups. Another study by Bae et al. (2008) revealed that a significant proportion of Korean school-aged children from low income families skip breakfast and dinner because of food shortage. The authors indicated that meal skipping habit was correlated with lower nutrition and health status and poorer academic performance.

2.5.2.2 Overweight and Obesity

In the last couple of decades, an additional worrying issue linked to FI in middle-income and low-income countries (LMIC) is the "dual burden" of underweight and overweight (Doak et al., 2005; Wang et al.; 2002). In countries experiencing rapid socio-economic change, the incidence of overweight, especially in urban children, has attained levels equivalent to those in developed countries (Kosti & Panagiotakos, 2006). In western countries, childhood obesity is inversely correlated with socio-economic status (Shresbery & Wardle, 2008). Ironically, in LMIC, childhood obesity is detected in high socio-economic groups (Wang et al., 2006). Consequently, numerous studies have looked at obesity and FI, with some showing a linear association between FI and adult obesity (Holben & Pheley, 2006). However, most studies have demonstrated a U- shaped pattern; to be precise, obesity increased as FS decreased to marginal and intermediate levels (Wilde et al., 2006). However, no such justification has been assumed to explain the childhood FI-obesity link.

Generally, studies have shown a direct FI-obesity relationship for women (Martin & Lippert, 2012a), similar results for adolescents (Martin et al., 2012b), but ambiguous evidence among children, and little evidence among men (Hanson et al., 2007). Research on children has found a positive relationship between FI and obesity (Casey et al., 2001, Dubois et al., 2006; Jyoti et al., 2005; Oh et al. 2003; Larson et al., 2011). In contrast, some have found no relationship (Alaimo et al., 2001b; Kaiser et al., 2002; Martin et al., 2007; Gunderson et al., 2008; Gunderson et al., 2009a; Bhargava et al., 2008), while others have found a negative relationship (Matheston et al., 2002; Jimenez- Cruz et al., 2003, Rose and Bodor, 2006). Finally, Eisenmann et al. (2011) conducted a review of previous literature on the relationship between FI and overweight status of children, and demonstrated that CFI and overweight status of children coexist, but a limited number of studies support the causal association.

The occurrence of obesity has more than doubled amongst US children and quadrupled for adolescents (Ogden et al., 2014). In an effort to quantify the prevalence of obesity among children from different SES, Casey et al. (2006) used the HFSSM and data from the National Health and Nutrition Examination Survey (NHANES) 1999-2002 for anthropometric measures of 6995 children, grouped by age (3-5, 6-8, 9-11, 12-17 years) and by gender and ethnicity (white, black, Hispanic) to check the prevalence of obesity amongst children. The overall results showed 28% of children from FS households and 38% of children from FI households were obese. The study concluded that children from FI background had a 32% increased risk of being overweight and obese, while controlling for age, gender, race, and poverty status.

Nevertheless, Iriart et al. (2011) argue that the high rate of obesity in US children may be masking other health problems such as height deficit or stunting in underserved communities like immigrants. The investigators chose a sample of children 2-19 years old from the NHANES 2007-2008, to investigate the association between chronic malnutrition and overweight/obesity. The participants were categorized according to BMI percentiles, with 85th$<$BMI$<95^{th}$ percentile for overweight and BMI$>$95th for obese classifications. Further, children who fell below the 5^{th} percentile for the height-for-age-sex group were classified as stunted. Overall, the prevalence of overweight/obesity was 1 in 3 of total children and the incidence of stunting was 3%; nonetheless among Hispanics alone stunting was 7%. Consequently, the authors concluded that BMI measurement should always be accompanied with height-for-age-sex measure that reflects the nutritional history of the child.

Possible reasons for the FI and child obesity paradox may be overeating when food is abundant (Scheier, 2005), households going through episodic shortages of food (Laraia, 2013), consumption of cheaper, energy-dense foods to avoid feeling of hunger (Darmon et al., 2002; Drewnowski et al., 2004), eating irregular meals or skipping breakfast (Kempson et al., 2002), consumption of less nutrient dense foods such as milk, fruits and vegetables particularly later in the month (Tarasuk et al., 2007), having different perceptions of what comprises an adequate diet (Mello et al., 2010), having protective parents that overfeed children when food is available (Mc Intyre et al, 2003) or mother experiencing FI during pregnancy (Laraia et al ,2006). Hence, FI is considered both a cause and a consequence of poor human development and investment in child nutrition is being promoted as stratagem for economic progress (Mc Gregor et al., 2007).

2.6 Food insecurity and diet quality

It has been proven by a large number of epidemiological studies that diet quality follows a socioeconomic gradient (Darmon & Drewnowski, 2008). In developed and industrial countries, morbidity and mortality statistics follow a socio-economic gradient, which shows inequalities in health (Darmon & Drewnowski, 2008). In general, people from lower SES backgrounds tend to suffer higher rates of obesity and chronic diseases that have a direct connection to diet quality. The more affluent class tend to consume healthier diets (based on lean proteins, vegetables and fruits), and are thinner and healthier than their poor counterparts (Drewnowski & Darmon, 2005).

2.6.1 Food Cost and diet quality

In the last few years, the global food organizations have demonstrated an outstanding commodity price evolution. The FAO Food Price Index (FPI) consists of the monthly change in intermediate prices of a basket of five food commodities (including meat, dairy, cereals, vegetables oils, and sugars), traded internationally, and weighed with the average export share of each group (Tadesse et al., 2014). As shown in Figure 2.9, the prices of almost all food products increased by almost 50% in 2007-2008, followed by another price spike in 2010-2011 (FAO, 2013b). This sudden increase in international food prices was translated as an inflation of domestic prices, which affected the marginalized populations who spend large proportion of their earnings on staple foods (Kalkuhl, 2014).

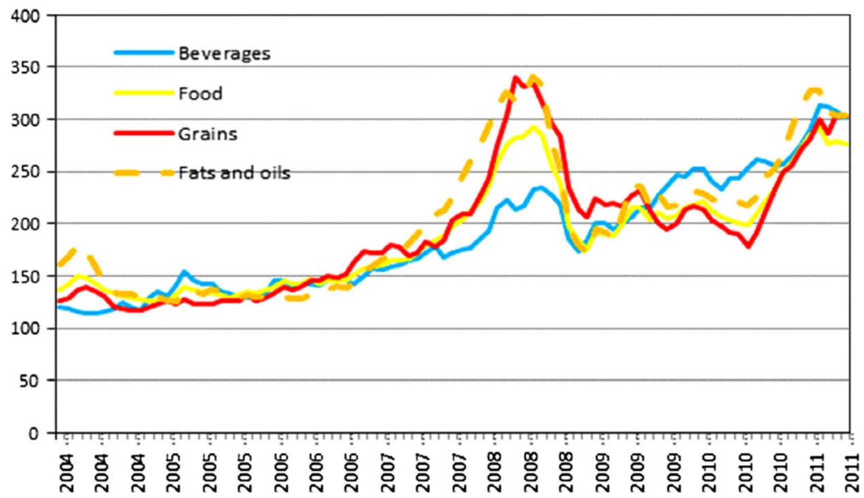


Figure 2.9. FAO food indices from January 2004 to November 2011 (FAO, 2013b)

In an effort to assess the impact of the global food inflation on food habits, food quality and their effect on health, Brinkmann et al. (2010) used several means of evaluation, such as assessment surveys, cost of a Healthy Food Basket (HFB) and the Food Consumption Score (FCS). The authors discerned that the cost of the HFB increased in many countries, reflecting a reduction in the quantity and the quality of food consumed. Further, the FCS was negatively correlated with the increases in food price, reflecting less dietary diversity. Further, the high food prices affected mostly the nutritional status of poor families in LMIC that spend a large share of their income (50% to 80%) on food, and middle income families that spend (35% to 65%) of their total expenditure on food (Brinkmann et al., 2010).

According to literature, the price of a food product is the primary influence on the consumer's food choice. Nevertheless, many different issues influence food selection such as convenience, food preferences and habits, taste, quality of food, body weight and image, nutritional and health benefits that influence food choice (Lennernas et al., 1997). In a cross sectional study conducted on the factors affecting food choice of US adults, taste was the primary influential factor followed by cost and nutritional qualities of food (Glanz et al., 1998).

For those with low wages or having low educational level, food prices or restricted budgets are a barrier to the purchase and consumption of nutrient dense diets (Bihan et al., 2010; Turrell et al., 2009). In the last few decades, progress in agriculture and food industries produce palatable energy dense foods at very low cost. This idea was demonstrated by Drewonswki & Specter (2004) where a direct and inverse relationship between the price and energy density of selected foods was drawn (Figure 2.10). Energy-dense foods composed of refined grains, added sugars, or fats are low on key vitamins and micronutrients and represent the lowest-cost option to the consumer. These food types have little nutritional value, are cheaper and have fewer price fluctuations over time compared to nutritious foods (Lee, 2011).

In extreme poverty cases, a process called "Engel's phenomenon" takes place (Karp & Greene, 1983) whereby the poor consumer's food choice narrows down the food selections providing high energy foods at lowest cost. Eventually, certain micronutrients will be lacking from the diet and specific nutrient shortage symptoms will follow (Monsivais et al., 2012). Darmon et al. (2002) argued that this was not true for adult populations, since the diet of FI adult individuals did not differ in energy when compared to their FS counterparts; however, the variation was in the diet composition which was higher in density and lower in nutrient adequacy in the FI sample.

Adults experiencing FI consumed lower number of servings from meat, fish, poultry, and legume food groups (Dachner et al., 2010), bread and cereal (Nnakwe, 2008), dairy products, milk, fruits, and vegetables compared to food secure adults (Tarasuk et al., 2007). In addition, Gulliford et al. (2005) confirmed that FI children and adolescents consumed energy dense foods and less than recommended quantities of fruits.

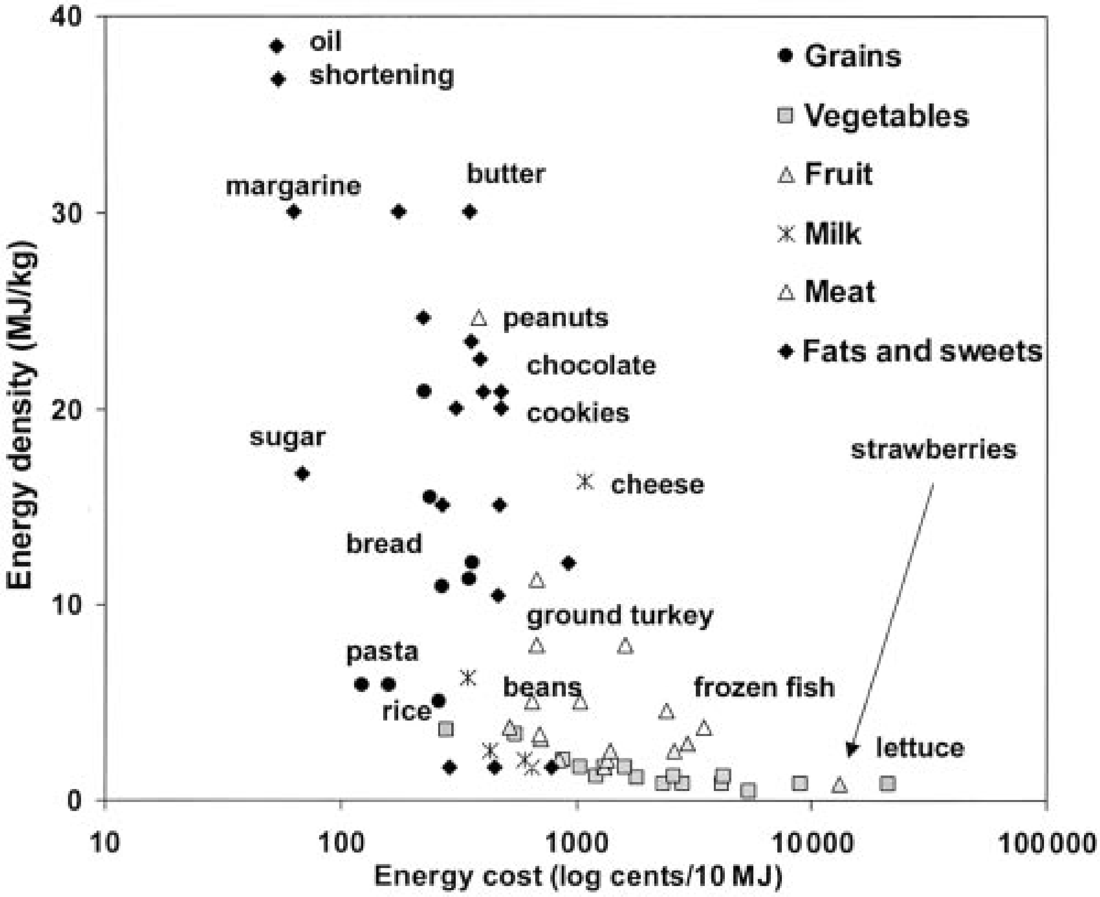


Figure 2.10. Relationship between the energy density of selected foods and energy costs ($/MJ) (Drewnowski & Specter, 2004)

Thus, poverty may lead also to a monotonous diet, based on energy rich shelf stable packaged foods (Drewnowski, 1998) rich in refined grains, and added fats and sugars to avoid food spoilage and waste (Dowler, 1997).

Investigators have proven that the vulnerable consumers, when faced with food inflation, primarily reduce the consumption of nutrient dense foods, such as animal sources (Ruel et al., 2010) that eventually will lead to micronutrient deficiencies. Further, when the FI situation worsens, the consumers may reduce the size and the number of meals; they will likely experience macronutrient and energy deficiencies that lead to body thinness among adolescents and adults and amplify the risk of acute malnutrition among young children (Torlesse et al., 2003).

Many studies have demonstrated a significant correlation between food prices and children's and adolescents' weight status (Powell & Bao, 2009; Powell, 2009). Moreover, research has proved that price manipulations could potentially lead to adjustments in food choices, improving diet quality and reducing eventual chronic health risk factors (Horgen et al., 2002). Hence, in order to examine whether changes of food price will influence diet quality or food choice of children and adolescents, Beydoun et al. (2011) observed the association between prices of fast food, healthy foods and BMI. The authors determined that a higher fast food price index was correlated with lower fast food consumption amongst children and improvement in overall diet, accompanied to higher intake of fiber, calcium, fruits, vegetables, and dairy products. The same positive results were observed amongst adolescents, with a higher healthy diet index and higher intakes of calcium and dairy. Subsequently, Beydoun et al. (2011) investigated a higher fruit and vegetables price index that was correlated with lower fiber consumption and higher BMI among low SES children. Thus, food price manipulation proved to be beneficial for FI children and adolescent consumers, for chosing heathier food options instead of fast food.

In a review of studies on the financial subsidies in promoting healthier food purchase and consumption, Ruopeng and colleagures (2013) confirmed the effectiveness of monetary incentives in modifying health behavior. Wall et al. (2006) demonstarted that financial incentives gave a positive feeedback on food purchase, food consumption and weight loss, while Jensen et al. (2011) proved that price incentives were efficient in changing children's food and beverage consumption in a school setting. Finally, merging food taxes with subsidies was found to be an efficient way to improve diets of FI individuals by switching to healthy food items without incurring additional costs (Thow et al., 2010). Thus, changing relative food prices may substentially improve the diet quality of FI adults and children.

2.6.2 Dietary diversity

Dietary diversity is a simple measure of classification of food count or food groups over a given reference period (Arimond & Ruel, 2004). Dietary diversity (DD) could be measured for an individual or a household (Ruel, 2003). In the context of LIMC, simple food or food group counts are principally used to measure DD.

In research, dietary diversity was shown to be associated with nutritional status and nutrient sufficiency and was positively correlated with income and affluence. Previous studies have found a positive significant association between diet diversity and child nutritional status in Kenya (Onyango et al., 1998), Mali (Hatloy et al., 2000), Niger (Tarini et al., 1999) and China (Taren & Chen, 1993). In most of these studies, dietary diversity was positively associated with mean height for age Z-score (HAZ), which reflects the long term outcome of nutritional status (Arimon & Ruel, 2004; Ruel, 2003)

In low- and middle-income countries, lack of dietary diversity is a significant issue where diets consist mainly of starchy staples, with less variety in the diet of nutrient dense foods such as animal proteins, vegetables, and fruits (World Bank, 2007). An extensive body of research has shown that increasing the consumption of foods across and within food groups and within varieties is indispensable for ensuring sufficient intake of nutrients and their non nutrient beneficial components (Ruel, 2003).

In research, it has been documented that FI households have always DD score lower than FS households (Champagne et al., 2007). Therefore, DD could be a useful instrument to assess the impact of FS on diet quality and to monitor changes in dietary patterns over time.

2.6.3 National Food Budget Standards

Access to an affordable and nutritious diet is crucial for the health and development of FI children. In industrialized countries, national budget standards are created and priced; they include the total basic living needs of the citizens such as services and goods for consumption (Nelson et al., 2002). In a similar manner, the healthy food basket (HFB) is a survey instrument frequently applied to measure the cost of healthy food that represents the current nutrition recommendations and food purchasing patterns in a certain community (Palermo & Wilson, 2007). HFB is applied to monitor both accessibility and affordability of basic foodstuff and connect the cost of HFB to individual and family income. There are no standard rules to create a HFB; in Australia, for example, several HFB's have been created in different states. In 2013 Ward et al., proposed a HFB based on commonly available foods to supply 70% of nutritional requirements and 95% of estimated energy requirements for a reference family of six members over a two weeks period (Ward et al., 2013).

In another experiment implemented in Sweden a food price index was created describing the cost of a nutritious diet to a health conscious consumer. The research assessed if the prices of healthy food ingredients have increased over the specified time lapse (1980-2012) (Hakansson, 2015). The author determined, that the sensible consumer who tried to minimize food cost and fulfill all the nutrient recommendations, did not experience a tangible price increase in the food basket compared to the normal increase in food price. However, certain exceptions of food items rich in certain recommeded nutrients such as vit D, iron, and selenium were proven to become expensive to puchase on a regular basis. Still to comply with the dietary recommendations of fruits and vegetables was acceptable as the price increases of these latter foods were acceptable. Thus, the study concluded that the nutritional index is important tool to monitor the cost of a nutritious diet over time. The results of Hakansson (2015) could be compared to a study executed in the United States between 2004-2008 by Monsivais et al. (2010), who demonstrated that the cost of high nutrient density foods increased faster than low nutrient density foods.

In Lebanon, the CAS National Statistics Center publishes the monthly Consumer Price Index (CPI), which is a vital national, social and economic indicator (CAS, 2012). This statistical tool was created based on the prices of sample representative items, whose prices are collected on a monthly basis. The CAS uses the term "weights" as a means of evaluating the average expenditure of goods and services by a household (CAS, 2005). These weights do not take into consideration household size, SES, or income levels. The food basket, as defined by CPI, consists of 12 divisions. Table 2.7 represents a comparison between 1997 and 2004, noting that the food and beverage expenditure is reduced from 32% to 20% for the average Lebanese household. However, transport, communication, water, electricity, fuel, and other expenses increased. Subsequently, poor and vulnerable households apply elasticity of substitutions between food and non food items in cases of inflation or change in prices. Furthermore, the higher the relative price fluctuation, the higher the food portion in total expense consumption and the lower the price elasticity (Dessus et al., 2008).

Food cost, diet diversity (DD), and national food standards are interrelated in a country since food baskets are created on weighed averages of price changes (Brinkman et al., 2010). In response to inflation or increased food prices, households reduce quality and quantity of foods consumed, thus the DD is reduced, and it is negatively correlated with food prices.

Table 2.7. CPI basket as measured by weight consisting of 12 divisions, comparison between 1997 and 2004 (CAS, 2005)

Expenditure Division	1997weights in percentage	2004 weights in percentage
Foods and non-alcoholic beverages	32.3	19.9
Alcoholic beverages, tobacco and narcotics	2.3	2.1
Clothing and footwear	6.3	6.2
Housing, water, electricity, gas and other fuels (including rents)	8.8	25.7
Furnishing, household equipment & routine household maintenance	7.9	3.9
Health	8.8	6.8
Transport	9.8	12.3
Communication	1.5	4.8
Recreation and culture	2.0	3.7
Education	13.4	7.7
Restaurants and hotels	3.4	2.7
Miscellaneous goods & services	3.5	4.2

2.7 Food insecurity and food Environment

Food environments have been established as independent predictors of food buying practices, dietary quality and behavior (Moore et al., 2006). According to Glanz & Sallisi (2005), food environment is multi-dimensional and can be grouped into four major measures:

(a) Community nutrition environment – focuses on the categorization of the food outlet type, number, distance, and accessibility to the general population

(b) Organizational nutrition environment – related to food outlets at proximity of residence, workplace, or school

(c) Informational environment – aspects such as media and publicity of food products

(d) Consumer nutrition environment – factors that affect the customer whilst in the food store like placement, cost and promotions of products, quality of food and beverage available

Numerous studies in the US have demonstrated that individuals who reside in close proximity to large supermarkets or chain stores consume better quality diets (Dean & Sharkey, 2011), have higher consumption of fresh fruits and vegetables (Morland et al., 2002; Caldwell et al., 2008) even within low-income communities (Rose & Richards, 2004) at cheaper prices than small corner stores (Gustafson et al., 2012).

Disadvantaged families living in deprived locations may have less healthy food services and outlets such as supermarkets or large grocery stores compared to more affluent areas (Beaulac et al., 2009). The existence of such areas known as “food deserts” was first expressed in Scotland during the 1990’s to describe poor access to affordable and healthy diet (Cummins & Macintyre, 2002). Even if differences in food access do not exist, food outlets in deprived areas may sell lower quality foods (Cummins et al., 2009), prices may be higher or lower depending on the food type and store type, and convenience or discount stores may be more accessible in underprivileged locations (Droulin et al. 2009).

Several factors such as the proximity of food outlet, cost, and limited availability of healthy foods reduce the access to healthy food options in low income environments (Gittelsohn & Sharma, 2009). Access to food outlets and supermarket has been the subject of major studies in different country locations such as Canada, the US, Australia, Europe, and the UK with mixed conclusions. In certain studies, poor or deprived areas provided little or no access to supermarkets (Ball et al., 2009; Powell et al., 2007; Morland et al., 2002; Moore et al., 2006), whereas other studies found modest or no difference between deprived and privileged areas in access to supermarkets (Walker et al., 2012; Winkler et al., 2005). Some researchers concluded that affluent environments had better access to food compared to underprivileged neighborhoods (Sharkey & Horel, 2008; Pearce et al., 2008). Similar to the latter, findings from different country settings such as Australia (Ball et al., 2009), Scotland (Cummins et al., 2009) and the south of England showed that affluent areas had a greater variety of healthy food products, such as fruits and vegetables compared to disadvantaged neighborhoods (Black et al., 2012).

Although many researchers have studied the effect of food environment on the diet of adults, few have focused on the association between food environment and children's dietary quality. A recent review of studies conducted in the US focusing on the effect of food environment on children's diet showed a positive correlation on dietary intake up to 18 years of age (Engler-Stinger et al., 2014). Moreover, a cross-sectional study conducted in the US (Jennings et al., 2011) tested the effect of food outlet stores on dietary intake and weight status of 9-10 year old children. The study classified convenience stores and fast food outlets as "BMI-unhealthy", non-fast food restaurants as "BMI-intermediate", and supermarkets and fruit and vegetable stores as "BMI-healthy" within a radius of 800 m around the residential area. Further, weight and height measures, four days 24-hour recalls and child physical activity (quantified over one week by an activity monitor) were assessed. The results showed that 27% of the children were classified as overweight-obese and these children lived in "BMI-unhealthy" neighborhoods; the opposite was true for children with lower weight status. Subsequently, the study confirmed that the proximity of fast food outlets and convenience stores was related to poor diet quality for young consumers, while supermarkets were correlated with a better diet quality.

In addition to the influence of food environment, health behavior is affected through an array of social, personal and household milieu factors (Stokols, 1996). Few studies have focused on individual food predilections of inhabitants in deprived areas. Locher et al. (2009) investigated instigators that impinge on food choices among homebound older adults and found that sensory factors such as taste and aesthetics were of primary influence on food choice. In another age group, 12 to 18 years old African American girls, Boyington et al. (2008) discovered that cultural attitude, perceptions of healthy eating, and food environment affect food choice.

In more underprivileged settings, Hendrickson et al. (2006) carried out a study in four Minnesota food desert communities to identify obstacles and motivators of healthy eating. Adult participants expressed lack of desire to consume fresh produce even when accessible. Similarly, Walker et al. (2011) concluded that food desert inhabitants did not opt to consume fruits and vegetables due to their aftertaste.

In the same manner, to investigate the association between urban neighborhood characteristics, grocery store availability and child fruit and vegetable intake, a sample of 797 preadolescent girls aged 6-11 years participating in an obesity prevention study were studied (Mushi-Brunt et al., 2007). Socio-demographic data and body measurements were collected from children in addition to percentage of poverty in the neighborhood and grocery store location. From the total sample, 78% failed to meet fruit and vegetable recommendations of at least five servings per day (NHS, 2013). Further, the study illustrated that children who live in low poverty neighborhoods, where grocery stores are accessible, consumed more quantities of fruits and vegetables compared to children from high poverty areas. Moreover, children residing in districts less than one mile from grocery stores consumed fruit and vegetables less than the daily dietary recommendation. Thus, the authors suggested that in addition to food outlet distance, children's healthy food selection was influenced by taste preferences, parent's food purchase awareness, and healthy food availability in the house.

Therefore, the proximity to healthy food selections does not necessarily lead to optimal food consumption in the case of children (Dibsdall et al., 2003). This same idea is highlighted in a British study that was implemented to determine the relationship between distance and density of food outlets on 9 to 10 years old children's food choices (Skidmore et al., 2009). The authors found a small effect of distance to or the density of food outlet on children' food choices. Close proximity to supermarkets was correlated to less consumption of fruits and vegetables, while density of the supermarkets in the children's environment was correlated to increased vegetable consumption but also excess consumption of unhealthy foods. Moreover, living in close proximity to convenience stores was also related to more consumption of white bread, crisps, and chocolate (Skidmore et al., 2009).

In summary, the environment may be an important component to include in research on child and adolescent FI since they are vulnerable age groups and their dietary choices and physical activities are greatly influenced by the surrounding home and school environments.

2.7.1 Food Insecurity Enviornment: Rural versus Urban

Over the last few decades, with the fast rate of urbanization fueled by migration from rural to urban areas, rural populations are considered a disproportionate minority. In the LMIC, the urban split of the population ranges from 37% in sub-Saharan Africa to 80% in the Caribbean and Latin America (UNFPA, 2015) and 81% in Lebanon (FAO, 2007). Subsequently, urban living sways lifestyle habits such as nutrition, cognition, growth and development of children, and their future wellbeing. In the last few decades, a substantial body of evidence from LMIC has documented that children in urban settings have a better nutritional status compared to their rural counterparts. This could be explained by food habits and lack of material resources (Van de Poel et al., 2007). Further, Ruel et al. (1998) confirmed rural malnutrition was validated by stunting (height-for-age) and underweight (weight-for-age) of the rural population.

To cast a deeper probe into the urban-rural differentials in children's nutritional status, a study was conducted on children from 141 low- and middle-income countries, dating from 1985 until 2011 (Paciorek et al., 2013). The study covered 673 population-based resources, including a total of 8.6 million children whose weight and height data were collected. The authors observed the variation trends of the anthropometric measurements over a period of twenty five years. The number of stunted children fell from 239 million in 1985 to 163 million in 2011 as a result of tremendous efforts by different states to reach the MDG goals in 2015 (Figure 2.11). Moreover, the number of children who were classified as underweight was reduced from 151 million to 105 million in 2011. A large part of the progress in childrens anthropometrics was in rural populations; this progress was coupled to a simultaneous increase in the prevalence of urban child malnutrition probably due to increased urbanization in the same time frame (Paciorek et al., 2013).

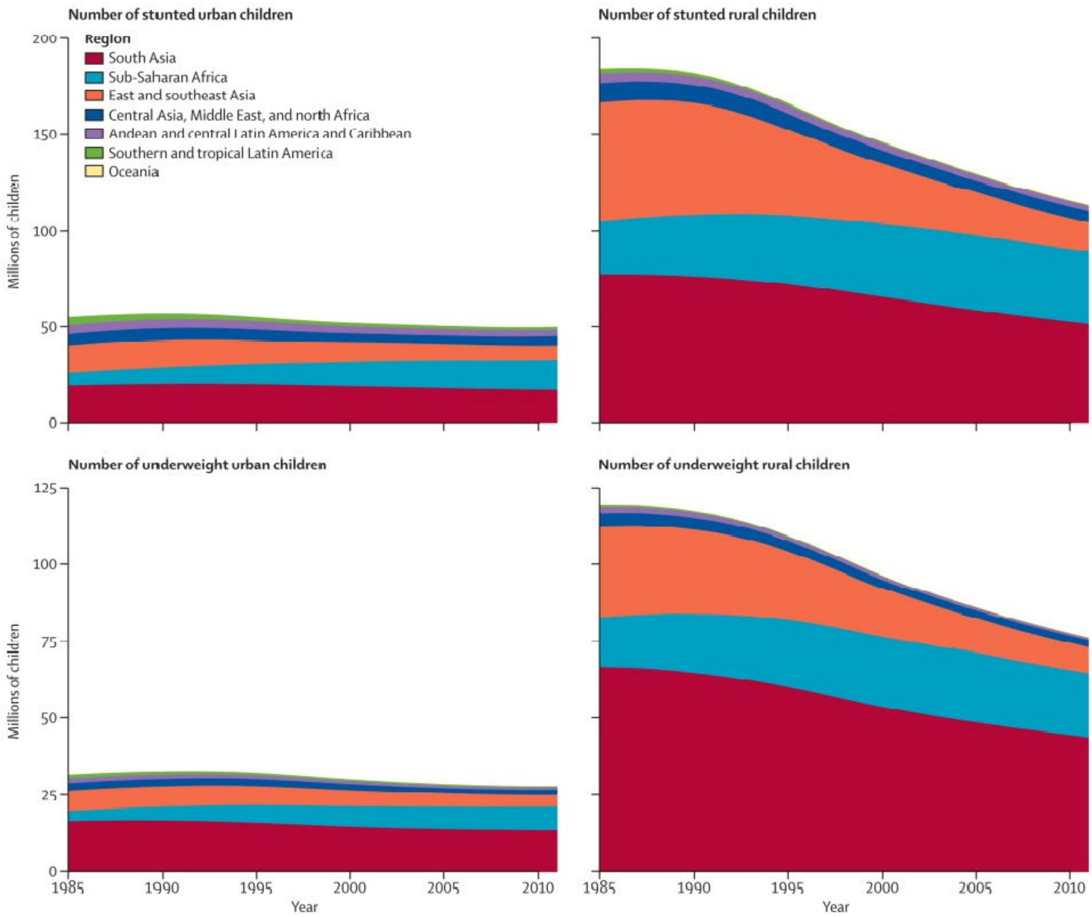


Figure 2.11. Number of underweight and stunted children by region and urban or rural places of residence, 1985-2011 (Paciorek et al., 2013)

In general, rural communities are poor and have limited access to health care and other resources due to spatial inequity of livelihood; they are susceptible to increased risks of morbidity and poor nutritional health (Ruel et al., 2010). However, recent evidence from LMIC indicates that the focus of poverty and malnutrition is progressively shifting from rural to urban settings since the number of urban poor is growing faster than the number of rural poor (Haddad et al., 1999; Srivastava, 2012). Researchers observed that the urban poor are affected by certain factors that make them economically vulnerable (Ruel el al., 2010)

(a) dependence on monthly salaries

(b) Women working outside the house and have reduced time for child care.

(c) limited access to land and food resources

(d) Changes in lifestyle and nutrition transition with urbanization (Ruel et al., 2010).

Poor households in urban settings may have a fixed income; however, the cost of living is higher and they may be more liable to unexpected expenditures due to sudden economic changes common in urban livelihood (Zalilah et al 2008b). Conversely, in rural households income may be unpredictable (seasonal or hourly wage), the cost of living relatively less, with less unexpected expenses that could influence the overall FS of the households (Zalilah et al., 2008b).

In Sub-Saharan Africa, one of the features of urban poverty is the propagation of over populated slums and shanty towns distinguished by unhealthy environmental and hygienic conditions (Brockerhoff & Brennan, 1998). In such environments, the rate of child malnutrition and FI, consequent morbidity and mortality are very elevated compared to advantaged urban and rural areas (Fotso, 2007).

In conclusion, efforts by policy makers and non-governmental organizations (NGOs) should aim at securing continuous affordable food supply and health care, to endeavor a reduction of the urban-rural gap in overall health and nutritional status.

2.8 Food insecurity, nutrition knowledge and nutrition education

In general, nutrition knowledge of consumers is limited to certain subjects of interest to their health or well-being (Worsley, 2002). Nevertheless, it is proven that nutrition knowledge of mothers, even at different levels of FI, will influence positively the food behavior of children (Ruel et al., 1992).

In a study conducted in the UK (Parmenter et al., 2000), significant differences in knowledge concerning healthy eating habits was discovered between different socio-demographic groups, with women being more knowledgeable than men, and nutritional knowledge declining parallel to educational level and SES. In addition, poor education and lack of nutrition knowledge are proven to be important features increasing the risk of malnutrition or at least increasing its severity (Briggs, 2010).

2.8.1 Children's nutrition knowledge and nutrition education

It is believed that young children do not make their own food choices although children as young as 6-7 years of age can be encouraged to make healthier food choices after being educated about healthy eating basics (Matvienko, 2007; Fahlman et al., 2008). In FI communities, nutrition education is considered a long-term solution to the problem instead of nutritional supplementation which is considered short-term (Kapur et al., 2003).

Nutrition education programs encompass the application of the nutrition knowledge basics into action (Contento et al., 2002). These programs applied within school premises have been effective vehicles in improving nutrition knowledge and behavior because the school environment is a place of learning and regular attendance is guaranteed (Fahlman et al., 2008). Within poor communities, research was undertaken in three Indian cities in northern India to test the influence of a school-based education program that involved 40,196 students aged 12 to 18 years, 25,000 parents and 1,500 teachers (Shah et al., 2010). The education curriculum included subjects about nutrition, healthy practices, physical activity, and non-communicable diseases. Randomly 3,128 children, 2,241 parents, and 841 teachers were selected for pre-intervention and post testing of acquired knowledge. Post intervention, test scores improved in all groups, with the most significant progress observed in children aged 8 to 10 years compared to the older aged children. Further, female participants improved more than males and children from public schools improved more than private school members. Thus, children's nutrition awareness and behavior changes may be improved through classroom program implementation, supplemented by teacher training and parent involvement. However, researchers working on nutrition education of FI households state that interventions experimented with moderatly FI households were more successful than interventions tested with severly FI households (Piwoz & Viteri, 1985).

2.8.2 Mother's nutrition knowledge and nutrition education

A substantial body of evidence illustrates that maternal educational level is a key factor for child health outcomes compared to other socio demographic factors such as paternal education, household income, health and insurance services available (Semba et al., 2008). Moreover, reseracher established a direct correlation between mothers' nutrition knowledge and children's nutritional status and diet quality, especially among the young children (Vereecken & Maesh, 2010). Abuya et al. (2012) studied parent educational level, marital status, and employment in two slums in Nairobi that were diverse in socio demographic characteristics. The sample consisted of 5,156 children (0-42 months) of whom 40% were stunted. Maternal educational level was the major predictor of child stunting, in addition to other factors related to the mother and the household.

The positive outcome of mother's education on child nutritional status has been shown in different country settings in Bolivia (Frost et al., 2005), Kenya (Kabubo-Mariara et al., 2009) and Jamaica (Handa, 1999), although the mechanism by which mother's education has a positive impact on the nutritional status and health of the child is not fully understood. Some authors suggest that knowledge transmitted by formal education facilitates the mother's capacity to recognize a disease, the source of disease, and the mode to prevent or cure it (Glewwe, 1999). Furthermore, Frost et al. (2005) suggested that socio economic status has a direct link to child health since education is directly linked to income, higher paying jobs, better housing conditions, and amenities. Thus, more money is spent on healthcare, medicine, clothing, and nutritious food.

Along this line, Roy et al. (2005) undertook an intervention study in rural Bangladesh to monitor the effect of maternal supplementary nutrition courses on child nutritional status, for which a sample of 282 moderately malnourished children aged 6-24 months was recruited. The test group was divided into two: group 1 received intensive maternal nutrition education twice a week for a period of three months, and group 2 received the same education concurrently to children's home based supplemental feeding. In parallel, a control group obtained nutrition education twice a month from community nutrition supporters. Six months after the intervention period, the nutritional status of children improved from mild malnutrition to moderate or normal nutrition status in group 1 (59%) and group 2 (86%) compared to the control group (30%). The mothers significantly improved in their daily feeding habits, using separate pots, the number of feedings per day, cooking methods and additional feedings to children (Roy et al., 2005). Thus, health-oriented intervention projects, especially in LMIC, should prioritize female basic education, in all age groups, with a special emphasis on health and nutrition related issues.

2.9 Summary

The literature provides an overview of the health situation of children in industrialized and LMIC settings, with special attention to an array of issues, at macro and micro levels, that shape their nutrition, health, and consequent development. The recent high global food prices coupled with the increased political insecurity have unstabilized the overall economic and health situation of vulnerable individuals in the MENA region. Thus, the major aims of this thesis are to:

1. Generate a validated FI questionnaire to report child FI trends in the area and to assess FI severity and geographic distribution.
2. Assess the difference in CFI category of school aged children from private (HS) and public (LS) schools and recurring socio demographic charactersistics connected to CFI.
3. Develop an approach addressed to both FI parents and their children to cope with the issue according to the fluctuations of unstable daily or monthly income or other environmental changes that could modify the nutritional choices and the adverse side effects of dietary restrictions on child development and health.
4. At the parental level, introduce a new approach to train mothers or caretakers face different degrees of FI and have on restricted daily or monthly budgets, and educate them subtle means of food preparation and feeding.
5. At the child level, educate the CFI child the essentials of healthy nutrition, physical activity, and basic hygiene to be applied on a quotidian basis.
6. Create an educational program that could be included in the curriculum of private and public schools to enhance basic healthy nutritional lifestyle with minimal budgetary requirements.

The key focus of the application of the thesis is to encourage policy makers to adopt new health and nutritional status screening methods for a consistent nutritional assessment of children in schools, especially in underprivileged Lebanese regions.

Chapter 3 : Translation, validation and testing of the Arab Food Insecurity Questionnaire (AFIQ) in Lebanon

3.1 Introduction

FI is a complex, multifaceted concept and consequently measuring it has been a constant challenge to researchers (Coates et al., 2007). Ethnographic investigations in the United States that focused on the prevalence of FI and hunger, amongst low income individuals, rouse the urge to create the means to measure this experience. Researchers determined that this social phenomenon starting initially with uncertainty and concern about food quantities, could reach extreme cases of FI causing reduction in the amounts of food consumed (Radimer et al., 1992).

The HFSSM tool, developed in 1992, proved to be an efficient tool to measure household and individual household FI (details section 2.4.1). Its application, accompanied with other indicators of socioeconomic or nutritional conditions, add to a better understanding of determinants and outcomes of household and individual FI (Cafiero et al., 2014).

FI being a covert attribute, it is practically difficult to check the validity and reliability of questionnaires measuring FI. Therefore, correlations are undertaken with the causal phenomenon, studying factors like income, adult educational level, health conditions, food expenditure, dietary intake in addition to FI measurement, to induce noticeable changes in the figures used for measurement (Ballard et al., 2013).

Previously, researchers have proved validity of HFSSM for groups of households (Olson el al., 1999; Kendall et al., 1995). Further, Frongillo (1999) assessed the questionnaire validity for individual households. Kendall et al. (1995) compared the results achieved from the FI questionnaire to socio economic criteria theorized to be related to poverty. The investigators discovered that as the FI got exacerbated; there was a significant increase in the number of households participating in food aid programs, progressive decline in the level of education and employment, reduced incomes, and less food availability at home and fruit and vegetable consumption.

The HFSSM proved its ability to address issues such as food shortage, food quality and the concern about the continuous access to food, although certain aspects of the instrument were not valid with Samoan subgroups, signifying that the instrument is not essentially suitable with all racial or ethnic groups (Derrickson et al., 2000).

Kaiser et al. (2002) concluded that children from FI families in California did not meet the daily food guide pyramid recommendations. Generally, FI denotes decreased variety and quantity of food primarily fruits and vegetables when the income is short (Oh et al., 2003) and the consumption of dairy and meat is directly related to payday (Matheston et al., 2002). Furthermore, FI adults report having more health complications and going through continuous anguish and depression (Vozoris et al., 2003) compared to FS adults.

No previous study has investigated the FI of school aged children in the MENA regions. Thus, the primary aim of this study was to translate, validate and test the FI and socio-economic questionnaires on a small sample of the population involved.

This investigation used both Household FI Access (HFIAS) and the Household Food Security Supplement Module (HFSSM) questionnaires simultaneously to provide a comprehensive assessment of FS status of both the household and the child. The pilot study investigated the association between household FI and children's eating habits and nutritional knowledge. In addition, both HFSSM and HFIAS scores were compared to growth and anthropometric measurements and socio-demographic factors of the school-aged children in public schools including more children from low socio-economic (LS) background and private schools from higher socio-economic (HS) groups. Furthermore, the study validated the content of the HFIAS and the HFSSM questionnaires into the native language (Arabic), along with the validation of the term “balanced meal” in the culture of the studied population.

3.1.1 Food Insecurity and Nutrition Knowledge Questionnaires

3.1.1.1 HFSSM

In different country settings and different languages, several researchers have developed FI assessment tools. Researchers either adapt a version of the HFSSM, which was initially developed to be applied in the USA. Otherwise, investigators construct a tool from ground up, based on their research experience in the field (Frongillo et al., 2006). In both cases, investigators proved to have valid and accurate questionnaire measurements (Frongillo et al., 2003).

In several studies, the HFSSM was modified and successfully tested in studies in different country settings such as Brazil (Perez-Escamilla, et al., 2004), Bolivia (Melgar-Quinonez et al., 2006), Venezuela (Lorenzana et al., 2002), Peru (Vargas, 2009), Trinidad and Tobago (Gulliford et al., 2006), Iran (Rafiei et al., 2009) and Ecuador (Hackett et al., 2007).

If the questionnaire is not available in the language of the target population, translation is a primary procedure. The translator should avoid mechanical translation, taking into consideration the cultural context for clarification of expressions. Back translation is a necessary step, especially for questionnaires related to health surveys (Behling & Law, 2000).

In research, translated questionnaires need to go through validation, to determine whether the tool is suitable for providing valuable methodical measurement for a given intention and situation (Alaimo et al., 1999). Validation is composed essentially of three constituents; 1) criterion 2) content and 3) construct validity (Frongillo, 1999).

In Lebanon, thus far a study by Sahyoun et al (2014) developed a FS tool in Arabic, based on the HFSSM (Bickel et al., 2000) and Yemeni National food Security survey (Kabbani, et al., 2004). The two scales underwent construct and face validity, in addition to a psychometric assessment that proved only 7 items of the questionnaires to have good internal validity and reliability (Sahyoun et al., 2014). The questionnaire was tested with two underprivileged communities in Lebanon, a community in the south (Tyre) and the second community of Palestinian refugees and socio demographic and food consumption information were collected from the participating families. According to the authors, the higher the educational level of the head of household, the higher average monthly income and the less risk of FI. Conversely, the higher the FI level the less was the expenditure on food and less the food categories except legumes, which was highly consumed among Lebanese FI households. The authors concluded that the seven item scale is a valid FI tool for assessment and monitoring of food insecurity in the MENA region covering a wide range of FI severity.

3.1.1.2 Household Food Insecurity Access Scale (HFIAS)

Adapted versions of HFSSM were used for research purposes, in low and middle income countries, based on these experiential questionnaires the Household Food Insecurity Access Scale (HFIAS) was developed. The HFIAS is the result of a USAID project, created to be used cross-culturally. The HFIAS is a scientifically valid, easy and user-friendly approach to measure the access component of the household FI (Coates et al., 2006). The main purpose of HFIAS is to capture the household level issues related to food access, like the ability to access food in the market or other means such as money transfers or gifts (Webb et al., 2006).

The HFIAS questionnaire consists of nine FI "occurrence" questions, covering incidents experienced during periods of FI, with increasing level of severity (Coates et al., 2007). The occurrence questions relate to three different fields of food insecurity access: uncertainty about food supply, unsatisfactory quality, decreased quantity of food and the physical consequences. Finally, the most severe question consists of going to sleep hungry and all day and night without food. The occurrence questions expect two response options (0= no, 1= yes) (Coates et al., 2007).

For households that respond "yes" to the occurrence question, subsequently they will respond to the frequency of occurrence to determine the rate of recurrence (Coates, 2007). For the frequency they have to answer to the question "how often did this happen in the last month?" A range of scores apply to the response (1=rarely, 2=sometimes, 3=often). Consequently, the HFIAS questionnaire generates a total score ranging from 0 to 27 (score zero corresponding to "food security" and score 27 "maximum food insecurity"). Therefore, the higher the HFIAS score the more FI access the household experienced, by using the information on the occurrence and the severity of the previous thirty days (Jones et al., 2013). Three degrees of FI were classified; mild FI score (1-11), moderate FI score (12-16), severe FI score (17-27) (Coates, 2007). The HFIAS score is used for evaluating FI in a certain geographic area at a specific time variable and it is also a valid tool to assess and monitor variations in FI access over a period of time (Coates et al., 2003).

HFIAS is a simple tool that could be used in different country settings that organizations apply to population groups to assess, evaluate and monitor the HFI access on monthly basis. Many efforts were exploited to translate and validate the HFIAS questionnaire in different country settings, like Tanzania (Knueppel et al., 2009), Iran (Salarakia et al., 2014), Sri Lanka (Wijayatilaka et al., 2014) and West Africa (Becquey et al., 2010).

The paper by Wijayatilaka et al. (2014) recruited one hundred and fifty households from different socio economic status to assist in validation of the HFIAS in Sri Lanka. For internal validity Cronbach's alpha was applied resulting in 0.879 proving acceptable internal consistency of the nine questions. The external validation of the questionnaire was tested by using socio economic variables like food intake, wealth index and the household per capita income that is the total income divided by the total number of members per household. The HFIAS demonstrated a statistically significant correlation between socio economic variables and FI. Further, it was observed that foods of animal origin and fruits were not consumed on daily basis by FI households, to the exception of milk which is of animal source but consumed on daily basis by all socio economic groups.

3.1.1.3 CATCH Questionnaire

CATCH (Co-coordinated Approach to Child Health) is a multi-component, multi-year coordinated school health promotion program designed to encourage children decrease the consumption of fat, saturated fat, sodium intake in children's diet, increase physical activity and prevent tobacco use. Research conducted by Lupeker et al. (1996) found that when exposed to CATCH, there was a decrease in the risk of overweight in school-aged children; the study was successful in reducing the fat consumption of the children and the fat content included in school meals. Further, there was a noticeable increase in the self reported physical activity of the children, which was maintained as long term habit (Lupeker et al., 1996). The researchers observed that school staff training was a key factor in changing school culture. Staff who were formally less empowered to change the school health environment gained a sense of purpose and involvement within this new culture.

