Assessing the Effectiveness of an Obesity-Prevention Intervention to Improve Healthy Lifestyle among Saudi School Girls Aged 9 to 16: A Feasibility Study

Duaa Hasan Hefni

Submitted in Partial Fulfilment of the Requirements of the

Degree of Doctor of Philosophy

University of Salford, Manchester, United Kingdom

School of Health and Society

January 2017

Table of Contents

List of Tables

List of Figures

Abbreviations

ANOVA	Analysis of variance
BMI	Body Mass Index
CDC	Centre for Disease Control and Prevention
CG	Control Group
CVI	Content validity index
DNK	Diet and Nutrition Knowledge
FRF	Frequency and Relative Frequency
HIV	Human Immunodeficiency Virus
HSCIC	The Health and Social Care Information Centre
IG	Intervention Groups
IOTF	The International Obesity Task Force
kCal	Kilo Calorie
Kg	Kilogram
KSA	Kingdom of Saudi Arabia
m^2	Square Metre
MET	Metabolic Equivalent
NHS	National Health Service
OHR	Overall Health Rating
PA	Physical Activity
PCA	Principal Component Analyses
R-CVI	The representative content validity index
RPs	Research Participants
SAL	Sedentary and Activity Level
SPA	Sedentary and Physical Activities
UK	United Kingdom
STI	Sexually Transmitted Infections
US	United States
WHO	The World Health Organisation

Acknowledgements

My utmost thanks to Allah for blessing me with the opportunity, ability and inspiration to conduct this study. I express my heartfelt appreciation to my supervisors: Prof Tony Warne, Dr Joy Probyn and Prof Caroline Hollins Martin, for their relentless support, guidance and patience. It was a very inspiring stint to be under your leadership.

I give special thanks to my family members and friends for their encouragement, support and inspiration to achieve my studies this far.

Further, I acknowledge and thank the Ministry of Health, Kingdom of Saudi Arabia that granted me the chance to complete my studies in the United Kingdom. I extend my gratitude to all participants in this study including schoolgirls, their parents or sponsors, school nurse and teachers. I thank the school head teacher for her permission and support to complete this study. This study would not have been complete without your participation, thanks again.

Dedication

This thesis is dedicated to my lovely sons Hassan and Hamza. Your love and existence in my life is a motivation to achieve more in life.

I further dedicate this study to my family: my late Father who would inevitably be proud of his daughter - all mercy on his soul, I would like to thank my brothers Zaid, Amro, Fahad and Ashraf and my mother who offered unlimited support and encouragement along this study journey. My family instilled in me courage and hopes to overcome life's challenges and achieve my Doctoral studies, thank you for believing in me.

I also dedicate this study to my best friend Nora Jawdatt for her great companionship during my study, it was a blessing to have great mind, full of encouragement and understanding.

Finally, I dedicate this study to all Saudi Arabia schoolgirls – it is possible that one time Saudi schoolgirls can live an obesity free life.

Abstract

The prevalence of overweight and obesity is increasing worldwide at an alarming rate and the Kingdom of Saudi Arabia at increased risk of a multitude of obesity-associated problems. There are multiple causal factors associated with childhood obesity, but the modifiable ones are dietary and activity behaviours. In order to accomplish this, it is vital to assess and evaluate whether an intervention to promote healthy lifestyle behaviours in school-age girls is effective in reducing their Body Mass Index (BMI). To measure the effect of such an intervention requires a large sample across a wide geographical mass and therefore a feasibility study is necessary before conducting a study of this size, to explore the most effective form of the intervention and methods for measuring its effectiveness. Although several obesity-related intervention studies were published worldwide, the current feasibility study was conducted for the first time in Madinah, Saudi Arabia. Therefore, this feasibility study was conducted to determine the viability of promoting healthy eating and physical activity with school girls (aged 9 to 16 years) in Saudi Arabia, in order to prevent childhood obesity.