The questionnaire is introduced by a structured interview and the content of the original CATCH questionnaire can be changed to fit the culture. The questionnaire consists of nine consecutive domains:

(a) Demographic information (age, gender and ethnicity) (questions 1 to 4)

(b) One day food recall on specific items of food consumption (5-10)

(c) One day recall on physical activity practices (question 11)

(d) One week recall of number of hours spent on sedentary activities, such as TV watching or computer use (questions 12 –17)

(e) Assessment of child nutritional knowledge (questions 18- 20, and 43-52)

(f) Assessment of selected food practices (questions 21-27)

(g) Assessment of food choices/preferences (questions 28-34)

(h) Assessment of food frequency (questions 35-42)

(i) Assessment of frequency of physical activity (questions 53-56)

In a pilot test of the CATCH questionnaire accompanied with an education program, for 3 to 5 years old children, in a low income population where 39% of the participants were overweight (Sharma et al., 2011). The program was implemented by trained teachers over six weeks, pre and post food intake and physical activity at school was assessed. The program proved feasible, since the children's consumption of vegetables, fruits and 100% fruit juice was increased, in addition to increased effort of the children to practice physical activity at school.

CATCH kids club implemented as an after school study to children in elementary school, with a mean age of 9 years, split between grades 3 to 5 (Kelder et al., 2005). The program included 15 nutrition lessons, healthy snack preparation lessons and 30 min of daily physical activity. The overall results proved that the children responded well to the snack and physical activity sessions, but were not very compliant to the nutrition sessions. Thus the authors concluded that nutrition intervention programs could be efficient with children for long term results.

3.2 Quality assurance

3.2.1 Validation AFIQ, AHFIAS and socio-economic health (SEH) questionnaires

The English version of HFSSM, which includes the child and household FI in 18 questions, translated into Arabic was titled Arab Food Insecurity Questionnaire (AFIQ) (Appendix 6) and second FI questionnaire is the FI access questionnaire (HFIAS in English) which covers the access component of FI in nine questions. The translated HFIAS was titled Arab Household Food insecurity access scale (AHFIAS) to be applied in the pilot study (Appendix 7).

For the face validation of both AFIQ and AHFIAS questionnaires, the original English versions were translated into Arabic by a professional translator. The Arabic versions of the questionnaires were discussed at a consultative workshop with a panel group that included the Researcher, a local advisor, a dietitian, a population studies expert and two public health nutritionists. The translated Arabic versions of both questionnaires did not require any major modifications.

The Arabic copies AFIQ and the AHFIAS were back translated to English by another independent translator, who had no access to the original English versions. The back translated English copies were examined for consistency with the original HFSSM and the AHFIAS questionnaires. No major modifications were necessary because the two English copies were almost matching (Behling & Law, 2000).

The socio-economic health questionnaire SEH (Appendix 8) was developed by the Researcher and the local Advisor. This was again discussed in two meetings with the same panel group members mentioned above. Major modifications were made and the final version consisted of 61 questions.

A qualitative study was conducted, where the revised versions of the three questionnaires were discussed at a focus group meeting with six beneficiaries from a

Ministry of Social Affairs (MOSA) center. The group included three male and three female parents of children from the LS group from Beirut and the near suburbs. The language of the questionnaires was clear to the participants and the range of convictions and behaviors represented those of the target population.

3.2.2 Validation CATCH questionnaire

The original CATCH questionnaire consists of nine consecutive sections that include 54 questions. For the pilot study, minor changes were made to the content of the questions in the food choice/preference section, to fit the Lebanese culture. For example, doughnut was replaced by "*manakish*" (a local fatty dough-based staple commonly consumed for breakfast in the Middle East). In addition, two questions were added concerning the habit of drinking carbonated beverages to check the level of consumption, as it was reported to be highly consumed in the Lebanese culture (Nasreddine et al., 2014a). Thus, the modified final version of the CATCH questionnaire applied consisted of 56 questions.

The original CATCH questionnaire was translated into Arabic by a professional translator. The translated copy was discussed question-by-question with a focus group of 15 children aged 6-10 years, recruited from a public school in Beirut. During the meeting, the level of comprehension of each question and children's responses to the questions were noted. Some expressions that were written in the formal Arabic language were difficult to understand by the focus group; therefore, further minor modifications were made by the translator to simplify the Arabic version. The focus group was repeated in a different group of 15 children from a different public school to finalize the content validation of the CATCH questionnaire (Appendix 10). The final Arabic copy of the CATCH was back translated to English by another translator, who had no access to the original English questionnaire. The back translated English copy was compared with the original CATCH questionnaire. No major modifications were necessary because the two English copies were almost matching (Behling & Law, 2000).

3.2.3 Term "balanced meal"

Previous research reported that there was a misinterpretation of the term "balanced meal" mentioned twice in the HFSSM, questions four and six (Derrickson et al., 2001). A survey was conducted in two different MOSA centers to clarify the interpretation of the term "balanced meal". The survey included 100 subjects (beneficiaries of the MOSA centers): 78 females and 22 males from various ethnographic backgrounds and age groups. These individuals were structurally interviewed by the researcher. The qualitative responses were evaluated and the interpretation of the term "balanced meal" was added to the questionnaire. A "balanced meal" is described as a meal that includes a source of complex carbohydrates, vegetables, fruits and a source of protein such as meat or dairy derivatives, beans or eggs.

3.3 Ethical approval

The study protocol received the approval from the University Research Ethics Committee (UREC) at Oxford Brookes University, UK (Appendix 1) and from the Lebanese Ministry of Education (Appendix 2). Further, as one of the local advisors was affiliated to the American University of Beirut (AUB), Ethical approval was also obtained from the Research Unit and the AUB Medical Centre (Appendix 3).

3.4 Subjects and sampling methods

This was a cross-sectional study in the city of Greater Beirut that included students from three public schools and three private schools from poor and middle class residential districts. For practicality, 30 elementary schools affiliated with *Ajyalouna* (a research oriented non-profit organization that provides financial and medical assistance to schools) were considered for further selection. Using a random digit table, three private and three public schools from the list were randomly chosen. The total number of students at the selected schools was 1800. All children aged 6-10 years were considered eligible for participation and thus were target to take part in the study; however, due to political instability in Lebanon at the time of the research, a small number of parents consented to participate 196 from public schools and 54 from private schools.

The school administrations were contacted to inform about the study. Consequently, a list of eligible students (based on date of birth) was obtained from the school administration and parents of children aged 6-10 years old were sent an explanatory letter (Appendix 4) to invite them to a workshop with the Researcher in the school premises. During the meeting, the parents were served a small brunch followed by a short lecture, presented by the Researcher, concerning the subject of "Healthy and basic nutritional requirements of school aged children". At the end of the lecture the Researcher explained the details of the study to the parents and distributed consent forms (Appendix 5). In addition, the two household food insecurity questionnaires AFIQ (Appendix 6) and AHFIAS (Appendix 7) and the socio-economic health (SEH) questionnaires (Appendix 8) were administered. The children of the parents, who responded positively and completed the forms, during the meeting, were chosen to take part in the study. A second appointment was set by the school administration to obtain the children's anthropometric and body composition measurements (Appendix 10) that were accomplished according to details mentioned in section 3.5 of this thesis. During the same meeting, the Researcher interviewed the children for the CATCH questionnaire (Appendix 10). The work with the children was completed during recess hours or physical education sessions. All data collection was completed between March and April 2008.

3.5 Anthropometric Measures

All anthropometric measurements were taken at the school nurse's quarters. The measurements were made with the children wearing light clothing and no footwear. To avoid measurement errors, two readings were taken for each measurement. Anthropometric techniques were followed as described by Lohmann et al. (1988).

Body weight measurements were taken to the nearest 0.1 kg using the bioelectric impedance analysis technique Biospace in Body 230 (Figure 3.3), body composition analyzer, Biospace Co. Ltd, following the instructions provided by the same company (In Body 230, 2014). Standing height was measured using a Seca stadiometer. Circumference measurements were taken using a fiberglass tape measure (Figure 3.2). WC was measured at standing position mid-way between the lowest rib margin and the iliac crest and HC was measured at the maximum extension of the buttocks. MAC was measured on the non-dominant arm at the midpoint between the elbow and the acromion, with the elbow flexed to 90 degrees to the side of the trunk.

Skinfolds were measured using a Harpenden caliper, calibrated before each measurement session (Figure 3.1). Triceps was measured, on the non-dominant arm, 1 cm above the midpoint of the upper arm of the triceps muscle. The biceps was measured 1 cm above the midpoint of the upper arm of the biceps muscle. The suprailiac was measured slightly medial to the iliac crest, at a natural fold line. The subscapular skinfold was measured at a natural fold line, just below the line of the bottom corner of the scapula. All the anthropometric measurements were taken twice; the average of the two values was calculated, and compared to the CDC standard charts for each sex and age category.

Figure 3.1. Measurement of Biceps

Figure 3.2; Measurement of Waist Circumference

Figure 3.3. A volunteer on the body composition

3.6 Statistical analysis

All questionnaires were coded and the data entered into the CS-Pro software, developed by the US Census Bureau, designed to minimize data entry error, especially in large questionnaires. After data entry, all data were transferred to Statistical Product and Service Solutions software (SPSS, version 15) for statistical analysis. Data were cleaned, whereby frequencies were listed as a double check on the codes for possible errors and code inconsistencies.

Data from the questionnaire were coded and used to create scores and categorization. The HFIAS items were summed to create a FS score. Similarly, eight items of the CFI items were summed. Both instruments had guidelines to categorize the FI level: the HFIAS or AFIQ scores were categorized as food secure, mild, moderate and severely insecure; the CFI scores were categorized as food insecure and food secure. The details for the AFIQ categorization according to scores are depicted in Table 2.4.

Summary statistics were calculated and presented for all variables. In case of numerical data the mean and the standard deviations were used as summary measures, whereas the frequency and the percentage were used for categorical data. Nurmerical data were tested for normality using the QQ plot, as well as the Kolmogorov–Smirnov test. Differences in mean scores between groups were tested using the independent t test (student t test) when the number of groups was 2 (such as Public and Private schools) and using the analysis of variance (ANOVA) test when the number of groups was equal to or greater than 3 (such as low, moderate and high FI) with the bonferoni pairwise comparison. Differences in proportion, on the other hand, were tested using the Pearson's Chi-square. Correlations between numerical variables (such as height and CFI scores) were tested using the Pearson's correlation coefficients. Statistical significance was set at $P<0.05$.

For data analysis of anthropometric measurements, Epi-info program was used to obtain standardized Z-scores for a number of body measurements available. The grouping of Z values according to the categorization used by the CDC.

3.6.1 Sample Size

The main purpose of this first study is to get an overview of the level of FI among Lebanese children. This experiment was to put the base for national study that was to follow. The formula used to determine the sample size is the following (Fleiss et al., 2013):

$n = N*X / (X + N - 1)$ where $X = (Z\alpha/_2)^2 *p*(1-p) / E^2$,

$Z\alpha/_2$ is the critical value of the Standard Normal distribution at **$\alpha/2$**. For our calculation the confidence level desired was 95%, producing an**α** of 0.05 and a critical value of 1.96.

E is the margin of error determined by the researcher desired of accuracy; in our study we selected it to be 6.5%

P is the sample proportion, with absence of previous information of what the prevalence of food insecurity is among Lebanese children the value of 0.5 (50%) is used as a conservative estimate (meaning it will result the largest sample size needed)

N is the population size, this is used when the population is not considered infinite, and as a result in our example 5000 was used as estimate of the Lebanese children schooled in Beirut city in the targeted age. The sample size needed was found to be 218, we were able to recruit 250 (196 Public Schools & 54 from Private Schools).

This sample size is necessary to assess the proportion of FI in the population and build a confidence interval. Further, the sample size will allow some comparison tests such as comparing means and proportions among groups. For example, to detect the difference in Child FS between the public and private schools, magnitude of an effect size of 0.5 (difference in mean of 2, with standard deviation of 4), with 80% power and 5% alpha, 50 subjects per sample are necessary or a total of 100 subjects for both groups. It was determined that for power of 80%, and an alpha of 5%, a sample of 243 would be required to detect an effect size F= 0.21; this effect size is considered to be moderate to small. Therefore, with a sample size of 250, the study would have the power needed (i.e. at least 80%) to run the planned analyses.

3.7 Results

3.7.1 Food insecurity questionnaires

In the analysis of the parents' questionnaire (Table 3.1), a comparison of classifications was run between the two FI questionnaires, the AFIQ and the AHFIAS. The prevalence of FS was significantly low for households affiliated to private school (46%) compared to household from public schools (16%) according to the AHFIAS classification. However, according to AFIQ classification, prevalence of FS was (61%) for private against (21%) public schools.

Table 3.1. AHFIAS and AFIQ scores by school type classifications

	Private (HS)		**Public (LS)**				
	N	**%**	**N**	**%**	**Tests value**	**df**	**P-value**
HFIAS							
Secure	24	46	28	14			
Mild Insecure	5	10	30	16			
Moderate Insecure	10	19	50	26			
Severely Insecure	13	25	86	44	25*	3	**<0.001**
Mean (SD) score	3	(4)	8	(6)	5^	242	**<0.001**
AFIQ							
Food Secure	33	61	41	21			
Food Insecure without hunger	17	32	84	43			
Food insecure with hunger	4	7	71	36	36*	2	**<0.001**
Mean (SD) score	2.5	(3)	6.7	(4.7)	6.2^	248	**<0.001**

* Pearson Chi-square; ^Independent t test; significant p-values are in bold

Further, comparison between the AHFIAS and the child FI component of the AFIQ (Table 3.2.) scores were evaluated. The results were significant with a P<0.001. The CFI classification illustrated a very high FS prevalence for children, in private schools 98% and public school prevalence was 74 %. The same sample was evaluated with the HFIAS, that presented 46% households from private and 14% from public schools as FS. There is a large difference in the categorization of the two FI modules.

Table 3.2. CFI and AHFIAS scores by school type classifications

	Private (HS)		Public (LS)				
	N	**%**	**N**	**%**	**Tests value**	**df**	**P-value**
AHFIAS							
Secure	24	46	28	14			
Mild Insecure	5	10	30	16			
Moderate Insecure	10	19	50	26			
Severely Insecure	13	25	86	44	25*	3	**<0.001**
Mean (SD) score	3	4	8	6	5^	242	**<0.001**
Child Food Security CFI							
Secure	53	98	144	74			
Insecure	1	2	52	27	15*	1	**<0.001**

* Pearson Chi-square; ^Independent t test; significant p-values are in bold

In Table 3.3 the AHFIAS and the AFIQ classification of FI are compared to the level of paternal education. As can be seen, the higher the education level, the higher the prevalence of FS in both classifications. Similar to the results in Table 3.2, the percentage of FS participating households is higher in the AFIQ as compared to the AHFIAS classification.

Table 3.3. AHFIAS and AFIQ classification by paternal education

	Illiterate		**Elementary**		**Intermediate**		**Technical**		**College**		
	N	%	N	%	N	%	N	%	N	%	**p-value***
AHFIAS											
Secure	2	5.1	12	14.0	15	21.1	9	34.6	13	61.9	
Mild Insecure	6	15.4	13	15.1	8	11.3	4	15.4	3	14.3	
Moderate Insecure	6	15.4	28	32.6	17	23.9	5	19.2	4	19.0	
Severely Insecure	25	64.1	33	38.4	31	43.7	8	30.8	1	4.8	**<0.001**
AFIQ											
Food Secure	5	12.5	21	24.1	19	26.8	13	46.4	14	66.7	
Food Insecure	14	35.0	40	46.0	33	46.5	9	32.1	4	19.0	

without hunger											
Food insecure with hunger	21	52.5	26	29.9	19	26.8	6	21.4	3	14.3	**<0.001**

* P-value produced by the Pearson Chi-square test; significant p-values are in bold

3.7.2 CATCH questionnaire

Comparing the domains of the CATCH questionnaire according to school type (Table 3.4), the results were significant in the LS group for the use of healthy food, nutrition knowledge score and the dietary behavior. However, in the HS group, children had only better nutrition knowledge compared to the LS group.

Table 3.4. CATCH scores by school type

	Private (HS)		Public (LS)				
	Mean	**SD**	**Mean**	**SD**	**Tests Value***	**df**	**P-value**
1-day food record score (healthy items)	1.37	1.03	1.18	0.95	1.251	248	0.212
Week sedentary score	1.13	1.13	1.22	1.34	-0.475	248	0.635
Knowledge score	6.78	2.01	5.83	2.03	3.056	248	**0.002**
Dietary behavior	1.85	1.11	2.30	1.37	-2.190	248	**0.029**
Food choice score	3.46	1.36	3.24	1.35	1.077	248	0.283
Frequency of using health food score	1.85	1.91	2.86	2.07	-3.232	248	**0.001**
Frequency of PA score	0.98	1.05	1.26	1.45	-1.296	248	0.196

* Independent t test; significant p-values are in bold

3.7.3 Anthropometric Body measurements

Using the CFI classification, there was no significant difference for the anthropometric measures between FS and FI children (Table 3.5). The only interesting but borderline significant results were the height and the triceps of the children, that were higher in the FS group.

Table 3.5. Anthropometric measurements by CFI classification

	Food secure		Food insecure				
	Mean	**SD**	**Mean**	**SD**	**Test* Value**	**df**	**P-value**
Weight (kg)	28.4	7.8	27.4	8.72	0.798	248	0.425
Height (cm)	127.0	9.6	124.5	9.27	1.674	248	0.095
BMI (kg/m^2)	17.4	3.0	17.3	3.22	0.086	248	0.931
MAC (cm)	19.3	2.9	19.0	3.31	0.534	248	0.594
Biceps SKF (mm)	6.0	2.9	5.7	3.81	0.625	248	0.533
Triceps SKF (mm)	8.3	3.8	7.4	3.71	1.516	248	0.131

Suprailiac SKF (mm)	9.4	6.5	8.7	7.42	0.671	248	0.503
Subscapular SKF (mm)	8.5	6.3	7.6	6.11	0.998	248	0.319
WC (cm)	57.6	7.6	56.1	8.21	1.289	248	0.199
HC (cm)	68.6	9.3	67.6	8.88	0.721	248	0.472
W/H ratio	0.83	0.05	0.83	0.05	0.689	248	0.492
Body fat (%)	23.7	8.5	22.9	7.6	0.599	247	0.550

* Independent t test

Further, Table 3.6 shows the correlations between the CFI score and different anthropometric measurements. There were weak negative correlations between CFI score and height and triceps skinfold.

Table 3.6. Correlation between anthropometric measurements and CFI score

	Pearson Correlation	P-value
Weight	-0.086	0.173
Height	-0.143	**0.023**
BMI	-0.020	0.748
MAC	-0.064	0.315
Biceps SKF	-0.061	0.340
Triceps SKF	-0.119	0.060
Suprailiac SKF	-0.058	0.358
Subscapular SKF	-0.070	0.269
WC	-0.102	0.107
HC	-0.066	0.299
W/H ratio	-0.025	0.693
Body fat percentage	-0.047	0.458

Significant p-values are in bold

Anthropometric measurements were compared to AHFIAS classification of FI (Table 3.7). There was a significant difference in height amongst the four categories; children in the FS households were significantly taller than children in the FI households. Overall it is a decreasing order of the height measure from 129.1 to 124.7, from the FS to the severely FI.

Table 3.7. Anthropometric measurements by AHFIAS classification

	FS		Mild FI		Moderate FI		Severely FI		
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**P***
Weight (kg)	29.8	9.0	27.5	7.1	28.1	7.9	27.5	7.6	0.380
Height (cm)	129.1[a]	10.7	125.0	8.8	127.1	10.3	124.7[a]	8.4	**0.034**
BMI (kg/m^2)	17.5	3.1	17.4	2.9	17.1	3.0	17.4	3.1	0.904
MAC (cm)	19.7	2.9	19.2	2.8	19.0	3.2	19.1	3.0	0.688
Biceps SKF (mm)	6.2	3.1	5.6	2.7	5.8	2.7	5.9	3.5	0.793
Triceps SKF (mm)	8.9	4.2	8.2	4.1	7.8	3.4	7.8	3.7	0.390
Suprailiac SKF (mm)	10.0	7.3	9.3	6.6	9.2	7.0	8.7	6.2	0.768
Subscapular SKF (mm)	8.4	5.5	8.5	6.0	8.2	6.4	8.3	6.7	0.998
WC (cm)	58.5	7.0	57.3	8.3	57.0	8.0	56.8	8.0	0.657
HC (cm)	69.9	9.7	67.4	9.7	68.4	8.5	67.6	9.0	0.455
W/H ratio	0.84	0.05	0.83	0.05	0.83	0.05	0.84	0.05	0.856
Body fat (%)	23.5	8.1	23.5	9.0	23.1	8.5	23.7	8.1	0.984

*p-value produced by the ANOVA F test; significant p-values are in bold

[a] indicates pairwise comparisons that yielded statistical difference using the Bonferoni test

Table 3.8 illustrates the correlations between the AHFIAS score and different anthropometric measurements. There were significant weak negative correlations between FI score and height and triceps skin fold measures of the children.

Table 3.8. Correlations between AHFIAS score and the anthropometric measurements.

	Pearson Correlation	P-value
Weight	-0.100	0.120
Height	-0.136	**0.034**
BMI	-0.043	0.502
MAC	-0.083	0.196
Biceps SKF	-0.055	0.389
Triceps SKF	-0.142	**0.027**
Suprailiac SKF	-0.098	0.126
Subscapular SKF	-0.074	0.248
WC	-0.118	0.066
HC	-0.116	0.071
W/H ratio	0.004	0.953
Body fat percentage	-0.038	0.552

Significant p-values are in bold

Anthropometric measurements were compared according to school type (Table 3.9). There was a significant difference in height and weight between HS and LS schools. In addition, children in HS group had significantly higher triceps and suprailiac skinfold measurement and hip circumference measurement, but a significantly lower waist/hip ratio.

Table 3.9. Anthropometric measurements by school type

	Private (HS)		Public (LS)				
	Mean	**SD**	**Mean**	**SD**	**Test* Value**	**df**	**P-value**
Weight (kg)	31.1	9.0	27.4	7.5	3.009	248	**0.003**
Height (cm)	130.2	10.9	125.4	9.0	3.329	248	**0.001**
BMI (kg/m^2)	18.0	3.1	17.2	3.0	1.733	248	0.084
MAC (cm)	19.8	3.4	19.1	2.9	1.625	248	0.105
Biceps SKF (mm)	10.3	7.0	9.0	6.6	1.251	248	0.212
Triceps SKF (mm)	6.9	3.5	5.7	2.9	2.725	248	**0.007**
Suprailiac SKF (mm)	9.7	4.4	7.7	3.5	3.459	248	**0.001**
Subscapular SKF (mm)	9.8	7.9	7.9	5.7	1.937	248	0.054
WC (cm)	58.9	7.6	56.9	7.8	1.736	248	0.084
HC (cm)	71.4	10.7	67.6	8.5	2.767	248	**0.006**
W/H ratio	0.82	0.05	0.84	0.05	-2.447	248	**0.015**
Body fat (%)	25.2	8.6	23.0	8.2	1.754	247	0.081

* Independent t test; significant p-values are in bold

In Table 3.10 the anthropometric measurements of the children were evaluated according to the CDC standards. The values were borderline significant for BMI.

Table 3.10. Height and BMI classification according to CDC standards by school type

	Private (HS)		Public (LS)				
	N	**%**	**N**	**%**	**Test Value**	**df**	**P-value**
Height							
Stunt	2	4	12	6			
Short	1	2	12	6			
Normal	51	94	169	88	2.22*	2	0.329
BMI							
Wasted	2	4	3	2			
Underweight	0	0	6	3			
Normal	29	54	131	68			
At risk	16	30	31	16			
Obese	7	13	22	11	Fisher ^		0.079

* Pearson Chi-square; ^Fisher exact test used when count/frequency is small

3.8 Discussion

The current study shows that there was a significant difference in the estimation FIof households from both HS and LS groups, affiliated to private and public schools respectively. This was an expected consequence as Maxwell et al. (2013) documented that the domains of the AHFIAS questionnaire are based on mild manifestations of FI, psychological anxiety and food preferences, resulting in high prevalence of FI. The HFIAS depends on an algorithm method to create and categorize FI; therefore, the occurrence of a certain FI experience can place the household into a more severe FI category.

Comparing the results of categorization of the CFI questionnaire with the HFIAS, children were predominantly categorized as FS. However, these FS children were found living in households classified as FI with different severities. This observation could be interpreted by the fact that parents protect their children from FI by compromising their own food intake. McIntyre et al. (2003) demonstrated that in FI families the mothers' diet was steadily poorer than their children. This difference in nutrient inadequacy widened, along the course of the month during which time the research experiment was undertaken. Few investigations have focused on CFI and its consequences on health. Cook et al. (2006) evaluated and pursued the health status of children aged 36 months, over the course of six years. The results presented that HFI was positively correlated with fair/poor health and risk of hospitalization. With the presence of both HFI and CFI simoultanously, the risk of being sick and hospitalized was much more.

Many studies have tried to analyze the causative factors of FI. In our study, paternal education was significantly correlated with FI classification of the households. The prevalence of FS increased with increase in the degree of paternal education. According to AHFIAS, in the case of father's illiteracy FS was 5%, the FS was 62%

prevalent within the group of households with fathers carrying college degree. In parallel, the AFIQ classification within the same population categorized 13% FS for illiterate fathers and and 67% FS for households with paternal college degree. These results are consistent with other studies where the households' educational attainment was correlated with the FI (Rose, 1999; Tingay et al., 2003). In the same manner, studies in Iran (Shoae et al., 2007) and Colombia (Hackett et al., 2010) determined an inverse correlation between the mother's and father's education with child hunger level.

In an effort to examine the causes of FI, the nutritional knowledge of the participating children was evaluated. Comparing the scores from the seven domains of the CATCH questionnaire and socioeconomic status did not reveal high statistical significance. Few correlations had borderline significance, for example children from LS who consumed healthy foods scored well in nutrition knowledge and applied good food practices. In comparison, children from HS had better nutrition knowledge than the LS children, but their daily food consumption was not healthy. These findings are contradictory to a study conducted on elementary school children in Seoul, to investigate their nutrition knowledge, attitude and behavior (Choi et al., 2008). The investigators discovered that the higher the household income (HS), the better the dietary behavior of the children; in addition, nutrition attitude and diet behavior was positively correlated to the mothers' education. Thus, it can be suggested that the children from low socioeconomic (LS) status living in Beirut, may consume more high fiber foods such as beans, vegetables and fruits, plus they lack the purchasing power to buy extra fast food and snacks. In comparison, children from high socioeconomic background (HS), are knowledgeable about healthy eating practices, but they have more opportunity to consume fast food and snacks.

To compare and test the strength of the FI measuring tools applied in the pilot study, the FI values resulting from the experiment were compared to anthropometric measurements. There were no significant differences in anthropometric measurements between the FS and FI children, except for height and triceps, which were greater in FS children. In addition, there was a weak negative correlation between height and triceps skinfold measurement with the CFI and AHFIAS classification, indicating that as the FS level decreased, height and the triceps skin fold measurements increased. In the literature, there is much emphasis on the effect of mothers' education on child height (Thomas et al., 1992). A similar research executed in Indonesia, illustrated that the longer formal education of the mother and the father decreased the odds of child stunting by 5% and 3%, respectively (Semba et al., 2008).

In the United States, studies conducted on Hispanic children from low SE groups showed these children to have shorter stature, are heavier in weight and have higher mean skinfold thickness (Ryan et al., 1990). These conditions do not apply to the current sample since the anthropometric values showed to increase (triceps, supra-iliac and hip) as the level of the FS increased. Moreover, there were significant weak negative correlations between CFI score and height and triceps skinfolds.

By classifying the children according to school type as public (LS) and private (HS), the HS children had significantly greater weight and height measurements, and greater biceps and triceps skinfold measurement. However, the waist/hip ratio, which is considered as a health risk indicator, was lower in the HS group. Finally, comparing the anthropometric values (BMI) to CDC standards, children from HS background had double risk (30%) of obesity, compared to LS children (16%). The overall anthropometric results are interesting but not significant due to small sample size.

3.9 Summary

In conclusion, this validation study has set the base for the upcoming national study. From the validation study, the following criteria have been identified to ensure a successful national FI study:

1. The present study suggests the need to do further research on a larger scale of subjects in order to be representative of the children's overall population that covers all the geographic areas of the country. The questionnaires have to be more concise, especially the parents' questionnaire, for the time factor and to have better cooperation from the head of household or parent participating in the study.
2. Validated FI questionnaires, validated socio economic, health and knowledge questionnaires, easily understood by the target population.
3. Proportionate representation of the number of schools from each of the six geographic regions included in the study.
4. Proportionate sampling of the number of children from each geographic region, according to the total number of students registered in Ministry of Education documentation.
5. Staff training and testing for inter-rater reliability.
6. Ethical approval for the study and approval from the Ministry of Education and participating school administrations to partake in the study.

Chapter 4 : Prevalence of child food insecurity in Lebanon

4.1 Introduction

In our modern era, FI is a global epidemic resulting from the confluence of multiple pressures including developmental, population increase, economic and environmental (Johnston et al., 2014). Thus, the urgent need to undertake research focused on FI and specifically CFI to unravel the prevalence and causes and help alleviate its long term consequences on the FI children and possible solutions.

The pilot study validated questionnaires and presented preliminary data on the prevalence of FI in school-aged children in Lebanon. The aims of the main cross-sectional study were to:

(i) conduct a detailed assessment of FI in Lebanon by region;

(ii) assess the geographic regions that have the highest levels of CFI;

(iii) assess the parameters that contribute to FI in Lebanese children.

4.2 Ethical approval

Ethical approval for the cross-sectional study was obtained from the University Research Ethics Committee (UREC) at Oxford Brookes University, UK (Appendix 13) and from the Lebanese Ministry of Education (Appendix 14). The PI and two of the raters that were carrying out the interviews also obtained the (NIH, 2010) (Appendix 15) based training course certificate for “Protecting Human Research Participants”.

4.3 Study Protocol

A list of eligible students (based on date of birth) was obtained from the administration and parents of children aged 7-10 years old were sent an explanatory letter to invite them to a workshop to meet with the (Principal Investigator) PI in the school premises (Appendix 16).

Some schools requested a lecture to be given to the parents in a manner to attract them to participate in the study. A concise 15 minutes lecture was prepared by the PI entitled "Healthy Nutrition of school aged children: Growth, energy and healthy memory". During the meeting with the parents, the PI explained the full details of the survey, the steps to be taken with the children and the aims of the research. The parents who agreed to take part signed the parent consent forms (Appendix 17) and were interviewed by the assistant researchers and the PI for the AFIQ (Appendix 6) and SEH (Appendix 8) questionnaires. The children of the parents who responded positively and filled out the forms were chosen to take part in the study. A second meeting was scheduled with the help of school administration to meet with the children for interview and measurements. The meeting with children took place in the school nurses' premises, usually during physical activity class or recess. The participants were given a five minutes brief and the child consent form (Appendix 9) was signed before starting the interview and measurements taken. After the meeting with the children, a short nutritional assessment form was sent to the caregiver of each child. The form included the basic anthropometrics such as weight, height and body composition as calculated by the In Body machine (Appendix 21), with a brief nutritional recommendation written by the PI.

4.4 Subjects and sampling methods

The study covered the six *mouhafazas* of Lebanon, with proportionate sampling used to have a representative sample. The target population for this study was school-aged children aged 7 to 10 years attending school. To ensure a proportionate representation of the different geographical areas of Lebanon and the different types of schools, the sampling of the school was carried out within each stratum (combination of area and school type) such as all private schools in the Beirut area would constitute a stratum. The size of the sample to be withdrawn from that stratum was proportionate to the total number of cycle 1 and 2 students in that stratum (cycles 1 and 2 are classes that cover the target age 7 to 10 years).

Proportionate sampling was applied to the total number of children registered in the schools to calculate the number of children needed from each category (Table 4.1). Comparing the results to the total number of children aged 5 to 9 years in the general population, the numbers proved to be very similar (Ministry of Education, 2006)

Table 4.1. Distribution of participant children required and recruited

	Public schools		Free schools		Private schools	
	Needed	Recruited	Needed	Recruited	Needed	Recruited
Beirut	28	35	16	23	71	81
Suburb Beirut	44	47	69	65	229	210
Mount Lebanon	36	44	25	26	91	107
Bekaa	69	73	86	90	66	61
North	201	173	63	76	134	155
South	109	120	75	72	87	81

4.5 Materials and methods

4.5.1 Parent Questionnaire

For this research, the parents' questionnaire consisted of the AFIQ (Appendix 6) and the SEH (Appendix 8) questionnaires only; the AHFIAS (Appendix 7) was deleted from this survey for two reasons: first it overestimated the prevalence of FI in the studied population; second was to reduce the size of the parent questionnaire.

4.5.2 Child Food Knowledge Test (CFK)

Initially, to test the nutritional knowledge of the children in the pilot study, the CATCH was translated and applied to assess the nutritional knowledge of the children. The correlations between the CATCH questionnaire scores and the children diet knowledge revealed poor statistical association (Table 3.4). Consequently, the PI along with local advisor developed the Child Food knowledge (CFK) questionnaire (Appendix 18) based on the CATCH questions, customised to the Lebanese culture. The resulting CFK consists of 73 questions and was divided into three domains: nutritional knowledge; 24 hours recall of food groups consumed; and one-week physical activity recall.

4.6 Anthropometric Measurements

The day of the school visit the PI and the assistant researchers interviewed the children for the CFK and the consent form was signed by each child (Appendix 9); concurrently their body measurements were taken wearing light clothing and no footwear. Three readings for each measurement were recorded, and an average value calculated. The details of the anthropometric measurements are mentioned in details in section 3.5 of this thesis.

4.7 Statistical Analysis

Questionnaires were completed by interview; besides to the PI, there were four other interviewers all trained on completing the questionnaires. Data were coded and entered into the CS pro software and then transported into SPSS. A series of procedures were run on SPSS to check for data cleaning and errors of inconsistencies. These procedures included a run of the frequency for all variables and a check for all incorrect codes. Another procedure was to cross examine two related variables to check for inconsistent results. SPSS was also used for analyzing the data.

Body measurements were taken three times and the average of the three was used in the calculation of z-scores of weight-for-age (WHZ), height-for-age (HAZ), BMI-for-age and mid-arm-for-age to express the deviation of the measurements from the CDC growth chart values (Ogden et al., 2002). The Z score values were calculated using the Epi Info software, version 3.3.2 (Appendix 19) (Kuczmarski et al., 2000). Epi Info was also used to calculate percentile values for waist circumference, triceps**,** biceps, and subscapular skinfolds (Appendix 20), because the latter values do not exist as Z score values.

For data analysis of anthropometric measurements, Epi-info program was used to obtain standardized Z- scores for a number of body measurements available. The grouping of Z values was applied, according to the categorization used by the CDC.

The CFK (Appendix 18) questionnaire was based on a set of 73 multiple choice questions, with only one possible correct answer per question. The number of correct answers was computed and a score over 100 was created. The children's questionnaire also included 24-hour recall questions about the number of times the child consumed a certain type of food on the day before the interview. These were used to create an estimate of food consumption of the following categories: convenience food; starchy food; fruits and vegetables; dairy products; and protein rich foods.

The parent questionnaire included the FI items that were added and categorized according to the score into three categories: high/marginal food secure, low food security, and very low food security. A regrouping was carried out to create binary variables identifying the food secure group from the food insecure group.

In the same questionnaire, the after school activity was measured using the PDPAR instrument (Weston, 1997) to assess the type and intensity of activity each child was involved in from 15:00 until 23:30 hours. Each activity was translated into a MET (metabolic equivalent task) core according to the intensity of that activity. MET is a ratio of work metabolic rate to resting metabolic rate (Weston, 1997). Each child received a total MET score summing the activity from 15:00 until 23:30 hours, which was multiplied by the body weight (kg) of each child to calculate expenditure (kcal) per hour (Trost et al., 1999).

For comparing the distribution of categorical data (such as FS) by another categorical data (such as region, or school type), the Chi-square test was used. For comparing the distribution of measurement data (such as food knowledge score) by binary data (such as gender), the independent t-test was used, otherwise the ANOVA F-test (with the bonferoni pairwise comparison) was used if the variable had more than two categories (such as BMI Z groups). Nurmerical data were tested for normality using the QQ plot, as well as the Kolmogorov–Smirnov test. All analysis was carried at the 0.05 significance level.

4.7.1 Sample Size Determination

The focal purpose of this study is to get an overview of the level of child FI in the different Lebaneses governorates and to compare the severity of CFI between HS high socio economic and LS groups. The main approach was basically the same for the pilot study (chapter 3), while introducing the fact that it would be over the six national governorates rather than just one. As such the formula used to determine the sample size is the following (Fleiss et al., 2013):

$$\mathbf{n = N*X / (X + N - 1) \quad where\ X = (Z\alpha/_2)^2 *p*(1-p) / E^2,}$$

$Z\alpha/_2$ is the critical value of the Standard Normal distribution at **$\alpha/2$**. For our calculation the confidence level desired was 95%, producing an**α** of 0.05 and a critical value of 1.96.

E is the margin of error determined by the researcher desired of accuracy; in our study we selected it to be 6.5%

P is the sample proportion, with absence of previous information of what the prevalence of food insecurity is among Lebanese children the value of 0.5 (50%) is used as a conservative estimate (meaning it will result the largest sample size needed)

N is the population size, this is used when the population is not considered infinite. The determined sample size was 250 (rounded up) which was multiplied by six having to replicate the sample in each of the six Lebanese governorates, resulting in a total sample size of 1500, i.e. 250 * 6.

The total sample size (N=1500) is sufficient to do the necessary analysis for the nationwide study. When the total sample size is combined it provides the necessary power (>80%) to detect effect of moderate to small size.

4.8 Quality Assurance

To assure the applicability of questionnaires, two characteristics need to be addressed: validity and reliability (Frongillo, E.A., 1999).

4.8.1 Validity

The face validation of the AFIQ and the SEH are explained in details in section 3.2.1. The new questionnaire for this study was the CFK which was discussed question-by-question with a focus group of 20 children aged 7-10 years, recruited from a private school in Beirut. During the meeting, the level of comprehension of each question and children's responses to the questions were noted and minor vernacular modifications applied to the questionnaire.

4.8.2 Questionnaire Test-retest reliability

For the purpose of assessing reliability of the AFIQ, namely stability, the questionnaire was administered twice in a specific sample. The test re-tested was done on the first group of interviewed households from the cross-sectional study, based in Beirut. After one week from the initial meeting, the caregiver of each household was contacted by land line or cellular line, and asked again the 18 questions of the AFIQ. Families without any contact information, or non-responsive to the call were not included in this reliability testing. The test was done with a total of 101 families that responded a second time to our questionnaire. The number 100 was determined to achieve significance based on a minimum agreement of 50% with a minimum error of 20%. To achieve statistical agreement or relative error involves a smaller sample size (Cantor, 1996).

The kappa statistical method was used to assess the questionnaire item-by-item stability (Table 4.2). The kappa is designed to assess the agreement between the first time the item was asked and the second time during correction for chance agreement (Viera et al., 2005). Comparing the kappa values obtained, to the interpretation guidelines presented in Table 4.3, it can be concluded that there is high level of agreement on the majority of the items of the questionnaire. This step highlights the importance of AFIQ as a reliable and stable tool to measure HFI and CFI in communities where Arabic is the main spoken language.

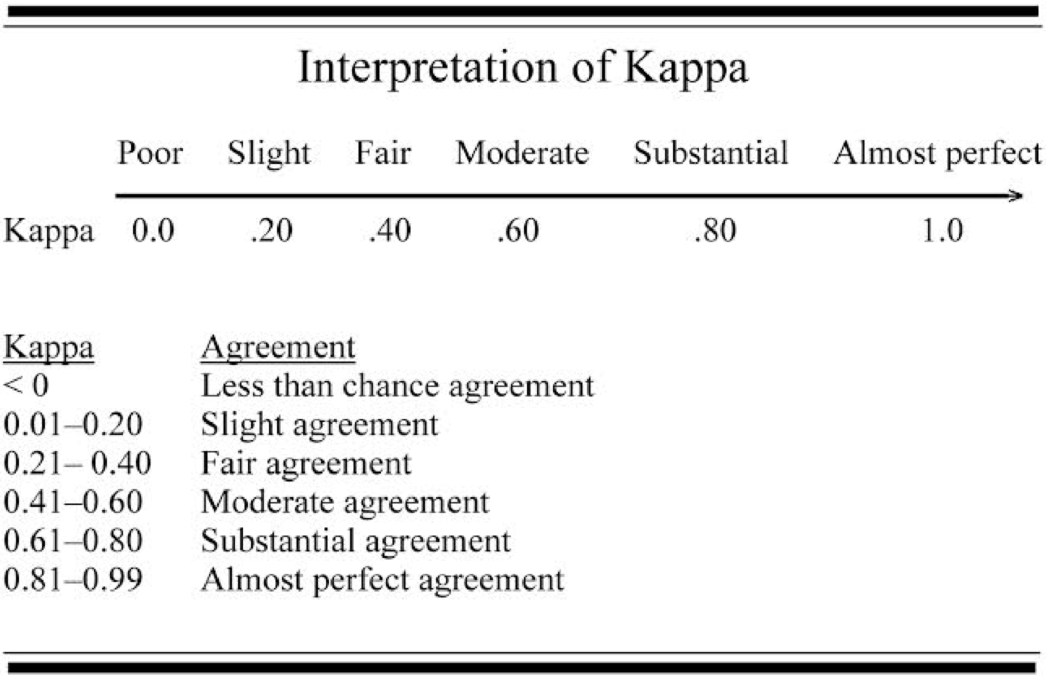
As denoted in Table 4.2, items 13 and 16 have few responses because they correspond to the frequency of occurrence of relatively severe FI situations question like item 12: "In the last 12 months, did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food?" The majority of Individuals of our test group answered "No" to question 12 and subsequently skipped the item 13.

Table4.2. Test re-test results using Kappa

Item	Kappa	p-value
1	.502	**<0.001**
2	.514	**<0.001**
3	.591	**<0.001**
4	.674	**<0.001**
5	.657	**<0.001**
6	.263	**0.006**
7	.315	**<0.001**
8	1.00	**0.008**
9	.559	**<0.001**
10	.374	**<0.001**
11	.519	**<0.001**
12	.386	**<0.001**
13	**	
14	.261	**0.008**
15	.322	**<0.001**
16	**	
17	.219	**0.028**
18	.490	**<0.001**

**too few to produce a value; significant p-values are in bold

Table 4.3. Kappa values interpretation



Kappa	Agreement
< 0	Less than chance agreement
0.01–0.20	Slight agreement
0.21– 0.40	Fair agreement
0.41–0.60	Moderate agreement
0.61–0.80	Substantial agreement
0.81–0.99	Almost perfect agreement

4.8.3 Inter-researcher reliability

One of the items of reliability is to assure the minimum variation in-between assistant researchers in the measured values. The PI and five assistant researchers undertook two training sessions for anthropometric, circumference and body weight and height measures. At the third training session, a group of 24 children was chosen from a private for free school, where the PI and the five researchers took three readings for each physical measure. To assess the agreement in measurement between the PI and the other assistants, a correlation was calculated that indicates how close the measure values are from the different researchers. The measure of agreement between the assistant researchers, is a correlation which can vary on a continuum from 0 (no reliability) to 1 (absolute agreement and thus very strong reliability). In our results, all of the correlations were very close to 1 indicating a very strong reliability, indicating that the measurement taken by the PI and any of the assistants were almost identical. Thus the result of the analysis showed that all the assistant researchers had a very high inter-researcher reliability on the physical measures (Table 4.4).

Table 4.4. Test retest for the six assistant researchers

	Results of 6 Researchers					
	CH	**B**	**N**	**CE**	**H**	**R**
Weight	1.000	1.000	--	--	--	--
Height	.998	1.000	1.000	1.000	1.000	1.000
Waist	1.000	.996	.984	.971	.999	.999
Hips	1.000	.999	.999	1.000	1.000	1.000
Mid-arm	1.000	.997	.979	.980	.998	.998
Bicepts	.996	.993	.996	.910	.952	.960
Tricepts	.986	.960	.979	.956	.946	.966
Subscappular	.998	.991	.983	.996	.993	.988
Supra	.999	.994	.961	.987	.993	1.000

P value for all correlations were <0.001

4.8.4 Internal Consistency

Internal consistency is another measure of reliability; it aims at measuring how consistent are the items of a single scale among each other. For example a household experiencing low FS, score low on most items of the FS scale, scoring high on some of the items and low on others shows inconsistency in the measuring items.

In this experiment, internal consistency was measured using the cronbach alpha (Osburn, 2000). All questions of the AFIQ, except three frequency of occurrence questions (items 8, 13 and 16), were looked at for internal consistency. The three items were excluded because they did not provide information for the entire sample and were measured on a different scale. The Cronbach alpha was 0.915, a very high value, indicating a high internal consistency of the AFIQ (Osburn, 2000). Internal consistency as mentioned before is a measure of reliability. Thus, the AFIQ proves to be reliable when administered in Arabic, to the study population.

4.8.5 Quality Assurance of Data Collection and Data Entry

For measuring children's weight the Biospace bioelectric impedance digital balance was used (In Body 230). The balance was subject to a monthly check, by a professional technician from the company, during the research period. This calibration included verifying of external weight plates and internal impedance current.

The device has an internal auto calibration system that is completed each time the device is turned on, this latter is experimentally approved for research, documented by a certificate (Appendix 28). Further, on the day when measurements were taken, a 10 kg weight plate (Mettker-Toledo Intl. Inc) was used for a second calibration purpose. The PI was present during all the school visits to ensure that data collection was carried out correctly. Further, the PI checked the questionnaires before data entry; any missing information was completed by telephone, either by calling the school administration or the parents directly. CS Pro (Census and Survey Processing System) was used for data entry, user friendly software that reduces data entry errors by allowing only preset codes to be entered. For instance if the person doing data entry mistakenly type 788 Kilograms for weight, the software which was programmed to request a confirmation for any weight above 100, would respond to that entry. Data cleaning was used to check for errors in codes and inconsistency in variables.

4.9 Results

4.9.1 Internal Validation of the AFIQ questionnaitre

Face validation testing of the AFIQ proved to be a reliable and consistent tool (section 3.2.1). Furthermore, a statistical comparison was evaluated between the Lebanese and the American populations, to compare the severity of prevalence between the two populations. After the termination of the survey the scores of the AFIQ were compared to the average household FI prevalence scores in the US as evaluated by the HFSSM (English version). This testing was restricted to 1413 households that had completed all of the eighteen questions of the AFIQ.

Item calibration is a technique to compare an unknown test item with a reference standard and indicates the relative harshness of an item. Quuestionnaire items with lower calibrations are confirmed by subjects with lesser degrees of FI than items with higher calibrations (Toit, 2003). For the item calibration of the questionnaire the Rasch model or the one-parameter logistic model was applied. In this model, all items are assumed to be equally selective and items only vary with respect to their relative item severities. For the present analyses, item response models were fixed discarding missing values.

Item response models were analyzed using the BILOG-MG program from Scientific Software International (Toit, 2003) using marginal maximum likelihood (MML) assessment. A one-parameter logistic model (1PL) was set to the data for all individuals as one group (Embretson, 2000).

Table 4.5. Item responses and item statistics for ten AFI items (1PL, one parameter logistic model; SE, standard error).

Item	Question number	Affirmative (Row %) (1413)	Item-score correlation	1PL model Item calibration (SE)
Worried food would run out	1.	449 (32)	0.664	-3.013 (0.022)
Couldn't afford balanced meals	3.	451 (32)	0.669	-3.032 (0.022)
Food didn't last	2.	348 (25)	0.726	-1.983 (0.024)
Adults skip meals	7.	228 (16)	0.758	-0.520 (0.027)
Eat less than should	9.	214 (15)	0.767	-0.322 (0.027)
Adults skip meals often	8.	202 (14)	0.745	-0.146 (0.028)
Hungry but didn't eat	10.	112 (8)	0.647	1.456 (0.034)
Lose weight, not enough food	11.	114 (8)	0.631	1.413 (0.033)
Did not eat for whole day	12.	58 (4)	0.517	2.940 (0.043)
Adult did not eat whole day often	13.	51 (4)	0.502	3.206 (0.046)
Cronbach's alpha			0.907	

According to Table 4.5, out of the 13 items analyzed three received strong negative item calibration scores (item 1, 3 and 2) for the AFIQ questionnaire. These 3 items were related to "worry" domain that addressed running out of food. Four items received positive calibration scores (2 moderate and 2 strong for items 10, 11, 12 and 13 respectively) that were related to the "not enough quantities of food" domains, whereas the three negative items were related "to running out of food". The overall Cronbach's alpha a measure of internal consistency of item among themselves was 0.9 indicating a strong internal consistency, and thus items of the AFI are coherent among themselves.

Table 4.6. Item responses and item statistics for eight CFI items

Item	Question number	Affirmative (Row (%)	Item-score correlation	1PL mode Item calibration(SE)
Few kinds cheaper foods for children	4.	522 (37)	0.640	-2.555 (0.022)
Couldn't feed children balanced meals	5.	416 (29)	0.678	-1.933 (0.023)
Our children not eating enough	6.	275 (20)	0.664	-1.001 (0.025)
Cut size children's meals	14.	110 (8)	0.638	0.570 (0.034)
Children hungry couldn't afford food	17.	84 (6)	0.635	0.976 (0.038)
Children skip meals	15.	94 (7)	0.683	0.808 (0.037)
Children skip meals often	16.	84 (6)	0.663	0.976 (0.019)
Children didn't eat whole day	18.	35 (3)	0.446	2.160 (0.054)
Cronbach's alpha			0.881	

Table 4.6 shows that out of the eight items analyzed for child food insecurity, two received strong negative calibration scores dealing with type of food (item 4 and 5); whereas item 18 received a strong positive calibration and that had to do with child not eating for a whole day. The overall Cronbach's alpha was 0.88 indicating a strong positive internal consistency and thus the items of the CFI measure are coherent among themselves.

Furthermore, comparing the survey results of the Lebanese FI data against the American population data as presented by Nord et al. (2002), the item calibration results revealed a strong agreement. Figure 4.1 shows both plots of data for the US and Lebanon, and compares the results from Lebanon to the US by having the US values plotted by a straight line playing the role of the standard. The results of Lebanese FI survey are then checked for deviations from the straight line. Further deviance is indicative of non valid results with the reference country, whereas plots close the line are indicative of a validation with the reference. The US data were scaled to the same mean and SD as the Lebanon data resulting in an almost straight line indicating an identical pattern in the calibration of severity of FI items. In conclusion, Figure 4.1 supports the validity of the AFIQ among the Lebanese population.

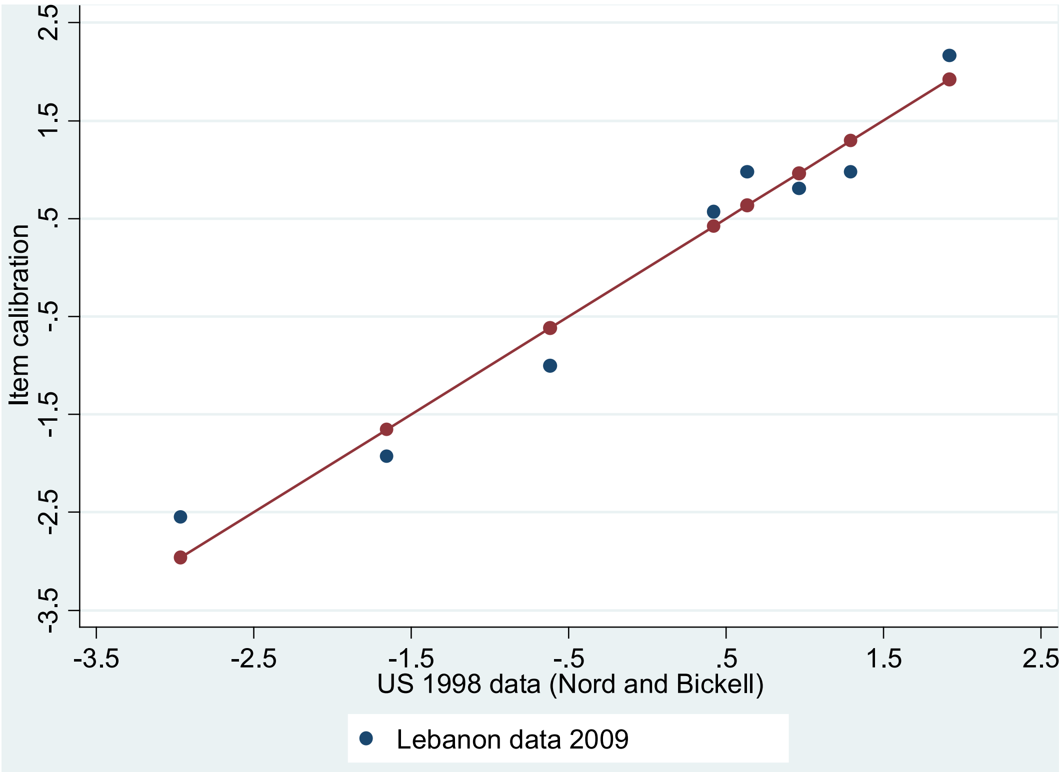


Figure 4.1. Plot of item calibrations for CFS items in Lebanon data against item calibrations for US data 1998 (Nord et al., 2002)

4.9.2 Description of the Study Population and FI Prevalence

A total of 1530 children and a parent/guardian were interviewed in the cross-sectional study. The sample of participating school-aged children was equally distributed between 50% males and 50% females. The algorithm-based categorization of CFS showed that 32% (n 492) were low CFS and 8% (n 122) were very low CFS.

Although only parents of children aged 7 to 10 years were invited to take part in the study, parents of younger or older children were eager to participate. Misinterpretation of age of occurred because certain parents could not remember the birthdates of the child during the interview. Consequently, the actual birthdates were noted from the school administration. Thus, the sample included a small number of 6 and 11 year olds.

The school types considered in this study were: public schools, private schools, and private for free. The geographic and administrative distribution of the country included the capital Beirut, the suburbs of the capital, Mount Lebanon, South Lebanon, North Lebanon, and finally the Bekaa. The Bekaa is situated in the eastern part of the country and is mostly a valley area rich in agriculture activity.

As shown in Table 4.7, there was an equal representation of age groups in terms of gender, school type and geographic area. There was no difference in the sample according to gender (P = 0.411), area (P = 0.220) or school type (P = 0.053).

Table 4.7. Number (%) of sample population according to age group

	6 years N (%)	7 years N (%)	8 years N (%)	9 years N (%)	10 years N (%)	11 years N (%)
Gender						
Male	53 (7%)	176 (23%)	231 (30%)	188 (25%)	112 (15%)	10 (1%)
Female	41 (6%)	174 (23%)	201 (27%)	208 (28%)	118 (16%)	13 (2%)
Area						
Beirut	6 (5%)	27 (19%)	43 (31%)	37 (26%)	26 (19%)	2 (2%)
Beirut Suburb	18 (6%)	79 (25%)	86 (27%)	85 (26%)	49 (15%)	5 (2%)
Mount Lebanon	12 (7%)	47 (27%)	51 (29%)	36 (21%)	28 (16%)	2 (1%)
Bekaa	16 (8%)	50 (24%)	58 (28%)	43 (21%)	39 (19%)	2 (1%)
North	30 (8%)	96 (24%)	123 (30%)	111 (28%)	42 (11%)	5 (1%)
South	12 (5%)	51 (19%)	71 (26%)	84 (31%)	46 (17%)	7 (3%)
School type						
Public	41 (9%)	107 (22%)	135 (28%)	133 (27%)	70 (15%)	-
Private free	19 (6%)	66 (20%)	94 (28%)	90 (27%)	59 (18%)	-
Private paid	34 (5%)	175 (26%)	202 (30%)	170 (25%)	101 (15%)	-

A more detailed analysis by region (Table 4.8) illustrated a statistically significant difference in all measures of FI distribution according to geographical area (P<0.001 for all three measures). Very low FS of the household was highest in North Lebanon 25% and Bekaa 22%. Twelve percent of respondents from Beirut reported a very low HFS. Similar findings were seen for AFS with 20% of North having a very low FS, 17% in Bekaa, and 10.5% in Beirut. Finally, 15% of children in the North were categorized as having very low CFS, 12% among Bekaa and 7% among Beirut.

Table 4.8. Frequency and Percentage of FI categorization according to AFIQ, AFS and the CFS in the six different geographic areas

	High & Marginal FS	Low FS	Very Low FS	
Household FS (AFIQ)	**N (%)**	**N (%)**	**N (%)**	**P-value ***
Beirut	101 (71%)	23 (16%)	17 (12%)	
Beirut Suburbs	246 (76%)	46 (14%)	30 (9%)	
Mount Lebanon	135 (76%)	32 (18%)	10 (5%)	
Bekaa	119 (57%)	44 (21%)	46 (22%)	
South	185(67%)	63 (23%)	26 (9%)	
North	209 (50%)	101 (25%)	100 (25%)	**<0.001**
Adult FS (AFS)				
Beirut	113 (80%)	13 (9%)	15 (10%)	
Beirut Suburbs	269 (83%)	29 (9%)	24 (7%)	
Mount Lebanon	155 (87%)	15 (8%)	7 (4%)	
Bekaa	138 (66%)	35 (16%)	36 (17%)	
South	203 (74 %)	53 (19%)	18 (6%)	
North	247 (60%)	78 (19.)	82 (20%)	**<0.001**
Child FS (CFS)				
Beirut	109 (72%)	23 (16%)	9 (6%)	
Beirut Suburbs	254 (79%)	51 (16%)	17 (5%)	
Mount Lebanon	133 (75%)	37 (21%)	7 (4%)	
Bekaa	124 (59%)	60 (29%)	25 (12%)	
South	201 (73%)	67 (24%)	6 (2%)	
North	217 (53%)	132 (32%)	58 (14%)	**<0.001**

* P-value produced by the Pearson Chi-square; significant p-values are in bold

The parent survey questionnaire included a list of socio-economic factors that proved to be significantly correlated with CFS (P<0.001). These correlations are tabulated in Tables (4.9) and (4.10).

Table 4.9 CFS and Socio- Economic Factors (I)

		Child Food security Group						
		High or marginal CFS		Low CFS		Very Low CFS		P-value*
• Do you have any household help?	Yes	262	25%	27	7%	11	9%	**<0.001**
• Type of residence	Private	788	76%	227	62%	44	36%	
	Rent	212	20%	124	34%	65	53%	**<0.001**
• Does the father smoke cigarettes or hubbly-bubbly?	Yes	538	53%	241	66%	86	73%	**<0.001**
• Does the mother smoke cigarettes or hubbly-bubbly?	Yes	302	29%	133	35%	47	38%	**0.015**
• Has the mother been diagnosed with any chronic diseases?	Yes	206	20%	116	31%	50	42%	**<0.001**
• Do you spend any allowance on restaurants?	Yes	519	50%	35	9%	4	3%	**<0.001**
• Do you have any private source of fruits, vegetables	Yes	275	26%	70	19%	9	7%	**<0.001**

* P-value produced by the Pearson Chi-square; significant p-values are in bold

Table 4.9 compares children with high/marginal CFS to those with low and very low CFS. Children experiencing very low CFS were the least likely to have household help for cleaning (9% compared to 25% in the FS group), more likely to rent the place of residency rather than to own it. The percent of households owning the place of residency shows an interesting trend, where 76% of children with high/harginal CFS live in a place of residency that is purchased by the parents, that percent drops to 62% among low CFS, and down to 36% among the very Low CFS group (53% rent) and (21% rent) in the FS group.

Likewise, the smoking habits of the parents were correlated to the CFS status in a reverse trend. There was a higher prevalence of smoking among lower level of CFS: 53% of fathers and 29% of mothers among high/marginal CFS; 66% of fathers and 35% of mothers were smokers among low CFS; finally 73% of fathers and 38% of mothers were smokers among very Low CFS. Further, Table 4.9 demonstrated that mothers predisposition to chronic disease were also associated with CFS. Almost 20% of mothers of children in the high/marginal CFS group were diagnosed with chronic disease, 31% in the low CFS, and 42% in the very low CFS. Finally, only 3% of the very low CFS households spent money on restaurants compared to 51% of the CFS, and were less likely to have private supply of produce such as produce from an agricultural land they work on or food donations (7% compared to 27% in the FS group).

Table 4.10: CFS and Socio- Economic Factors (II)

	High or Marginal CFS		Low CFS		Very Low CFS		
	Mean	SD	Mean	SD	Mean	SD	p-value*
• Number of vehicles (cars and trucks) in the household?	2.19[a]	0.724	1.58[a]	0.576	1.33	0.471	**<0.001**
• Number of children under 18 years living under the same roof	2.72	1.125	3.52	1.641	4.32	1.861	**<0.001**
• Total number of people living under the same roof	5.26	1.51	6.31	2.18	7.34	3.02	**<0.001**
• Number of rooms in the house (besides the kitchen and toilettes)	3.53[a]	0.724	2.98[a]	0.88	2.49	0.944	**<0.001**
• The monthly allowance spent (LBP) on food besides restaurants	**721,876[a]**	**391,705**	**464,238[a]**	**494,712**	**370,500[a]**	**322,868**	**<0.001**

* P-value produced by the ANOVA F test; significant p-values are in bold
[a] indicates pairwise comparisons that yielded statistical difference using the Bonferoni

Table 4.10 addresses housing situation, car ownership and money spent on food in association with CFS category. When the ownership of car was considered, households with very low CFS were observed to have fewer cars on average than the other CFS groups. The number of children (18 years old and younger) and total number of people living in the house was observed to be higher among the groups with the lower CFS. The mean number of household members living under the same roof was 5.26 for high or marginal CFS and it increased to 7.34 for very low CFS households. In addition, the larger families also lived in smaller houses (number of rooms 2.49 in the lower CFS compared to 3.53 in the higher CFS). Finally, the amount spent on food was almost 50% less on the monthly food ration for low CFS: 370,000 LBP on average compared to 721,000 LBP for the high or marginal CFS families.

More analysis of the influence of socio-demographic factors, Figure 4.2 demonstrates the effect of father and mother education on CFI. This figure illustrates an increasing order of CFI with decrease in educational level for both parents, ranging from university degree to illiteracy.

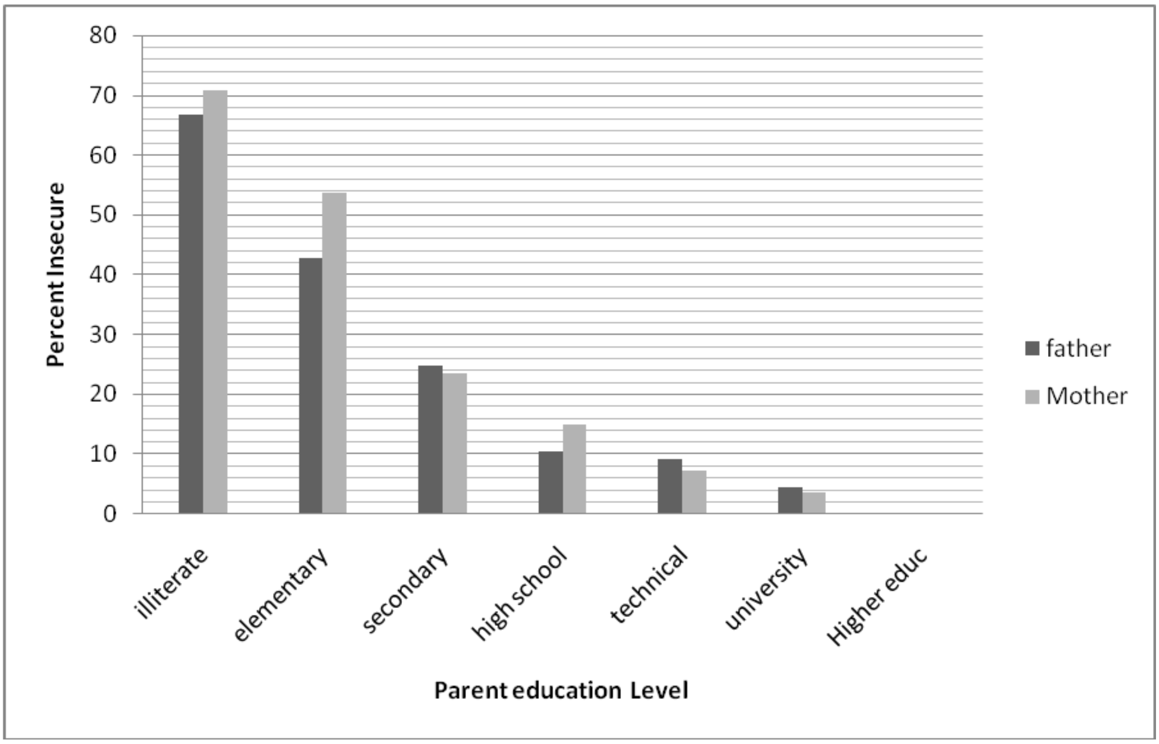


Figure 4.2. CFI and Father and mother education level

4.9.3 CFI and anthropometric measurements

The prevalence (%) of the sample population within each classification of anthropometric measurements according to CDC Z-score is given in Table 4.11 (Kuczmarski et al., 2000).

Table 4.11. Body measurements according to CDC Z-score: number (%)

	CDC z-score				
	≤ -2	**-2 and -1**	**-1 and 1**	**1 and 2**	**≥ 2**
	N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**
Weight-to-age (WAZ)	41 (3%)	170 (11%)	930 (61%)	290 (19%)	94 (6%)
Height-to-age (HAZ)	42 (3%)	226 (15%)	1019 (67%)	199 (13%)	39 (3%)
BMI-to-age	44 (3%)	130 (9%)	927 (61%)	323 (21%)	101 (7%)
Mid-arm-to-age	72 (5%)	333 (22%)	809 (53%)	142 (10%)	164 (11%)

Adding up the first two columns ($Z < -1$), the expected maximum prevalence is 17% and last two columns ($Z > 1$) the expected prevalence is 17% in a normal population distribution. However, our results showed a larger cumulative prevalence, i.e. body weight was 14%, less than the expected in Z <-1 and more than expected in Z >1 (25%). The height measures were in-line with expected growth in both sections. However, the BMI calculated was less than the expected in Z < -1 (12%) and more than expected in Z >1 (28%). Furthermore, the mid-arm measures were higher than expected in both sections Z < -1 (27%) and Z > 1 (21%).

Subsequently, further statistical investigation was conducted to explore the factors that influence the BMI of the children from the different regions and different socio-economic backgrounds. The total sample distribution according to the BMI by age (CDC Z score calculated using Epi-info) is demonstrated in Table 4.12. The first factor appearing in the table is the geographical region where the child resides. Further, table 4.12 illustrates the regions with the highest percent of children with BMI Z scores below -2, are the Bekaa 4.3% and the North 3.7%. The expected percent for this category is 2.25% and thus observed percentage above 2.25% could be interpreted as a region with higher than expected prevalence of children that are wasted.

Table4.12. Total sample distribution of BMI by age according to geographical region, gender, school type and parents' educational level

	BMI to AGE										
	≤ -2 N (%)		-2 and -1 N (%)		-1 and 1 N (%)		1 and 2 N (%)		≥ 2 N (%)		P-value*
Region											
Beirut	3	2.10%	14	9.90%	83	58.90%	29	20.60%	12	8.50%	
Beirut Suburbs	9	2.80%	29	9.00%	176	54.70%	82	25.50%	26	8.10%	
Mount Lebanon	2	1.10%	13	7.40%	92	52.30%	52	29.50%	17	9.70%	
Bekaa	9	4.30%	19	9.10%	142	68.30%	25	12.00%	13	6.30%	
South	11	2.70%	30	7.40%	272	67.00%	77	19.00%	16	3.90%	
North	10	3.70%	25	9.20%	161	59.40%	58	21.40%	17	6.30%	**0.004**
Gender											
Boy	23	3.00%	61	7.90%	449	58.20%	168	21.80%	70	9.10%	
Girl	21	2.80%	69	9.20%	477	63.30%	155	20.60%	31	4.10%	**0.002**
School Type											
Public	14	2.90%	46	9.40%	343	70.10%	67	13.70%	19	3.90%	
Private Free	9	2.70%	25	7.40%	205	60.70%	78	23.10%	21	6.20%	
Private paid	21	3.00%	56	8.10%	375	54.30%	178	25.80%	61	8.80%	**<0.001**
Father Education											
Illiterate	2	1.40%	16	11.60%	93	67.40%	25	18.10%	2	1.40%	
Primary	15	3.70%	23	5.70%	274	68.30%	62	15.50%	27	6.70%	
Secondary	16	4.60%	36	10.30%	190	54.40%	83	23.80%	24	6.90%	
High/Tech School	7	2.20%	33	10.20%	186	57.40%	73	22.50%	25	7.70%	
University	4	1.50%	20	7.50%	155	58.30%	67	25.20%	20	7.50%	**0.001**
Mother Education											
Illiterate	4	2.90%	15	10.90%	100	73.00%	15	10.90%	3	2.20%	
Primary	9	3.20%	26	9.20%	192	67.80%	45	15.90%	11	3.90%	
Secondary	12	3.20%	31	8.20%	229	60.30%	82	21.60%	26	6.80%	
High/Tech School	12	2.90%	35	8.40%	231	55.40%	104	24.90%	35	8.40%	
University	6	2.00%	22	7.40%	169	56.90%	74	24.90%	26	8.80%	**0.002**

* P-value produced by the Pearson Chi-square; significant p-values are in bold

On the other side of the spectrum, children with Z scores greater or equal than +2, the Bekaa and the North regions are the lowest with the prevalence of children in this category. As for the gender factor, the results appear to be similar for boys and girls in the category below -2 (3.0% for boys, and 2.8% for girls), though in the next category (-1 to -2), a high proportion of girls is noted (9.2% of girls compared to 7.9% for boys). The difference becomes more obvious on the other extreme category where 9.1% of boys have a BMI to age score above Z score of +2 as compared to only 4.1% of girl participants.

In addition, the role of school in the BMI distribution is evident as well, where the percent of children with BMI Z score between -1 and 1 (expected to be 68%) was actually 70% in the public school, 60.7% for the private for free, and 54.4% for the private paid. The rest of the children were in favor of lower Z scores in the public school, and higher Z score for the private schools. Similarly, mother education was found to be associated with the BMI to age Z score category the child belonged to. Starting with 73% of children to illiterate mothers with BMI Z score between -1 and 1, this percent drops as the mother education increased till 55% when mother education is above secondary level. Major discrepancy between the children occurring at higher scores of the Z distribution, for instance the percent of children belonging to the Z of +1 to +2 value, was almost 11% when the mother is illiterate, 16% when the mother with primary education, 21.6% for mother with secondary education and 25% for higher maternal education.

Table 4.13. Body measurements according to percentile cut-off values: number (%) (Kuczmarski et al., 2000)

	CDC cut-off points						
	<10% N (%)	**10-15% N (%)**	**15-25% N (%)**	**25-75% N (%)**	**75-85% N (%)**	**85-90% N (%)**	**>90% N (%)**
Waist circumference	304 (22%)	95 (7%)	175(12%)	657 (47%)	78 (6%)	42 (3%)	55 (4%)
Triceps	332 (22%)	97 (6%)	184 (12%)	723 (48%)	82 (5%)	48 (3%)	57 (4%)
Subscapular	414 (27%)	115 (8%)	128 (8%)	608 (40%)	126 (8%)	40 (3%)	89 (6%)

The triceps and subscapular skinfolds and waist circumference were categorized using the CDC data on percentile (Kuczmarski et al., 2000). As can be seen in Table 4.13, waist circumference distribution in our sample was more than expected at the lower end (22% against the expected 10%) and less than expected at the higher end (4% against the expected 10%). Similarly, the triceps measurements were more than expected at the lower end and less than expected at the higher end. Finally, the subscapular measurements were more than expected at the low end, and less than expected at the high end.

4.9.4 CFI and Child Food Knowledge (CFK)

The Child Food Knowledge (CFK) test consisted of 73 questions including questions about the food guide pyramid, food hygiene and food habits. Multiple comparisons were applied to all the children. The food knowledge was created to be over 100 to facilitate interpretation. Thus a child scoring 50 has answered 50% of the question correctly. The mean of the scores was 58 (± 15) with a margin of minimum 0 score to 100.

Multiple comparison testing, namely the Bonferoni technique, was applied for the association between the children's BMI and test score (Figure 4.3). The children with BMI Z-score between -2 and -1 (specifically at risk of underweight) had a significantly ($P < 0.001$) lower FKS average score compared to the children with normal BMI (i.e. $-1 <$ BMI $Z < +1$). Moreover, children at risk for overweight ($1 <$ BMI $Z < 2$) demonstrated better knowledge score compared to children with lower BMI ($P < 0.001$).

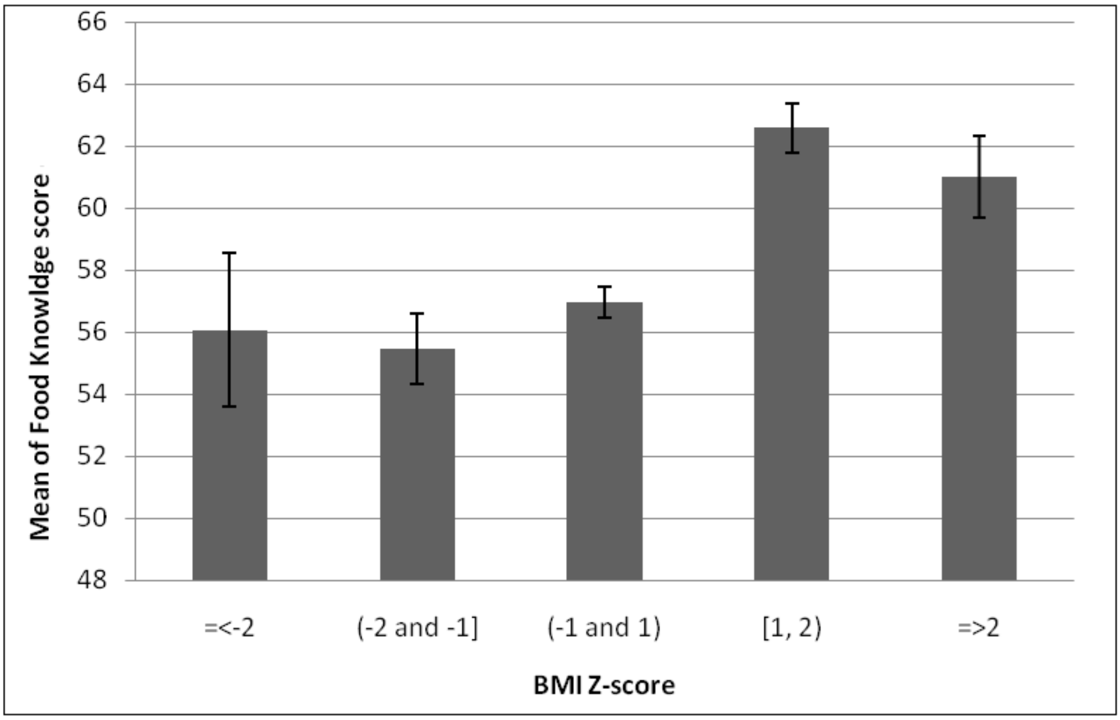


Figure 4.3: Mean CFK score (± SD) and BMI Z-score

As the level of CFS went from high to very low, the score of food knowledge became lower in an almost linear fashion (P <0.001). Similar patterns were observed among boys and girls, as depicted in Figure 4.4 (P <0.001). Girl participants scored better than boys in the same FI status. An interaction test was applied between the BMI and the FKS, the p-value for the interaction was 0.546, which did not prove to be statistically significant. Further, a regression model was applied including BMI, CFS with CFK which also did not prove to be statistically significant.

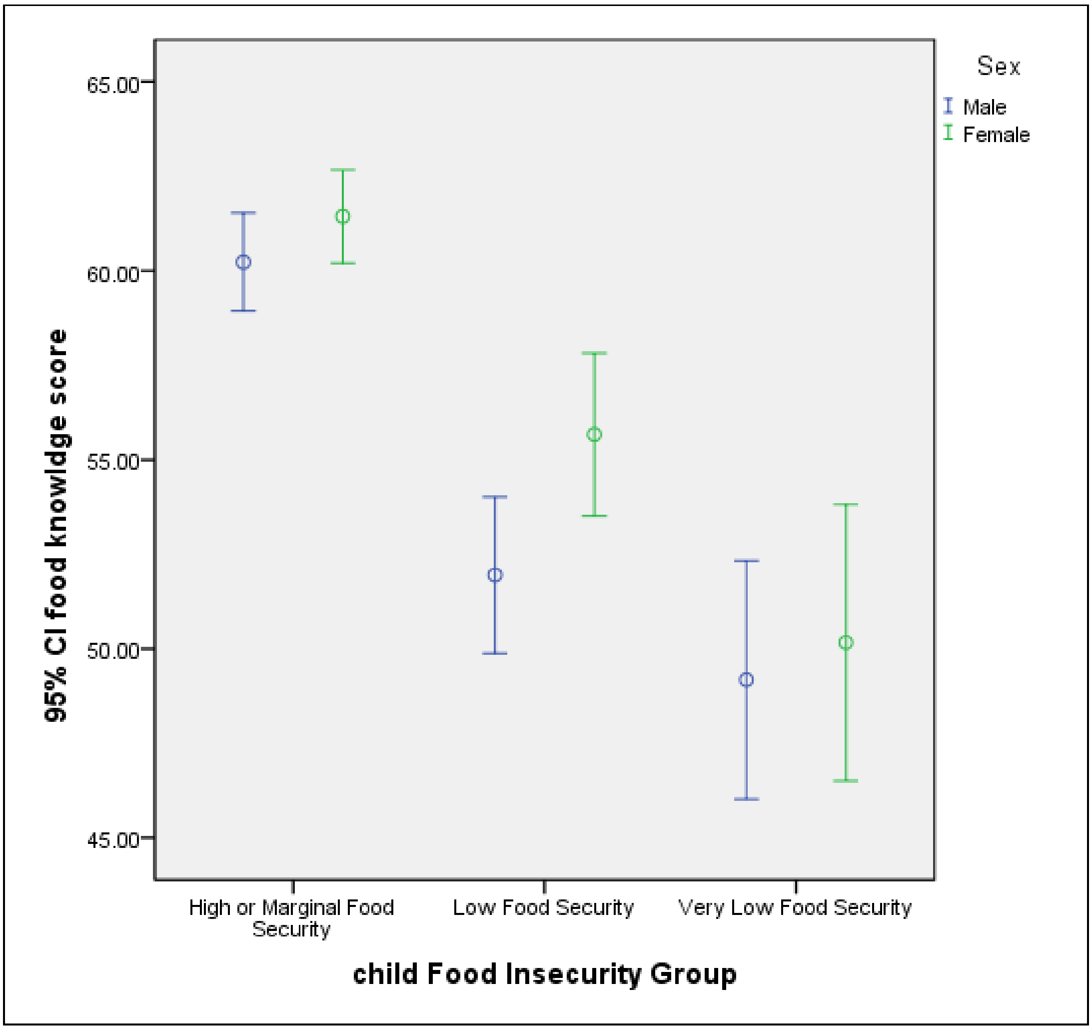


Figure 4.4. Mean and 95% Confidence Interval for CFK questionnaire by gender and CFI Classification

The trend of an increase in food knowledge with increase in level of FS existed in the three groups of children from different types of schools (Figure 4.5). The average CFK score increased starting from public school, to subsidized and private schools (P-value < 0.001).

The statistical interaction between Child BMI and food knowledge was checked, but the results did not show any interaction (p= 0.546). Subsequently, a regression model was applied with BMI and child food security classification (CFS) and food knowledge as outcome. The results showed both BMI classification and CFS were related to food knowledge but there was no interaction between the two factors and thus no statistical significance was derived. Further, comparisons were investigated between CF categorie and child food knowledge score within the six geographic regions but no statistically significant interaction was observed.

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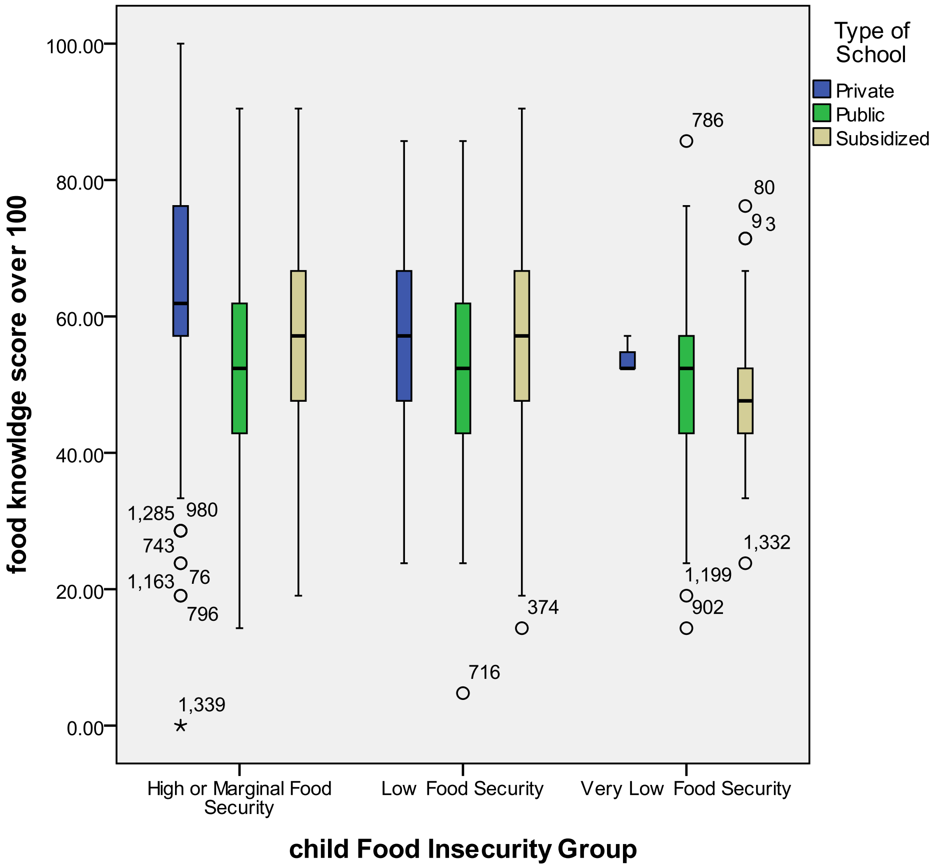


Figure 4.5. Box plot for CFK score of children from public, private and subsidized schools and CFS classification.

4.9.5 CFI and Children's Physical Activity

The child physical activity was measured by the MET, the higher the MET the more active the individual. The mean MET for all the children in the study was 14 (SD 5), the minimum was 9 and the maximum was 69 (Table 4.14). Boys had a higher MET than girls (P<0.001) and children from public schools had a higher MET than private school children (P=0.005). The highest MET was found in the South Region of Lebanon. There was no difference in MET according to CFS (P= 0.357) as illustrated by Table 4.14.

Table 4.14. Mean MET values according to gender, region and FS classification

	Mean (SD) MET value	P value
Gender		
Boys	14.4 (4.9)	**<0.001***
Girls	13.4 (4.6)	
School Type		
Private	13.5[a] (4.9)	**0.005^**
Public	14.4[a] (4.7)	
Subsidized	13.9 (4.5)	
Region		
Beirut	13.2 (4.0)	**<0.001^**
Suburbs	12.8[a] (2.9)	
Mount Lebanon	14.7[a] (6.4)	
Bekaa	13.8 (4.1)	
North	13.4 (4.1)	
South	15.9[a] (6.2)	
Child Food Security		
High/Marginal	13.8 (5.0)	0.357^
Low	13.9 (4.2)	
Very Low	14.5 (4.7)	

* P-value produced by the independent t test; ^p-value produced by the ANOVA F test; significant p-values are in bold
[a] Letters indicate pairwise comparisons that yielded statistical difference using the Bonferoni

4.9.6 CFI and Food Quality

As presented in Table 4.15, to statistically evaluate the food quality according to the level of CFI, both independent t test and ANOVA F tests were applied. The table 4.15 illustrates the number of convenience food portions consumed in the studied sample was higher for boys than girls (P=0.003), highest in public schools and lowest in private schools (P< 0.001), highest for Bekaa and south areas and lowest for the North (P=0.048). The convenience food consumption trend showed a linear and inverse relation with CFS, with the higher CFS children consuming less convenience food (P< 0.001).

Table 4.15. Mean (SD) portions of the food groups consumed according to gender, school type, region and CFS level

	Convenience Food	Starch	Fruits/ vegetables	Dairy	Protein
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Gender					
Boys	3.5(2.4)	3.0(1.4)	2.1(1.5)	1.8(1.3)	0.8(0.8)
Girls	3.2 (2.2)	2.8 (1.4)	2.1 (1.4)	1.7(1.2)	0.8 (0.8)
P-value*	**0.003**	**0.020**	0.671	0.261	0.168
School Type					
Private	3.0^{a} (2.2)	2.9 (1.4)	2.1^{b} (1.4)	1.8^{a} (1.2)	0.8 (0.7)
Public	3.7^{b} (2.4)	3.1 (1.3)	2.2^{b} (1.5)	1.8 (1.3)	0.7 (0.9)
Subsidized	3.6^{b} (2.2)	2.8 (1.4)	1.9^{a} (1.4)	1.6^{b} (1.2)	0.8 (0.9)
P-value^	**<0.001**	**0.033**	**0.008**	**0.030**	0.404
Region					
Beirut	3.2 (2.2)	3.1 (1.3)	2.2 (1.5)	1.9^{b} (1.3)	0.8 (0.8)
Suburbs	3.3 (2.3)	2.9 (1.4)	2.0 (1.3)	1.7 (1.2)	0.8 (0.8)
Mount Lebanon	3.3 (2.2)	3.1 (1.3)	2.3^{b} (1.5)	1.9^{b} (1.1)	0.9^{a} (0.8)
Bekaa	3.7^{a} (2.6)	3.0 (1.4)	2.2 (1.6)	1.9^{b} (1.3)	0.8 (0.8)
North	3.1^{b} (2.1)	2.8 (1.3)	1.9^{a} (1.3)	1.56^{a}(1.1)	0.7^{b} (0.8)
South	3.6 (2.4)	2.9 (1.4)	2.1 (1.4)	1.9^{b} (1.3)	0.8 (0.8)
P-value^	**0.048**	0.109	**0.021**	**0.003**	**0.027**
Child Food Security					
High/Marginal	3.2^{a} (2.2)	2.9 (1.4)	2.1 (1.4)	1.8 (1.2)	0.8 (0.8)
Low	3.6^{b} (2.4)	2.9 (1.3)	2.0 (1.4)	1.8 (1.2)	0.7 (0.8)
Very Low	3.9^{b} (2.7)	3.0 (1.3)	2.1 (1.5)	1.7 (1.2)	0.7 (0.8)
P-value^	**<0.001**	0.755	0.840	0.588	0.129

* P-value produced by the independent t test ^p-value produced by the ANOVA F test
significant p-values are bolded
[a,b] Letters indicate pairwise comparisons that yielded statistical difference using the Bonferoni

In the starch food group, there was a higher consumption of starchy foods for boys compared to girls (P= 0.02), a higher consumption among public school compared to private and subsidized schools (P = 0.033); however, there was no difference in the region of residence and the level child FS.

The vegetable and fruit consumption pattern was not different according to the gender (P= 0.671). The lowest consumption was among children in subsidized schools (P= 0.008). The highest consumption of vegetables and fruit was observed in children from Mount Lebanon and Bekaa, whereas the lowest consumption was seen in the North and suburbs (P= 0.021). There was no difference in portions of vegetables and fruit consumed according to CFS.

The dairy product consumption was the same for boys and girls, but a lower consumption was seen in the subsidized schools (P = 0.003), with the highest in private schools. According to region, the lowest consumption was seen in the North and highest in Beirut and Bekaa (P= 0.003). There was no difference in portions of dairy products consumed according to CFS.

Portions of protein consumed showed no difference according to gender and type of school (P= 0.168 and P = 0.404, respectively). According to region, the highest level of protein consumption was seen in Mount Lebanon and Beirut (P= 0.027). There was no difference in protein consumption according to CFS (P = 0.129).

Finally, for statistical clarification multi variant analysis was applied, to check the socio demographic factors that might influence the CFI while controlling the cofounders. Table 4.16 illustrates the results of the multivariate logistic regression, using CFI as the outcome and uses multiple variables to explain the CFI. In the statistical model, school type, gender of the child, age of the child, the mother education, the BMI, and the food knowledge were used. The results of the analysis proved that only school type was found to be statistically significant (p=0.042) and age was borderline significant (p=0.054).

Table 4.16. Multivariante analysis with CFI (dependent variable)

	B	S.E.	p-value	OR
School Type				
Public	2.319	1.142	**0.042**	10.3
Private (ref)	1			
Gender				
Girls	0.511	0.676	0.450	1.67
Boys (ref)	1			
Age	-0.592	0.307	0.054	0.553
Mother Education	-0.39	0.377	0.301	0.677
BMI	0.131	0.081	0.108	1.139
Food Knowledge Score	0.008	0.207	0.971	1.008

OR= odds ratio; SE = Standard error; B= Regression Coefficient; Significant p-values are in bold

As demonstrated in the results of school type, the probability of children to be CFI is ten folds more for children from public school compared to children from private schools (OR=10.3). As for age, the OR was 0.553, indicating that as age increases the odds of being FI decreases by about 45%, meaning that older children are more protected from CFI than younger ones.

4.10 Discussion

The current national survey included 1530 households with at least one school-aged child. There was an equal representation of age groups in terms of gender, school type and geographic area. There was no difference in the sample according to gender, area or school type. Adult, child and household FI prevalence rates were significantly dissimilar in the different geographical areas. It appears that CFI was most concentrated in three of the six regions of Lebanon in the North, the Bekaa mostly and less in Beirut. These results were predictable as the North and Bekaa are predominantly rural areas, with a high rate of urbanization and a low level of government funds. The capital Beirut, suffers from a high population density and urbanization that increased the number of FI households. These results are in accordance with Haddad et al. (1999), which states that rapid rate of urbanization in low- and middle-income countries is shifting the base of poverty from rural to urban areas.

Fotso (2006) conducted a comparative study of 15 African sub-Saharan countries to explore the extent of socioeconomic disparity between rural and urban CFI and child health. The study showed that in all the researched countries, discrepancy of FI and health conditions within urban children was greater than the overall urban-rural gaps. It was concluded that CFI and malnutrition have traditionally been higher in rural areas; however, the recent socio economic inequalities are higher in the urban context, especially when including populations from urban slums (Fotso, 2006).

Results from our analyses of the long list of correlates of FI, demonstrated that CFI households had a higher number of children, had a greater crowding index, lived in smaller houses, paid housing rent, did not own a car and spent less percentage of income on food. These socio economic factors were classified according to child FI and not urban–rural settings. In a similar context, Wolde et al. (2015) investigated the causative factors of under-nutrition in 7 to 14 years old Ethiopian school aged children. The authors documented that FI household, large family size, mothers without primary school education and inadequate carbohydrate intake were the primary determinants of children being underweight, stunting or wasting.

The body measures of the surveyed Lebanese children, when compared to the CDC standards, proved to be heavier particularly when looking at the BMI prevalence (i.e. the > +1 (25%) and >+2 (27.5%) Z-score values for BMI -for- age. These results support the findings of Sibai et al (2003) who stated that the obesity prevalence in Lebanon is close to observations of the high-income countries such as the US. However, ironically, the percentage of children below the threshold for 15th percentile in the waist (WC) and triceps and subscapular skinfolds were significantly higher than expected.

Nasreddine et al. (2012b) documented BMI data on 6 to 19 years old, overweight prevalence was 21% and obesity prevalence 11%, with the obesity rates being double in males compared to females (16% and 7%, respectively). The results of the current study for BMI +> 1 are close to these figures. The contrasting results for the triceps and subscapular skinfolds and the waist circumference place the weight of the children in the undernourished Z <-2. These divergent results could be the result of mishandling of the skinfold caliper and measuring tape. It is documented that anthropometric measurements inherently have a high chance of error between the measurement and the mechanical constraint (Geeta et al., 2009). For example, a source of error for the skinfold caliper could be the inverse numbering on the caliper, a researcher could mistake a 9 for 6 (Hashemi-Nejad et al., 2013). Alternatively, there is a chance that the international percentile cut off points for these measures are not applicable to all ethnicities, specifically the Middle Eastern population in this case.

Further, WC is not regarded as an important indicator of adiposity in children, until it has been proven to be a sensitive marker of upper body fat accumulation in children (Taylor et al., 2000). In a study conducted in Lebanon on metabolic syndrome in children, it was discovered that 100% of the participants had elevated WC, when compared to the WHO standards, considering the WC> 90^{th} percentile to be obese (Nasreddine et al., 2014a).

On the subject of children's nutrition knowledge, the CFK scores increased with child FS level, thus proving a linear correlation between CFK and child FS. The CFK was also better in girls compared to boys, plus children from private schools proved to have a slightly better knowledge about nutrition compared to children from other schools. However, the nutrition knowledge in this population needs improvement as the overall average was 50% with a maximal score of 64%. In an analogous study conducted on Lebanese adolescents, Nabhani-Zeidan et al. (2011) discovered that adolescents from high and low SES had good nutrition knowledge, but children from high SES scored better for the nutrition knowledge tests. Still, the analysis of the eating patterns showed that the nutrition knowledge was not put to practice most likely due to environmental and cost factors.

During infancy and early child hood the home environment is the main influence of eating habits and food choices (Perez-Rodrigo & Aranceta, 2001). Later on, school-aged children are influenced more by teachers, peers and people at school in addition to media and social leaders (Birch & Fisher, 1998). As children pass a great amount of their time in school, school-based health and nutrition education programs proved to efficiently achieve short and long term behavior changes (Kelder, 1995). Additionaly, Wardle et al. (2000) showed that nutrition knowledge of the young has a positive influence on lifelong food choices. Therefore, in an era of high technology it is challenging to develop a nutrition education curriculum to be interesting for the young. Many studies in high-income countries have experimented with the implementation of an educational program to promote healthy lifestyle (Manios et al., 1999), healthy habits (Fahlman et al., 2008) and increased physical activity (Gortmaker et al., 1999). Most of these studies have shown positive results, in the short term at least.

Consistent with our findings, Oldewage-Theron et al. (2010) tested the nutrition knowledge of 9 to 13 years old South African children, discovering many gaps in basic nutrition knowledge such as the role of food groups in a healthy diet and hygiene practices.

The food quality analysis of the surveyed population showed that Lebanese boys consumed significantly more portions of high carbohydrate (starch) and convenience foods compared to girls. Further, convenience food consumption showed a linear trend with the level of food insecurity. The FS children consumed less convenience food, and children from private schools consumed less compared to children from public schools.

The protein food group which included vegetarian and animal protein sources was higher in Beirut and Mount Lebanon, while it was lower in the North and the South. This could be explained by the fact that Beirut and Mount Lebanon are big cities, housing families from higher SES backgrounds who can afford more expensive protein foods.

Many studies from different country settings have demonstrated that children's dietary habits and meal consumption are related to the family SES status (Samuelson, 2000). Contrary to our results, studies from high-income countries have demonstrated that girls from low SES backgrounds have irregular daily meals and tend to over-snack (Hogluand et al., 1998). An article published by Howard (2013) evaluated the correlation between the HFI and the quality of food consumed by 10-13 year old children. The study concluded that children from FI households consumed a higher number of servings of fruits and vegetable per day, and that children who consumed larger quantities of fruit, green salad, carrot and other vegetables were more physically active. This study by Howard (2013) is in contradiction with the survey results which illustrated a low consumption of vegetarian foods. Still, it is in line with the activity results of the survey, where children from LS milieu had a higher MET than schoolaged children from HS background (P =0.005). According to Gordon-Larsen et al. (2006), the presence of recreational facilities near residence will encourage children to be physically active irrespective of SES, and is associated with BMI and physical activity level. This is not the case in Lebanon, where poor neighborhoods tend to have less green space appropriate for children, however as it was noted that a small percentage of LS families owned cars, thus the children are obliged to walk to school or do the daily chores by foot.

The present research highlights the need to focus on the CFI communities for the intervention study, offering nutrition related knowledge with minimal budget and home economics techniques for children and parents, in addition to basic hygiene and physical activity sessions.

4.11 Summary

This study has provided the background for the intervention study. Based on the findings from this study, the following criteria are needed for a successful intervention study:

1. To focus the interventional phase of the research project on one urban and one rural Lebanese CFI communities
2. To compare the intervention in rural and urban settings to evaluate the severity of CFI consequences on the child nutritional status and further assess the efficiency of the intervention of children's nutrition knowledge.
3. To ensure that all body measurements of the children are taken by the PI, before, during and after the intervention, to reduce and avoid measurement error.
4. To reduce measurement error, three anthropometric measurements of body parts to betaken.
5. To develop an efficient nutrition education intervention program to help alleviate the severity of CFI and help adopt healthier habits for families with nominal funds.

Chapter 5 : The value of targeted nutrition intervention and education in amelioration of food insecurity in children

5.1 Introduction

Child food insecurity is on the rise in both rural and urban communities. Nonetheless, limited number of efforts investigated the prevalence, causes and long term side effects of CFI. In Lebanon, three FI studies were conducted, two studies validated FI questionnaires translated into Arabic (Naja et al., 2015; Sahyoun et al., 2014) and the third based the FI survey on a marginalized community of Bedouin settlers (Ghattas et al., 2013a).

Very few studies have focused on CFI of school aged children, their nutritional status and nutrition education. In FI studies, more attention is stressed on maternal- infant malnutrition, breastfeeding and education of mothers of children less than five years (Bhutta et al., 2008). Many researchers confirmed that nutrition education of poor and FI mothers is successful in improving the nutrition outcome for young children (Kulwa et al., 2014); still, published research on nutrition education of both mother and child in FI conditions is limited.

Knowing that children experiencing CFI, have reduced quality and energy intake (Matheston et al., 2002), research to assess the dietary deficiencies and nutrition education of this age group is essential. In the last few decades, to evaluate the diet and nutrient defficiencies of individuals, researchers have apllied different methods such as dietary recalls, diet history, diet records and food frequency questionnaires (Sawaya et al., 1996). In an effort to improve the data gathered by the standard 24 hour dietary recall, in 1999 the USDA developed the 5-step multiple pass method (Conway et al., 2003). This method consists of five steps of dietary interview, through which the participants obtain prompts to help them describe foods they consumed in the previous day (Conway et al., 2003).

More recently a computer-assisted multi-pass method was developed, during which the program directs the respondent, providing response options for different drink and food options. In a research conducted to test the validity of this computerized method (Moshfegh et al., 2008), 78% of men and 74% or women of normal weight were categorized as acceptable energy reporters. However, energy intake was underreported by individuals classified as obese, considering their weight for height (BMI > 30). Previous research with adults has justified that three 24-hour dietary recalls (including two weekdays and one weekend day) over an average of one week period, is optimal for estimating energy intake (Yunsheng et al., 2009). Nevertheless, diet reporting errors are very common due to under- or over-reporting of portions (Black et al., 2001), inaccuracy in estimation of portion sizes (Poslusna et al., 2009) and selective misreporting of certain food types such as foods that are rich in fat and sugar (Scagliusi et al., 2003).

In an attempt to reduce bias in estimation of portion sizes of 24-hour dietary recalls, a study by Matthiessen et al. (2011) was performed on 9 to 12 year old children, to take digital photos of the food they consumed between 5 pm and bedtime for a week. Comparing the results with traditional 24-hour dietary recalls, the researchers discovered that the digital method was effective in assessment of all food groups except for grains such as bread. The advantage of the digital photo method is that different proportions of food in mixed dish could be estimated without depending on memory.

Advances in technology have created promising innovations even in 24-hour dietary recall. A recent effort was applied to quantify the daily beverage intake of 20 to 40 year old individuals through a three-day smartphone assisted recall (Smith et al., 2014). The results were compared to written 24-hour dietary recalls and urine samples were collected. The results showed that the smartphone recorded method reported fewer beverages than the written record. The authors concluded that this discrepancy of results was due to indolence of the participants who found the smartphone recording cumbersome. A similar innovation in 24-hour dietary recalls was pilot tested by Hongu et al. (2015), with young adults (aged 19 to 28 years), which was a new food picture application on smartphones. The program was designed to capture the images of each meal and snack before and after consumption.

All of the above innovations in 24-hour dietary recalls were unfortunately not applicable to the current sample as most of the parents or caretakers did not own computers or smartphones or were illiterate and had to have assistance with the 24-hour dietary recalls.

In this thesis, the previous studies translated the FI questionnaire into Arabic and tested its validity. In addition, prevalence of FI at the household, adult and child levels were estimated in the different Lebanese territories. In light of the above, the aim of this intervention was to work with households with CFI school aged children, to integrate both parents/caregiver and children in an intervention program. The aim is to improve the overall child health status and reduce eventual repercussions of CFI on children's development. Further, the experiment aimed to test the efficiency of nutrition educational sessions at the child and parent/caretaker levels. The results will be quantified at three stages: testing of the improvement of the child knowledge, variations in body measurements and modifications in the dietary intake pre and post intervention. Further, testing of other factors that might affect the wellbeing of the children such as the level of activity and mothers' education will be measured.

5.2 Ethical Approval

Approval for this study was given by the University Research Ethics Committee (UREC) of Oxford Brookes University (Appendix 22) and formal approval from the Lebanese Ministry of Education (Appendix 23), the authorization to collaborate with seven public schools for the intervention study.

5.3 Materials and Methods

5.3.1 Parent Questionnaire

For this intervention study, the parents' questionnaires consisted of the AFIQ (Appendix 6) and SEH (Appendix 25) questionnaires. The SEH was the same as the questionnaire used for the pilot and survey studies (Appendix 8), still some of sections of the original questionnaire were eliminated to have a concise form covering 21 questions (Appendix 25). The eliminated sections covered the child's health condition in addition to their nutrition knowledge and dietary habits.

The intervention sessions were designed based on the data derived from the analysis of SEH Questionnaire of the previous survey. Moreover, both AFIQ and SEH were validated for the pilot study, mentioned in section 3.2.1.

5.3.2 The 24 hours Recall Questionnaire

The recall applied in this study was developed by the PI (Appendix 26). The recall consisted of two pages of description of the foods classified according to food groups followed by three pages to fill in forms, to mark the types and quantities of food and drink consumed by the child over the 24 hour period. Each 24-hour dietary recall form included three sections for two week days and one weekend day on non-consecutive days. During the five months period of the intervention, 24-hour dietary recalls were collected from the IG at three time frames: before, during and after the intervention. However, for the CG, 24-hour dietary recalls were collected only before and after the intervention.

The PI met the parent or caretaker on a specified date in the school, for an explanatory session of the 24-hour dietary recall. The PI gave details of portion sizes using common household measures such as measuring cups, spoons and rulers. In addition, tri-dimensional food models (Figure 5.1) were used for different food groups to visualize portions (Nasco, 2015). Further, nutrition facts were explained for packaged foods. The participants were familiarized with the 24-hour dietary recall form to be completed. After data entry, the evaluation of 24-hour dietary recall and nutrient content of the specified portion sizes was applied using the food composition tables provided by N4 software (Axxya Systems, Nutritionist Pro for analysis, 2010) in addition to the food composition table of Middle Eastern foods for local and traditional dishes (Pellet & Shadarevian, 1970).

Figure 5.1. Food models for 24 HR diet recall (Nasco, 2015)

5.3.3 Child Food Knowledge Questionnaire (CFK)

The Child Food Knowledge (CFK) questionnaire (Appendix 27) consisted of 20 questions pertinent to the nutrition workshops addressed to the children and six questions related to the food guide pyramid. The 20 food knowledge questions addressed issues related to knowledge about subjects listed in Table 5.1. Each of the 20 questions had four multiple choices with only one correct answer. The correct answer was allocated a code of 1 and all other a 0 (including a non-response). Thus, adding the codes of the 20 questions per child provided a score ranging from 0 (all answers were wrong) to 20 (all answers were correct). Furthermore, for ease of interpretation, the score was transformed into a 100 point score (dividing by 20 then multiplying by 100). For the food pyramid section, the child was asked to match the six sections of the pyramid (bottom to top) with the correct choice of the 6 food groups provided (grains, vegetables, fruits, dairy, proteins and miscellaneous). A child correctly matching all six elements to their appropriate location in the pyramid received a score of six, whereas a child mislocating all six elements received a score of zero.

5.4 Enrollment

The intervention study was implemented in two economically deprived and geographically distant regions, the Bekaa and Northern regions of Lebanon, which proved in the survey to have a high prevalence of CFI (Figure 5.2).

The intervention study was conducted between December 2010 and May 2011, for a period of 20 weeks. The sample of schools was chosen from the previous national survey.

The schools included in the study were chosen from Bekaa (rural); two intervention schools and two control schools. The second geographic location Tripoli (urban) schools chosen were; one intervention school and two control schools. Only one school was chosen from the urban area as the school had a large number of enrolled students and a large number of parents were cooperative to take part in the study. Moreover, all the seven schools included were homogenous at baseline because they had many had many specifications in common such as:

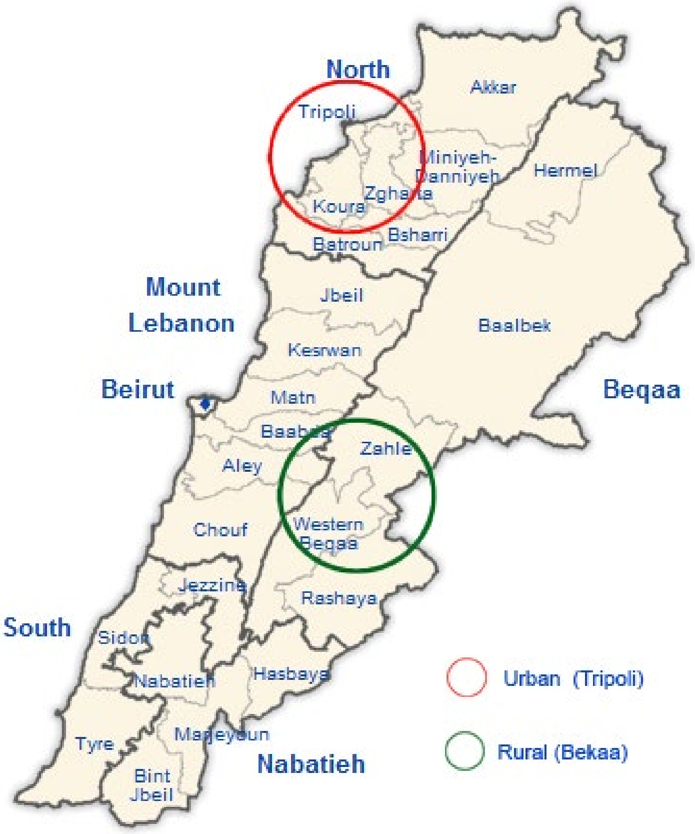


Figure 5.2. The Intervention study geographic locations

-all were public schools

-mixed students: boys and girls

-the second spoken language was French

-classified as medium to large schools

-students and their respective families were similar in their socio-demographic characteristics

5.4.1 Subjects and sampling methods

Schools within each region were randomly allocated to either arms of the student. This form is known as cluster randomization, and functions when the participants are clustered within families, clinics, or in our case school grade levels. Cluster randomization method protects the study results from potential bias, specifically in this intervention study children attending the education sessions, could share the information with their friends and peers, a statistical phenomenon referred to as contamination. Additionally, due to the nature of the intervention (educational training sessions) blinding was not achievable. However, in this case measurement bias is not threatening since most outcomes variables are objective such as anthropometric measures.

The schools were contacted and detailed invitation letters (Appendix 24) were sent to the parents of children aged 7 to 10 years. During the first parents' meeting in December 2010, the PI explained the full details of the intervention study and the degree of cooperation required from the parents and children until completion.

The parents were given detailed consent forms to sign, in addition to the AFIQ (Appendix 6) and the SEH (Appendix 25) questionnaires to be filled in. After the completion of the forms, the PI measured the level of CFS; families who were deemed to be child FS were discouraged from participating in the study. The original sample of participating households was 161 families. The parent or caretaker was given an appointment to meet with the PI on a different day to be given the 24 hrs diet recall form (Appendix 26). This form is a one-day diary detailing the foods consumed by an individual, specified in quantities and quality. In this case, the parent or caretaker was assigned to record the details of the child's diet for three days including (two weekdays and one weekend day). Thus, during the second meeting the PI explained the form and method used to enumerate the different foods and beverages consumed. In the case of illiteracy or other disability of the mother or caretaker, another close member of the household was asked to complete the task. The forms were handed in after one week.

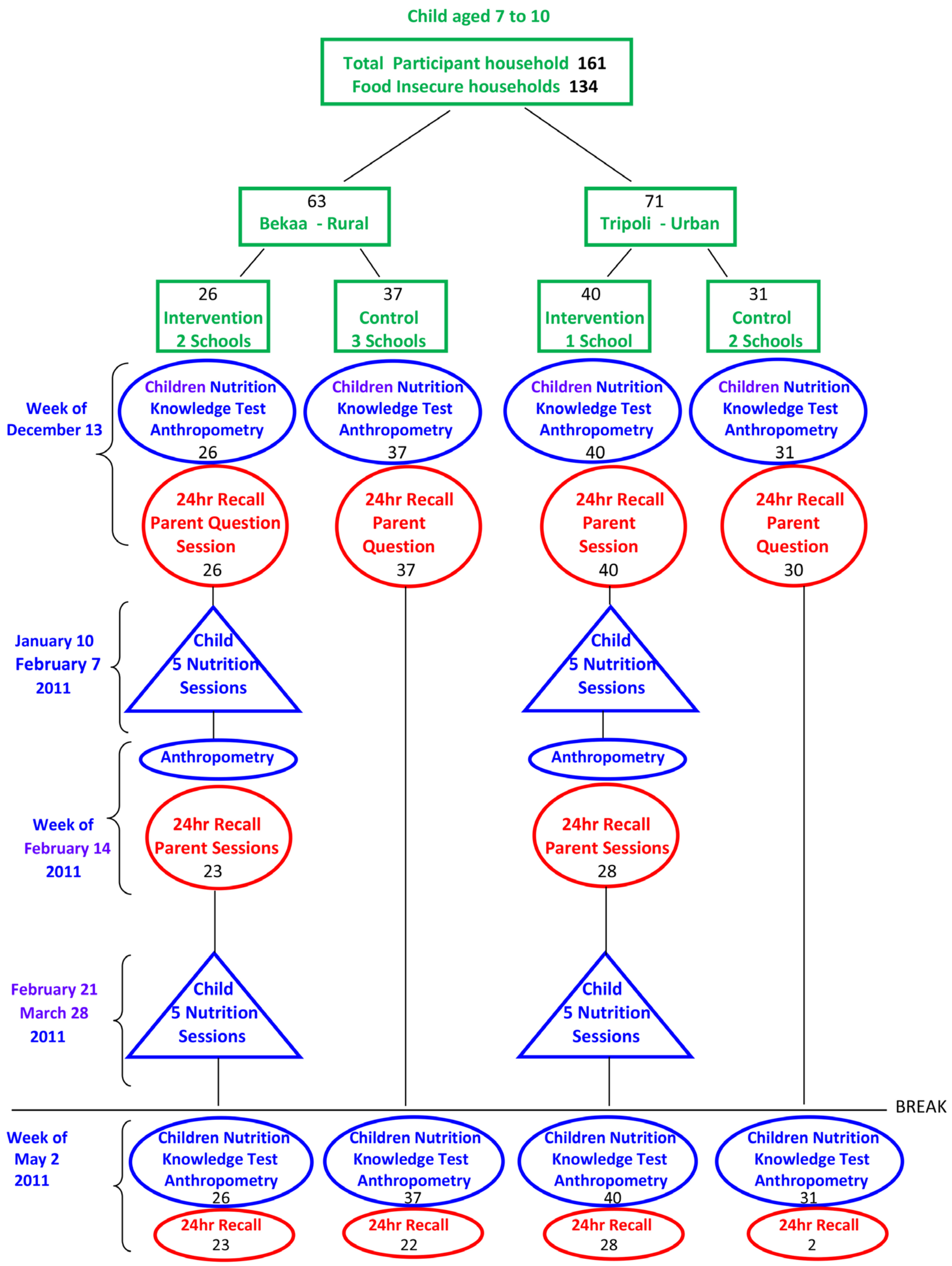
The total number of children combined in the study were 161, but during data analysis 27 households were considered to be CFS, therefore these households were withdrawn from the study. The final sample size for data analysis consisted of 66 intervention group (IG) and 68 control group (CG), adding up to a total of 134 households.

5.5 Intervention Study Program

The current study focused on school-aged children (7 to 10 years) with mild to severe CFI. The intervention covered 20 weeks, starting with the recruitment of the households that took place during the first week. In the succeeding weeks the following steps were undertaken (Figure 5.3):

- Interview parent/caretaker of each child involved, to measure the extent of CFI and to apprehend the dietary habits. Both parents of the intervention group (IG) and control group (CG) were involved.
- Interview children of the households enrolled to understand the extent of their basic nutrition knowledge, anthropometric measurements taken at baseline for both IG and CG children.
- Parent session to complete a 24-hour dietary recall for both IG and CG.
- Basics of home economics, healthy child nutrition instructions and cooking tips given to mother/caretaker of IG only.
- Children of IG given five healthy and economical nutrition sessions, on a once per week basis.

– Mid-intervention measurements taken and 24-hour dietary recalls collected for a second time only for IG children.



(*) Numbers of Participants at the different phases of the study are indicated in black.

Figure 5.3. Flowchart showing details of the intervention study

- IG children given the second set of five healthy and economical nutrition sessions, on a once per week basis.
- At the end of 20 weeks, both IG and CG children tested for nutrition knowledge and anthropometric measurements taken.
- IG and CG parents complete the last 24-hour dietary recall for three days during the 20th week of the study.

5.5.1 Parent Nutrition Education Workshops

Research about the mother's nutrition knowledge and education has been well documented in section 2.8.2. In this study, there were two educational sessions for the IG caretaker or parent: one in December 2010 and a second session during the first week of February 2011. The IG baseline session provided information on the method to complete the 24-hour dietary recall and general nutritional guidelines for the children, based on data collected previously about the regional food habits. Further, home economic and food management skills such as making a budget, bills management and stretching grocery were included. In addition, detailed shopping and cooking tips for a family on a budget were provided. The CG baseline session of the parents in December 2010, provided only information to complete the 24-hour dietary recall and the aim of the study was explained.

During session two, feedback and reinforcement was given on the progress of the children, in addition to tips on recipes on a budget and food preparation for a basic household of four on less than 10,000LL (7 US $/meal). The two parents' sessions were followed by breakfast brunch and food rations were distributed. The parents of CG participants did not get any information, but food rations were distributed to each household after each 24-hour dietary recall collection.

5.5.2 Child Nutrition Education Workshops

Research about child nutrition knowledge and education has been well documented in section 2.8.1 of this thesis. In this study, the child educational sessions included ten sessions, on a once per week basis, for 45 minutes. The organization of the session was in the following manner: 10 minutes repetition of the main points from the previous session and handouts; 15 minutes explanation of a new concept; 10 minutes demonstration; and 10 minutes questions and distribution of new handouts. Table 5.1 gives details of the subject and objectives of each session, in addition to the activities applied after the theoretical explanation and handouts distributed to reinforce the subject to the children.

5.6 Anthropometric body measurements

During the same week, the PI visited the children on a specified date and time agreed by the school administration. The children were given a brief about the upcoming research and they signed the consent forms. The PI interviewed each child for the Child Food Knowledge (CFK) questionnaire (Appendix 27) and body measurements were taken by the PI.

Children's height and weight were measured using standardized techniques and BMI Z-scores were calculated to express the deviation from the mean CDC growth chart values (Ogden et al., 2002). The measurements were taken by the PI; three readings for each measurement were recorded and an average value calculated. The details of the anthropometric measurements are mentioned in details in section 3.5 of this thesis

Table 5.1. Child Nutrition Education Sessions Program

SESSION	TITLE	OBJECTIVE	ACTIVITY	HANDOUTS
1	Food Guide Pyramid	Variety and balance of nutrients from each group	Handcraft and demonstartions about the food guide pyramid	Pyramid handicraft to tag and color as home activity Appendix 30
2	Fruits and Vegetables 5 a Day	Importance of daily intake of fruits & vegetables, daily consumption of 5 colors, low cost weedand seasonal vegetables	Preparation of Mallow and purslane salad	Create a vegetarian recipe and coloring of the vegetables' sheet Appendix 31
3	Calories and the meal distribution in one day (adult/children)	Importance of meals and timing precise quantities for child	Preparation of a healthy breakfast	Home activity to create a healthy one day menu for a child with coloring page Appendix 32
4	Protein and Dairy Intake	4 a day Calcium food sources and the story of Mr. Tooth, Vegetarian and animal protein sources	The cycle of milk from cow, to factory to supermarket Visit to milk farm	Recognition of Calcium sources in menu + Maze Appendix 33
5	Sugar and Fat in our Diet	Recognition of foods high in fat and sugar	Peparation of fruit salad	Homework listing of foods health with coloring activity Appendix 34
6	Fiber and Health	Fiber in the daily food choices	Preparation of pasta necklace and saaj bread cooking	Daily fiber needs calculations. Make a list of fiber rich foods and coloring activity Appendix 35
7	Daily Hygiene	General hygiene basics, source of virus / bacteria in our lives	Demonstrations on daily hygiene routine	
8	The activity Pyramid	The importance of daily physical activity	Demonstartion with sports teacher daily physical activity	Coloring of the activity Pyramid Appendix 36
9	The importance of Drinking Liquids	Avoiding carbonated drinks and juices and commercial juice consumption	Preparation of fruit Milk Shake & Ayran (Salty Yogurt Drink)	Leaflet Water Content of Foods Appendix 37
10	Easy and quick meals /snacks	Cooking healthy (meals and snacks) on a budget and thrifty grocery shopping	Preparation Vegetarian pasta salad /Popcorn	

5.7 Sample Size Determination

For this study the sample size focused on comparing the intervention group to the control group. The sample size calculation was based on the change in food knowledge score that will be produced by the intervention and thus comparing the two groups at the end of the intervention. The formula to choose a representative sample was (Rosner, 2010):

Sample size per group = (σ12 + σ12/κ)(Z1-α/2 + Z1-β) / (U1-U2)2

κ = ratio of sample size per group, in this case it was 1

σ = standard deviation of food score knowledge estimated at 30

U = mean food knowledge score for both groups estimated to be 60 for the control group and at least 75 for the intervention group

Z1-α/2 = was the standard normal distribution cut point for alpha of 5% and was equal to 1.96

Z1-β= was the standard normal distribution cut point for power of 80% and was equal to 0.8416

N calculated was 60 per group

Thus a total of 120 children, from both genders, were needed to obtain a statistically representative data for this study. The final sample was recruited from schools in 2 different regions in Lebanon and thus the size of sample was affected by the classrooms of these schools. The total sample recruited was 161, out of whom 134 met the criteria of being CFI, 66 in the IG, and 67 in the CG. This provided the required power (at least 80%) to detect statistical differences. Even for the nutrition intake data (derived from the 24 hour recall), which had a lower sample size due to the complexity of the data collected, this still had the necessary power (i.e. at least 80%) to detect statistical differences in the measurements between the two groups.

5.8 Statistical Analysis

Information collected from parents and children, including anthropometric measures, socio-economic questionnaire, 24-hour dietary recalls and food knowledge questionnaires, were coded and entered into the computer using Excel and then exported to SPSS V18. Continuous variables such as age, weight, and BMI were evaluated for departure from normal distribution. To check for normal distribution, mean and median were compared, histograms were generated and shape evaluated and QQ plots were evaluated, as well as the Kolmogorov–Smirnov test. There was no evidence of marked deviation from normality that would warrant special procedures. Control Group (CG) and Intervention Group (IG) groups were compared for general characteristic to establish comparability between the two groups at the baseline and thus rule out any potential selection bias effect.

The computed statistics were frequency and percentage for categorical data and means and standard deviations for numerical data. The baseline data were compared using the independent t test for continuous variables, such as age, gender, and income, whereas the Pearson's Chi-square test was used to compare the two groups for categorical variables, such as gender.

The data from the 24-hour dietary recalls was entered in the computer as approximation of household measures of given simple (uncombined) foods chosen from the Nutrition Pro program; however, combination foods were checked for recipes already included in the program. New recipes were entered in the Nutrition Pro program and labeled accordingly. The resulting nutrient analysis provided a report of energy, macronutrient and micronutrient details of the average of the three days.

Impact of intervention was addressed for three major categories of outcome variables: 1) nutritional intake; 2) food knowledge; 3) anthropometric measures. The analysis approach was identical for all three sections:

The CG and IG were compared at baseline and after intervention for differences in nutrient intake from 24-hour dietary recalls, food knowledge score and anthropometric measurements. The comparisons were based on the independent t test or the Person's Chi-square depending on nature of the variable.

Differences in means from baseline to post intervention were computed by subtracting the baseline values from the post intervention values and assessed using the paired test.

In the case of the nutritional data, a third time point measure was done during intervention for the IG only, and the repeated measures ANOVA was utilized to assess statistical significance among the three time points: baseline, during intervention, and post intervention.

5.9 Results

The results of the study are divided into four sections: (i) descriptive results of the sample; (ii) dietary analysis; (iii) Child Food Knowledge results; (iv) Anthropometric measurements.

5.9.1 Descriptive Statistics

The sample of CFI children participating in the intervention study was comparable in the control and intervention groups in terms of gender and region (Table 5.2).

Table 5.2. Distribution of the sample between intervention and control groups

	Total N =161	Control Group	Intervention Group	Total %	P-value
North N=88	Boys N=51	21 (56.8%)	30 (58.8%)	58.00%	
	Girls N=37	16 (43.2%)	21 (41.2%)	42.00%	0.999*
	Total	37	51		
Bekaa N=73	Boys N=39	23 (54.8%)	16 (51.6%)	53.40%	
	Girls N=34	19 (45.2%)	15 (48.4%)	46.60%	0.816*
	Total	42	31		
				Interaction	0.97

* P-value produced by the Pearson Chi-square; significant p-values are in bold

When comparing the socio-economic characteristics at baseline for CG and IG, there was no selection bias. The two groups had very similar characteristics in terms of housing, car ownership, and residence with both parents and the educational level of the parents. Therefore, any change that may appear at the end of the intervention study was unlikely to be attributed to the effect caused by the selection bias or the initial factors listed in Table 5.3.

Table 5.3. Comparison of socio economic factors between intervention and control groups

	Intervention		Control		Total		
	N	%	N	%	N	%	p-value*
Number of rooms in the house (besides the kitchen and the bathrooms)							
One	9	11%	9	11%	18	11%	0.518
Two	24	29%	18	22%	42	26%	
Three	30	37%	38	48%	68	42%	
Four or more	18	22%	14	17%	32	20%	
Type of residence:							
Private	42	51%	44	55%	86	53%	0.709
Rent	37	45%	32	40%	69	43%	
Refugee	0	0%	1	1%	1	0%	
Unspecified	2	2%	2	2%	4	2%	
Number of vehicles (cars & trucks) in the household:							
None	56	68%	50	63%	106	65%	0.507
1	26	31	28	35%	54	33%	
2	0	0%	1	1%	1	0%	
The child is living with:							
Parents	79	96%	78	98%	157	97%	0.267
Single parents (divorced)	2	2%	0	0%	2	1%	
Single parents (multiple marriage)	1	1%	0	0%	1	0%	
Relatives	0	0%	1	1%	1	0%	
Father education							
Not able to read or write	15	18%	21	27%	36	22%	0.333
Completed elementary	54	67%	42	54%	96	61%	
Completed intermediate	8	10%	8	10%	16	10%	
Completed secondary (bacc)	2	2%	5	6%	7	4%	
Completed Technical school	1	1%	0	0%	1	0%	
Completed College	0	0%	1	1%	1	0%	
Mother education							
Not able to read or write	9	11%	13	16%	22	13%	0.484
Completed elementary	42	52%	41	52%	83	52%	
Completed intermediate	26	32%	19	24%	45	28%	
Completed secondary (bacc)	2	2%	4	5%	6	3%	
Completed Technical school	0	0%	1	1%	1	0%	
Completed Higher Education	1	1%	0	0%	1	0%	
Does monthly household income cover all the food needs							
No the Salary is not enough	28	34%	36	45%	64	39%	0.334
Yes it covers some of the food needs	49	59%	39	49%	88	54%	
Yes it covers all of the food needs	5	6%	4	5%	9	5%	
Total Household Income							

Under 550 K LB / Month	49	59%	42	53.20%	91	56%	0.319
551 - 700 K LB / Month	24	29%	31	39%	55	34%	
701 - 1199 K LB / Month	7	8%	5	6%	12	7%	
1200- 2000 K LB / Month	2	2%	0	0%	2	1%	
>2000 K LB / Month	0	0%	1	1%	1	0%	
Do you have a regular income if yes							
Yes	8	9%	6	7%	14	8%	0.627
No	74	90%	73	92%	147	91%	
Monthly salary							
Yes	4	4%	2	2%	6	3%	0.432
No	78	95%	77	97%	155	96%	
Do you have any private source of fruits, vegetable or any other food type							
Yes	6	7%	0	0%	6	3%	**0.014**
No	76	92%	79	100%	155	96%	

* P-value produced by the Pearson Chi-square; significant p-values are in bold

It is worth mentioning that more than half of the sample in the IG (60%) and the CG (57%) were below the minimal national income of 600,000 LL Lebanese pounds (Table 5.3). Further, as illustrated in Table 5.3, more than 90 % of the sample in both groups had no regular monthly salary or income. A significant difference between the two groups was the question concerning the “private source of fruits, vegetables or any food”; however, the impact of this was considered to be minimal as the percentage of parents reporting to have a private source was very small (4%).

5.9.2 Dietary analysis and nutrient intake

The dietary intake of the children is derived from the 24-hour dietary recalls collected at three different phases of the intervention: at baseline, week 10 mid-intervention and week 20, directly post intervention. The total number of 24-hour dietary recalls analyzed added up to either 132 at baseline and 101 post intervention. From a total of 161 participanting households, 28 households did not provide information for baseline and 60 families did not provide full details of the 24-hour dietary recalls for the mid and end of intervention analysis. Therefore, the dietary analysis focused on 132 children's diets (54 control, 78 intervention) for baseline analysis and 101 children's diets (50 control, 51 intervention) for post intervention analysis. All remaining measurements and CFK statistics are based on the total 161 children.

Table 5.4. Macronutrient intake for CG and IG at baseline

	Control (CG) N=54		Intervention(IG) N=78		
BASELINE	Mean	SD	Mean	SD	P-value*
Kilocalories (kcal)	1937	610	1859	732	0.521
Protein (g)	67.8	27.1	66.4	29.7	0.777
Carbohydrate (g)	236.0	72.5	227.2	86.8	0.540
Cholesterol (mg)	193.9	137.2	152.2	95.1	**0.041**
Fat, Total (g)	83.0	31.8	78.7	35.7	0.487
Saturated Fat (g)	20.3	8.3	18.5	9.2	0.237
Monounsaturated Fat (g)	27.8	10.2	24.1	12.0	0.064
Polyunsaturated Fat (g)	18.6	9.0	16.4	9.4	0.183
Dietary Fiber, Total (g)	17.6	7.6	16.8	8.3	0.599
Sugar, Total (g)	76.4	39.0	72.0	46.5	0.574

* P-value produced by the independent t test; significant p-values are in bold

For continuous variables, such those present in table 5.4, their distribution was tested for normality. Departure from normality was tested using different techniques including checking for the distribution using a histogram, comparing the difference between the mean and the median, looking at the QQ plot, as well as using the Kolmogorov–Smirnov test for normality. The variables present in table 5.4 were found to meet the normality requirement, since all had a non significant Kolmogorov–Smirnov test p-value.

At baseline the dietary intake of macronutrients was similar in both groups, except the CG had a higher energy intake and higher intakes of total fat and sugars and total calories, although these differences were not significant as shown by the tabulated p-values (Tables 5.4 & 5.5).

Table 5.5. Macronutrients as percent energy for IG vs CG

Nutrient	(%) contribution diet **CG**	(%)contribution diet **IG**	**P-value***
Protein	271 calories (~13.8%)	265Calories (~14.1%)	0.777
Carbohydrate	944 calories (~48.1%)	909Calories (~48.2%)	0.540
Total Fat	747 calories (~38.1%)	709Calories (~37.7%)	0.487

* P-value produced by the independent t test; significant p-values are in bold

Table 5.6. Micronutrients intake of CG and IG at baseline

	Control N=54		**Intervention** N=78		
BASELINE	Mean	SD	Mean	SD	P-value*
Sodium (mg)	2065.0	739.4	2014.4	1019.1	0.755
Potassium (mg)	2437.6	899.0	2326.3	1086.0	0.536
Vitamin A (RE)(ug)	679.3	524.1	858.1	842.9	0.169
Vitamin C (mg)	107.1	61.9	87.1	72.6	0.101
Calcium (mg)	812.3	504.6	873.3	525.8	0.506
Iron (mg)	14.1	5.1	13.4	5.6	0.425
Vitamin D (ug)	29.0	28.8	20.9	18.5	0.053
Thiamin (mg)	1.4	0.6	1.4	0.6	0.530
Riboflavin (mg)	1.7	1.1	1.8	1.1	0.592
Niacin (mg)	15.5	6.6	15.6	7.1	0.932
Pyridoxine (Vitamin B6) (mg)	1.2	0.4	1.2	0.6	0.882
Folate (Total) (µg)	338.4	134.9	321.6	136.7	0.488
Cobalamin (Vitamin B12) (µg)	2.8	2.1	4.6	6.2	0.046
Iodine (µg)	25.5	39.7	15.1	27.2	0.076
Zinc (mg)	8.9	3.6	8.2	3.7	0.271

* P-value produced by the independent t test; significant p-values are in bold

Similar to the previous two tables, Table 5.6 indicates that at baseline both CG and IG were similar in micronutrient intake and the overall diets IG and CG diets were homogenous.

Table 5.7. Macronutrient intake of control and intervention group after intervention

	Control N=50		Intervention N=51		
After Intervention	Mean	SD	Mean	SD	P-value*
Kilocalories (kcal)	1682.5	668.6	1897.9	576.2	0.086
Protein (g)	56.0	24.3	68.9	27.8	**0.014**
Carbohydrate (g)	205.0	80.1	222.9	67.7	0.228
Cholesterol (mg)	144.2	91.05	172.0	87.1	0.119
Fat, Total (g)	73.9	36.1	84.2	30.1	0.124
Saturated Fat (g)	18.8	8.1	19.7	7.3	0.571
Monounsaturated Fat (g)	24.4	10.6	27.0	9.4	0.194
Polyunsaturated Fat (g)	18.0	10.0	19.2	10.1	0.575
Dietary Fiber, Total (g)	14.1	6.4	16.5	8.3	0.110
Sugar, Total (g)	67.3	49.5	74.5	40.0	0.395

* P-value produced by the independent t test; significant p-values are in bold

According to Table 5.7, after intervention the mean energy intake for the CG was lower compared to the IG, although the difference was not statistically significant (p=0.086). However, post-intervention showed a significant difference in protein intake with the IG reporting a higher protein intake compared to the CG (p=0.014). Similarly, intakes of fat, carbohydrate and sugar were higher in the IG post-intervention, but the differences were not significant.

Table 5.8. Micronutrient intake of control and intervention group after intervention

	Control N=50		Intervention N=51		
After Intervention	Mean	SD	Mean	SD	P-value*
Sodium (mg)	1780.1	678.8	2175.0	1578.3	0.107
Potassium (mg)	2250.9	1125.5	2493.6	1280.5	0.315
Vitamin A (RE)	564.5	476.4	1180.4	2017.1	0.038
Vitamin C (mg)	105.1	98.4	79.8	65.3	0.131
Calcium (mg)	726.1	455.4	969.9	567.4	**0.019**
Iron (mg)	11.6	4.2	13.5	5.4	0.054
Vitamin D (ug)	15.9	14.1	20.3	18.2	0.187
Thiamin (mg)	1.1	0.5	1.4	0.6	**0.033**
Riboflavin (mg)	1.3	1.0	1.9	1.2	**0.018**
Niacin (mg)	12.8	5.5	15.6	6.1	**0.020**
Pyridoxine (Vitamin B6) (mg)	1.07	0.5	1.2	0.6	0.080
Folate (Total) (µg)	276.4	145.6	299.8	123.2	0.384
Cobalamin (Vitamin B12) (µg)	3.5	4.9	3.3	3.6	0.852
Iodine (µg)	12.8	18.3	17.6	29.6	0.330
Zinc (mg)	7.5	3.0	8.8	3.7	0.067

* P-value produced by the independent t test; significant p-values are in bold

Table 5.8 illustrates that post-intervention, dietary intakes of some micronutrients were significantly higher in the IG compared to the CG. In particular, for vitamin A the mean intake was almost double in the IG (p=0.038).

Table 5.9. Change in macro nutrient intake from before to after intervention

	Control N=50			Intervention N=52		
	Mean Change	SD	p-value*	Mean Change	SD	P-value*
Kilocalories(kcal)	-262.75	625.88	0.005	95.13	911.61	0.460
Protein(g)	-12.73	26.28	0.001	4.80	40.21	0.398
Carbohydrate (g)	-30.33	75.64	0.007	3.36	98.08	0.807
Fat, Total(g)	-9.82	34.63	0.053	7.49	49.23	0.282
Cholesterol(mg)	-48.74	139.22	0.018	31.14	104.69	**0.039**
Saturated Fat(g)	-1.70	9.02	0.192	1.81	10.38	0.220
Monounsaturated Fat(g)	-3.17	11.25	0.054	3.58	15.88	0.113
Polyunsaturated Fat(g)	-0.45	12.50	0.801	3.34	14.08	0.097
Dietary Fiber, Total(g)	-3.49	7.61	0.002	0.80	10.52	0.590
Sugar, Total(g)	-10.29	51.08	0.165	4.07	49.06	0.557

* P-value produced by the Paired t test; significant p-values are in bold

The change in macronutrient intake from baseline to post-intervention was calculated as the difference between the two values (baseline and post intervention) for each child and the mean value reported. According to Figure 5.4, in the CG the reduction in nutrient from baseline to post intervention is very well illustrated in protein, carbohydrate and fat intakes (Table 5.9). In a reverse order, the same macronutrients are increasing but in a smaller magnitude for the IG. All values demonstrated a significant decrease at post-intervention in the CG, but no such differences were observed in the IG. This suggests that without an intervention the mean intake of these nutrients may be reduced over time, however with the intervention sessions the mean micronutrient intakes remained the same or even increased.

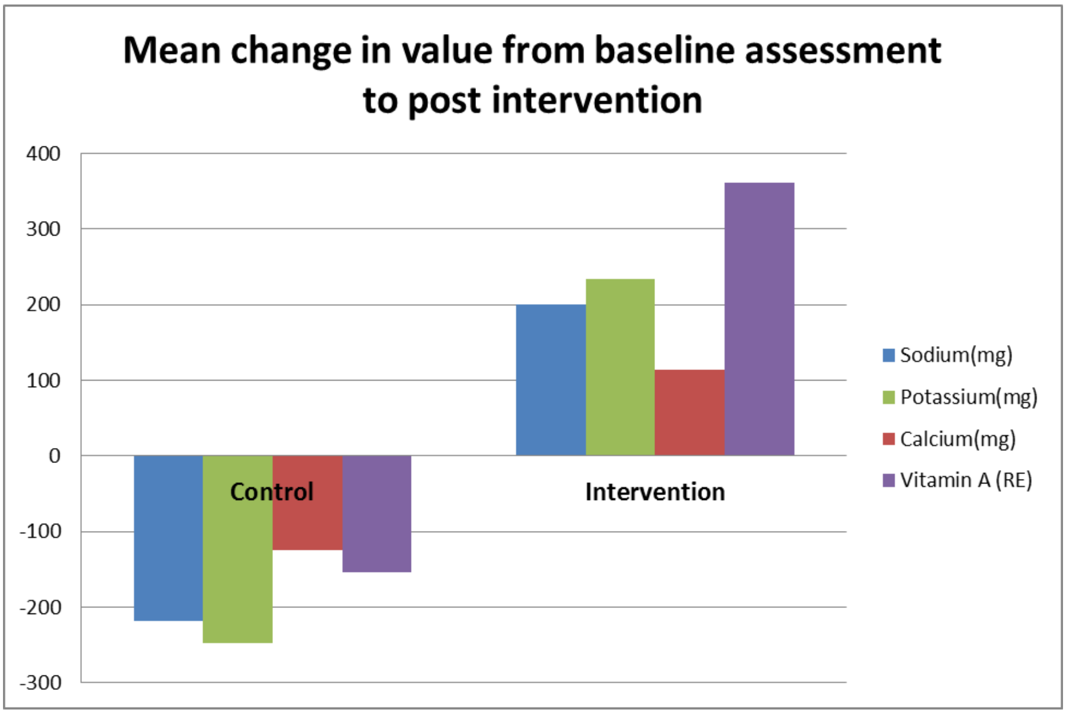


Figure 5.4. Change in micronutrient, sodium, potassium, calcium and vit A from baseline to post-intervention.
P-value for mean differences in **control group**: Sodium p =0.135; Potassium p=0.135; calcium p= 0.114; Vit A p=0.158
P-value for mean differences in **intervention group**: Sodium p =0.458;Potassium p=0.322; calcium p= 0.305; vit A p=0.231

Figure 5.5 demonstrates the trend of changes in nutrient intake of sodium, potassium, calcium and Vit A, between the IG and the CG. The trend is increasing for the IG and decreasing for the CG. All of these figures point towards the positive impact of the intervention.

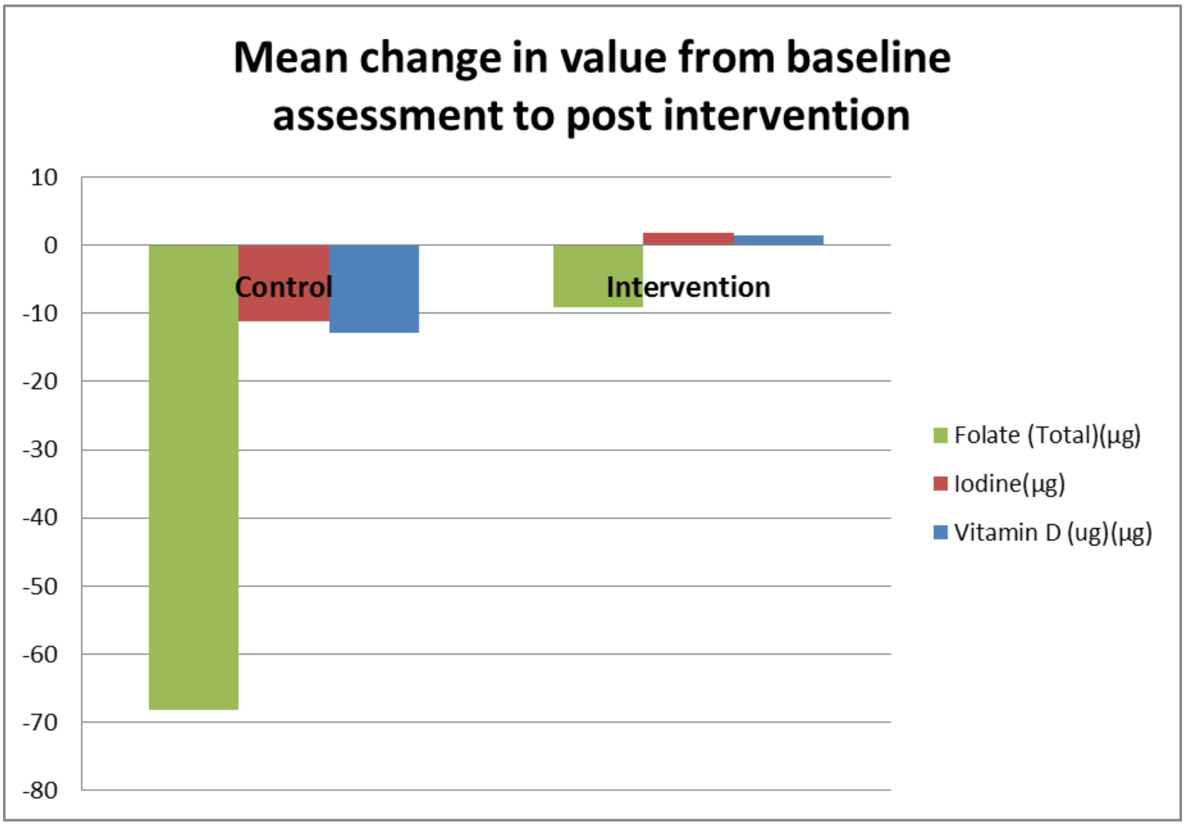


Figure 5.5. Change in micronutrient Folate, iodine and Vit D from baseline to post-intervention
P-value for mean differences in **control group**: folate p =0.006; iodine p=0.044; vit D p=0.003
P-value for mean differences in **intervention group:** folate p = 0.716; iodine p=0.759; vit D p=0.636

According to Figure 5.5 the decrease in the micronutrients iodine (p=0.044), folate (p=0.006) and vit D (p=0.003) were significant for the CG. However, for the IG non statistically significant increases of the same micronutrients were observed.

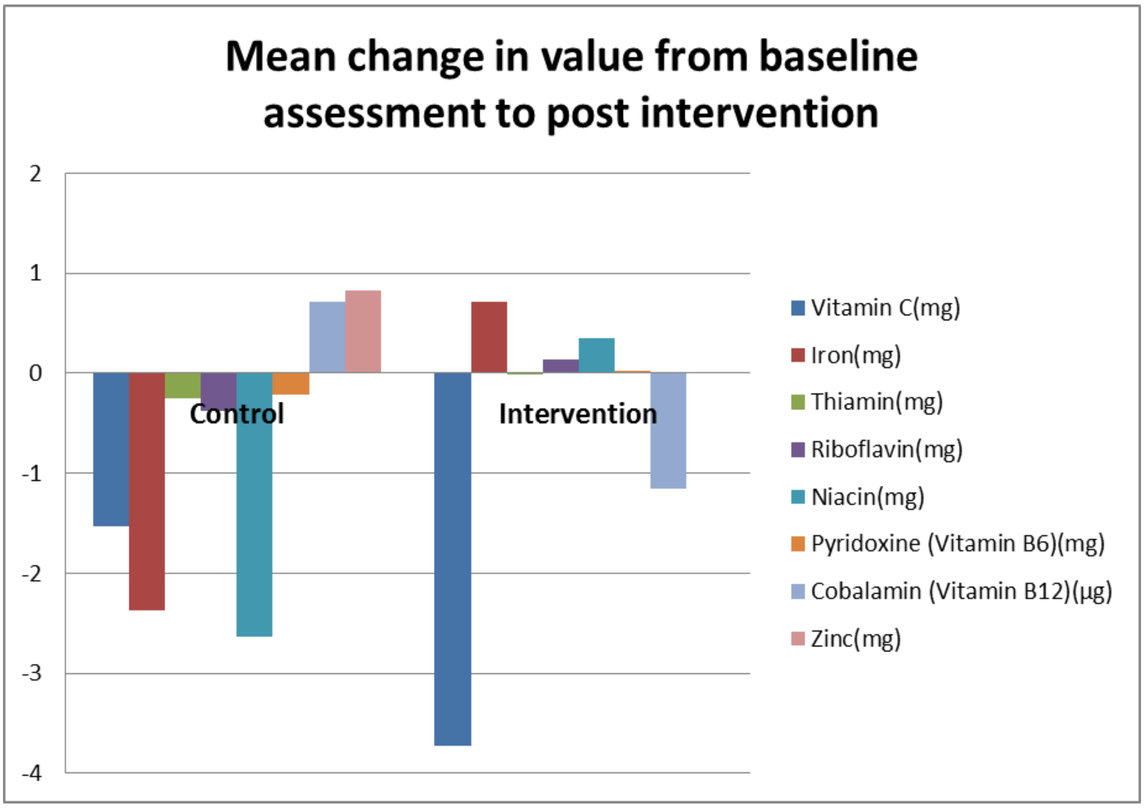


Figure 5.6. Change in Vit C, iron, Thiamin, Riboflavin, Niacin, Pyridoxine, Cobalamin and zinc from baseline to post-intervention
P-value for mean differences in **control group**: Vit C p= 0.920; Iron p= 0.011; Thiamin p= 0.015; Riboflavin p=0.034; Niacin p=0.013; Pyridoxine p= 0.016; Cobalamin p= 0.357; Zinc p= 0.010
P-value for mean differences in **intervention group**: VitC p = 0.771; Iron p= 0.522; Thiamin p= 0.928; Riboflavin p=0.573; Niacin p= 0.790; Pyridoxine p= 0.854; Cobalamin p= 0.301; Zinc p= 0.247

The trend of changes in nutrient intake for CG were significant decreases for Iron (P=0.011), Pyridoxine (P=0.016),Thiamone (p= 0.015) and Niacin (p=0.013), the rest of the nutrient changes were not signifant. For the IG the values for the changes are all non significan (Figure 5.6).

Table 5.10. Frequency and percent distribution of children according to daily requirement of selected nutrient at baseline and after intervention.

	Baseline					After Intervention				
	CG		IG			CG		IG		
	N	%	N	%	p-value*	N	%	N	%	p-value*
Vitamin A (RE)										
- Not meeting daily requirement	30	48%	38	40%	0.344	31	53%	20	34%	**0.040**
- meeting daily requirement	33	52%	57	60%		27	47%	38	66%	
- Total	63	100%	95	100%		58	100%	58	100%	
Riboflavin(mg)										
- Not meeting daily requirement	8	13%	13	14%	0.858	14	24%	6	10%	**0.049**
- meeting daily requirement	55	87%	82	86%		44	76%	52	90%	
- Total	63	100%	95	100%		58	100%	58	100%	
Niacin(mg)										
- Not meeting daily requirement	11	17%	17	18%	0.944	19	33%	5	9%	**0.001**
- meeting daily requirement	52	83%	78	82%		39	67%	53	91%	
- Total	63	100%	95	100%		58	100%	58	100%	
Carbohydrate (g)										
- Not meeting daily requirement	8	13%	12	13%	0.990	10	17%	1	2%	**0.004**
- meeting daily requirement	55	87%	83	87%		48	83%	57	98%	
- Total	63	100%	95	100%		58	100%	58	100%	

CG: Control Group, IC: Intervention Group; *P-value produced by the Pearson Chi-square; significant p-values are in bold

According to Table 5.10, vitamin A intake in the two groups was similar at baseline with almost 60% below requirements; after the intervention the percentage of children meeting their requirement was 66% in intervention group compared to only 47% in the control group, a difference of 20% (p=0.04). As for riboflavin, niacin, and carbohydrate, at baseline the percentage of children meeting their requirements were similar for the IG and the CG children; however, post-intervention the percentage of the IG children meeting daily nutrient needs increased significantly: riboflavin p=0.049; niacin p=0.001; carbohydrate p=0.004. All other nutrients did not show any statistical significant values when compared to their respective daily nutrient requirements

Table 5.11. Change in nutritional intake in IG from baseline, during intervention and post-intervention

Intervention Group N=42	Baseline Mean	Baseline SD	During Mean	During SD	After Mean	After SD	p-value*
Kilocalories (kcal)	1859.36	732.09	1877.5	615.3	1897.92	576.2	0.655
Protein (g)	66.4	29.7	64.9	24.8	68.9	27.8	0.259
Carbohydrate (g)	227.2	86.8	223.8	78.2	222.9	67.7	0.956
Fat, Total (g)	78.8	35.7	83.0	31.5	84.2	30.1	0.351
Dietary Fiber, Total (g)	16.8	8.3	15.2	7.1	16.5	8.3	0.620
Sugar, Total (g)	72.0	46.5	71.0	39.5	74.9	40.0	0.823
Saturated Fat (g)	18.5	9.2	20.2	7.7	19.7	7.3	0.152
Monounsaturated Fat (g)	24.1	12.0	27.2	10.4	27.0	9.3	0.232
Polyunsaturated Fat (g)	16.4	9.4	20.1	9.9	19.1	10.1	0.365
Sodium (mg)	2014.4	1019.1	2002.6	733.7	2175.0	1578.2	0.644
Potassium (mg)	2326.3	1086.0	2285.0	906.0	2493.6	1280.4	0.377
Vitamin A (RE)	858.1	842.9	765.3	763.2	1180.3	2017.1	0.415
Vitamin C (mg)	87.1	72.6	82.4	54.3	79.8	65.3	0.969
Calcium (mg)	873.3	525.8	824.7	502.2	969.9	567.4	0.283
Iron (mg)	13.4	5.6	12.6	4.3	13.5	5.4	0.776
Vitamin D (ug)	20.9	18.5	24.9	24.1	20.3	18.2	0.324
Thiamin (mg)	1.4	0.6	1.3	0.6	1.4	0.6	0.733
Riboflavin (mg)	1.8	1.1	1.6	1.1	1.9	1.2	0.407
Niacin (mg)	15.6	7.1	14.8	5.3	15.6	6.1	0.462
Pyridoxine (Vitamin B6) (mg)	1.2	0.6	1.1	0.4	1.2	0.6	0.349
Folate (Total) (µg)	321.6	136.7	305.2	128.4	299.8	123.2	0.947
Cobalamin (Vitamin B12) (µg)	4.5	6.2	4.8	7.0	3.3	3.5	0.587
Iodine (µg)	15.1	27.2	17.5	28.2	17.6	29.6	0.515
Zinc (mg)	8.2	3.7	8.2	2.	8.8	3.7	0.100
Cholesterol (mg)	152.2	95.1	174.8	93.2	172.0	87.1	0.073

* P-value produce by the repeated measure ANOVA F test; significant p-values are in bold

Analyzing the results of the "during", automatically reduced the sample size to 42 because the 24 hr analysis during intervention was limited to the IG, thus the CG were not included. Analyzing Table 5.11 there was no specific pattern and many of the nutrient values declined in the mid-intervention phase and increased again at the end of 20 weeks. This could be explained by the timing and the season, since the "during" information is collected in mid-February, when the consumption of the fruits and vegetables may have been reduced due to high prices of produce in the winter season.

Further, investigating the impact of the intervention, an evaluation of the macronutrient intake between the two groups (IG and CG), at baseline and post intervention, the results are tabulated in Table 5.12. The majority of the nutrients presented no difference between IG and CG, neither at baseline nor after intervention except in the case of carbohydrates. At baseline the two groups were similar in the percent of meeting daily requirement for carbohydrates (p= 0.99), however after the intervention the percent of children meeting daily carbohydrate requirement was higher among the intervention group IG= 83% and CG= 98% (p=0.004).

Table 5.12. Mean change in macronutrient intake from baseline to post intervention among IG and CG

MACRO	**Baseline**					**After Intervention**				
	Control group		**Intervention Grp**		**p-value***	**Control group**		**Intervention Grp**		**p-value***
	N	**%**	**N**	**%**		**N**	**%**	**N**	**%**	
Carbohydrate (g)										
- Not meeting daily requirement	8	13%	12	13%	0.99	10	17%	1	2%	**0.004**
- meeting daily requirement	55	87%	83	87%		48	83%	57	98%	
Fat, Total(g)										
- Not meeting daily requirement	0	0%	3	3%	0.277	1	2%	0	0%	0.429
- meeting daily requirement	2	3%	5	5%		4	7%	2	3%	
- Exceeding daily requirement	64	97%	89	92%		54	92%	56	97%	
Protein(g)										
- Not meeting daily requirement	2	3%	3	3%	0.995	2	3%	2	3%	0.999
- meeting daily requirement	61	97%	92	97%		56	97%	56	97%	
Dietary Fiber, Total(g)										
- Not meeting daily requirement	56	89%	81	85%	0.511	54	93%	50	86%	0.223
- meeting daily requirement	7	11%	14	15%		4	7%	8	14%	

* P-value produced by the Pearson Chi-square; significant p-values are on bold

Considering the impact of the intervention, a comparison of the micronutrient intake between the two groups (IG and CG), at baseline and post intervention was evaluated (Table 5.13). The results in the micronutrient values were not statistically significant except for a few micronutrients. Vit A in the percent meeting daily requirements were similar for both groups before intervention (p= 0.344), however after the intervention the percent of children meeting Vit A daily requirement was higher among the IG 66 % against 47% CG (p= 0.04).

In a similar manner for riboflavin, at baseline the two groups were comparable in percent daily requirements (p= 0.858), however after the intervention the part of children meeting Riboflavin daily requirement was higher among the IG 90% against 76% CG (p= 0.049). Likewise for Niacin, at baseline the two groups were similar in meeting daily requirement (p= 0.944), however after the intervention the percent of children meeting daily requirement was higher among the IG, 91% against 67% (p= 0.001). For Pantothenic Acid, at baseline the IG had a lower percent children meeting the daily requirement 41% against 65% CG (p=0.003), however this difference dissipated after the intervention (p=0.999). Finally, vit C at baseline the IG had a lower percent of children meeting the daily requirements 73% against 89% CG (p=0.014), however this difference reversed after the intervention (p=0.343).

Table 5.13. Mean change in micronutrient intake from baseline to post intervention among IG and CG

MICRO	Baseline					After Intervention				
	Control group		Intervention Grp			Control group		Intervention Grp		
	N	%	N	%	p-value *	N	%	N	%	p-value *
Vitamin A (RE)										
- Not meeting daily requirement	30	48%	38	40%	0.344	31	53%	20	34%	**0.04**
- meeting daily requirement	33	52%	57	60%		27	47%	38	66%	
Vitamin C(mg)										
- Not meeting daily requirement	7	11%	26	27%	**0.014**	9	16%	13	22%	0.343
- meeting daily requirement	56	89%	69	73%		49	84%	45	78%	
Vitamin D (ug)										
- Not meeting daily requirement	26	41%	40	42%	0.971	34	59%	25	43%	0.095
- meeting daily requirement	37	59%	55	58%		24	41%	33	57%	
Vitamin E (mg)										
- Not meeting daily requirement	26	41%	44	46%	0.532	22	38%	17	29%	0.326
- meeting daily requirement	37	59%	51	54%		36	62%	41	71%	
Vitamin K (µg)										
- Not meeting daily requirement	12	19%	23	24%	0.444	7	12%	12	21%	0.21
- meeting daily requirement	51	81%	72	76%		51	88%	46	79%	
Thiamin (mg)										
- Not meeting daily requirement	7	11%	12	13%	0.774	10	17%	5	9%	0.166
- meeting daily requirement	56	89%	83	87%		48	83%	53	91%	
Biotin (µg)										
- Not meeting daily requirement	35	56%	64	67%	0.133	43	74%	38	66%	0.312
- meeting daily requirement	28	44%	31	33%		15	26%	20	34%	
Calcium(mg)										
- Not meeting daily requirement	48	76%	69	73%	0.617	48	83%	41	71%	0.124
- meeting daily requirement	15	24%	26	27%		10	17%	17	29%	
Zinc(mg)										
- Not meeting daily requirement	15	24%	24	25%	0.836	22	38%	14	24%	0.108
- meeting daily requirement	48	76%	71	75%		36	62%	44	76%	
Potassium(mg)										
- Not meeting daily requirement	0	0%	0	0%	…	0	0%	0	0%	…

- meeting daily requirement	63	100%	95	100%		58	100%	58	100%	
Sodium(mg)										
- Not meeting daily requirement	0	0%	0	0%	…	0	0%	0	0%	…
- meeting daily requirement	63	100%	95	100%		58	100%	58	100%	
Riboflavin(mg)										
- Not meeting daily requirement	8	13%	13	14%	0.858	14	24%	6	10%	**0.049**
- meeting daily requirement	55	87%	82	86%		44	76%	52	90%	
Niacin(mg)										
- Not meeting daily requirement	11	17%	17	18%	0.944	19	33%	5	9%	**0.001**
- meeting daily requirement	52	83%	78	82%		39	67%	53	91%	
Pyridoxine (Vitamin B6)(mg)										
- Not meeting daily requirement	10	16%	14	15%	0.846	15	26%	10	17%	0.259
- meeting daily requirement	53	84%	81	85%		43	74%	48	83%	
Folate (µg)										
- Not meeting daily requirement	17	27%	25	26%	0.926	24	41%	21	36%	0.568
- meeting daily requirement	46	73%	70	74%		34	59%	37	64%	
Cobalamin Vitamin B12(µg)										
- Not meeting daily requirement	17	27%	24	25%	0.809	15	26%	11	19%	0.373
- meeting daily requirement	46	73%	71	75%		43	74%	47	81%	
Pantothenic Acid(mg)										
- Not meeting daily requirement	22	35%	56	59%	**0.003**	30	52%	30	52%	0.999
- meeting daily requirement	41	65%	39	41%		28	48%	28	48%	
Iodine(µg)										
- Not meeting daily requirement	59	94%	94	99%	0.063	58	100%	55	95%	0.079
- meeting daily requirement	4	6%	1	1%		0	0%	3	5%	
Iron(mg)										
- Not meeting daily requirement	12	19%	21	22%	0.643	20	34%	13	22%	0.15
- meeting daily requirement	51	81%	74	78%		38	66%	45	78%	
Phosphorus(mg)										
- Not meeting daily requirement	16	25%	25	26%	0.897	20	34%	11	19%	0.059
- meeting daily requirement	47	75%	70	74%		38	66%	47	81%	

* P-value produced by the Pearson Chi-square; significant p-values are in bold

5.9.3 Food Knowledge Scores

The Food Knowledge Score (FKS) questionnaire (Appendix 27) consisted of 20 questions pertinent to the nutrition workshops addressed to the children, in addition to six questions related to the food pyramid (FPS) (Appendix 27). The scoring of the 26 questions was as the sections of the correct answers, the total FKS out of 20 and the food pyramid questions scored out of 6.

Table 5.14 demonstrates the FKS scores at baseline for the CG and IG ($p < 0.001$). The IG scored higher at baseline compared to CG, further the improvement in the FKS for the intervention group was greater than CG. The results were very obvious in the Food pyramid score.

Table 5.14. FKS and FPS from baseline to post intervention for CG and IG by region

	Baseline					Post intervention				
	Control N=68		Interv N=66		P-value*	Control N=68		Interv N=66		P-value*
TOTAL	Mean	SD	Mean	SD	baseline	Mean	SD	Mean	SD	Post Int
FK Score (out of 100)	41.6	14.2	49.0	15.8	**0.002**	59.4	24.4	89.4	9.2	**<0.001**
FP Score(out of 6)	1.6	1.2	1.8	1.1	0.308	2.8	2.4	5.7	1.0	**<0.001**
REGION										
Bekaa	N=37		N=26			N=37		N=26		
FK Score (out of100)	42.4	14.2	50.1	11.2	**0.02**	66.9	26.9	95.0	1.7	**<0.001**
FP Score(out of 6)	1.5	1.5	2.1	1.2	0.09	3.2	2.7	6	0	**<0.001**
North	N=31		N=40			N=31		N=40		
FK Score (out of 100)	39.0	14.9	50.7	18.3	**0.005**	50.1	18.1	85.7	10.9	**<0.001**
FP Score(out of 6)	1.8	0.8	1.7	0.8	0.7	2.3	2	5.4	1.5	**<0.001**

FK: Food Knowledge FP: Food Pyramid * P-value produced by the Independent t test; significant p-values are bolded

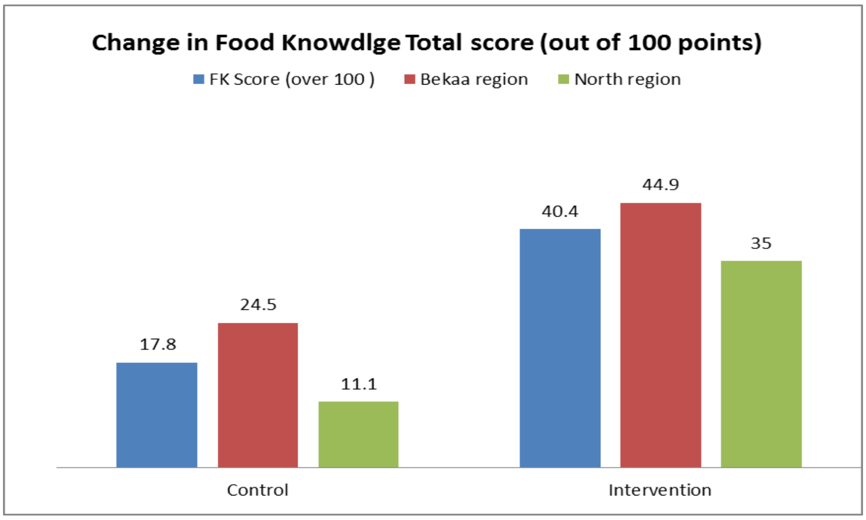


Figure 5.7. Change in Food knowledge score (FKS) from baseline to post intervention according to region.
P-value for mean differences in control group: Total sample p<0.001, Bekaa region p<0.001, North region p=0.007
P-value for mean differences in intervention group: Total sample p<0.001, Bekaa region p<0.001, North region p<0.001

The total change in score reached 45% for the Bekaa region and 35% for the North region in the IG (Figure 5.7) compared to 25% and 11% respectively in the CG. For the PKS the change in score from baseline to end of intervention was, for the Bekaa IG scored 3.9/6 against 3.6/6 for the North IG (Figure 5.8). In Figures 5.7 and 5.8 the change in the results of the Bekaa food pyramid score are higher compared to the north , probably since the IG included two schools which exposes the prospect for greater diversity of student knowlege, but the North IG was based only in one school.

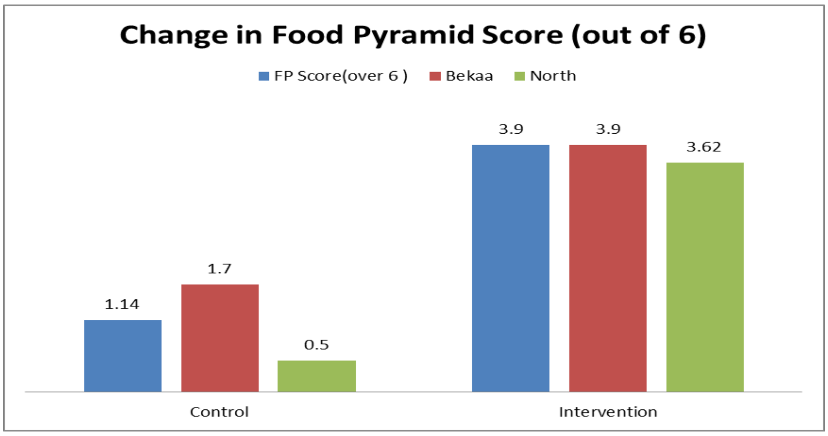


Figure 5.8. Change in score of FPS from baseline to post intervention
P-value for mean differences in control group: Total sample p<0.001, Bekaa region p=0.002 , North region p=0.140
P-value for mean differences in intervention group: Total sample p<0.001, Bekaa region p< 0.001, North region p<0.001

As illustrated in table 5.15 at baseline the intervention group had better food knowledge score than the control group 49 against 41 (p=0.002), but the difference amplified post intervention where the intervention group average became 89 compared to 59 to the control group (p <0.001). This indicates that the intervention raised the food knowledge among the children, specifically in the food pyramid questions where there was no difference at baseline (p=0.308) but there was a significant difference between the two groups post intervention (mean for intervention 5.7 against 2.8 for the control).

A similar analysis was undertaken for Bekaa and North regions separately, the results were comparable. In both regions the intervention groups started higher on food knowledge score, and post intervention the difference widened to the advantage of the IG. It is worth noting that the North (urban) region, the change in food knowledge scores for both intervention and control groups were lower compared to the Bekaa (rural) groups. In fact the control group score from baseline to post intervention was not significant (p=0.14).

Table 5.15. FKS and FPS at baseline and post intervention for CG and IG and by gender

	Baseline					Post intervention				
	Control N=68		Interv N=66		P-value*	Control N=68		Interv N=66		P-value*
GENDER	Mean	SD	Mean	SD	baseline	Mean	SD	Mean	SD	Post Interv
Boys	N=39		N=42			N=39		N=42		
CFK Score (over 100)	42.6	14.2	49.4	16.6	0.053	60.8	22.7	90.2	9.6	**<0.001**
CFP Score(over 6)	1.8	1.3	1.7	0.7	0.739	3.1	2.2	5.6	1.3	**<0.001**
Girls	N=29		N=24			N=29		N=24		
CFK Score (over 100)	38.6	15.1	52.3	14.3	**0.001**	57.24	27.3	88	9.9	**<0.001**
CFP Score(over 6)	1.5	1.2	2.3	1.3	**0.034**	2.59	2.7	5.7	0.9	**<0.001**

* P-value produced by the Independent t test; significant p-values are in bold

According to Table 5.15, the food knowledge score at baseline was similar for boys in the CG and IG, 49 against 42 respectively (p=0.053). This was not the case for CG and IG girls, 39 against 52 respectively (p=0.001). Post intervention, the IG had higher score for boys and girls, clearly the intervention influenced both boys and girls equally. These results are supported by the food pyramid score results.

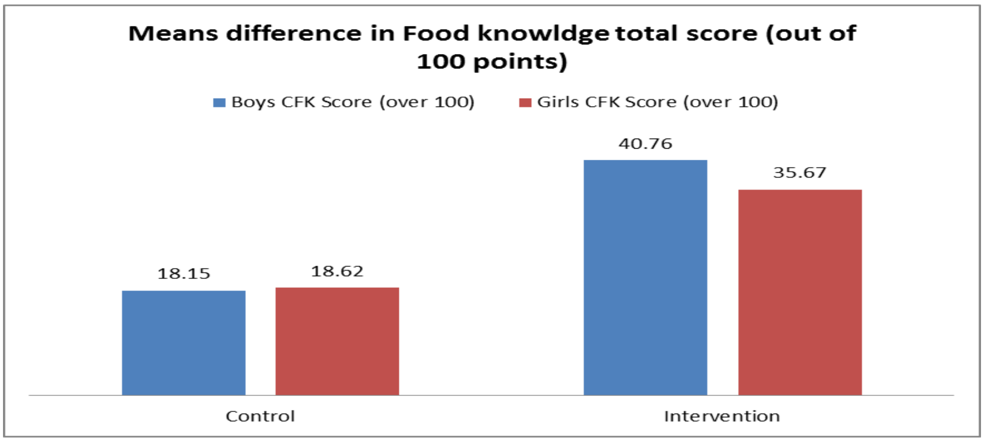


Figure 5.9. Change in FKS score from baseline to post intervention
P-value for mean differences in control group: Boys p< 0.001, Girls p= 0.001
P-value for mean differences in Intervention group: Boys p< 0.001, Girls p< 0.001

CFK improved for both CG and IG children, as illustrated by previous graphs. However, the increase was greater in the IG (Figure 5.9). As illustrated in the following Figure 5.10, the improvement in the FKS according to gender. The progress is comparable for boys and girls in both groups, with a difference of average of 40 points for boys and 35.7 points for girls.

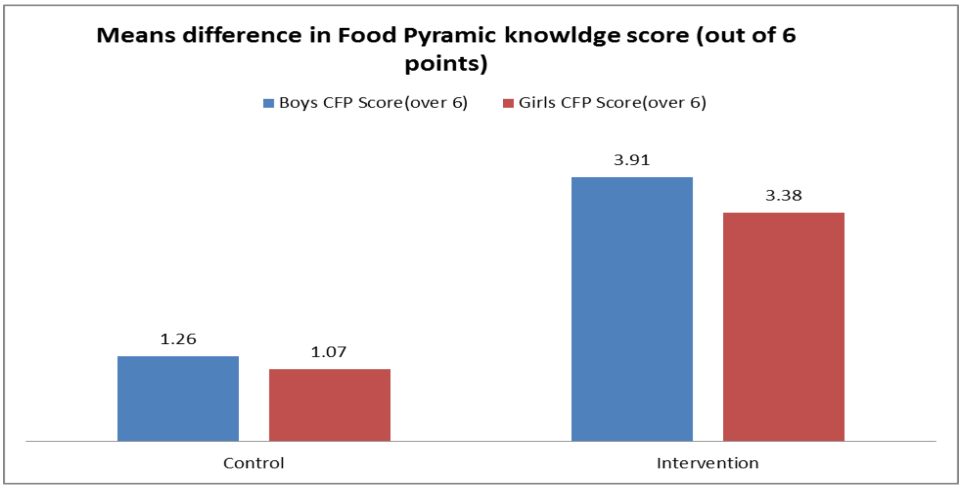


Figure 5.10. Change in FPS score from baseline to post intervention
P-value for mean differences in control group: Boys p= 0.007, Girls p= 0.048
P-value for mean differences in Intervention group: Boys p< 0.001, Girls p< 0.001

Figure 5.10 demonstrates that FPS, with both genders improved, and they progressed at almost the same rate. The improvement in food score is the almost the same for boys and girls, but boys improved slightly more compared to girls. Thus, the impact of intervention was efficient for both girls and boys.

Table 5.16. FKS and FPS at baseline to post intervention for CG and IG according to mother's education

	Baseline					Post Intervention				
	CG N=68		IG N=66		P-value*	CG N=68		IG N=66		P-value*
MOTHER EDUCATION	Mean	SD	Mean	SD	baseline	Mean	SD	Mean	SD	Post Int
Element or Below	N=46		N=45			N=46		N=45		
FK Score (over 100)	39.1	13.9	49.1	15.9	**0.002**	54.6	24.41	90.2	9.28	< **0.001**
FP Score(over 6)	1.7	1.05	1.9	1.14	0.222	2.6	2.37	5.6	1.32	< **0.001**
Second or Above	N=21		N=19			N=2		N=19		
FK Score (over 100)	44	15.54	53.2	15.6	0.068	67.8	22.47	88.2	10.02	**0.001**
FP Score(over 6)	1.6	1.75	1.8	0.6	0.521	3.2	2.51	5.89	0.46	< **0.001**

* P-value produced by the Independent t test; significant p-values are in bold

Table 5.16 and Figure 5.11 both demonstrate improvement in FKS, which appears to be similar among children whose mothers have secondary or higher education compared to elementary education and less. Nevertheless, there appears to be a similar effect of intervention on food knowledge score regardless of the mother's education.

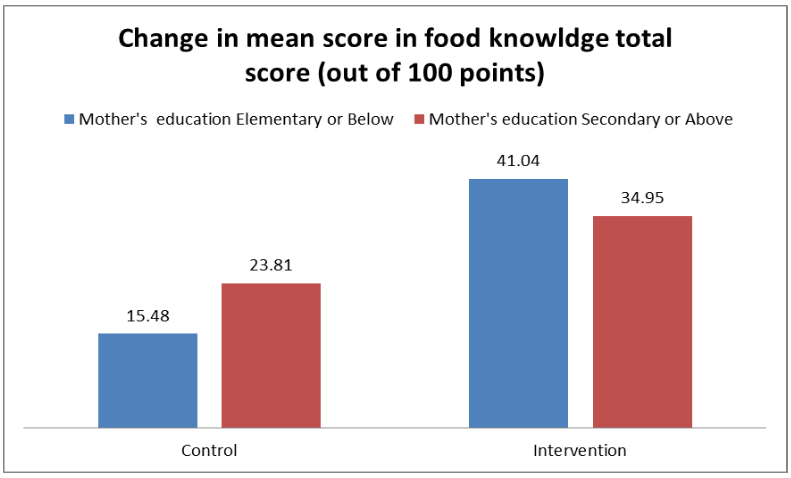


Figure 5.11. Change in FKS from baseline to post intervention according to mother's education

P-value for mean differences in control group: Mother's education Elementary or below $p<0.001$, Secondary or above $p=0.001$

P-value for mean differences in Intervention group: Mother's education Elementary or below $p<0.001$, Secondary or above $p< 0.001$

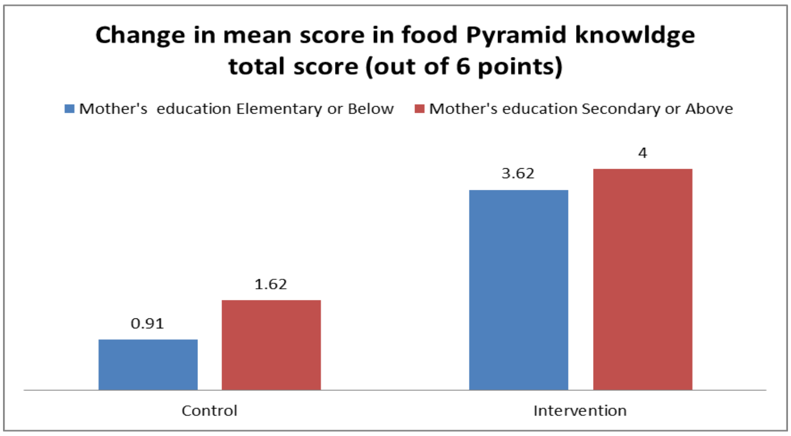


Figure 5.12. Change in FPS from baseline to post intervention according to mother's education

P-value for mean differences in control group: Mother's education Elementary or below $p=.014$, Secondary or above $p=0.040$

P-value for mean differences in Intervention group: Mother's education Elementary or below $p<0.001$, Secondary or above $p< 0.001$

In a parrallel, Figure 5.12 indicates that irrespective of the mother's education, the change in FPK was higher post intervention in IG compared to CG.

Table 5.17. FKS and FPS from baseline to post intervention for CG and IG by child physical activity (PA)level

	Baseline					Post Intervention					P-value for Change Over time^	
	Control N=68		Intervt N=66		P-value*	Control N=68		Interv N=66		P-value*		
Physical Activity	Mean	SD	Mean	SD	baseline	Mean	SD	Mean	SD	Post Int	Control	Interv
Low	N=36		N=36			N=36		N=36				
FK Score (over 100)	37.4	13.1	47.4	17.3	**.008**	56.7	24.0	89.9	10.18	<.001	**<.001**	**<.001**
FP Score(over 6)	1.4	1.10	1.86	1.0	.109	2.6	2.4	5.6	1.12	<.001	**.013**	**<.001**
High	N=3		N=30			N=32		N=30				
FK Score (over 100)	44.8	15.	54.13	13.0	**.013**	62.1	25.4	88.8	9.30	<.001	**<.001**	**<.001**
FP Score(over 6)	1.9	1.4	2.00	0.9	.841	3.0	2.4	5.6	1.33	<.001	**.027**	**<.001**

* P-value produeced by the Independent t test, ^ P-value produced by the Paired t test; significant p-values are in bold.

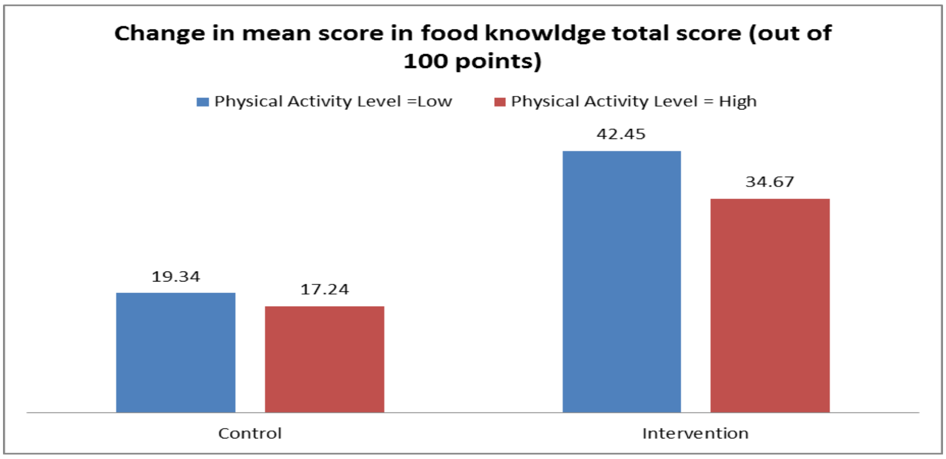


Figure 5.13. Change in FKS from baseline to post intervention according to child physical activity level.
P-value for mean differences in control group: Physical activity Low p<0.001, High p< 0.001
P-value for mean differences in Intervention group: Physical activity Low p<0.001, High p< 0.001

Table 5.17 demonstartes the change in FKS according to child physical activity (PA) level, classified as high or low activity intensities. The change in the FKS for children in the CG, for the low PA or the high PA, was similar. Thus, any difference in food knowledge is independent of child PA level.

5.9.4 Anthropometric Measurements

Table 5.18. Anthropometric measurements of CG and IG at baseline

	Baseline measurement				
	Control		Intervention		P-value*
	Mean	SD	Mean	SD	
Weight	27.8	6.7	26.2	5.7	0.103
Height	128.8	8.6	124.8	7.2	**0.002**
BMI	16.5	2.4	16.7	2.5	0.743
%BF	21.4	8.1	23.9	10.6	0.111
Waist	56.2	6.9	55.2	6.1	0.364
Hip	66.9	7.5	65.8	6.6	0.285
W/H	0.8	0.05	0.8	0.05	0.906
Midarm	18.5	2.3	18.6	2.2	0.651
Triceps	8.3	3.2	8.5	7.2	0.802
Biceps	5.7	2.5	5.6	3.1	0.833
Subscapular	7.3	4.6	6.7	5.2	0.422
Supriallaic	7.2	5.4	6.2	5.7	0.245

* P-value produced by Independent t test; significant p-values are in bold

Table 5.19 demonstrates that at baseline most of the body measurements were comparable with the exception of height, the CG had a higher average height compared to the IG (p=0.002)

Table 5.19. Changes in anthropometric measurements in CG and intervention groups IG from baseline to post intervention

	Post intervention measurement			
	Control (CG)		**Intervention (IG)**	
	Mean Change	p-value*	Mean change	p-value*
Weight	0.32	**0.003**	0.72	**<.001**
Height	2.13	**<.001**	2.87	**<.001**
BMI	-0.34	**0.003**	-0.25	0.148
%BF	-2.74	**<.001**	-4.20	**<.001**
Waist	0.34	0.403	-0.05	0.844
Hip	0.46	0.336	0.73	**<.001**
W/H	0.00	0.852	-0.01	**0.009**
Midarm	0.26	**0.027**	-0.02	0.767
Triceps	0.09	0.660	-0.42	0.543
Biceps	0.13	0.441	0.22	**0.050**
Subscapular	-0.01	0.982	0.14	0.186
Suprailliac	0.03	0.947	0.42	**0.025**

* P-value produced by the paired t test; significant p-values are in bold

A more profound assessment (Table 5.20) of the difference in height at baseline was undertaken, to prove that four girls in the control group 10-11 years age range, had heights above 140 cm.

Table 5.20. Height measurements in CG and intervention groups IG at baseline for boys and girls

	Baseline measurement				
	Control		Intervention		P-value*
	Mean	SD	Mean	SD	
Boys	128.2	7.45	126.8	7.45	0.419
Girls	130.7	9.77	123.2	6.76	0.**003**

*P-value produced by the independent t test; significant p-values are in bold

During the span of the study, the children were measured at three intervals, namely at baseline, after 10 weeks and at end of the study or 20 weeks (Table 5.21). In terms of weight and height, the CG was observed to have a mean increase in weight (p=0.003) and height (p<0.001); nevertheless, the IG was observed to have a higher increase in mean weight (p<0.001) and height (p< 0.001) compared to the CG.

Table 5.21. Change in anthropometric measurements among IG from baseline to post intervention by region

	Change from baseline to Post Intervention				
Intervention	Bekaa N=26		North N=40		P-value*
Group	Mean	SD	Mean	SD	
Weight	0.8	0.7	0.6	0.7	0.320
Height	4.5	1.3	1.7	5.4	**0.012**
BMI	-0.6	0.5	0.01	2.07	0.119
%BF	-3.8	2.5	-3.6	9.7	0.912
Waist	-0.5	2.6	0.08	2.1	0.299
Hip	0.8	1.8	0.6	1.6	0.570
W/H	-0.01	0.03	-0.006	0.03	0.143
Midarm	-0.2	0.6	-0.002	0.7	0.129
Triceps	0.06	1.06	-1.2	8.7	0.445
Biceps	0.1	0.9	0.1	1.1	0.865
Subscapular	0.04	0.5	0.	0.8	0.696
Supriallaic	0.3	1.02	0.6	2.0	0.550

* P-value produced by the independent t test; significant p-values are in bold

There was a significant increase in change in height in Bekka (rural) children compared to the North (urban) children in the IG. In the Bekaa, the children grew on average 4.6 cm as compared to the North where they gained an average of 1.8 cm. There was no significant difference in any other measurements (Table 5.21).

Table 5.22. Change in anthropometric measurements among IG from baseline to post intervention by mothers' educational level

	Change from baseline to Post Intervention Mother Education				
Intervention Group	Elementary or below N=45		Secondary or Above N=19		P-value*
IG	Mean	SD	Mean	SD	
Weight	0.5	0.7	0.9	0.8	0.077
Height	2.7	5.2	2.9	2.1	0.883
BMI	-0.2		-0.1	0.6	0.832
%BF	-4.1	7.4	-3.1053	9.1	0.648
Waist	-0.3	1.8	0.4	3.3	0.243
Hip	0.4	1.6	1.06	1.6	0.198
W/H	-0.0	0.02	-0.006	0.05	0.626
Midarm	-0.2	0.6	0.1	0.8	**0.024**
Triceps	-1.1	8.2	0.09	0.8	0.515
Biceps	0.1	1.1	0.3	0.7	0.370
Subscapular	0.04	0.7	0.09	0.7	0.773
Supriallaic	0.3	1.1	0.4	0.7	0.726

* P-value produced by the independent t test; significant p-values are in bold

Table 5.22 illustrates that there was a significant change in mid-arm circumference according to mother education in the IG. In other terms, the mother education neither did it impact the intervention nor did it effect the anthropometric measurements of the children.

Table 5.23. Change in anthropometric measurements among IG from baseline to post intervention by physical activity (PA) level

Intervention	Change from baseline to Post Intervention Physical activity Low N= 36		High N=30		P-value*
Group	Mean	SD	Mean	SD	
Weight	0.6	0.6	0.7	0.9	0.920
Height	3.1	1.8	2.5	6.4	0.604
BMI	-0.3	0.57337	-0.1	2.4	0.609
%BF	-4.6	10.1	-2.7	3.7	0.350
Waist	0.2	2.1	-0.5	2.5	0.173
Hip	0.8	1.4	0.5	2.001	0.571
W/H	-0.007	0.03	-0.01	0.03	0.355
Mid-arm	-0.02	0.6	-0.2	0.7	0.271
Triceps	0.2	0.8	-1.9	10.0	0.192
Biceps	0.3	0.8	-0.08	1.2	0.114
Subscapular	0.1	0.6	0.05	0.9	0.713
Suprailliac	0.2	0.5	0.7	2.4	0.236

* P-value produced by the independent t test; significant p-values are in bold

The PA level of the IG did not impact anthropometric measurement changes of the children post intervention (Table 5.23). Generally, when comparing the IG to the CG, the effect of the intervention on anthropometric measurements was not affected by any of the covariants that were checked, such as gender, region, mother education and physical activity. Thus the constructive outcome of the intervention on anthropometric measurements was irrespective of gender, region, or other factors, implying that this intervention structure is valid when applied to a wider sample of Lebanese children.

Finally, to do a reassessment on the validity of the bioelectric impedance machine, the resulting % BF values were compared to experimental equations applied to determine percent body fat in the same age group. The pre-pubertal equations exploited were proposed by Slaughter and they are illustrated in Table 5.25.

Table 5.24. Correlation between measured percent BF by bioelectric impedance and computed using formula by Slaughter at baseline and post intervention

	Baseline	Post Intervention
	Mean (SD)	Mean (SD)
Measured %BF	22.4 (9.43)	18.8 (8.08)
Estimated %BF	14.5 (7.8)	13.7 (6.0)
Pearson's correlation	0.53 (**P<0.001**)	0.54 (**P<0.001**)

Significant p-values are in bold

Table 5.25. Slaughter Equations for Boys and girls 8-18 years old

Slaughter	Boys %BF = 1.21 (Tri + Sub) −0.008 (Tri + Sub)2 − 1.7
	Girls %BF = 1.3 (Tri + Sub)- 0.013 (Tri + Sub)2 − 2.5
	Tri= triceps ; Sub=subscapular

The percentage of body fat estimated using the Slaughter formula, based on triceps and subscapular measures, produced average values lower than the average percentages values measured in this experiment (Slaughter, et al., 1998). The average difference of mean %BF values at baseline was (22.4 -14.5) 8 mm and (18.8-13.7) 5 mm post intervention (Table 5.25). The correlation between the measurements and the estimates were moderate, (r =0.5) for both baseline and post intrvention. The differences between measured and estimated values for body fat were in accordance with Nasreddine et al. (2012c), who concluded that international % BF estimation equations do not apply to Lebanese children.

5.10 Discussion

During the last couple of decades, the persistently high number of households suffering from FI has been considered a major public health issue. Thus, there is an increased interest in developing strategies to reduce the severity of FI outcomes on household members and principally children.

Traditionally, in LMIC, child malnutrition under the age of five years has been the focus of experiment and debate (Bhutta et al., 2009). However, very little research has focused on child FI and the nutrition education of the FI children. This is an important phase to acquire good nutritional habits, before adolescence when individuals are prone to be overweight and obese in situations of FI (Lohman, 2009).

The global trend of urbanization has also influenced the traditional diets which are being replaced by high energy, low nutrient foods accompanied with a sedentary lifestyle (Popkin, 1994). A paradoxal nutritional manifestation of this phenomenon is the increased occurrence of obesity in FI children and adolescents coinciding with micronutrient deficiencies, such as iron, vitamin A (De Valeria de Souza et al., 2007) and Zinc (Weisstaub et al., 2007). These findings are comparable to the current intervention which demonstrated that at baseline, children from both IG and CG groups had vitamin A intakes below daily requirements; however, post-intervention the number of children from IG with adequate daily vitamin A intake almost doubled. In addition, the children's diets were deficient in riboflavin, niacin and carbohydrate at baseline; nevertheless, post-intervention the IG showed an increase in calories, protein and a number of micronutrients such as calcium, potassium, sodium, iron, vitamin D and thiamine. Thus, the increase in the nutritional intake of the CFI children proves the positive impact of the intervention.

A steady association between FI and poor nutritional outcome has been established across a wide range of published studies. Still, very little research has been conducted regarding the dietary behavior of FI individuals particularly children. To this end, a longitudinal study was conducted in the United States, to compare the diet of children experiencing low FS against very low FS (Dave & Cullen, 2012). The children aged 9 to 12 years old were interviewed to obtain 24-hour dietary intake data. The results demonstrated a non-significant difference of 200 calories higher intake for the very low FS compared to the low FS children. Moreover, the nutrient intake of the two experimental groups was very similar. These results are similar to our experiment, since a statistically non-significant difference of 200 daily calories value was observed, greater for IG compared to CG. This difference in calories was in post intervention, pointing at the beneficial effect of the experiment.

In studies on privileged populations, it has been proven that elementary school years are ideal to encourage children to adopt healthy dietary habits and food preferences. Later, in middle school food habits and patterns of eating are more difficult to change (Kandiah et al., 2002). Generally, it is believed that young children do not make their own food choices; however, after nutrition education they are empowered to make improved healthy food choices (Matvienko, 2007). An educational intervention undertaken in India by Shah et al. (2010), involving parents, teachers and children, investigated the effect of nutrition and cooking sessions, health and physical activity sessions on chronic disease prevention. Both knowledge and behavior scores improved in all children except 15-18 years adolescents. The progress was more significant with females than males, significant improvement in public school children compared to private school children and the age group 8 to 11 years did improve more than the 12-18 years old children. Similar to our study, in children aged 7 -10 years, dietary behavior and food intake improved from baseline in the IG, specifically in certain nutrients such as total carbohydrate, vitamin A, riboflavin and niacin. This may be attributed to the finding that the IG participants increased the intake of low budget but healthy foods such as colored fruits and vegetables, canned fish, nuts, eggs and certain types of dairy.

In the current study, for the knowledge acquired by the children through the weekly sessions, at baseline IG scored higher in the FKS compared to the CG. Similarly, post-intervention the difference between the groups was greater, favoring the IG. This was clearly observed in the changes in food pyramid scores, where at baseline there was no significant difference between the two groups, but after the intervention the difference between the IG and CG was significant.

In contrast to the results of Shah et al (2010), boys scored higher than girls after the intervention study. As expected, the IG nutrition knowledge improved significantly compared to CG. However, the score of the CG improved as well, since children who undertook the first knowledge test, at the beginning of the study, were curious to seek for answers to the food knowledge questionnaire (Pirzadeh et al., 2014).

In LMIC, it is recognized that women play a major role in household FS (Zalilah et al., 2008a). Previous research has established evidence that educating women from FI households on food skills, in food selection and preparation could decrease the severity of FI but cannot compensate inadequate household income (Hersey et al., 2001).

In our study most of the mothers were not income earners, but were housewives responsible for the food production and care of household members. Thus, during the two sessions with the caregiver, basic nutrition and low budget healthy cooking tips in addition to smart coping strategies in case of decreased spending capacities were stressed. However, the mothers were not tested for their acquired knowledge before or after intervention in order to limit additional liability of cooperation for the study. Testing of the caretakers after the intervention sessions would have added value to the estimation of the intervention, level of understanding by the FI parents and the adjustments necessary to the content of the sessions. The feasibility of the mother education sessions is easy to quantify, in the case of mothers of newborns or toddlers, due to the quick changes of children's anthropometry. Many such applications were tested such as Roy et al. (2005) who provided intensive education to mothers with malnourished children aged 6 to 24 months. The mothers were given three months training and six months of observation; at the end of the intervention the nutrition status of the moderately malnourished children improved significantly, with or without food supplementation. Similar results were observed in Iranian nomadic children (0-59 months), where the nutrition education of the caretaker was efficient and eventually improved the nutritional status under poverty conditions (Salehi et al., 2004).

Furthermore, Burney et al. (2002) demonstrated that nutrition education for the caretaker or mother of household, increased the conscious of consumers to read labels and reduced household expenses by 124 to 234 $ over a year. Simultaneously, increased intakes of iron, vitamin C, vitamin B6 and fiber were observed as well as a reduced salt intake. The authors concluded that it is cost beneficial to educate mothers about home economics and healthy cooking on a budget (Burney et al., 2002).

It is well known that household income is a key and independent determinant of FI and malnutrition. In our sample of participating households from both CG and IG, almost 90% did not have a stable income and depended on daily remunerations. Furthermore, for more than 50% of the households, their monthly income did not cover all the dietary needs. It is documented that FI households and mothers are much affected by food price in choosing food quality and quantities. Michels et al. (2008) tested the impact of a reduction of food price opposed to intervention based on 'healthy food benefits' messages. The former motivated FI consumers to buy larger quantities of the food items on sale compared to the health benefits. As demonstrated in Appendix 29, in the current study, before the start of the intervention study, prices of a list of staple foods were compared between six different stores from each intervention region. The analysis verified that Tripoli (urban) was considered to be a cheaper food market for the purchase of packaged or ‘on the shelf’ products compared to the Bekaa (rural); still the Bekaa, being an agricultural region, enjoyed competitive prices for fresh products such as fruits and vegetables. Further, from the parent interviews, it was assumed that FI in the rural area follows a seasonal pattern, where the spring and summer harvest is the “food plenty” season followed by the “hungry” season.

There are a number of limitations of the current intervention study: (1) Respondent bias, as the FI caretaker or mother may be expecting to receive material assistance or benefits from taking part in the study (2) the CFI questionnaire was only tested once at baseline of the intervention study, thus no comparison of changes in CFI over time could be applied. (3) the timing of the study, which was between late winter and spring season, resulted in a number of partaker withdrawals from the study especially in the second half of the study, during spring harvest when the rural participants reduced their cooperation (4) the complexity of the study design, requiring multiple anthropometric measure, 24hrs recalls and follow up resulted in losing some of the participants. This step affected the statistical power of the analysis, especially at the subgroup level.

Thus, in futue work great effort should be invested to keep the enrolled participants during the subsequent phases of the study to avoid statistical bias of data results. A second solution could be the increase of the sample size to account for the loss of the paricipants. In such a case, evenual participant withdrawal from different subgroups requires sensitivity analysis, to estimate the impact of such bias on research results.

In conclusion, this nutrition intervention links the parent and child nutrition knowledge acquisition to the nutritional status and food intake of the CFI children. The impact of the intervention, between gender and region groups (Bekaa and North) was equally effective for both boys and girls in both geographic regions. In addition, the knowledge of both the CG and IG improved, but this improvement was greater in the IG compared to the CG. Furthermore, the nutritional status of both groups improved; however, the IG surpassed in certain measures most specifically the height. Finally, the dietary intake, as reported by the 24-hour dietary recall, improved from pre to post intervention for the IG group for some nutrients. For the CG the values either remained constant during intervention or reduced throughout the 20 weeks period. As a conclusion, the findings from this study demonstrated that this nutrition intervention was successful in promoting healthy nutritional behavior despite poverty of CFI children.

Chapter 6 : Conclusion, Limitations and Recommendations

6.1 Discussion & Conclusions

In the last few decades, maternal and child malnutrition are persistent and detrimental conditions in LMIC (Black et al., 2008). Accordingly, FI or limited quality or quantity of food is linked to diminished wellbeing, increased stress and associated consequences on children adolesents and adults (Holben, 2010). Further, it is a consensual fact that long-term under-nutrition in children will result in stunting, wasting, micronutrient deficiencies, increased weight and chronic morbidities such as hypertension and diabetes (Laraia, 2013).

At a global level, there is increased apprehension about the sustainability of the current food systems and its long term impact on the environment and human health. With the spread of globalization, environmental and climate matters, such as extremes of temperatures and droughts, all these factors influence food security and the nutritional status of vulnerable populations.

At a national level, gradual changes in dietary habits occurring in Lebanon, specifically in the FI population, are not only directed by economical or personal choices but due to government policies as well. The current political situation in Lebanon is such that issues concerning FI and diet are not of precedence for the government. Further, a large portion of government funds and private subsidization are attributed to staple foods in the agriculture sectors such as wheat and sugar. Regrettably the small dimension of funds dedicated to agriculture and environment do not help small and large hold farmers to increase the agricultural output under nutritional, economical and ecological criteria.

At the household level, FI being a multi-causal phenomenon, there has been a large body of literature linking CFI to socio demographic characteristics such family structure, age, educational level of the head of the household and health condition (Bartfeld & Dunifon, 2006). However, one key reason for CFI is low household income (Gunderson et al., 2011). Still households with low income but good financial skills and food management capacities are less likely to become FI (Gunderson & Garaksy, 2012). Thus, Gunderson (2009b) concluded that FI is associated to revenue and to non-pecuniary factors such as nutrition knowledge and economic management.

In light of this, national nutrition programmes addressed to FI parents and children are key in helping FI households adopt appropriate coping skills to buffer consequences of FI. Previous intervention studies have proven that teaching FI parents will give favorable results (Bhutta, 2008). Whereas Oldewage-Theron et al. (2010) tested the nutrition knowledge of 9 to 13-year-old South African children, discovering many gaps in basic nutrition knowledge such as the role of food groups in a healthy diet and hygiene practices.

The first pilot study approached child FI situation in the country by assessing CFI of children from low and high socio economic backgrounds. Therefore, two FI questionnaires were translated into Arabic local dialect (HFSSM and the HFIAS) and validated. This was a unique step since in one experiment we tested and compared two FI questionnaires, the former involving the FI status of household adults and children and the latter the access component of FI.

However, similar to Saaka et al. (2013), household food access or HFIAS questionnaire was not corellated with any of the direct indicators of the children's nutritional status. Therefore, the subsequent experiments were based only on the HFSSM Household FI questionnaire that comprised the child addressed questions of CFI. The importance of the pilot research was to test the validity of the parent socio economic and child health related questions, and to compare all the FI causative sociodemographic factors with the different severities of CFI. Furthermore, the child knowledge test translated from English into Arabic did not prove to be culturally appropriate therefore was discarded for the subsequent survey.

From this study we discovered that the anthropometric measures of the Lebanese children follow a socio-economic gradient, all the values of height, weight, triceps, biceps, suprailliac and hip circumference were higher in the high socioeconomic status (HS) children. But the results of overweigh and obesity were with agreement with Sharkey et al.(2012) where children with high CFI had a elevated risk of overweigh and obesity, associated with a greater intake of daily energy and percentage of calories from fat and sugar.

To further estimate the national prevalence of CFI, a country wide survey was performed, in the six different geographic areas in both LS and HS groups. This experiment demonstrated that 24% of the surveyed children were of low CFS and 8 % very low CFS. The low CFS children had common characteristics: big family, mother of no primary education and high carbohydrate consumption. In addition, there was a higher occurrence of stunting, wasting and underweight in the low CFS group. The distribution of CFI was varied between the regions, but it was mostly prevalent in the North (Tripoli), Bekaa and a small percentage in the capital Beirut.

The FKS, the score of the nutrition knowledge testing, showed a linear and increasing correlation with increase in FS in children. Further, the Lebanese mother's literacy level proved to have a strong impact on CFI. This is important information, since the nutritional and financial management skill teaching sessions to the mother or caretaker could be helpful in reducing the severity of CFI.

Despite the vulnerability of CFI children, very little research has been undertaken on the nutrition status of school aged children and their nutrition education especially in the context of FI households. Thus, the third experiment was based in the two regions that experience the most CFI: the Bekaa (rural) and the North (urban). This was an intervention study that included the parents and children from CFI households in a rural and urban context. The parents were provided with community based inter sectorial counselling to introduce low cost, nutrient rich diets to their families. The children's sessions were based on different topics of healthy and thrifty nutrition.

The intervention that lasted five months, both IG and CG did progress in knowledge; however the IG progress was more significant. Furthermore, boys progressed better in the nutrition education sessions (40 points against 35.7 for girls) which is surprising discovery since girls being more health and weight conscious progress more in such subjects.

Further, the physiologic change of the mean weight and height values, both CG and IG progressed during the course of the 20 weeks, however increased significantly in IG, during the experimental period. Further, the Bekaa (rural) children had a greater progress in the mean height value compared to the Tripoli (urban), which could be due to the increased difference in the diet quality of the former as a result of the intervention.

The diet quality in the IG progressed significantly with increases in daily calorie intake in addition to protein, fat, carbohydrate and sugars. In parallel, in the CG there was a significant reduction in the daily intake of nutrient values specifically iodine, vit D and folate. The progress was not clear in the mid intervention assessment (at 10 weeks), still it was significant at the last (20 weeks) evaluation.

Further, the intervention results were not influenced by mother education level, gender or region specific. These results pointed to the positive impact of the intervention, and to the universal applicability of the intervention programme in the Lebanon or other countries with similar socio-demographic characteristics.

To conclude, this thesis makes important contribution to our understanding of the living conditions and dietary habits of the FI communities in the Middle East. Moreover, this thesis challenges the intervention at both adult and child levels in two geographically distinct areas. Besides, this thesis highlights the importance of nutrition and health education in moderate and severe FI communities.

On the long run, governments should implement country specific identification of the causal pathways of the double burden of malnutrition, to determine the economic and environmental factors that jeopardize the availability and affordability of food, access to healthy diets, feeding practices and options for diet diversification. With Lebanon being a small import dependent economy, there is a pressing need for public intervention to fight nutrient deficiencies and malnutrition in susceptible population groups.

There are a number of potential national policies that could be considered:

- Policies to promote the availability, access and consumption of diverse nutrient rich foods need to be reinforced, particularly in poverty pockets in rural and urban areas
- Government policies involving different Ministries to improve economic growth and alleviate poverty through cash transfer programs, planning of family agriculture and food banks and low cost restaurants
- At the food market level, protection of children from marketing of unhealthy food and beverages, labelling and health claims, reformulation of processed foods to healthier ingredients like less salt and less sugar.
- Upgrading of market infrastructure to increase affordability of fresh and safe foods.

- Evidence-informed guidance for health and nutrition interventions should be considered at the governorate stage.
- Teach rural FI farmers cost-effective means to improve access to contributions, develop cash to purchase inputs and invest in agricultural infrastructure.

6.2 Study Limitations

The overall limitations of this thesis were, first the anthropometric measurement error being unavoidable in human studies, we took the precaution to do three readings for all the measurements during all the experiments. Further for the intervention study, to minimize the risk of error, the PI or the principal investigator took all the measurements during all the phases. As to the sessions, more emphasis should have been given educating the caretaker or the mother, more number of sessions or field work like thrifty cooking classes or shopping trips. Further, testing of the parent on the acquired theory of the sessions, before and after the intervention is another step that was missing, to quantify the effectiveness of the parental sessions.

The timing of the experiment between winter and spring season was a difficult period to get cooperation from the children's caretakers and the children, especially the rural population, who focus on outdoor or agricultural activities as a source of income. The inconvenience was the number of dropouts, especially in the IG, which could have affected the significance of the statistical values. As a recommendation for future experiments that involve children, autumn would be the best season to start when the wheather conditions should be mild and the children procuppied with school responsibilities. Finally, reassessment of the household FI should have been at the end of the 20 weeks to check if the intervention reduced the severity of FI at the childand household levels.

6.3 Recommendations for future work

- Additional research with larger sample size, to take into consideration the number of dropouts and have a significant number of participants in the experiment.
- To assure better cooperation of the parent or caretaker, create a model of study structure to encourage more involvement of the parent. For example, creation of a home garden or a discounted market for fruits and vegetables could trigger the interest of the parent and assure the long term cooperation of the parent.
- Longer follow-up periods as a longitudinal study are needed to better evaluate the validity of intervention studies for FI population. The FI domain being season sensitive, especially in rural communities, it is recommended to cover at least two full seasons to understand thee seasonal fluctuations in the degree of of FI.
- FI studies with intervention at child or adult level need to examine long term compliance of the intervention guidelines, thus reassessment after six and twelve months is a necessity. This could test the efficacy of the intervention and the adaptation of the newly acquired habits as long term.
- The experiments on the effect of FI on child health should be complemented with physiological parameters taken concomitantly, such as iron, calcium and Zinc blood levels. This method is costly but could enforce the conclusions derived from the theoretical part of a study.
- Additional longitudinal investigations are warranted, to evaluate the diet of CFI children over a period of three to four months, to monitor the variability in diets and assess the eventual cause.
- Assess the diet of the parent or caretaker, to check for parental buffering that protects children from food insecurity in periods of "hunger"; additionally in

case of parental reinforcement sessions a follow up, to quantify observable progress in the diet of the parent.

- Empowerment of women through technical education on home economics or creation of “part-time “jobs to manage better the different aspects of household organization and maybe contribute in the overheads of the household.

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APPENDECIES

Appendix 1: Ethical Approval UREC - Pilot

University Research Ethics Committee
Wheatley Campus, Wheatley Oxford OX33 1HX UK
t. +44 (0)1865 485741
ethics@brookes.ac.uk
www.brookes.ac.uk/res/ethics

Dr Helen Lightowler
School of Life Sciences
Oxford Brookes University
Gipsy Lane

28 January 2008

Dear Dr Lightowler

UREC Registration No: 070302 Child food insecurity in the Lebanon: Effects on physical development

Thank you for your email of 25 January 2008 outlining your response to the points raised in my previous letter for your research student Carla Yardemian Hage's study and attaching the revised documents.

Thank you for explaining how the focus groups will consider the content and validate the questionnaires being used in the study and for producing separate information sheets for the focus group, MOSA Administration and for the parents of the main study. There are a few minor typographical errors in the focus group and parent information sheets which need to be addressed, for example you may wish to remove one of the statements 'to avoid any unnecessary interruptions' as this is mentioned twice very close together in the information sheet for parents. Once these amendments have been made, please forward them to the UREC administrator, Louise Wood and, on this basis, I have given Chair's Approval for the study to begin.

The UREC approval period for this study is two years from the date of this letter, so until 28 January 2010. If you need the approval to be extended please do contact me nearer the time of expiry. Please remember, as stated in my previous letter, that the committee decided that **it would grant approval for the first and second phases subject to you meeting the conditions,** but asked that you come back to the committee with a further application before reaching the implementation of the final two month intervention, when you intend to provide a 'healthy food basket' to reduce food insecurity for a number of families.

In order to monitor studies approved by the University Research Ethics Committee, we will ask you to provide a (very brief) report on the conduct and conclusions of the study in a year's time. If the study is completed in less than a year, could you please contact me and I will send you the appropriate guidelines for the report.

I look forward to hearing from you soon.

Yours sincerely,

Teresa Smallbone
Chair, University Research Ethics Committee

cc Carla Yardemian Hage
Dick Craven
Graduate Office

REPUBLIC OF LEBANON
Ministry of Education and Higher Studies

Archives Number
Outgoing Number 11170/4

Seal of the Ministry of Education
And Higher Studies
Education Cabinet
Registration Number 12623/3
Date December 5, 2007

Attention the General Director

Kindly be informed with a proposal to approve the petition of Mrs. Carla El-Hage to have access to the State official schools to prepare the diploma of P.H.D in the Nutrition Sciences provided to co-ordinate with the principals of the concerned schools to assure the good function of the school work.

The Directress of the Primary Education
Charlotte El-Makdessi
Signature and seal

11623/3
Attention the Directorate of the Primary Education
Approving your proposal within what has been shown.
To be aware of and to act accordingly
The General Director and interim
Wael El Tannir
Signature and seal

To be remitted to the petitioner
The Directress of the Primary Education
Charlotte El-Makdessi (signature and seal)
Dec. 5, 2007

True and correct translation of the Arabic attached document.
The Sworn Translator Boulos Joseph Misk Tel/Fax 01/561995

Appendix 2: Lebanese Ministry of Education Approval

Republic of Lebanon
Ministry of Education And Higher Education
Minister

12530/11

Septembre 28, 2007

١- تشرين الأول ٢٠٠٧

Hafez Elzein, MD, MS
Director/ Clinical research Unit
American University of Beirut Medical Center

Dear Dr. Elzein,

This letter is to officially inform you that the Ministry of Education in the Republic of Lebanon, fully endorses the activities you intend to conduct in the elementary schools where the Ajialouna organization operates. These activities are part of your proposed studio entitled: "Integrated School-and Clinic Based Management Model of Childhood Obesity", and include:

- Training of teachers by the study staff
- Inclusion of materials about overweight prevention, nutrition, and physical activity in the curriculum
- Conducting physical activity sessions during school day
- Permission day to use the school facility for a limited time after school hours

It is our pleasure to see that such activity is contemplated with the goal of improving the health of our school children. I hope you receive the funding to make this program happen.

Khaled Kabbani, Phd

Minister of Education and Higher Education
Republic of Lebanon

Appendix 3: AUB Medical Center Approval – Pilot Study

لجنة الأخلاقيات
كلية الطب
INSTITUTIONAL REVIEW BOARD
FACULTY OF MEDICINE

AUB American University of Beirut
الجامعة الأميركية في بيروت

To: Dr. Hafez El Zein
Date: Feb. 18, 2009

Principal Investigator: Dr. Hafez El Zein
American University of Beirut Medical Center
Protocol Number: IM.HZ.02
Protocol Name: Child food insecurity in Lebanon/ effects on physical development

Thank you for submitting to the IRB your letter dated Feb. 12, 2009 in response to IRB comments letter dated Feb. 02, 2009 for review.

The IRB reviewed in an expedited manner your reply, the modified Arabic parental Consent form (version dated Feb. 2009), the modified Arabic child assent form (version dated Feb. 2009), the Arabic children's Questionnaire.

This is to grant you approval to the study proposal, the modified Arabic parental Consent form (version dated Feb. 2009), the modified Arabic child assent form (version dated Feb. 2009), the Arabic children's Questionnaire, the Arabic parents' Questionnaire,

Kindly note that if pilot testing necessitates any amendments on the protocol, informed consent forms, Questionnaires, you should report to IRB for approval prior to implementation.

The membership of this Institutional Review Board complies with the membership requirements defined in the US Code of Federal Regulation (21CFR56 and 45CFR46) of the Food and Drug Administration. In addition, the IRB operates in a manner consistent with Good Clinical Practices under the ICH guidelines, with FDA and applicable national/local regulations.

Sincerely,

Ibrahim Salti, MD, PhD
Chairperson of the IRB

cc. Dr. Ali Bazarbachi, Assistant Dean for Research, Faculty of Medicine

BLISS STREET - P.O.BOX 11-0236 - BEIRUT - LEBANON - TEL (961) 1 350 000 - EXT. 4910/1 - FAX (961) 1 744464 - E-mail: resdean@aub.edu.lb
NEW YORK OFFICE: 3 DAG HAMMARSKJOLD PLAZA, 8TH FLOOR - NEW YORK, NY 10017-2303 U.S.A. - TEL. (212) 583 7677 FAX (212) 583 7650

Appendix 4: Invitation letters to parents of children – Pilot Study

School Name and logo

Child Nutrition & Assessment Day

You are invited to participate in a research undertaken with a group of doctors and dietitians from the American University of Beirut.

The parents are invited to the school on ………………………….starting **……………**to attend a lecture about child nutrition / breakfast brunch in the school lecture hall. Following the lecture, parents will do discussion for 15 minutes to fill out a questionnaire, concerning household and children food habits.

On the same day, the researchers will work with the children whose parents attended the meeting, and signed the consent form, to take the body measurements and percent body fat to check the level of development. Further; the researchers will do a small discussion with each child for 10 to 15 minutes, to check his or her knowledge about nutrition. The meeting with the child will be scheduled at the time and place assigned by the school administrator.

The child body measurements will include height, weight, waist and hip measures, caliper measures and percentages body fat assessed with professional equipments (In body 230 machine). Later, you will receive a free written evaluation about the level of growth and nutrition status of the child.

Only children (aged 7 – 10 years old) whose parents attended the lecture and filled out the questionnaire will be given a full evaluation. This study is in collaboration with Department of Nutrition - Oxford Brookes University in the U.K. Ethics Committees from AUB and Oxford Brookes approved of the procedure of this research.

Thanks to taking time to read this info for further info contact Mrs. Carla Yardemian Hage at: 03 – 773523

Name of student: ___________________________________ class: _____________

I agree to participate ☐ I do not agree to participate ☐

Appendix 5: Parent Consent Form – for Pilot Study

PARENT CONSENT FORM

Name, position and contact address of Researcher: **Carla Yardemian-Hage**
Clinical dietitian
PoBox.90-988

Please initial box

1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason. ☐

3. I agree to take part in the above study. ☐

4. I agree to my child having their BMI measurements taken by a school nurse ☐

5. I agree to my child having their BMI measurements taken by the research group

Appendix 6: Arab Food Insecurity Questionaire (AFIQ)

Arab Household Food InsecurityQuestions AFIQ

1. "**We worried whether our food would run out before We got money to buy more.**"

1- [ ] Often true

2- [ ] Sometimes true

3- [ ] Never true

4- [ ] Don't know or Refused

2. **"The food that we bough just didn't last, and we didn't have money to get more."**

1- [ ] Often true

2- [ ] Sometimes true

3- [ ] Never true

4- [ ] Don't know or Refused

3. "**We couldn't afford to eat healthy nutritious / meals**.

1- [ ] Often true

2- [ ] Sometimes true

3- [ ] Never true

4- [ ] Don't know or Refused

4. **"We relied on only a few kinds of low-cost food to feed our) child/the children because we were running out of money to buy food."**

1- [ ] Often true

2- [ ] Sometimes true

3- [ ] Never true

4- [ ] Don't know or Refused

5. **"We couldn't feed the children a nutritious/ healthy meal, because we couldn't afford that."**

1- [ ] Often true

2- [ ] Sometimes true

3- [ ] Never true

4- [ ] Don't know or Refused

6. **"Our child was not eating enough because we just couldn't afford enough food."**

1- [ ] Often true

2- [ ] Sometimes true

3- [ ] Never true

4- [ ] Don't know or Refused

7. **In the last 12 months, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?**

1- [ ] Yes

2- [ ] No

3- [ ] Don't know or Refused

8. **IF YES How often did this happen** – almost every month, some months but not every month, or in only 1 or 2 months?

1- [ ] Almost every month

2- [ ] Some months but not every month

3- [ ] Only 1 or 2 months

4- [ ] Don't know or Refused

9. **In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money to buy food?**

1- [ ] Yes

2- [ ] No

3- [ ] Don't know or Refused

10. **In the last 12 months, were you ever hungry but didn't eat because you couldn't afford enough food**?

1- [ ] Yes

2- [ ] No

3- [ ] Don't know or Refused

11. **In the last 12 months, did you lose weight because you didn't have enough money for food?**

1- [ ] Yes

2- [ ] No

3- [ ] Don't know or Refused

12. **In the last 12 months, did you or other adults in your household ever not eat for a whole because wasn't enough money for food?**

1- [ ] Yes

2- [ ] No

Appendix 6: Arab Food Insecurity Questionaire (AFIQ)

13. **IF YES How often did this happen** – almost every month, some months but not every month, or in only 1 or 2 months?

1- [ ] Almost every month

2- [ ] Some months but not every month

3- [ ] Only 1 or 2 months

4- [ ] Don't know or Refused

14. **In the last 12 month, did you ever cut the size of your child's meals because there wasn't enough money for food?**

1- [ ] Yes

2- [ ] No

3- [ ] Don't know or Refused

15. **In the last 12 months, did your child ever skip meals because there wasn't enough money to buy food?**

1- [ ] Yes

2- [ ] No

3- [ ] Don't know or Refused

16. **IF YES How often did this happen** – almost every month, some months but not every month, or in only 1 or 2 months?

1- [ ] Almost every month

2- [ ] Some months but not every month

3- [ ] Only 1 or 2 months

4- [ ] Don't know or Refused

17. In the last 12 months, was your child ever hungry but you just couldn't afford more food?

1- [ ] Yes

2- [ ] No

3- [ ] Don't know or Refused

18. In the last 12 months, did your child ever not eat a whole day because there wasn't enough money for food?

1- [ ] Yes

2- [ ] No

3- [ ] Don't know or Refused

3- [ ] Don't know or Refused

Adult Food Insecurity (AFI) Score _________

Child Food Insecurity (CFI) Score _________

Total AFIQ Food Insecurity (CFI) Score _________

Appendix 7: Household Food Insecurity Access Scale (HFIAS)

Form N°: |___|___|___|___|

Child's Full Name: ___________________________________

- What is your relation ship to this child? ______________

Home address ____

Governorate: _____________________________ District:____________________________

Telephone Number: |__|__| |__|__|__|__|__|__| Mobile Phone Number: |__|__| |__|__|__|__|__|__|

Household Food Insecurity Access Scale (HFIAS)

In answering each of the following questions, please respond according to your situation in the past 30 days			
No	**Question**	**Response Options**	**Code**
1.	Did you worry that your household would not have enough food?	0 = No (skip to Q2) 1 = Yes	…
1. a	How often did this happen?	1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30days) 3 = Often (more than ten times in the past 30 days)	…
2.	Were you or any household Member not able to eat the kinds of foods you preferred because of a lack of resources?	0 = No (skip to Q3) 1 = Yes	…
2. a	How often did this happen?	1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than ten times in the past 30 days)	…
3.	Did you or any household member eat a limited variety of foods due to a lack of resources?	0 = No (skip to Q4) 1 = Yes	…
3. a	How often did this happen?	1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than ten times in the past 30 days)	…
4.	Did you or any household member eat food that you preferred not to eat because of a lack of resources to obtain other types of food?	0 = No (skip to Q5) 1 = Yes	…
4. a	How often did this happen?	1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than ten times in the past 30 days	…
5.	Did you or any household member eat a small meal than you felt you needed because there was not enough food?	0 = No (skip to Q6) 1 = Yes	…
5. a	How often did this happen?	1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than ten times in the past 30 days)	…
6.	Did you or any other household member eat	0 = No (skip to Q7) 1 = Yes	

	fewer meals in a day because there was not enough food?		…
6. a	How often did this happen?	1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than ten times in the past 30 days)	…
7.	Was there ever no food at all in your household because there were not resources to get more?	0 = No (skip to Q8) 1 = Yes	…
7. a	How often did this happen?	1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than ten times in the past 30 days)	…
8.	Did you or any other household member go to sleep at night hungry because there was not enough food?	0 = No (skip to Q9) 1 = Yes	…
8. a	How often did this happen?	1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than ten times in the past 30 days)	…
9.	Did you or any other household member go a whole day without eating anything because there was not enough food?	0 = No (questionnaire is finished) 1 = Yes	…
9.a	How often did this happen?	1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than ten times in the past 30 days)	…

Appendix 8: Parent Socio Economic and Health (SEH) Questionnaire – Pilot and Survey Study

NATIONAL HEALTH SURVEY OF SCHOOL-AGED CHILDREN

CONFIDENTIAL

Form N°: |___|___|___|___|

Child's Full Name: ____________________________________

- What is your relation ship to this child? ______________

Home address ____

Governorate: _____________________________ District:____________________________

Telephone Number: |__|__| |__|__|__|__|__|__| Mobile Phone Number: |__|__| |__|__|__|__|__|__|

Form N°: |___|___|___|___|

Socio Economic Health Questionnaire

1-Security situation in the region:

1-Very Unstable ☐
2-Sometimes Unstable ☐
3-Sometimes Stable ☐
4-Stable ☐

2-Has the child been living in the same house for the Past 3 years? ☐ 1- Yes ☐ 2- No

3-If the answer is No, please specify the region(s) where the child has lived for the past 3 years? ___________

____

4-Number of rooms in the house (besides the kitchen and the bathrooms)

1- One ☐
2- Two ☐
3- Three ☐
4- Four or more ☐

5-Total number of people living under same roof (including household help) : ____________

6-Number of children under 18 years living under the same roof ___________

7-Do you have any household help? ☐ 1- Yes ☐ 2- No If yes how many?_____________

8-Type of residence:

1- Privately owned ☐
2- Rent ☐
3- Refugee Camp ☐
4- Unspecified _________________________

9-Number of vehicles (cars & trucks) in the household:

1- None ☐
2- One ☐
3- Two ☐
4- Three or more ☐

10-The child is living with:

1- The parents ☐
2- A single parent (divorced parents) ☐
3- A single parent (separated parents) ☐
4- A single parent (multiple marriages) ☐
5- Relatives other than the parents ☐
6- A guardian ☐
7- Other, specify ____________________

C- General Information about the parents

11-Are any of the parents restricted from any food type due to medical reasons? ☐ 1- Yes ☐ 2- No

12-If Yes, specify the types of food: ____

____

13-Father's Age: ___________

14- Father's weight------------ 15- Father's height---------------cm 16- Father's BMI -------------

17-Does the father smoke cigarettes or hubbly-bubbly? 1- yes 2- No

18- 1- If yes specify number of cigarettes per day--------
Number of cigarettes per week------
Number of cigarettes per month-----
19- 2-If yes specify number of hubbly-bubbly per day--------
Number of hubbly-bubbly per week------
Number of hubbly-bubbly per month-----

20- Has the father been diagnosed with any of these chronic diseases?

Disease	**Yes / No**	Less than < 1 year	1 - 5 Years	10 Years	More than > 10 Years
1- Diabetes					
2-Hypertension					
3- Heart & Arterial Diseases					
4- High Cholesterol					
5- High Triglycerides					
6- Malignant Tumors (Cancer)					
7- Osteoporosis					
8- Goiter					
9- Anemia (Diagnosed by Physician)					
10- Rheumatoid arthritis					
11- Any other chronic disease, (please specify) ________________________________					

21-What is the father's education level?

1- Not able to read or write (illiterate) ☐
2- Completed elementary level ☐
3- Completed intermediate level ☐
4- Completed secondary (baccalaureate) ☐
5- Completed Technical School ☐
6- Completed College ☐
7- Completed Higher Education ☐

22- Please specify the father's occupation ____

23- Activities the father shares with the child:

1- Reading ☐
2- Sports & physical activities ☐
3- School homework & studying ☐
4- Watching TV & listening to radio ☐
5- Social Games (e.g. cards, monopoly etc.) ☐
6- Other Activities, specify ________________

24-How much time (hours per day) does the father spend (doing the activity) with the child on weekdays?

____

25- How much time (hours per day) does the father spend (doing the activity) with the child on weekends?

____

26- Mother's Age: ___________

27- Mother's weight------------ 28- Mother's height---------------cm 29- Mother's BMI -------------

30- Does the mother smoke cigarettes or hubbly-bubbly? 1- yes 2- No

31- 1- If yes specify number of cigarettes per day--------
Number of cigarettes per week------
Number of cigarettes per month-----

32- 2-If yes specify number of hubbly-bubbly per day--------
Number of hubbly-bubbly per week------
Number of hubbly-bubbly per month-----

33- Has the mother been diagnosed with any of these chronic diseases?

Disease	**Yes / No**	Less than < 1 year	1 - 5 Years	10 Years	More than > 10 Years
1- Diabetes					
2- Hypertension					
3- Heart & Arterial Diseases					
4- High Cholesterol					
5- High Triglycerides					
6- Malignant Tumors (Cancer)					
7- Osteoporosis					
8- Goiter					
9- Anemia (Diagnosed by Physician)					
10- Rheumatoid arthritis					
11- Any other chronic disease, (please specify) ________________________________					

34- What is the mother's education level?

1- Not able to read or write(illiterate) ☐
2- Completed elementary level ☐
3- Completed intermediate level ☐
4- Completed secondary (baccalaureate) ☐
5-Completed Technical School ☐
6- Completed College ☐
7- Completed Higher Education ☐

35-Please specify the mother's occupation ______________________________

36-Activities the mother shares with the child:

1- Reading ☐
2- Sports & physical activities ☐
3- School homework & studying ☐
4- Watching TV & listening to radio ☐
5- Social Games (e.g. cards, monopoly etc.) ☐
6- Other Activities, specify _______________

37-How much time (hours per day) does the mother spend (doing the activity) with the child on weekdays?

____

38-How much time (hours per day) does the mother spend (doing the activity) with the child on weekends?

____

39- Total Household Income (total income of all family members, salary & monetary aid):

1-Under 550 thousand Lebanese pounds per month ☐
2-Between 551 & 700 thousand Lebanese pounds per month ☐
3-Between 701 & 1199 thousand Lebanese pounds per month ☐
4-Between one million two hundred & two million Lebanese pounds per month ☐
5-More than two million Lebanese pounds per month ☐

40- Do you have a regular income (tick all that apply)?

1- Monthly salary ☐
2- Monetary aid from abroad ☐
3- Organizations (religious organizations, charities or private organizations) ☐
4- Income from private work (e.g. plumber, blacksmith, carpenter, painter, housecleaner, babysitter, selling cigarettes & lottery tickets or as a taxi driver in return of payment in kind or cash) ☐
5- Payment from renting a land, an apartment or buildings ☐
6- Alimony ☐
7- Other revenues, please specify ___________________________

41- What is the monthly allowance spent on food besides restaurants in Lebanese pounds? ________________

42- What is the monthly allowance spent on food besides restaurants in percentage from monthly allowance?

____

43- Do you spend any money on restaurants? 1- yes 2- no

44- How much do you spend on restaurants per month (in Lebanese pounds)? __________________________

45- Do you have any private source of fruits, vegetable or any other food type?

46- If yes (quest. 61),Approximately what proportion of food consumed at home is of your own cultivation:

1- Olives [%]
2- Grains [%]
3- Meat, Chicken [%]
4- Vegetables [%]
5- Fruits [%]
6- Dairy [%]
7- Other specify? ____

47- How much did this child weigh at birth? (if you do not know, do not guess but state "don't know")

1- grams __________

2- don't know ☐

48- What was the length of pregnancy for this child? (if you do not know, do not guess but state "don't know")

1- weeks _________

2- months _________

3- don't know _________

49- Did the child breast-feed? 1- yes 2- no

50- If yes, specify the number of months of breast-feeding -----------------

51- Was this child the result of twin or triplet pregnancy?

1- yes ☐

2- no ☐

52- Specify the number of absence days during the school year? ______________________

53- Cause of absence

1- Sickness ☐
2- Helping parents at work ☐
3- Other reasons please Specify ____

54- Does the child work after school hours? ☐ 1-Yes ☐ 2- No

____

55- If yes, please specify type of work:

56- If Yes, please specify the number of hours/ week: __________

57- The number of meals the child consumes outside the home (in restaurants) on weekly basis:

1- none
2- one meal ☐
3- two meals ☐
4- three meals or more ☐

58-Please specify type of restaurant : ____

59- Specify the no of major meals the child consumes per day --------

60- The number of daily snacks:

1- none ☐
2- one ☐
3- two ☐
4- three or more ☐

61- What are the child's snack choices (tick all that apply) :

1- Fruits ☐
2- Sandwiches ☐
3- Chips ☐
4- Cake, biscuits & chocolate ☐
5- Other, specify ______________________________________

62- Does he/she eat meals at school? ☐ 1-Yes ☐ 2- No

63- If the answer is Yes, specify the source:

1- Meal brought from home ☐
2- Meal bought at the cafeteria ☐
3- Other, specify ______________________

64- Does the child drink milk on a daily basis? ☐ 1- Yes ☐ 2- No

65- If Yes, specify the number of cups a day ☐

66- If the child doesn't drink milk on a daily basis, how many cups of milk does he/she drink weekly?

Specify ☐

67- Number of times he/she consumes red meat? (cow, mutton) Per week ☐ Per month ☐

68- Number of times he/she consumes chicken? Per week ☐ Per month ☐

69-Number of times he/she consumes fish (canned fish not included)? Per week ☐ Per month ☐

70- Number of servings he/she consumes vegetables? Per day ☐ Per week ☐

71- Number of servings he/she consumes fruits? Per day ☐ Per week ☐

72- Does the child have any food allergies or intolerance? 1- Yes ☐ 2- No ☐

73- If Yes, specify to which food types:

1- Cow Milk ☐
2- Egg ☐
3- Sea food, shellfish ☐
4- Fish ☐
5- Peanuts / Nuts ☐
6- Wheat or gluten ☐
7- Other foods please specify _____________________

74- Do you feel your child is healthy? ☐ 1- Yes ☐ 2- No

75- Does he/she take any vitamins or minerals supplements? ☐ 1- Yes ☐ 2- No

76- If yes, who prescribed him these supplements?

1- Medical prescription ☐
2- Relatives or neighbors ☐
3- Pharmacist ☐
4- The child's parents ☐

77- Is the child on any medical treatment for any disease? ☐ 1- Yes ☐ 2- No

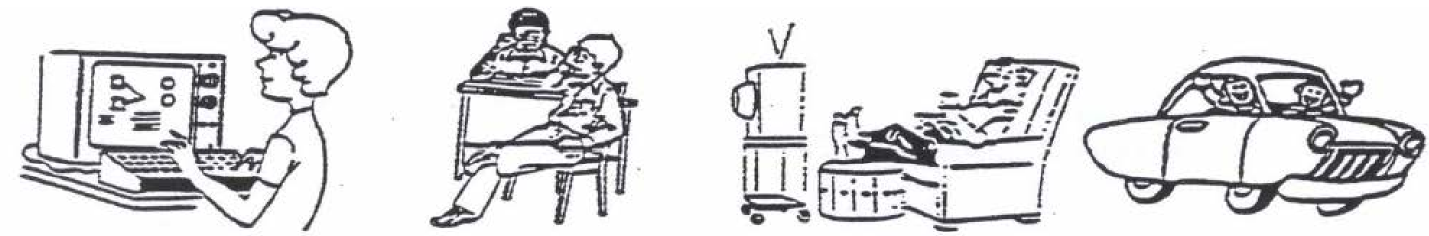
78- If Yes, please specify the disease ____

Activities Scale

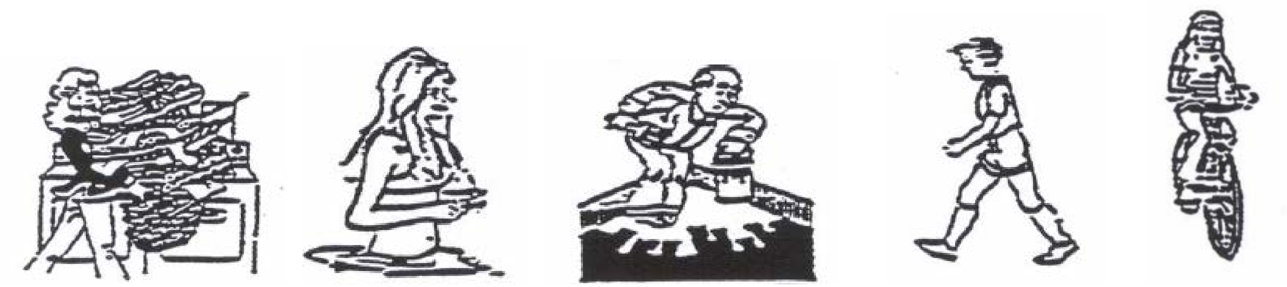
On the next page is a scale which records the **main** activities you did yesterday. Please be certain to write on the scale the **day of the week** that “yesterday” was.

1- For **each** time period write in the **number(s)** of the main activities you actually did in the boxes on the time scale.
2- Then rate how physically hard these activities were. Place an “X” on the rating scale to indicate if the activities for each time period were:

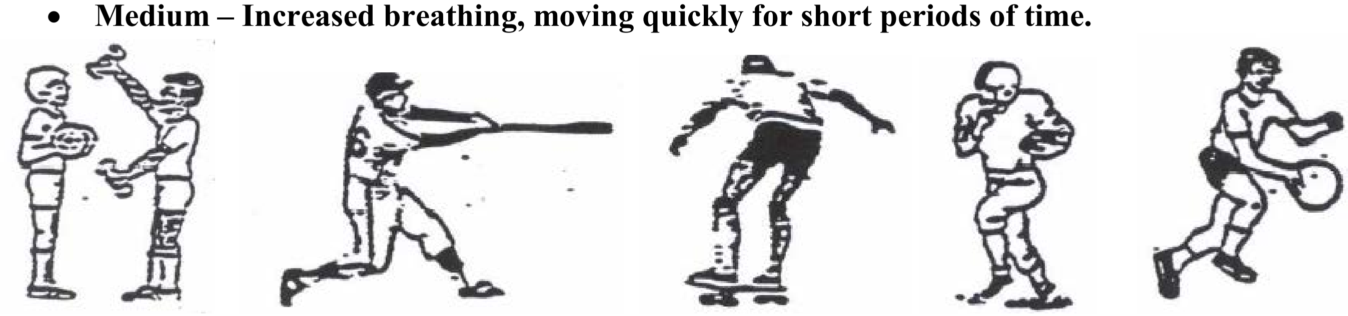
- **Very light – Slow breathing, little or no movement.**



- **Light – Normal breathing, regular movement.**



- **Medium – Increased breathing, moving quickly for short periods of time.**



- **Hard – Hard breathing, moving quickly for 20 minutes or more.**

Please be as accurate as possible but fill out the scale quickly.

Activity Numbers

Eating

1- Meal
2- Snack
3- Cooking

Sleep/Bathing

4- Sleeping
5- Resting
6- Shower/bath

Transportation

7- Ride in car, bus
8- Travel by walking
9- Travel by bike

Work/School

10- Job (list) ______________________________
11- Homework/paperwork
12- House chores (list) ______________________________

Spare Time

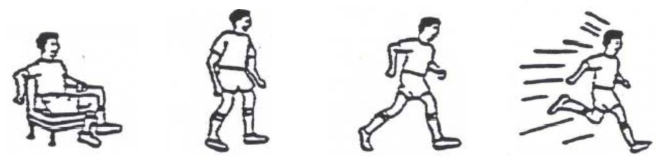
13- Watch TV
14- Go to movies/concert
15- Listen to music
16- Talk on phone
17- Hang around
18- Shopping
19- Play video games
20- Other (list) ______________________________

Physical Activities

21- Walk
22- Jog/run
23- Dance (for fun)
24- Aerobic dance
25- Swim (for fun)
26- Swim laps
27- Ride bicycle
28- Lift weights
29- Use skateboard
30- Play organized sport
31- Did individual exercise
32- Did active game outside
33- Other (list) ______________________________

Put Activity
1. Numbers in
This column

2. Put an T to rate
bow hard
these activities were



		Activity Numbers	Very Light	Light	Medium	Hard
	3:00					
Afternoon	**3:30**					
	4:00					
	4:30					
	5:00					
	5:30					
Supper	**6:00**					
	6:30					
	7:00					
	7:30					
Evening	**8:00**					
	8:30					
	9:00					
	9:30					
	10:00					
Night	**10:30**					
	11:00					

Appendix 9: Child Assent Form for Pilot Study

Consent to participate in research
CHILD PARTICIPANT ASSENT FORM

Title: Assessment of nutrition status development of Lebanese children and nutritional choices

Principal investigator: Dr. Hafez Al-Zein
Researcher Assistant: Ms. Carla Yardemian Clinical – Dietitian
Title: American University of Beirut
Bliss Street, Beirut, Lebanon
Phone number: 01-350000, P.O.Box address 5414
Study site: official and private schools of the six governorates of Lebanon and Beirut suburbs

Dear student,

You are invited to participate in scientific research to assess the nutritional status of Lebanese children between the ages of 7 to 10 years.

Your parent /caretaker is fully aware of the details of this study and has approved for your participation in this project. The lady researcher is going to take your bodymeasurements: weight, height, measures of waist and hip, arm, stomach and back with using simple equipments like the plastic tape and a machine called caliper. Measurements will not hurt or cause discomfort other than the caliper may feel a slight tingling for a few seconds.

If you feel any discomfort you can announce it to the person working with you.
Further you will have to answer to questions concerning your food habits and the quality of your favorite foods and quantities consumed, in addition to your daily physical activity.

Your participation will help in improving the eating habits and physical activity level of Lebanese children.

If you have any questions you can contact Dr. Hafez Al-Zein on the following number 01-350000.

If you approve to participate please sign your name.

Thanks for your time!

Date ______________ Name of child and birth date ____

Signature

Appendix 10: Children's Nutrition Knowledge (CATCH) and habits Questionnaire Co-ordinated Approach to Child Health

CATCH
Kids Club

CATCH KIDS CLUB
AFTER-SCHOOL STUDENT QUESTIONNAIRE

The following questions ask about foods and meals you eat, and what you know about nutrition and physical activity. **This is not a test.** We want to learn about what kids your age eat and know about nutrition and about physical activity.

The answers you give will be kept private. No one will ever know what you say unless you tell them. Your name will never be used.

Please be as honest as you can.

You will receive a password to write down. Please write the password here:

Password: ---

CATCH KIDS CLUB
AFTER-SCHOOL STUDENT QUESTIONNAIRE

1. What grade are you in? --

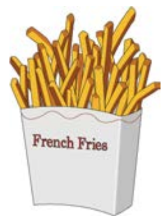
2. How old are you? ------- years old

3. Are you a boy or a girl?
   - ☐ Boy
   - ☐ Girl

4. How do you describe yourself?
   - ☐ Palestinian
   - ☐ Lebanese
   - ☐ Syrian
   - ☐ Armenian
   - ☐ Other specify ----------------------------

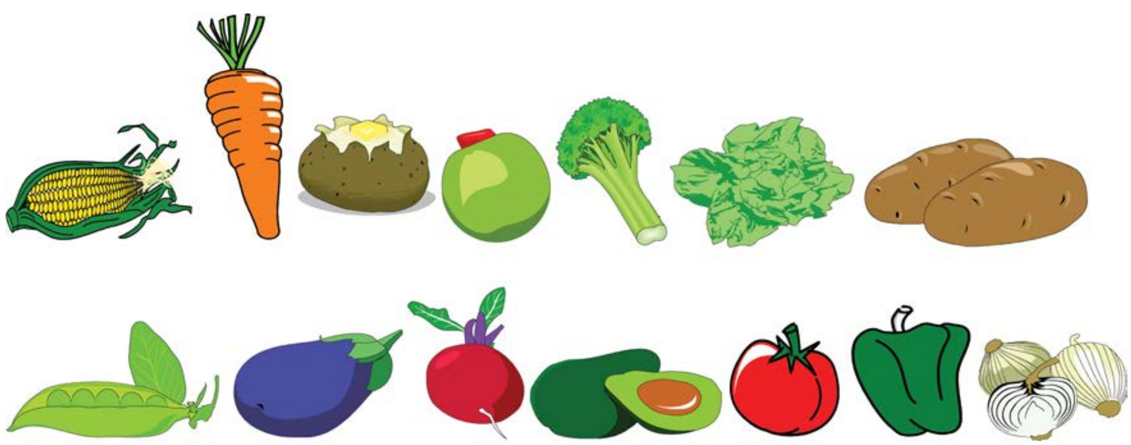
INSTRUCTIONS: Please CIRCLE your answer

5. Yesterday, did you eat French fries or chips ?
Chips are potato chips, tortilla chips, corn chips, or other snack chips.



a. No, I didn't eat any French fries or chips yesterday.
b. Yes, I ate French fries or chips **1 time** yesterday.
c. Yes, I ate French fries or chips **2 times** yesterday.
d. Yes, I ate French fries or chips **3 or more times** yesterday.

6. Yesterday, did you eat any vegetables?
Vegetables are salads; boiled, baked and mashed potatoes; and all cooked and uncooked vegetables or stews.
Do not count French fries or chips.

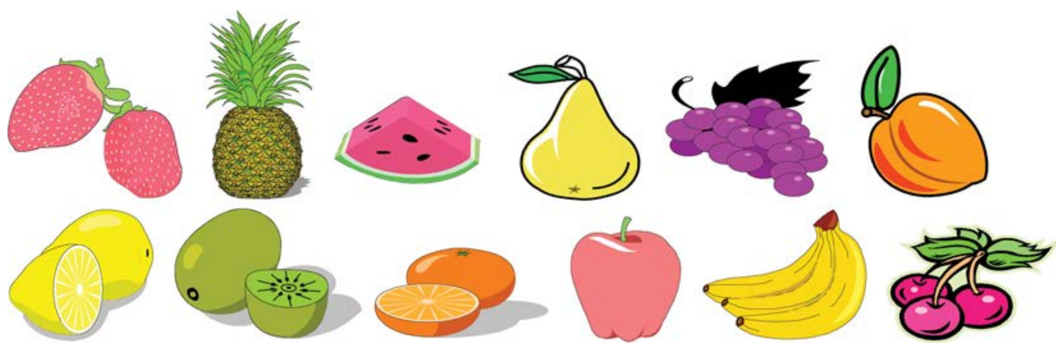


a. No, I didn't eat any vegetables yesterday.
b. Yes, I ate vegetables **1 time** yesterday.
c. Yes, I ate vegetables **2 times** yesterday.
d. Yes, I ate vegetables **3 or more times** yesterday.

7. Yesterday, did you eat beans such as pinto beans, baked beans, *foul,* kidney beans, or meat and beans?

a. No, I didn't eat any beans yesterday.
b. Yes, I ate beans **1 time** yesterday.
c. Yes, I ate beans **2 times** yesterday.
d. Yes, I ate beans **3 or more times** yesterday.

8. Yesterday, did you eat fruit?
Do not count fruit juice.



a. No, I didn't eat any fruit yesterday.
b. Yes, I ate fruit **1 time** yesterday.
c. Yes, I ate fruit **2 times** yesterday.
a. Yes, I ate fruit **3 or more times** yesterday.

9. Yesterday, did you drink fruit juice?
Fruit juice is a drink, which is 100% juice, like orange juice, apple juice, or grape juice.
<u>Do</u> <u>not</u> <u>count</u> punch, tang, sports drinks, and other fruit-flavored commercial drinks, like bonjus, syrup, or lemonade.

a. No, I didn’t drink any fruit juice yesterday.
b. Yes, I drank fruit juice **1 time** yesterday.
c. Yes, I drank fruit juice **2 times** yesterday.
d. Yes, I drank fruit juice **3 or more times** yesterday.

10. Yesterday, did you eat, doughnuts, cookies, brownies, Arabic sweets, petit fours, pies, or cake?

a. No, I didn’t eat any of the foods listed above yesterday.
b. Yes, I ate one of these foods **1 time** yesterday.
c. Yes, I ate one of these foods **2 times** yesterday.
d. Yes, I ate one of these foods **3 or more times** yesterday.

11. Yesterday, did you exercise or participate in sports activities that made your heart beat fast and made you breathe hard for at least 20 minutes. (For example: basketball, jogging, skating, fast dancing, swimming laps, tennis, fast bicycling, or aerobics)?

a. Yes
b. No

12. During the week, how many hours per day do you usually spend watching TV shows or videos?

a. I don't watch TV or videos
b. Less than 1 hour a day
c. 1-2 hours a day
d. 3-4 hours a day
e. more than 4 hours a day

13. During the week, how many TV shows or videos do you usually watch each day?

a. I don't watch TV or videos
b. 1
c. 2
d. 3 or more

14. During the weekend, how many hours <u>per day</u> do you <u>usually</u> spend watching TV shows or videos?

a. I don't watch TV or videos
b. Less than 1 hour a day
c. 1-2 hours a day
d. 3-4 hours a day
e. more than 4 hours a day

15. During the weekend, how many TV shows or videos do you usually watch each day?

a. I don't watch TV or videos
b. 1
c. 2
d. 3 or more

16. During the week, how many hours per day do you usually play video games like Nintendo, Sega, games at the mall, or use the computer to surf the Internet or chat on Internet?

a. I don’t play video games or use the computer
b. Less than 1 hour a day
c. 1-2 hours a day
d. 3-4 hours a day
e. More than 4 hours a day

17. During the week, how many hours per day do you usually play video games like Nintendo, Sega, games at the mall, or use the computer to surf the Internet or chat on Internet?

a. I don’t play video games or use the computer
b. Less than 1 hour a day
c. 1-2 hours a day
d. 3-4 hours a day
e. More than 4 hours a day

18. Do you ever read the nutrition labels on food package?

a. Almost always or always
b. Sometimes
c. Almost never or never

19. How many total servings of fruits and vegetables should you eat each day.

a. At least 2
b. At least 5
c. At least 9
d. At least 10
e. I don't know

20. The foods that I eat drink now are healthy.

a. Yes, all of the time
b. Yes, sometimes
c. No

21. Do you ever eat high fiber cereal (Bran flakes or weetabix)?

a. Almost always or always
b. Sometimes
c. Almost never or never

22. Do you ever eat whole wheat bread (*Nekhaleh or Khobj Asmar*)?

a. Almost always or always
b. Sometimes
c. Almost never or never

23. Do you ever drink 100% freshly squeezed fruit juice?

a. Almost always or always
b. Sometimes
c. Almost never or never

24. Do you ever eat fruit for dinner (minor meal)?

a. Almost always or always
b. Sometimes
c. Almost never or never

25. Do you ever eat vegetables for Lunch (main meal)?

a. Almost always or always
b. Sometimes
c. Almost never or never

INSTRUCTIONS: Please CIRCLE one of the two foods that you would pick if you had to choose just one.

26. If you were at the movies, which one would you pick as a snack?

a. popcorn **with** butter

b. chips or crisps

27. Which would you pick to drink?

a. regular milk

b. low fat or skim milk

28. Which food would you eat for a snack?

a. chocolate

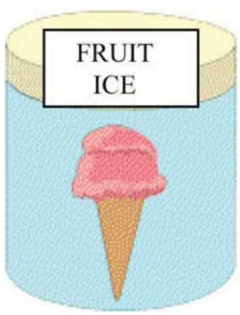
b. fresh fruit

29. Which would you do if you were going to eat a piece of chicken?

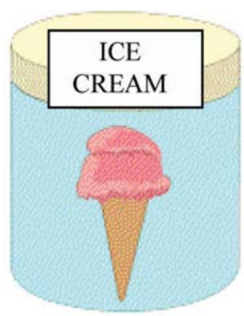
a. leave on the skin

b. take off the skin and not eat the skin

30. Which food would you ask for?



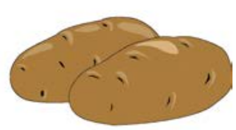
a. sherbet or fruit ice



b. ice cream like chocolate or vanilla

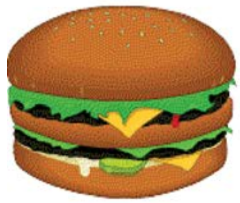
31. Which would you choose to cook if you were going help make dinner at home?

a. French fries



b. baked potato

32. Which would you order if you were going to eat at a fast food restaurant?



a. a regular hamburger? b. a grilled chicken sandwich

INSTRUCTIONS: The questions in this section ask how likely you are to eat some of the foods below. Please answer by circling either NOT LIKELY, or VERY LIKELY for each question.

33. How likely are you to drink low fat or skim milk instead of regular white milk?

a. Not likely
b. Likely
c. Very likely

34. How likely are you to eat sandwich instead of a *croissant*?

a. Not likely
b. Likely
c. Very likely

35. How likely are you to eat fruit instead of chocolate?

a. Not likely
b. Likely
c. Very likely

36. How likely are you to take the skin off of chicken (and not eat the skin)?

a. Not likely
b. Likely
c. Very likely

37. How likely are you to ask for sherbet instead of ice cream?

a. Not likely
b. Likely
c. Very likely

38. How likely are you to eat a baked potato instead of French fries?

a. Not likely
b. Likely
c. Very likely

39. How likely are you to drink fruit juice instead of a soft drink (Pepsi or 7-Up or crush) ?

a. Not likely
b. Likely
c. Very likely

40. How likely are you to order a grilled chicken sandwich at a fast food restaurant instead of ordering a hamburger?

a. Not likely
b. Likely
c. Very likely

INSTRUCTIONS: Please CIRCLE ONE of the two foods that you think is better for your health

41.

a. whole wheat bread

b. white bread

42.

a. baked BBQ meat

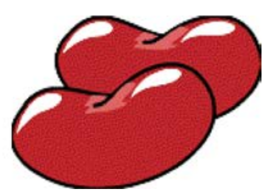
b. baked fish

43.

a. corn flakes with milk

b. *manakish zaatar*

44.



a. beef

b. beans

45.

a. chicken

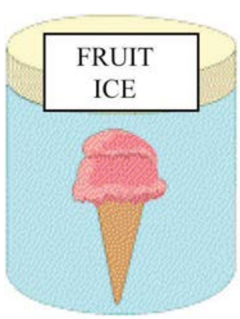
b. regular hamburger

46.

a. regular milk

b. low fat or skim milk

47.

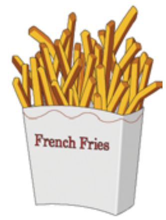


a. sherbet or fruit ice

b. ice cream like vanilla
or chocolate flavors

48.

a. green salad



b. French fries

49.

a. French fries

b. baked potato

50.

a. 100% fruit juice
freshly squeezed
fruit juice

b. commercial
packed juice

INSTRUCTIONS: The questions in this section ask how likely you are to be physically active or eat certain foods. Please answer by circling either NOT LIKELY, LIKELY or VERY LIKELY for each question.

51. How likely are you to be physically active 3-5 times a week?

a. Not likely
b. Likely
c. Very likely

52. How likely are you to exercise and keep moving for most of the time in your after school program?

a. Not likely
b. Likely
c. Very likely

53. How likely are you to run or bike 3-5 times a week?

a. Not likely
b. Likely
c. Very likely

54. How likely are you to keep on exercising without stopping for 15-20 minutes when you exercise?

a. Not likely
b. Likely
c. Very likely

Appendix 11: Anthropometric Form for Children

CHILD NUTRITION ASSESSMENT

1- Name of child:______________________ 2- **Sex::** ☐ Male ☐ Female 3- **Date of Birth :** _____/___/_______	**13- Waist Circum:** 1- ____________ 2- ____________ 3- ____________
4- Name of school: ______________________ a- Private b- Public c- Subsidized	**14- Hip circum:** 1- ____________ 2- ____________ 3- ____________
5- Annual tuition fee ______________________	**15- W/H Ratio:** 1- ____________ 2- ____________ 3- ____________
6- Ranking of Student in class: **1- Excellent (85+)** ☐ **2- Good (70-85)** ☐ **3- Average (50-70)** ☐ **4- Weak (<50)** ☐	**16- 11- Mid-Arm circum:** 1- ____________ 2- ____________ 3- ____________
7- Did the child repeat any of his classes 1- Yes ☐ 2- No ☐ **8- If the answer is Yes, how many time did he/she repeat class?** 1- Once ☐ 2- Twice ☐ 3-Three times or more ☐	**17- Triceps :** 1- ____________ 2- ____________ 3- ____________
9- Weight: 1- ____________ 2- ____________ 3- ____________	**18- Biceps** : 1- ____________ 2- ____________ 3- ____________
10- Height: 1- ____________ 2- ____________ 3- ____________	**19- Subcapular:** 1- ____________ 2- ____________ 3- ____________
11- BMI: 1- ____________ 2- ____________ 3- ____________	**20- Suprailliac:** 1- ____________ 2- ____________ 3- ____________
12- Percent Body Fat: ______________________	

Appendix 12: Validation Form

Name --

Date -------------------------------

Validation of Specific Terms for Parent Focus Group

The committee member @ AUB (Dr. Sana Ghaddar) recommends that response scale of questionnaire be validated as mixed understanding of the scale may introduce biased to the results especially that the scale will be translated into Arabic.

The focus group participant will be asked to rate their understanding on a response scale using zero *as never true* & ten *as always true* scale. The Thurstone and Chave (1929) method of equal – appearing intervals can be employed. If you feel that this validation of response scale is not necessary, we can skip it.

Ref. Thurstone, L.L., and Chave, E.J (1929). The Measurement of Attitude. Chicago: University of Chicago Press.

On a scale of 0 to 10, where 0 indicates *"never true"* and10 indicates *"always true"*, please indicate the best scale that corresponds to the following terms:

(1) On a scale 0 to 10, how do you rate *Often true* –(e.g. My child was not eating enough because we just could not afford enough food. This was often true)

I I I I I I I I I I I

0 10

(2) On a scale 0 to 10, how do you rate *Sometimes true* – (e.g. The food that we bought just did not last for a month and we did not have money to get more. This was sometimes true)

I I I I I I I I I I I

0 10

(3) On a scale 0 to 10, how do you rate *Never true* – (e.g. We could not feed our child a balanced meal because we could not afford that. This was never true)

I I I I I I I I I I I

0 10

On a scale of 0-10 where 10 indicates *all the months* and 0 *no months,* please indicate the best scale that corresponds to the following terms:

(4) On a scale 0 to 10, how do you rate *Almost every month* – (e.g. In the last 12 months, did you ever not eat for a whole day because there wasn't enough money for food. This happened almost every month)

I I I I I I I I I I I
0 10

(5) On a scale 0 to 10, how do you rate S*ome months but not every month* – (e.g. In the last 12 months, were you ever hungry but did not eat because you could not afford enough food. This happened some months but not every month)

I I I I I I I I I I I
0 10

Please explain briefly, in your own words, what you understand by the following expressions:

(6) Food insecurity

----

(7) Food security

----

(8) Balanced Meal

Thank you for your cooperation!

Appendix 13: UREC

University Research Ethics Committee
Headington Campus, Gipsy Lane, Headington, Oxford OX3 0BP UK
t. +44 (0)1865 483484
ethics@brookes.ac.uk
www.brookes.ac.uk/res/ethics

Dr Helen Lightowler (Director of Studies)
Dr. Hafez Zein (exterenal supervisor)
Dr. Martin Gulliford (external supervisor)
School of Life Sciences
Oxford Brookes University
Gipsy Lane Campus

26th July 2010

Dear Dr Helen Lightowler (Director of Studies)

UREC Registration No: 100483: "The value of targeted nutritional education in amelioration of food insecurity in children"

Thank you for your email of the 26th July outlining your response to the points raised in my previous letter for the study on behalf of your PhD student **Carla Yardemian Hage** and attaching the revised documents.

Thank you for confirming that copies of the letters from the Ministry of Education and relevant school principals will be forwarded in due course.

I am pleased to inform you that, on this basis, I have given Chair's Approval for the study to begin.

The UREC approval period for this study is two years from the date of this letter, so the 26th July 2012. If you need the approval to be extended please do contact me nearer the time of expiry.

In order to monitor studies approved by the University Research Ethics Committee, we will ask you to provide a (very brief) report on the conduct and conclusions of the study in a year's time. If the study is completed in less than a year, could you please contact me and I will send you the appropriate guidelines for the report.

Yours sincerely

Dr Elizabeth T Hurren
Chair of the University Research Ethics Committee

cc Jill Organ, Graduate Office
Louise Wood, UREC Administrator
Dick Craven, Life Sciences

REPUBLIC OF LEBANON
Ministry of Education and Higher Studies

Archives Number
Outgoing Number 11472/4

Seal of the Ministry of Education
And Higher Studies
Education Cabinet
Registration Number 12573/3
Date November 13, 2008

Attention the General Director

Kindly be informed with a proposal to approve the petition of Dr. Hafez El Zein and Mrs. Carla El-Hage to allow them to the State official schools to prepare the diploma of P.H.D in the Nutrition Sciences provided to co-ordinate with the principals of the concerned schools in to assure the good function of a National Survey that covers the 6 Regions Legislative. The Results of the study will be beneficial for the Lebanese Children.

The Directress of the Primary Education
Charlotte El-Makdessi
Signature and seal

12573/3
Attention the Directorate of the Primary Education
Approving your proposal within what has been shown.
To be aware of and to act accordingly
The General Director and interim
Wael El Tannir
Signature and seal

To be remitted to the petitioner
The Directress of the Primary Education
Charlotte El-Makdessi (signature and seal)
November 13, 2008

True and correct translation of the Arabic attached document.
The Sworn Translator Boulos Joseph Misk Tel/Fax 01/561995

LIST OF PUBLIC SCHOOLS – BEIRUT, MONT LEBANON, NORD, ECT…..

LIST OF PUBLIC SCHOOLS WHICH WERE CHOSEN BY RANDOM SAMPLING FOR NUTRITION ASSESSMENT SURVEY

REGION	NAME OF SCHOOL	REGION	NAME OF SCHOOL
BEIRUT	Al Malaab Al Balady Elementary Mixed School	NORTH (Cont')	Al Houeich Public Mixed School
	Unesco Elementary Mixed School		Wata Mouchmouch Public Mixed School
	Wata Al Mousaitabeh Public Mixed School		Ras Maska Public Mixed School
	Ras El Nabeh Public School For Girls		Rajam Khalaf Al Kalkha Public School
	Al moustakbal Public Mixed School		Elementary of Alma Public Mixed School
	Ras Beirut First Public Mixed School		2nd Barkasouna of Public Mixed School
	Laure Moughayzel Secondary Public School For Girls		
	Achrafieh Secondary First Public School For Boys	BEKAA	Intermediary Public School of Al Marej
	Salma Sayegh Public School For girls		Intermediary Public School of Ghazat
	Al Tabaris Public School For girls Al Namouzagiyah		1st Intermediary Public School of Britel (Section English)
	Al Jinah Public Mixed Shool		2nd Intermediary of Majdel Anjar Public Mixed School
			Intermediary Al Swairy Public School
MONT LEBANON	4th Public School of Bourj Al Barajineh		Intermediary Salim Haidar Public School
	3rd Public Mixed School of Bourj Al Barajineh		Hay Al Omrieh Elementary Public School
	2nd Public Mixed School of Bourj Al Barajineh		1st IntermediaryAl Manarah public School
	Intermediary Public School of Jal El Dib for Boys		Al Ansar Public School
	1st Sin El Fil Public Mixed School		3rd Intermediary of Zahle Public School for Boys
	1st Sed El Bouchrieh Intermediary Mixed School		Hoch Al Oumara Public School for Girls
	Intermediary of Zalka Public Mixed School		2nd Intermediary of Zahle Public School for Boys
	Intermediary of Haret Al Naimeh Public Mixed School		
	Intermediary Public School of Bourj Al Dimas	SUD	Intermediary Al Islah Public Mixed School
	Intermediary of Barja Public School for Girls		Intermediary of Al koulaylah Public School
	Intermediary of Abeyh Mixed Public School		Harat Saida Public School
	Intermediary of Kayfoun Mixed Public School		Adloun Intermediary Public School
	1st Intermediary Public Mixed School of Barja		Al Bazourieh Intermediary Public School
			Al Kharayeb Intermediary Public School
NORD	Al Tabaned Intermediary Public School		Ain Beaal Intermediary Public School
	Loukman Public Mixed School		Al Bayad Intermediary Public School
	Babnyn Public School For Girls		Al Chahid Mounir Saaad Intermediary Public School of Barish
	Wadi Al Nahleh Public Mixed School		Zaita Elementary Public School
	Abou Firas Al Hamdani Tripoli		Kawsarieh Al Sayad Iternediary public School
	Miryata Public School		
	Al Zahiriyeh Public School Of Boys	NABATIYEH	2nd Intermediary of Kfarhanoun
	Bourj Al Arab Public Mixed School		Haris Intermediary Of Public School
	Tal Al Zarainat Public Mixed School		Zibdin Intermediary Of Public School
	Al Namouzaj Public School for Girls		Habouch Intermediary Of Public School
	Public School of Al Majdel		Al Doueir Elementary Of Public School
	Al Tal Al Jadidah Public Tripoli School for Girls		Public School of Jdeidet Ansar
	Zouk Al Habalisat Public Mixed School		2nd Intermediary of Al Khiyam Public Mixed School
	Al Kalamoun Public School for Boys		
	Al Kalamoun Public School for Girls		
	Kaws Akar Public Mixed School		
	Al Haysah Public Mixed School		
	Takmiliat Al Houweich Public Mixed School		
	Al Fared Public School of Wadi Khaled		
	Karhaya Public ixed School		
	2nd Public Shool of Zogharta for Boys		

Appendix 15: NIH Certificate

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Carla Hage** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 05/08/2009

Certification Number: 227763

Appendix 16: Invitation Letters to parents of Children – Survey Study

Principal Investigators

Dr. Hafez el Zein - Mrs Carla Yardemian Hage

Contact Details: 961 - 3 – 773523 / 961 - 3 – 637137

Dear parent or caretaker,

Your child is being invited to take part in a research study in the school premises. Before you decide to allow your child whether or not to participate, it is crucial for you to understand the purpose of the research and what it will involve. Please read carefully the following information.

The first part of the research is a national study that assesses the nutritional status of school age children (6-10 years old) from public and private schools, in the six different *Mouhafazas* of Lebanon. The children chosen randomly from each school will have their measurements taken including weight, height and specific techniques to analyze percent body fat and its distribution in the body. The children will be asked later to fill out the CATCH questionnaire that will assess their food preferences and food habits, physical activity and nutrition knowledge . The collected data and the questionnaires will be analyzed statistically and compared to international standards to determine the level of physical and cognitive growth of the children in Lebanon. The second part of the research will include a meeting with the parents of children who took part in the study, to fill out a questionnaire that includes socio-economic and health data of the child. In addition, both Household and Child Food insecurity questionnaires that will be filled out with the parents or the person in charge of food preparation in the house to analyze the availability of food and the food consumption level at the household in the last 12 months.

The study will run for a period of 3 to 4 months. It will provide information about the nutrition status of school age children in the different Lebanese geographic areas. Based on the results of the data analysis, practical recommendations will be proposed to health oriented government institutions and NGO's.

The study will include schools from different geographic areas chosen by random sampling. Your child will be asked to participate in the above mentioned study because you are enrolled in a school that was chosen to take part in the study. From the chosen schools an average 25 students will be chosen randomly according to their birth date.

However, it is entirely up to you to decide whether or not you allow your child to take part. If you decide your child to take part, you will be given this information sheet and be asked to sign a consent form. Still, if you take part in the study but eventually you decide otherwise, you are free to withdraw at any time and without giving any reason.

Practically, the measurements of the children will be taken place in the schools' first Aid/Nurse department, during (recess) recreation period. The equipment used to take the measurements will cause neither physical nor psychological stress to the children. The above mentioned procedure will be complete in 10 minutes. The measurement session is just one time.

The child will get an immediate free nutritional and body fat assessment at the time of measurements. Moreover, the results of the study will be considered a national study, which will be used as a reference upon which to base further recommendations.

Data of measurements collected will be kept anonymous for use in statistics and publication of research material. Furthermore, the information generated in the course of research will be kept strictly in paper or electronic form for a period of five years after the completion of the research project.

I, Carla Yardemian Hage, am conducting the research as a student of Nutrition and Food Science Group, from the school of Life sciences at Oxford Brookes University in the U.K.

The research has been approved by the University Research Ethics committee of Oxford Brookes University. For further information feel free to contact locally 03 – 773523. However if you have any further concerns about the procedure in which the study has been conducted, you should contact the chair of University Ethics committee on ethics@brookes.ac.uk.

Thank you for taking time to read this information sheet.

January 2009

Appendix 17: Consent Form

Oxford Brookes University
School of Life Sciences
Nutrition and Food Science Group
In collaboration with
American University of Beirut
Department of Nutrition and Food Technology

Child food insecurity in the Lebanon-effects on physical development

The following project is conducted for research purposes. Your child's involvement in the project is voluntary, thus you or your child could withdraw from the project at any time. The collected data will be kept confidential and used in the research under specified codes.

	YES	NO
1- I confirm that I have read and understood the information sheet for the above research project.	☐	☐
2- I confirm that I have had the opportunity to ask questions to the school administration and have received satisfactory answers to my questions.	☐	☐
3- I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason, or to withdraw any unprocessed data previously supplied.	☐	☐
4- I understand that confidentiality of information provided can only be protected within the limits of the law.	☐	☐
5- I wish my child to participate in the research project	☐	☐

Name of the student________________________________ Date_________________

Parents signature ________________________________

Contact number ________________________ email __________________

Residence adress____
____

Appendix 18: Children's Nutrition Knowledge (CFK)

Child food habits, nutrition knowledge and physical activity questionnaire

Name of researcher: ______________________________

Name of student __________________________________

Class: _________________

1- **Age: ___________**
2- **Sex:** ☐ Male ☐ Female
3- **Nationality**
    1- Lebanese ☐
    2- Other, specify ___________________
4- **Language spoken at home :**
    1- English
    2- French
    3- Arabic
    4- Other, specify ____________________

5- **Yesterday did you eat sausage, hamburger, or hot dog or any other meat?**
    1- No, yesterday I did not eat any of the foods mentioned
    2- Yesterday I ate once
    3- Yesterday I ate twice
    4- Yesterday I ate 3 times or more
6- **Yesterday did you eat fried meat, escalope, chicken nuggets, or fried chicken?**
    1- No, yesterday I did not eat any of the foods mentioned
    2- Yesterday I ate once
    3- Yesterday I ate twice
    4- Yesterday I ate 3 times or more
7- **Yesterday did you eat soup (from meat stock)?**
    1- No, yesterday I did not eat any of the foods mentioned
    2- Yesterday I ate once
    3- Yesterday I ate twice
    4- Yesterday I ate 3 times or more

8- Yesterday did you eat nuts or pistachio?

1- No, yesterday I did not eat any of the foods mentioned

2- Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

9- Yesterday did you eat *halawi* (made from *tahin*i)?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

10- Yesterday did you eat cheese sandwich, cheeseburger, pizza or cheese manakish?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

11- Yesterday did you drink milk or hot chocolate or chocolate flavored milk or milk with cornflakes?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

12- Yesterday did you eat any *labneh*, yoghurt or *karisheh*?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

13- Yesterday did you eat rice, macaroni, spaghetti or noodles?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

14- Yesterday did you eat pita bread, French bread or *manakish*?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

15- Yesterday did you eat whole wheat bread?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

16- Yesterday did you eat any cornflakes?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

17- Yesterday did you eat any French fries or potato/corn chips?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

18- Yesterday did you eat vegetable or (baked/boiled) potato?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

19- Yesterday did you eat any bean or chickpeas or lentilles?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

20- Yesterday did you eat fruits (fruit juice is not considered as fruit)?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

21- Yesterday, did you drink freshly squeezed juice?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

22-Yesterday did you drink any commercial juice (like bonjus or topjuice)?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

23- Yesterday did you drink any type of soda like coca cola, 7up or mirinda?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

24- Yesterday did you eat ice cream?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

25- Yesterday did you eat sweet like kenafeh, maamoul, biscuits, coconut cookie, fruit pies or doughnuts?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

26- Yesterday did you eat any chocolate bar or candy?

1- No, yesterday I did not eat any of the foods mentioned

2-Yesterday I ate once

3- Yesterday I ate twice

4- Yesterday I ate 3 times or more

27- Yesterday did you have breakfast?

☐ 1- Yes

☐ 2- No

28- Yesterday how many meals did you eat?

1- Yesterday I did not eat any meal

2-Yesterday I ate one meal

3- Yesterday I ate two meals

4- Yesterday I ate three meals

29- Yesterday did you have any snacks?

1- Yesterday I did not snack

2-Yesterday I snacked once

3- Yesterday I snacked twice

4- Yesterday I snacked three time

30- During the past week, how many times did you have restaurant meals or ordered restaurant food?

1- None

2- Once

3- Twice

4- Three time or more

31- During the past week, how many times did you practice sports like swimming, running, basketball or football?

1- None

2- 1 day

3- 2 days

4- Three days

5- Four days

6- Five days

7- six days

8- seven days

32- During the last week how many times you played with the neighbor's children or your friends in front of your house (computer games are not included)?

1- None

2- 1 day

3- 2 days

4- Three days

5- Four days

6- Five days

7- six days

8- seven days

33- How many times of physical exercise (PE) you have at school?

1- None

2- 1 day

3- 2 days

4- Three days

5- Four days

6- Five days

34- Did you ever try to lose weight before

☐ 1- Yes

☐ 2- No

35- Yesterday how many hours of TV, DVD, Video or movies (cinema) did you watch?

1- None

2- 1 hour

3- 2 hours

4- Three hours

5- Four hours

6- Five hours

7- six hours or more

36- During this last year did you participate in any sports team? Like swimming, gymnastics, dance, karate, tennis, basket ball, football or soccer?

1- None

2- 1 team

3- 2 teams

4- Three teams or more

37- Nowadays, are you attending any sports classes? Like swimming, gymnastics, dance, karate, tennis, basketball or football or soccer?

☐ 1- Yes

☐ 2- No

38- How many hours you spend browsing on the computer per day?

1- I do not use computer

2- 1 hour

3- 2 hours

4- Three hours

5- Four hours

6- Five hours

7- six hours or more

39- How many hours you spend playing on the computer or play station per day?

1- I do not use computer or play station

2- 1 hour

3- 2 hours

4- Three hours

5- Four hours

6- Five hours

7- six hours or more

40- Are you trying to lose weight?

☐ 1- Yes

☐ 2- Non

41- Compared to your friend you find your weight?

1- Average (appropriate)

2- More (fatter)

3- Less (thinner)

42- In your opinion which of the following foods you need to eat more of?

1- Bread, rice, pasta or cornflakes

2- Milk derivative (labneh, cheese, yoghurt, milk)

3- Sweet, Chocolate, oil, butter

4- Fruits

5- Vegetables

6- Meat fish, eggs, chicken, beans

7- I do not know

43- In your opinion which of the foods you need to eat less of:

1- Bread, rice, pasta or cornflakes

2- Milk derivative (labneh, cheese, yoghurt, milk)

3- Sweet, Chocolate, oil, butter

4- Fruits

5- Vegetables

6- Meat fish, eggs, chicken, beans

7- I do not know

44- How many portions of fruits and vegetables you need to eat daily?

1- Minimum 2 portions

2- Minimum 3 portions

3- Minimum 4 portions

4- Minimum 5 portions

5- I do not know

45- Eating healthy food will make your heart strong and healthy?

☐ 1- Yes

☐ 2- No

☐ 3- I do not know

46- If you are overweight this will cause diseases?

☐ 1- Yes

☐ 2- No

☐ 3- I do not know

47- Do you think you eat and drink healthy?

1- Yes always

2- Yes sometimes

3- No

48- If you skip breakfast or lunch do you think this will reduce your concentration in class?

1- Yes always

2- Yes sometimes

3- No

49- Do you like to try new foods?

1- Yes always

2- Yes sometimes

3- Very few times

4- never

50- Do you eat at school?

1- Yes always

2- Yes sometimes

3- Very few times

4- never

51- Do you have a shop that sells food at school?

☐ 1- Yes

☐ 2- No

52- Do you think the food sold at school shop is healthy?

1- Always

2- Sometimes

3- Very few times

4- Never

5- There is no shop at school (not applicable)

53- Do you buy and eat from the school shop?

1- Always

2- Sometimes

3- Very few times

4- Never

5- There is no shop at school (not applicable)

54- What do you buy from school shop (please specify)? ______________________________

55- Do you bring any food from home?

1- Always

2- Sometimes

3- Very few times

4- Never

56- What do you bring food from home?

1- Bread, rice, pasta or cornflakes

2- Milk derivative (labneh, cheese, yoghurt, milk)

3- Sweet, Chocolate, oil, butter

4- Fruits

5- Vegetables

6- Meat fish, eggs, chicken, beans

7- I do not know

57- If you bring along sandwiches what type of sandwich do you bring along (please specify)?

____

Nutrition Knowledge Questionnaire

58- What is at the base of the food guide pyramid? 1- carbohydrates, starches 2- Fruits 3- Dairy& cheese 4- Oils, sweets, alcohol 5- I do not know	**66- What will cause tooth decay?** 1- Brushing the tooth constantly 2- Eating sweets 3- Drinking milk. 4- I do not know
59- Eating chocolate 1- Gives you energy 2- Will cause tooth decay 3- you need to eat it regularly 4- Need to eat it daily 5- Will help in concentration 6- I do not know	**67- Healthy and nutritious breakfast includes:** 1- Cornflakes with milk and chocolate bar 2- Labneh sandwich and cucumber and sweetened juice 3- Labneh sandwich and cucumber and cup of milk 4- I do not know
60 – Milk is rich in: 1- Calcium 2- Iron	**68- Need to wash hands** 1- Before entering the restroom 2- Before a meal 3- Before touching raw meat 4- 1, 2, 3 5- I do not know
61- Milk help to strengthen the: 1- Bones 2- Muscles 3- I do not know	**69- Need to eat per day:** 1- One meal 2- Two meals 3- Three meals. 4- I do not know
62- Healthy eating lifestyle includes: 1- Physical activity & exercise 2- Food type variety 3- Drinking good quantity of liquids 4- 1, 2, 3 5- I do not know	**70- What will help you gain weight?** 1- Watching TV 2- Playing Nintendo 3- Walking daily 4- Playing basketball 5- 1, 2 6- I do not know
63- Need to brush your teeth: 1- Minimum twice per day 2- Five times a day minimum 3- Not necessary to brush teeth 4- I do not know	**71- Cola drink:** 1- Contains lots of sugar 2- Does not contain any sugar 3- Contains a little sugar 4- I do not know
64- Drinking canned juice has the same benefits as drinking fresh huice: 1- Yes 2- No 3- I do not know	**72- What is better:** 1- Consuming white bread 2- Consuming brown bread 3- I do not know
65- Junk food includes: 1- Chips, candy, chocolate bars 2- Fruits, candy, meat 3- Fruits, milk. vegetables 4- I do not know	**73- What is better:** 1- Eating fried potato 2- Not eating fried potato 3- I do not know

Appendix 19: Anthropometric Score

Weight: Male			10	15	25	75	85	90	100
6	1	0	18.2	18.7	20.7	25.2	28.7	29	1000
7	1	0	21.6	22	23.3	30.1	32.8	33.1	1000
8	1	0	23.5	24.1	25.6	37.1	42.9	45.8	1000
9	1	0	26.5	27.2	28.4	38.4	45.3	49.6	1000
10	1	0	27.8	29.3	32.2	42.8	45.8	50.2	1000
11	1	0	31.2	32.9	34.7	49.6	54.7	57.2	1000
Female									1000
6	2	0	17.9	18.6	19.4	24.1	26.3	27.7	1000
7	2	0	20.3	21.4	22.3	28.3	31.3	32.9	1000
8	2	0	22.3	23.6	25.3	35.9	40.3	44.1	1000
9	2	0	25.6	26.9	28.8	41	44.6	48.4	1000
10	2	0	27.8	29.2	31.8	44.8	52.1	53.9	1000
11	2	0	32.9	35.5	38.1	55.5	64.3	69	1000
Male Height									1000
6	1	0	111.6	113.2	114.6	122.6	124.5	125.9	1000
7	1	0	117.7	119.5	122.5	129.9	132.3	135	1000
8	1	0	123.8	124.9	127.7	137.3	139.3	140.9	1000
9	1	0	130.1	131.8	133.4	141.8	143.8	145.4	1000
10	1	0	133.4	135.8	136.8	145.2	147.8	149.1	1000
11	1	0	139.7	141.5	143.6	152.9	155.2	157.4	1000

Female									1000
6	2	0	110.2	111.1	112.2	120.2	122.6	124	1000
7	2	0	117.5	119.1	121	127.7	129.3	131.6	1000
8	2	0	123	124.8	126.7	134.7	137.8	138.5	1000
9	2	0	128.2	129.3	131.8	141.6	143.7	146.5	1000
10	2	0	133	136	138.9	149.1	152.2	154	1000
11	2	0	141.1	144.1	146.3	156.4	159.1	161.1	1000
Boy BMI									1000
6	1	0	14.1	14.4	14.7	17.4	18.6	19.1	1000
7	1	0	14.8	14.9	15.2	17.8	18.9	19.9	1000
8	1	0	14.6	14.9	15.7	20.5	22.5	24.8	1000
9	1	0	14.7	14.9	15.6	20.4	22.1	23.9	1000
10	1	0	15.3	15.7	16.5	20.4	22.6	24.4	1000
11	1	0	15.9	16.1	16.9	21.2	24.3	24.7	1000
Female									1000
6	2	0	14	14.4	14.8	16.9	18.2	19.1	1000
7	2	0	14.1	14.4	14.9	17.6	19.2	20.3	1000
8	2	0	14.7	14.8	15.3	20	21.9	23.6	1000
9	2	0	14.8	15.1	16.2	20.1	22.7	23.7	1000
10	2	0	15.1	15.5	16.1	21.7	23.3	24.9	1000
11	2	0	15.6	16.5	17.6	22.7	26.2	28.1	1000

Appendix 20: Anthropometric Percentile Values

Waist: Male			10	15	25	75	85	90	100
6	1	0	49.4	50.5	51.7	58.3	61.3	63.9	1000
7	1	0	52.7	53.1	54	63.7	65.8	68	1000
8	1	0	53.9	54.6	56.2	69.7	75.1	79.8	1000
9	1	0	55	56.2	57.5	71.6	77	87	1000
10	1	0	56.3	57.6	60.5	74	79	81.9	1000
11	1	0	58.5	59.5	61.1	74.7	81.6	87.7	1000
Female									
6	2	0	48.9	50.5	51.3	57.2	60.2	63.5	
7	2	0	51.4	52.1	53.4	61.1	65.4	68.9	
8	2	0	53.1	53.6	55.1	69.3	74.3	77.8	
9	2	0	54.9	55.6	58.7	71.4	74.9	79.8	
10	2	0	55.4	56.8	58.4	74.3	81.8	84.4	
11	2	0	59.7	60.2	64.4	79.7	85.7	89.6	
Mare tricepts									
6	1	0	6	6.2	7.1	11.7	13.3	14.4	
7	1	0	6.2	6.7	7.4	11.3	14.4	15	
8	1	0	5.7	6.3	7.3	14.3	19.4	22.2	
9	1	0	6.9	7	7.7	15	21.4	25.8	
10	1	0	7.3	8.1	8.7	16.3	20.4	24	
11	1	0	7.1	8	8.6	18.2	22.3	24.7	

Female

6	2	0	6.6	7.3	8.3	12.7	13.6	15.2
7	2	0	7.3	7.5	7.9	13.3	16.8	18.1
8	2	0	8.1	8.4	9.6	17.3	22.9	24.8
9	2	0	8	9.2	9.7	19.7	21.7	23.4
10	2	0	8.1	8.7	9.7	19.4	23.1	25
11	2	0	9.3	10	11	20.9	24.8	27.9

subscapular

6	1	0	4	4.1	4.6	6.8	8.7	10.9
7	1	0	4.2	4.5	4.9	7.3	8.4	10.3
8	1	0	4.2	4.5	4.9	11.1	12.8	18.9
9	1	0	4.3	4.5	5	11.2	13.3	13.6
10	1	0	4.7	4.9	5.7	12.9	16.3	21.5
11	1	0	4.7	5.1	5.4	11.4	17.2	20.6

Female

6	2	0	4.5	4.6	4.9	8.2	9.4	10.6
7	2	0	4.6	4.7	5	8.4	11.8	13.5
8	2	0	4.9	5.1	5.7	12.5	17.8	21.8
9	2	0	5.3	5.6	6.3	13.2	15.4	19.4
10	2	0	5	5.5	6.3	16.5	21.5	23.3
11	2	0	5.9	6.2	6.9	14.8	17.9	19.4

Appendix 21: In Body 230 information sheet

VER(F/W):BIOSPACE V0.4(06.04.19)

Time 2009/03/27 10:05:03
ID ELIE
Gender Male Age 8
Height 127.0cm Weight 25.4kg

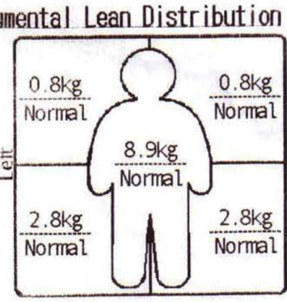
Body Composition

Weight	25.4kg	(22.5~30.4)
Muscle	10.2kg	(10.1~12.4)
Fat	4.8kg	(3.2~6.3)
TBW	15.0kg	(14.9~18.2)
FFM	20.6kg	(19.3~24.1)

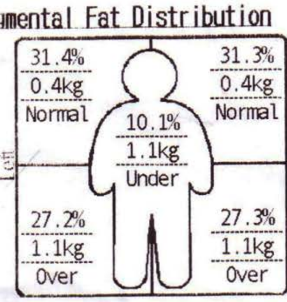
Obesity Diagnosis

BMI	15.7 kg/㎡	(13.4~19.4)
PBF	18.9 %	(10.0~20.0)
WHR	0.75	(0.80~0.90)
BMR	815 kcal	(790~883)

Segmental Lean Distribution



Segmental Fat Distribution



Muscle-Fat Control

Muscle +1.9kg Fat -0.8kg

*Segmental Fat is estimated.

230DMC23022/051/230DPC1209
230AB-0101/230AA-W114

Appendix 22: Ethical Approval of UREC – Intervention Study

University Research Ethics Committee
Headington Campus, Gipsy Lane, Headington, Oxford OX3 0BP UK
t. +44 (0)1865 483484
ethics@brookes.ac.uk
www.brookes.ac.uk/res/ethics

Dr Helen Lightowler (Director of Studies)
Dr. Hafez Zein (exterenal supervisor)
Dr. Martin Gulliford (external supervisor)
School of Life Sciences
Oxford Brookes University
Gipsy Lane Campus

26th July 2010

Dear Dr Helen Lightowler (Director of Studies)

UREC Registration No: 100483: "The value of targeted nutritional education in amelioration of food insecurity in children"

Thank you for your email of the 26th July outlining your response to the points raised in my previous letter for the study on behalf of your PhD student **Carla Yardemian Hage** and attaching the revised documents.

Thank you for confirming that copies of the letters from the Ministry of Education and relevant school principals will be forwarded in due course.

I am pleased to inform you that, on this basis, I have given Chair's Approval for the study to begin.

The UREC approval period for this study is two years from the date of this letter, so the 26th July 2012. If you need the approval to be extended please do contact me nearer the time of expiry.

In order to monitor studies approved by the University Research Ethics Committee, we will ask you to provide a (very brief) report on the conduct and conclusions of the study in a year's time. If the study is completed in less than a year, could you please contact me and I will send you the appropriate guidelines for the report.

Yours sincerely

Dr Elizabeth T Hurren
Chair of the University Research Ethics Committee

cc Jill Organ, Graduate Office
Louise Wood, UREC Administrator
Dick Craven, Life Sciences

REPUBLIC OF LEBANON
Ministry of Education and Higher Studies

Archives Number
Outgoing Number 12726/4

Seal of the Ministry of Education
And Higher Studies
Education Cabinet
Registration Number 13191/3
Date October 4, 2010

Attention the General Director

Kindly be informed with a proposal to approve the petition of Dr. Hafez El Zein and Mrs. Carla El-Hage to allow them to the State official schools to prepare the diploma of P.H.D in the Nutrition Sciences provided to co-ordinate with the principals of the concerned schools to assure the good function of the Intervention of Nutrition Courses to students, to help improve their knowledge of implement healthier eating habits.

The Directress of the Primary Education
Charlotte El-Makdessi
Signature and seal

13191/3
Attention the Directorate of the Primary Education
Approving your proposal within what has been shown.
To be aware of and to act accordingly
The General Director and interim
Wael El Tannir
Signature and seal

To be remitted to the petitioner
The Directress of the Primary Education
Charlotte El-Makdessi (signature and seal)
October 10, 2010

True and correct translation of the Arabic attached document.
The Sworn Translator Boulos Joseph Misk Tel/Fax 01/561995

SCHOOL NAMES:

1) **Koubba Rasmieh**
2) **Baal Al Mohsen Rasmieh**
3) **Kab Elias**
4) **Taalbaya**
5) **Meksieh Rasnieh**
6) **Baar Elias**
7) **Saadnayel**

Appendix 24: Parent Invitation and Consent Form – Intervention Study

|___|___|___|___|

Parental Consent Form to participate in the research

OXFORD BROOKES UNIVERSITY

The Value of Targeted Nutritional Education in Amelioration of Food Insecurity in Children

Principal Investigators: **Dr. Helen Lightowler , Mrs. Carla Yardemian-Hage**

Dear parent or caretaker,

You and your child are being invited to take part in a research study in the school premises. Before you decide whether or not to participate, it is crucial for you to understand why the research is being done and what it will involve. Please read carefully the following information.

The study will run for a period of five months and will aim to determine the basic ingredients of a diet that is healthy for maintenance and growth and also cost effective for a typical household with limited salary (healthy food basket). Further, this study will test the feasibility of nutrition education of the child and the caregiver to improve overall health and quality of life of children from households influenced by food insecurity.

According to the previous research, children age 7-10 in the *Bekaa*, North and Beirut suburbs were found to be the least food secure in Lebanon. Therefore, children of this age group and their parent or caretaker are chosen from these areas to participate in this study. There will be two groups: an experimental and a control, with one school from each of the three areas in each group. About 160 children and their parents will be included in each group. The experimental group has been selected from the earlier study that was conducted in spring 2009. The control group was matched for region, type of school, age range and food insecurity level. The volunteers will not know whether they are part of the control group or the experimental group so that the results will be compared. The experimental group will participate to nutrition education courses followed by Nutrition Knowledge Tests, however the control participants will partake only to the tests.

At the first meeting, parents who sign the consent form will be given instructions how to fill in a 24-hour dietary recall, concerning the food intake of the child, for 3 non- consecutive days. Further, weight, height and percent body fat are measured and parents will be invited to complete a Parent Nutrition Knowledge form. After the healthy food basket information are compiled, parents will be invited to a 45-minute educational session in the beginning to explain any differences between the proposed healthy food basket for their region from their current diet. Another session will be held mid study to provide further information about cooking healthy on a budget and discuss the experiences of the families. Both educational sessions will be followed by a breakfast brunch. The dates for your involvement are:

1. Baseline: sign consent, body measurements, and knowledge form and 24-hour dietary recall. Date: / /20…

2. Education session III & brunch Date: / /20…

3. Education session , brunch and 24-hour dietary recall Date: / /20…

4. Week 20: Farewell party and 24-hour dietary recall Date: / /20…

At baseline, after parent consent is obtained, body measurements and percent body fat of the children will be measured and the children will be invited to fill in the Child Nutrition Knowledge Form. In the upcoming 10 consecutive weeks, the children will be attending once a week, a half hour basic nutrition course. These sessions will be given during the recreation period, agreed upon with the school administration. The body measurements of the children will be taken 3 times during the course of the study at baseline and weeks 10 and 20.

Practically, the measurements of the children will be taken place in the schools' first aid/ Nurse Department, during (recess) recreation period. The measurements will be taken while the child is wearing light clothing and no footwear. The equipment used to take measurements will cause neither physical nor psychological stress to the children. The above mentioned procedure will be completed in less than 10 minutes.

As a result, the study will assess and try to improve food availability and the quality of food consumed by the children and the household in general. The study is expected to provide valuable information in the subject of food insecurity. This information may be integrated into school curriculum or applied in future community-based programs aimed at promoting healthy dietary practices and reducing food insecurity.

The participation of yourself and your child is entirely voluntary. Participation in the research will have no impact on the child's school assessments or grades. If you were kind to sign this consent and participate in the study, you may still withdraw at any time without any further commitments. The research group will be fully available to both the parents and the children to discuss the research process during the fieldwork.

The child and the parent will be given an immediate free nutritional and body fat assessment at the time of measurements in the school premises.

Data of test results and body measurements collected will be kept anonymous for use in statistics and publication of research material. Legal limitations apply to data confidentiality. Further, information generated in the course of research will be kept strictly in paper or electronic form for a period of five years after the completion of the research project.

It is worth mentioning that the results of the research will be used for a PhD thesis. Eventually the research will be published in a respectable journal. Copies of the published article will be distributed to the respective schools that took part in the study. If you agree to participate in such a project and follow up with the procedures mentioned above during five month, we would be grateful if parents and children sign the consent form to give their family consent.

I, Carla Yardemian Hage, am conducting the research as a student of Functional Food Centre, from the school of Life Sciences at Oxford Brookes University in the U.K.

The research has been approved by the University Research Ethics committee of Oxford Brookes University. For further information feel free to contact any of the supervisory team of the research:

	phone number	e-mail
Dr. Helen Lightowler	44-1865-483245	hlightowler@brookes.ac.uk
Mrs. Carla Yardemian-Hage	961-3-773523	carla@yardemian.com
Dr. Hafez Zein	961-70-956591	hafezein@aol.com
Dr. Martin Gulliford	44-207-8486631	Martin.gulliford@kcl.ac.uk

However if you have any further concerns about the procedure in which the study has been conducted, you should contact the chair on the University Ethics Committee on ethics@brookes.ac.uk.

Thank you for taking time to read this information sheet.

April 2010

PARENT CONSENT FORM

Name, position and contact address of Researcher: Carla Yardemian-Hage
Clinical dietitian
P.O. Box.90-988

Please initial box

1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason. ☐

3. I agree to take part in the above study. ☐

4.. I agree to my child having their BMI measurements taken by a school nurse

5. I agree to my child having their BMI measurements taken by the research group

Name of Parent -1	Date	Signature
Name of Parent -2	Date	Signature
Name of Child	Date	Signature
Name of Researcher	Date	Signature

RESEARCHER CONSENT FORM

Full title of Project: The Value of Targeted Nutritional Education in Amelioration of Food Insecurity in Children

Note for researchers:
Include the following statements, if appropriate*, or delete from your consent form*:

1. I agree to the use of anonymised quotes in publications

2. I agree that my data gathered in this study may be stored (after it has been anonymised) in a specialist data centre and may be used for future research.

Appendix 25: Parent SEH Questionnaire – Intervention Study

Socio- Economic and Sociological Questions

1-Number of rooms in the house (besides the kitchen and the bathrooms)

1- One ☐
2- Two ☐
3- Three ☐
4- Four or more ☐

2-Total number of people living under same roof (including household help) : ____________

3-Number of children under 18 years living under the same roof __________

4-Type of residence:

1- Privately owned ☐
2- Rent ☐
3- Refugee Camp ☐
4- Unspecified ________________________

5-Number of vehicles (cars & trucks) in the household:

1- None ☐
2- One ☐
3- Two ☐
4- Three or more ☐

6-The child is living with:

1- The parents ☐
2- A single parent (divorced parents) ☐
3- A single parent (separated parents) ☐
4- A single parent (multiple marriages) ☐
5- Relatives other than the parents ☐
6- A guardian ☐
7- Other, specify ___________________

7-Father's Age: ___________

8-What is the father's education level?

1- Not able to read or write (illiterate) ☐
2- Completed elementary level ☐
3- Completed intermediate level ☐
4- Completed secondary (baccalaureate) ☐
5- Completed Technical School ☐
6- Completed College ☐
7- Completed Higher Education ☐

9- Please specify the father's occupation ____

10- Mother's Age: ___________

11- What is the mother's education level?

1- Not able to read or write(illiterate) ☐
2- Completed elementary level ☐
3- Completed intermediate level ☐
4- Completed secondary (baccalaureate) ☐
5-Completed Technical School ☐
6- Completed College ☐
7- Completed Higher Education ☐

12-Please specify the mother's occupation _______________________________

13- Does monthly household income cover all the food needs :

1- No the salary is not enough ☐
2- Yes it covers some of the food needs ☐
3- Yes it covers all of the food needs ☐

14- Total Household Income (total income of all family members, salary & monetary aid):

1-Under 550 thousand Lebanese pounds per month ☐
2-Between 551 & 700 thousand Lebanese pounds per month ☐
3-Between 701 & 1199 thousand Lebanese pounds per month ☐
4-Between one million two hundred & two million Lebanese pounds per month ☐
5-More than two million Lebanese pounds per month ☐

15- Do you have a regular income if yes, (tick all that apply) 1- Yes ☐ 2- No ☐

1- Monthly salary ☐
2- Monetary aid from abroad ☐
3- Organizations (religious organizations, charities or private organizations) ☐
4- Income from private work (e.g. plumber, blacksmith, carpenter, painter, housecleaner, babysitter, selling cigarettes & lottery tickets or as a taxi driver in return of payment in kind or cash) ☐
5- Payment from renting a land, an apartment or buildings ☐
6- Alimony ☐
7- Other revenues, please specify ___________________________

16- What is the monthly allowance spent on food besides restaurants in Lebanese pounds? ____________

17- What is the monthly allowance spent on food besides restaurants in percentage from monthly allowance?
____

18- Do you spend any money on restaurants? 1- Yes ☐ 2- No ☐

19- How much do you spend on restaurants per month (in Lebanese pounds)? _________________________

20- Do you have any private source of fruits, vegetable or any other food type? 1- Yes ☐ 2- No ☐

21- If yes (quest. 61),Approximately what proportion of food consumed at home is of your own cultivation:

1- Olives [%]
2- Grains [%]
3- Meat, Chicken [%]
4- Vegetables [%]
5- Fruits [%]
6- Dairy [%]
7- Other specify? ____

Appendix 26: (24hrs) Recall Form

Collection of Questionnaire & Reception of Samples on the date…..

Dear Parent,

Kindly take note of the types of foods and drinks your child consumes (except spices, salt and water) during 3 days of the week. Choose two days between monday & thursday and one day between friday & sunday from early morning until sleep. For more information, you can contact the dietician Carla Yardemian El Hage on the following mobile number: 03-773523.

Eating at school: Make note of the items packed for the school recess. You should be careful to check the food quantities that the child consumed & take note of the foods which were returned. You should also record the child's purchases of food bought and consumed from the school cafeteria.

Eating at home: Precise the quantities of food and calorific drinks consumed (Juice, carbonated drinks, yoghurt etc..) by the child during main meals and in between meal snacks. Also make note of the methods used for cooking (boiling, broiling, frying or baking), added oil and other calorific additives during preparation.

It is necessary to follow the below mentioned instructions to estimate the quantities of food and the offered mugs(cups) used toestimate the size or weight of the foods consumed by your children:

- For food items that come in individual servings name the amount such as eggs, bananas or doughnuts

- Shapes for size of your fist, would be one serving of vegetables or fruitb or tennis ball, measures to about ½ cup of food (for example, ½ cup ice cream), large egg, is about a ¼ cup of dried fruit or nuts or six dice or one domino, would equal one serving of cheese (30g), tip of your thumb, about one teaspoon of butter or a computer mouse, one serving of a baked potato

-For weight deck of cards or the palm of woman's hand or the size of checkbook is equivalent to a serving of meat, fish or poultry (100grs)

- A rounded handful, about one half cup cooked or raw veggies or cut fruit, an average fruit portion, or ½ cup of cooked rice, burghol or pasta.

The below mentioned portions are for a single food serving from each category.
Please take note of each serving and category on a daily basis.

Vegetables (these portions are equivalent to a single food serving)
-1 cup of chopped fresh vegetables, such as lettuce, cabbage, carrot, tomato, cucumbers, etc…
-½ cup cooked vegetables such as spinach, cauliflower, green beans, okra etc...
-½ cup vegetable juice such as tomato or carrot juice

Fruits (these portions are equivalent to a single food serving)
- Medium portion of an apple, pear, orange, kiwi, tangerine (size of tennis ball)
- 1 cup of raspberry or strawberry
- ½ cup of fresh fruit juices
- Packed fruit juice (1 pack of commercial juice)

Milk and dairy products (these portions are equivalent to a single food serving)
- 1 tablespoon of strained labneh (strained sour yoghurt)
- white or yellow cheese (thin slice - 30 g)
- 1 cup of fresh milk (mug)
- 1 tablespoon of powdered milk
- 1 cup yogurt
- 1 tablespoon of kishk (a dehydrated mix of milk & wheat)

Proteins (these portions are equivalent to a single food serving)
- 1 slice of red meat or corn beef (a salt-cured beef) in the size of your palm
- 1 slice of fish fillets in the size of your palm
- 1 small can of tuna or sardines
- ½ chicken breast or one chicken thigh
- 5 pieces of meat cubes (red meat cubes)
- 1 medium sized hamburger or meatball
- ½ a cup of fava beans, runner beans, lentils, chickpeas
- 1 egg

Starches (these servings are equivalent to a single food serving)
- ¼ of big size pita bread
- ½ or 1 side of a medium sized pita bread
- ½ portion of Markouk flatbread
- 2 portions of medium size dry toast
- ¼ of a asrounia kaak (thin savory pastry bracelets, often flavored with aniseed or covered with sesame seeds)
- 1/4 Manakish (pastry topped with thyme with oil or cheese) - (precise with thyme or cheese)
- 1/2 cup of corn flakes
- ½ a loaf (15cm) of french bread
- 10 small round pieces of Kaak (crackers) or 3 “finger” kaak or 1 large portion of Kaak
- 3 pieces of dry biscuits

Starches (Continuation)
- ½ a hamburger bun
- ½ cup white or brown rice or bulgur
- 1 tablespoon of hummus with tahini
- ½ cup of boiled spaghetti or pasta
- 1 medium sized potato (baked or boiled), 12 pcs. of french fries or ½ cup of mashed pureed potatoe
- 3 cups of pop corn
- stuffed zucchini (one medium portion) – please mention the number of portions
- finger sized stuffed vegetables with rice & minced meat(grape vine, cabbage or swiss chard leaves) – please mention number of fingers
- 1 medium sized lahm bi ajin (medium sized pita bread topped with minced meat, vegetables and herbs)
- 1 small bag of potato chips (30g.)

Oils (these portions are equivalent to a single food serving)
- 1 teaspoon of vegetable or olive oil
- 1 teaspoon of butter or ghee
- 1 teaspoon of Mayonnaise
- 8 black or green olives
- ¼ of a avocado
- 1 teaspoon of tahini (a paste made from ground, hulled sesame seeds)
- fat Cube from meat (added to barbecue)

desserts (these portions are equivalent to a single food serving)
- 1 teaspoon of sugar
- 1 tablespoon of jam, honey, chocolate spread or halwa tahini sweet
- 1 small piece of baklava (sweet made of layers of pastry), maamoul (date filled cookies) or petit four biscuits
- 1 thin slice of sponge cake
- ½ a chocolate bar (please indicate brand or type) or 1 commercial chocolate serving-local brands (25g)

Day 1 Date: ________________ Precise Day: ______________________

Time	Place	Type of food or drinks	Quantities consumed	Mode of preparation (boiled, broiled, fried or baked)-please give recipe details

Day 2 Date: ________________ Precise Day: _____________________

Time	Place	Type of food or drinks	Quantities consumed	Mode of preparation (boiled, broiled, fried or baked)- please give recipe details

Day 3 Date: _________________ Precise Day: ______________________

Time	Place	Type of food or drinks	Quantities consumed	Mode of preparation (boiled, broiled, fried or baked) - please give recipe details

Appendix 27: CFK Child Food Knowledge Questionnaire

CHILD QUESTIONNAIRE

1- A good breakfast would include:
   A- Manakish (local oily thyme based pastry) and commercial juice
   B- Labneh (local sour cream cheese) sandwich, cucumber and a cup of milk
   C- Cheese sandwich, chocolate bar and cup of milk

2- I need to eat daily for healthy growth:
   A- Three major meals and in-between snacks
   B- Two meals per day
   C- One meal and Two snacks

3- If I am hungry in-between meals, it is a healthy habit to snack on:
   A- Chocolate, candies and cakes
   B- Fruits and vegetables
   C- Chips and fruits

4- We need to drink daily;
   A- Water 6 to 8 cups distributed during the day
   B- Cola drink to quench my thirst
   C- Juice abundantly only in the morning

5- Healthy means to preserve vegetables all year round:
   A- By freezing, drying, vacuum and addition of vinegar or brine
   B- Addition of ice cubes
   C- Addition of water and vinegar

6- For a healthy lifestyle, every day I need to:
   A- Watch cartoons at least 2 hrs
   B- Be physically active (running, playing ball games, cycling…) for half an hour and more in summer and winter
   C- Avoid games that require physical activity because they tire my muscles and body

7- Everyday I need to consume good protein food sources necessary for my growth such as:
   A- Beans, eggs, dairy, meat, seafood (or fish), poultry and nuts
   B- Beans and butter only
   C- Meat is the only protein I need

8- During every meal i need to include:
   A- Fruits and vegetable only
   B- 3 food groups from the food guide pyramid
   C- A convenience food like crisps bought from the store

9- A healthy diet should include the following 5 colors:
   A- Red, green, brown, purple and orange
   B- White, red, blue, green and pink
   C- White, red, green, purple and orange.

10- If mum did not cook a meal for lunch today what would you eat instead:
   A- Buy snacks from the nearby grocery store for lunch
   B- Meal ready from before available ready in refrigerator
   C- Avoid eating any meal

11- Calcium helps me build healthy bones so i need to consume daily:
   A- One cup of milk
   B- Three servings of Meat
   C- Three to four servings of dairy products
   D- Not necessary to consume dairy products daily

12- If lunch meal prepared at home is not to my taste:

A- I pretend that I am eating it and throw the food in the waste bin
B- I consume at least half the plate and share the rest with other family members
C- I run to the grocery store to buy chocolate and chips to satisfy my hunger

13- I need to wash my hands:

A- After finishing from the restrooms
B- Before a meal
C- Before starting to prepare a meal
D- A, B and C are correct
E- None of the above are correct

14-Fiber is an important ingredient in my daily diet, the best source of it is:

A- Fruit juices only
B- Meat and Dairy
C- Fruits, vegetables, beans, wheat bread and nuts

15- Better health and immunity is served by:

A- One portion of fruit or vegetable per day
B- Minimum Five portions of fruits and vegetables per day
C- Minimum two to three portions of fruits and vegetables per day
D- Five cups of fresh juice per day

16- Convenience foods are not considered healthy for children's health because:

A- They are full of vitamins
B- They contain nutritious ingredients for growth
C- They are high in calories, fat, sugar, salt and artificial coloring agents

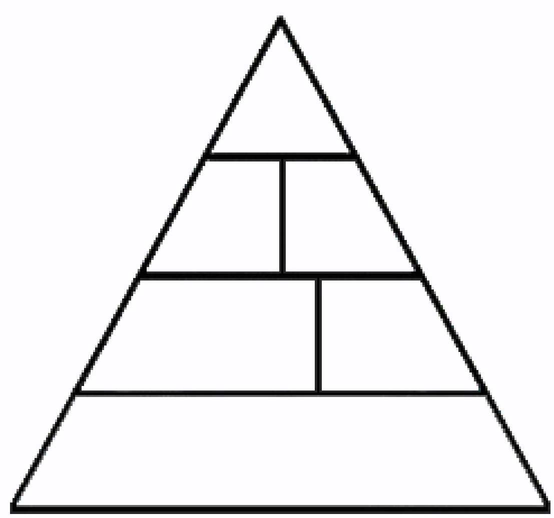
17- I need to brush my teeth :

A- Minimum twice per day
B- After each meal
C- Not necessary to brush the teeth daily
D- A and B are correct

18- The best form to consume oil with meals would be:
A- Used in frying foods
B- Having 1Tbsp of oil at every meal only
C- Having 10 Tbsp of oil at every meal

19- Bread is healthiest to eat as:
A- At least five loaves (big size pita) of white bread per day
B- One to two loaves of wheat bread per day
C- At least five loaves of wheat bread per day

20- Fill in the sections of the food guide pyramid (6 food groups to be filled in) according to alphabetic indicators
1- Grain and carbohydrate group
2- Vegetable group
3- Fruit group
4- Protein group: meat, beans, nuts, eggs
5- Dairy group and derivatives
6- Oily, salty and sugary foods



Appendix 28: In Body Calibration Certificate

Certificate KR08/75497

The management system of

Biospace Co Ltd

15, Heugam-gil, Ipjang-myeon, Seobuk-gu, Cheonan-si, Chungcheongnam-do
331-824 South Korea

has been assessed and certified as meeting the requirements of

Directive 2009/23/EC

Annex II.2

For the following activities

The company have been assessed and approved as meeting the requirements of the Non Automatic Weighing Instruments Directive (2009/23/EC) and the Non Automatic Weighing Instruments Regulations (SI 2000 No 3236) for the EC verification.

General Description of Machine Type	Type Certificate Number
InBody 230	T7416
InBody J30	T7416
InBody 720	T8035
InBody 770	T8409

Certified since 23 June 2014 until 23 June 2017 and remains valid subject to satisfactory surveillance audits.
Re certification audit due before 23 June 2017
Issue 6. Certified since 1 August 2008

Authorised by

SGS United Kingdom Limited, Notified Body 0120
Unit 202B Worle Parkway, Weston-super-Mare, BS22 6WA UK
t +44 (0)1934 522917 f +44 (0)1934 522137 www.sgs.com

SGS CE 05 0609 M2

Appendix 29: Comparison of prices of staple foods according to intervention areas

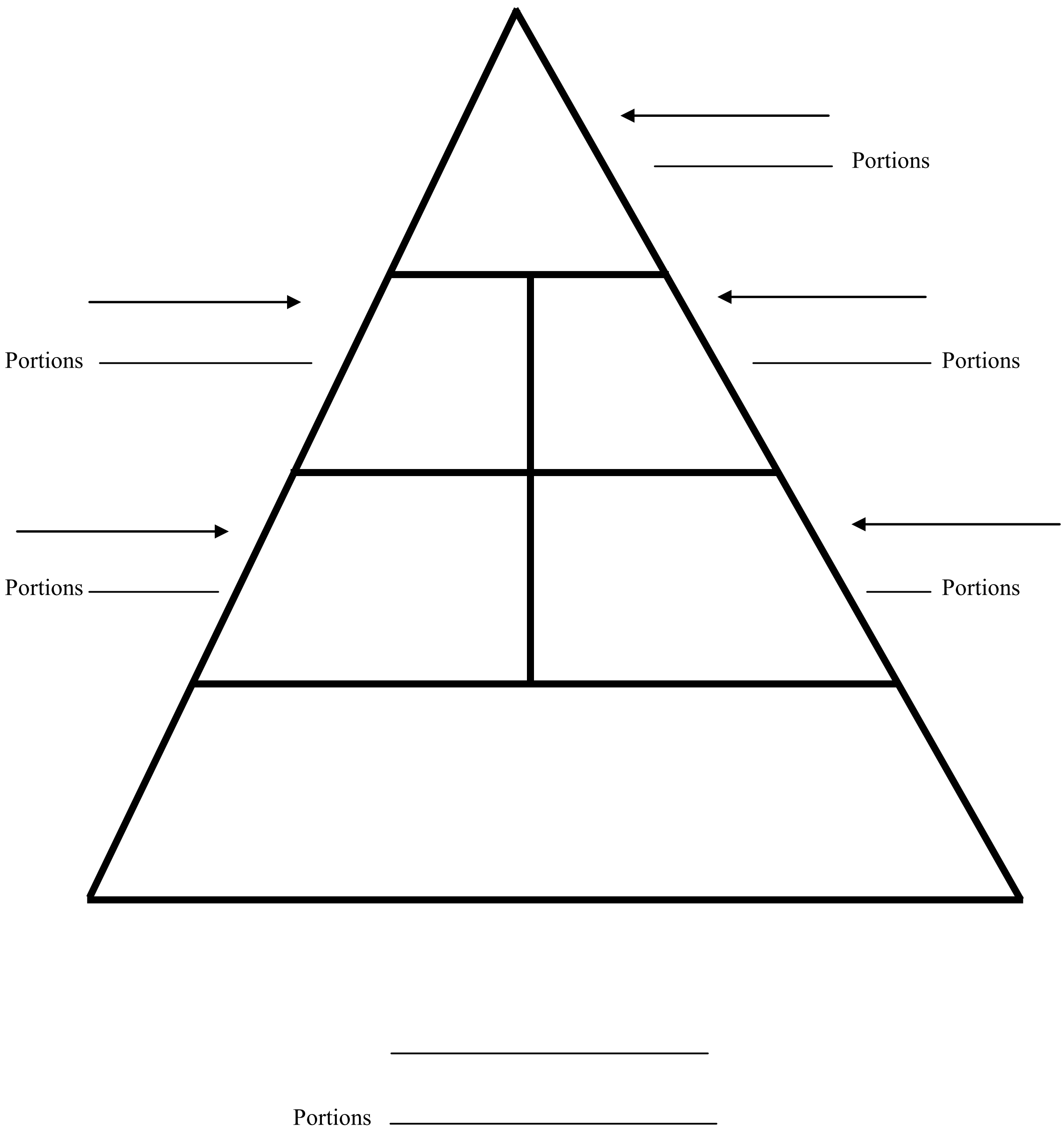
Food staples average price from six different grocery stores in Bekaa and North areas

VEGETABLES		Average price	Average price
	unit	Bekaa	North
Cucumber	1Kg	LBP 1,333	LBP 917
Tomato	1Kg	LBP 1,333	LBP 1,083
Lettuce	1Kg	LBP 1,500	LBP 500
Tomato sauce	1Kg	LBP 3,258	LBP 2,143
Spinach	1Kg	LBP 1,667	LBP 1,000
Carrot	1Kg	LBP 1,250	LBP 833
Cabbage	1Kg	LBP 1,000	LBP 833
Zucchini	1Kg	LBP 2,500	LBP 2,500
Green Beans	1Kg	LBP 4,750	LBP 2,667
FRUITS			
Banana	1Kg	LBP 1,167	LBP 1,000
Apple	1Kg	LBP 1,500	LBP 875
Orange	1Kg	LBP 1,167	LBP 588
Tangerine	1Kg	LBP 2,000	LBP 688
MILK & DAIRY			
Labneh	1Kg	LBP 5,400	LBP 2,700
Milk powder (3.3 %Fat)	1Kg	LBP 8,784	LBP 7,375
White (Feta) Cheese	1Kg	LBP 7,975	LBP 4,125
Picon	8 pc	LBP 2,516	LBP 950
Yellow Cheese	1Kg	LBP 6,575	LBP 6,142
Italian Mortadelle	1Kg	LBP 6,176	LBP 10,021
Yoghurt	1Kg	LBP 2,200	LBP 1,500

PROTEIN			
Egg	30 pc	LBP 4,495	LBP 4,375
White Beans	1Kg	LBP 2,845	LBP 2,375
Chicken Breast	1Kg	LBP 9,667	LBP 8,000
Broad Beans (fava) فول	1Kg	LBP 2,446	LBP 1,088
Lentilles	1Kg	LBP 2,645	LBP 2,250
Tuna Can	1Kg	LBP 9,291	LBP 5,058
Ground Beef	1Kg	LBP 12,583	LBP 8,917
CARBOHYDRATES			
Bread	1Kg	LBP 1,500	LBP 1,302
White Bread			
White Rice	1Kg	LBP 1,941	LBP 1,350
Macaroni cooked	1Kg	LBP 1,844	LBP 5,113
Olive Oil	1 L	LBP 9,490	LBP 3,279
Corn Oil	1 L	LBP 3,195	LBP 2,410
Butter	200g	LBP 1,850	LBP 1,740
Samneh	200g		LBP 1,519
MISCALLENOUS GROUP			
Sugar	1Kg	LBP 1,775	LBP 1,500
Jam	1Kg	LBP 4,611	LBP 3,326
Manakish zaatar			
Tea	25 pc	LBP 6,000	LBP 1,000
Magi cube 1chb	1 cube	LBP 212	LBP 215
Manakish kishek			
Homos b’thineh	1Kg	LBP 2,613	LBP 3,167
Halawa plain	1Kg	LBP 8,956	LBP 4,325
Thyme dry	1Kg	LBP 5,180	LBP 3,963
Manakish cheese			

Appendix 30: (Handout Educational Session One)

DAILY FOOD GUIDE PYRAMID



(Handout Educational Session One)

A healthy diet is to eat enough fibers, low in animal fat which reduces the dietary cholesterol.

A healthy diet also includes dairy & meats for a better complete nutritional balance.

The attached pyramid of food explains how we can reach our daily needs without taking a risk!

Appendix 31: Five Fruits & Vegetables a Day (Handout Educational Session Two)

What are the necessary colored vegetables which should be eaten during a single day?

Color the fist box with the appropriate color then draw a vegetable or fruit with the same color in the second box

Fruit or Vegetable of the same color

← Color

Fruit or Vegetable of the same color

← Color

Fruit or Vegetable of the same color

← Color

Fruit or Vegetable of the same color

← Color

Fruit or Vegetable of the same color

← Color

Appendix 32: Calories and the meal distribution of a day adult and child

(Handout Educational Session Three)

Name of School: ________________________ **Class:** ______________________________

Name of Student: ______________________ **Date:** ____________________________

DAILY SCHDULE

Breakfast: ____

____

Snacks in School: ____

____

Lunch: ____

____

Afternoon Snacks: ____

____

Dinner: ____

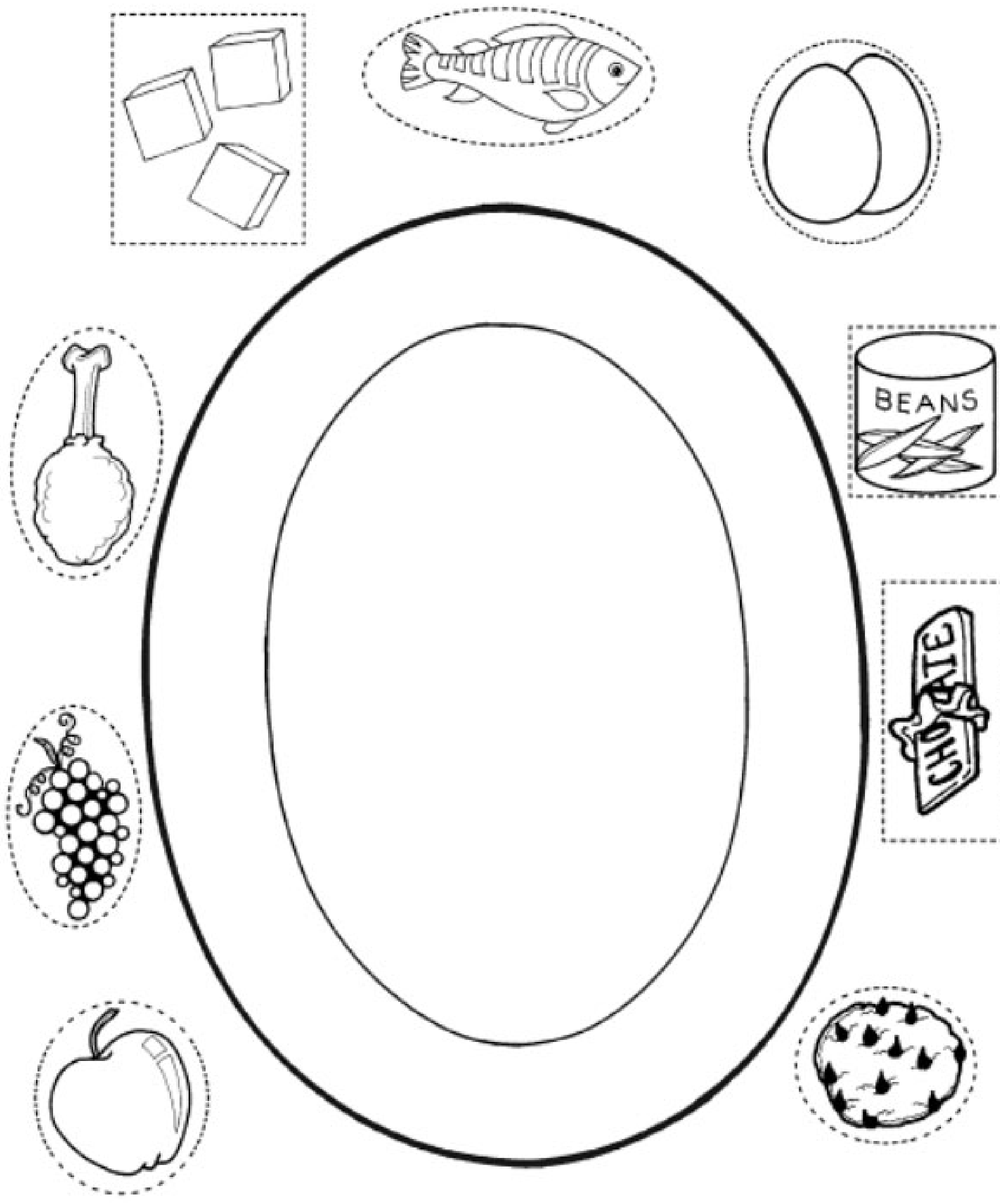
____

Appendix 32: Calories and the meal distribution of a day adult and child

(Handout Educational Session Three)

Making Samer's Meal

Make a meal for Samer. Color the Pictures of some things that you think Samer would like to eat. Cut them out and paste then onto the dish.



(Sterling, ME; 2004)

Appendix 33: Protein and Dairy Intake (Handout Educational Session Four)

Name of Student ____________________ **Name of School ______________________**

List ALL the Dairy products you consume on a daily basis

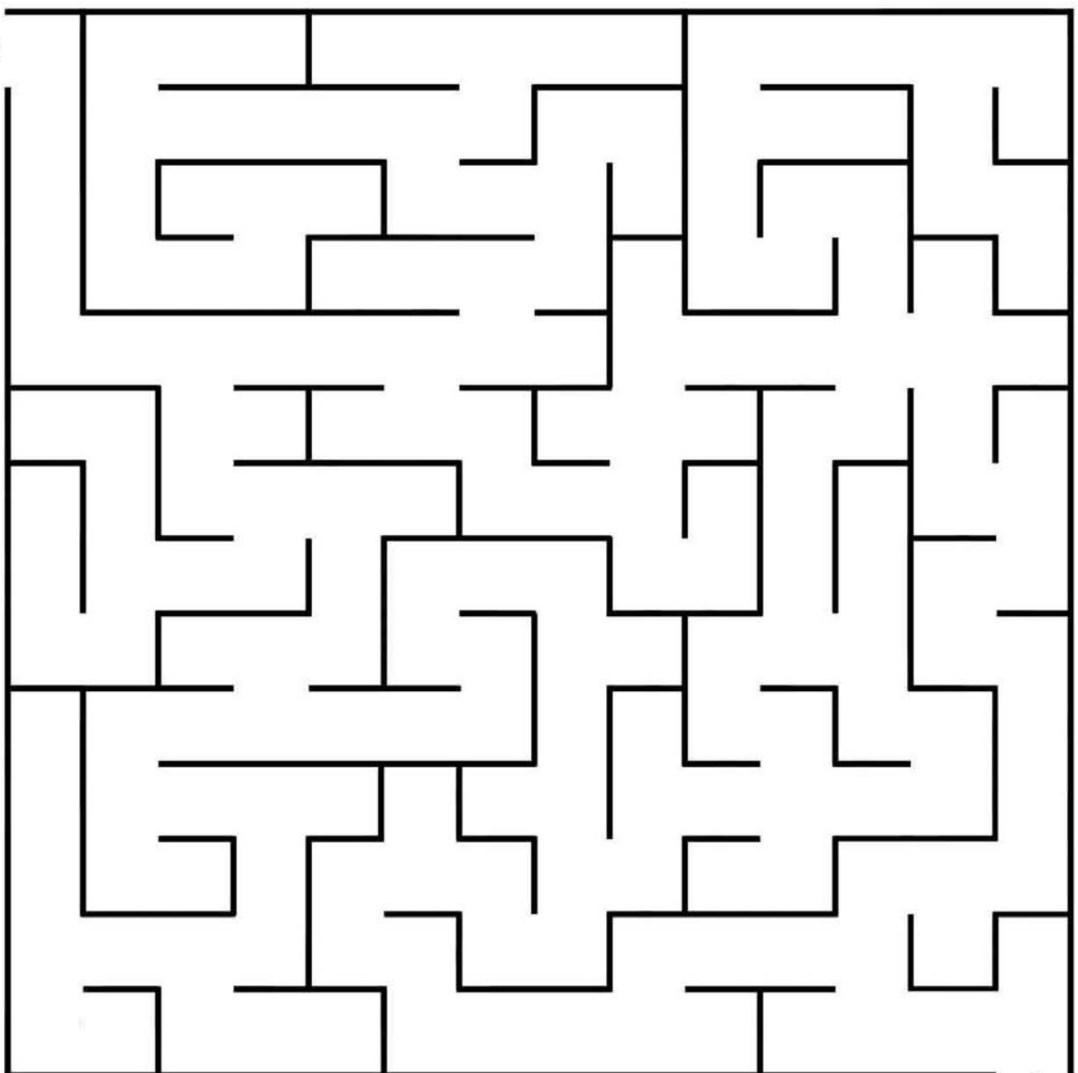
List the Dairy products you consumed	Day 1	Day 2	Day 3	Day 4
List the Dairy products you consumed				
Color the Star if you consumed 3 portions of Dairy Product	☆	☆	☆	☆

(Handout Educational Session Four)

Calcium is aMAZEing!

Like you, Bo needs calcium to keep bones and teeth strong and healthy. Help Bo find her way through the calcium maze to the Great Calcium Fair.

start



finish

Fat-free Milk
8 fluid ounces
(milligrams of calcium)

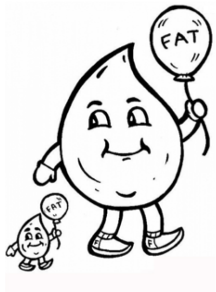
Broccoli
1 cup = 90mg

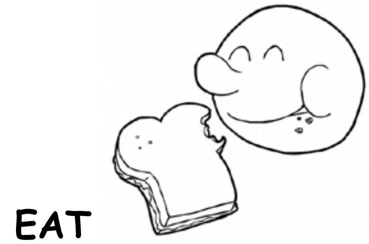
Macaroni & Cheese
1/2 cup = 180mg

Ice Cream
1 scoop = 118mg

Children 4 - 8 years old need 800mg of calcium daily!
Children 9-18 years old need 1300mg of calcium daily!

Appendix 34: Sugar and Fat in Diet (Handout Educational Session Five)





Foods Rich in Sugar and Fats

Name 4 types of Foods Rich in Fats and Oil that you need to avoid

1- ______________________________

2- ______________________________

3- ______________________________

4- ______________________________

Name 4 types of Foods Rich in Simple Sugars that you need to avoid

1- ______________________________

2- ______________________________

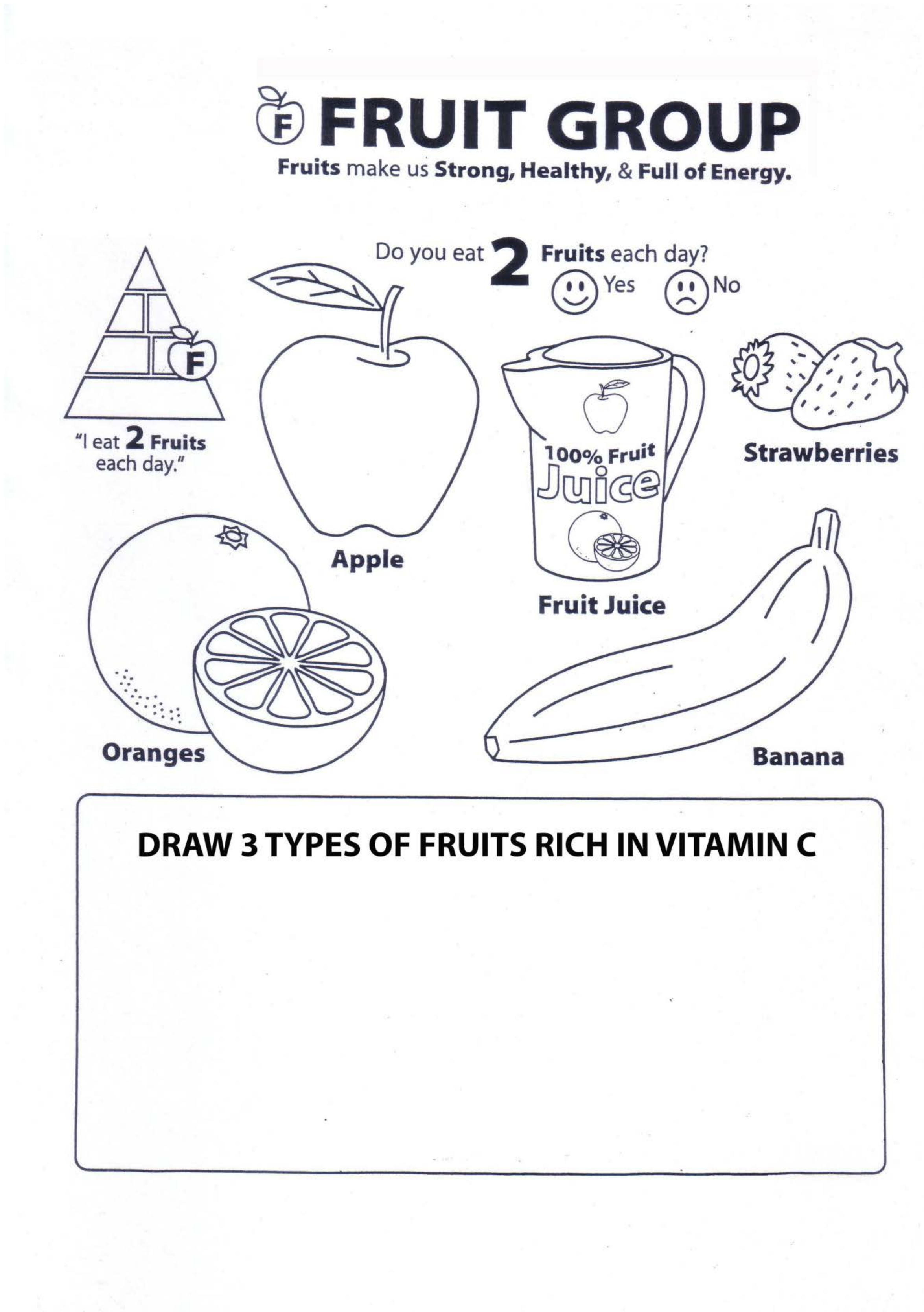
3- ______________________________

4- ______________________________

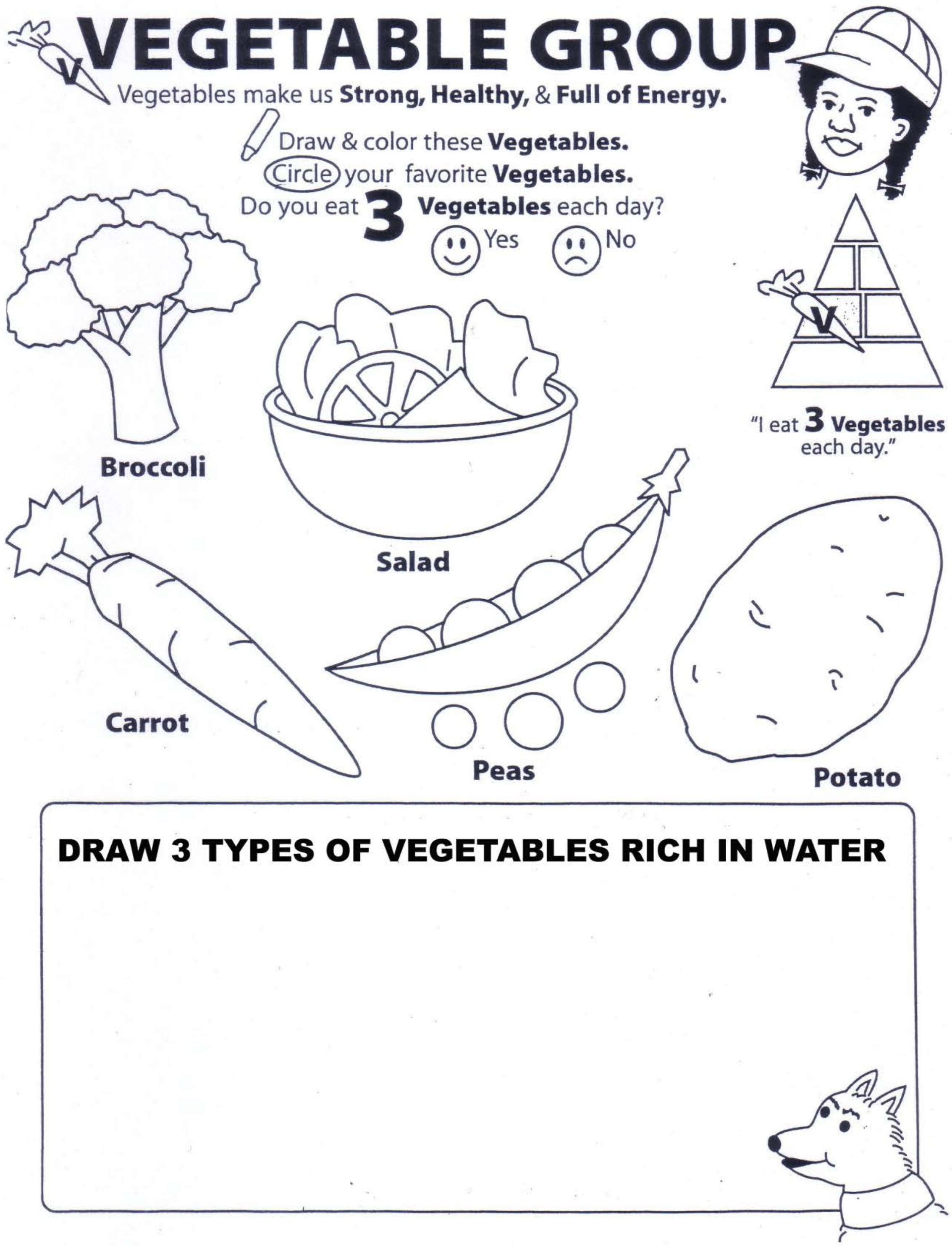
What food types are rich in protein and help muscle development? Name 4 Types

____

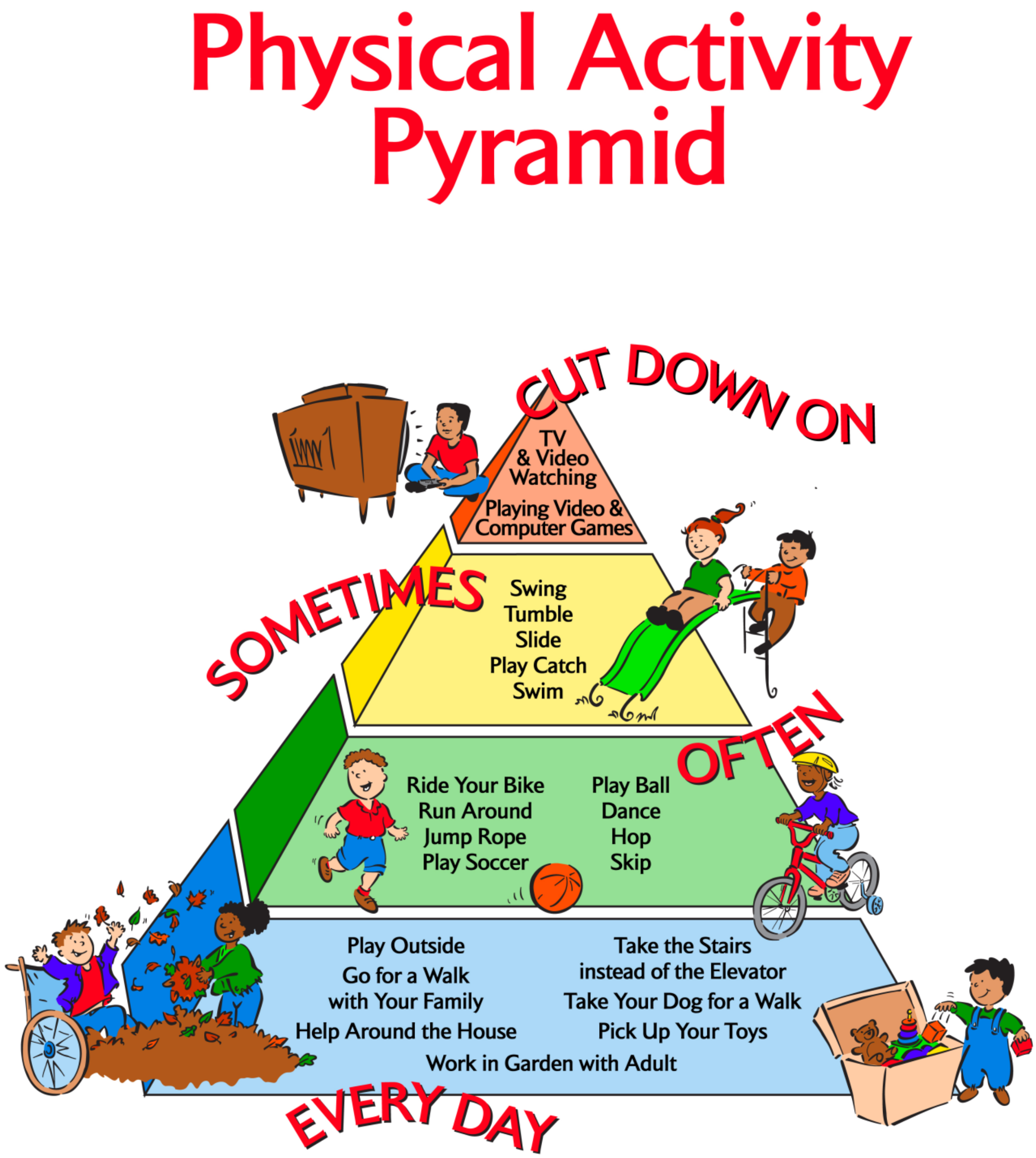
Appendix 35: Fiber and Health (Handout Educational Session Six)



(Handout Educational Session Six)



Appendix 36: The Activity Pyramid (Handout Educational Session Seven)



(South Central Public Health District, 2011)

Appendix 37: The importance of Drinking Liquids (Handout Educational Session Eight)