Saudi schoolgirls were included in the current feasibility study, using both quantitative and qualitative methods. A sequential explanatory design was adopted, allowing sequential implementation of quantitative and qualitative components. Parent questionnaires (n=90) on children's nutrition and physical activity habits were issued pre-intervention. A children's self-report questionnaire (n=90) and anthropometric measures were conducted pre- and post-intervention to assess the impact of the education programme. Semi-structured interviews (n=18) were conducted to explain the results from the questionnaires. The intervention aims to promote healthy eating and physical activity in Saudi School children, based on the constructs of the Social Cognitive Theory. The intervention consisted of two components: a presentation and interactive sessions delivered in about 2 hour session at Taibah school.

In the pre-intervention study, the results showed cases of overweight (23.3%) and obesity (5.6%). Participants showed some levels of nutrition and physical activity awareness. A significant proportion of girls engaged in sedentary behaviours (using a smartphone/tablet (28.9%) for >3 hours). Participants consumed energy-dense foods (fast foods 83%, non-diet drinks 66.7%) 1–3 times per week. In addition, the results indicated that after-intervention the participants' average number of hours of exercise was higher (M = 4.64) than the corresponding hours of exercise after intervention (M = 1.71), while sedentary activity

reduced. Reported decrease in consumption of unhealthy foods while healthy foods increased. There were no significant differences between pre- and post-intervention weight (p=0.669) or BMI (p=0.856). BMI categories changed, indicating more normal weight and fewer overweight participants. Further, the qualitative data analysis indicated that participants had prominent level of sedentary activities, mainly playing video or watching television. These data, also, indicated culture impact on the choice of food and level of physical activity.

The school-based intervention was found to be a feasible intervention that motivates changes in lifestyle behaviours and BMI. Regular physical education and healthy eating classes, and increased access to healthy foods at school shops can help to combat obesity. This school based-intervention has shown potential to improve health lifestyle among Saudi girls and to prevent childhood obesity, which can make a positive impact on their health. However, further research is needed to confirm the impact of obesity education intervention programme with a larger sample over a longer time-period.

Key Words:

Adolescents; children; lifestyle factors; obesity; Saudi Arabia; sedentary behaviour; healthier diet; overweight; intervention; physical activity and obesity prevention.

Chapter One: Introduction

1.1. Introduction

Educational intervention programmes are essential to prevent obesity among school children in Saudi Arabia, to improve behaviour toward healthy food and physical activities. Generally, in the last two decades, obesity and gain weight among Saudi children has increased (Al Dhaifallah et al., 2015). The development and testing of such an educational programme requires a large-scale randomised controlled trial. This research study aimed to test the feasibility of a school-based intervention to reduce weight and obesity in school girls in a school in Madinah City. No previous research has been conducted with this population of Saudi children, with a view to conducting a large-scale RCT based on the results of the study. The literature has reported between twelve and eighteen months duration to conduct of obesity-related intervention research in different countries (Shama & Abdou, 2009; Lloyd *et al.* 2011; Habib-Mourad, 2013). However, conducting the current education intervention programme was about three months, due to time and resources constraints. The outcomes of this feasibility study will give a clear indication of the effectiveness of the educational intervention programme and the methods applied to evaluate its effectiveness. Therefore, this introductory chapter focuses on the concept of obesity and gives information related to Saudi Arabia.

1.2. Overview

Obesity is a serious public health challenge of the 21st century that has affected both adults and children. It is associated with having an excess of body fat emergent from environmental and genetic factors that are difficult to control when dieting (The Obesity Action Coalition (OAC), 2014). The cause of obesity is linked to an individual's eating habits, inadequate physical exercise, and hereditary factors (Moreno et al., 2011). Obesity is measured using body mass index for age (BMI), which is a standard tool that measures weight in kilograms by height in metres squared (kg/m^2) (Pescovitz et al., 2004). According the National Health Service UK (NHS) (2012) obesity is classified as having a Body Mass Index (BMI) of 30 or greater, where BMI is a tool used to measure obesity based on the healthy weight for ones' height. Using BMI as standard tool to measure obesity, the measurement of weight in kilograms by height in metres squared (kg/m^2) (Pescovitz et al., 2004). The BMI standard then categorises the result such that if the BMI result obtained is between 25 and 29 a person is considered '*overweight*'; if between 30 and 40 a person is

considered *'obese'*; and if over 40 a person is considered '*morbidly obese*' (Flegal et al., 2010). Globally, the number of overweight and/or obese children under the age of five, in 2010, was estimated to be about 43 million and of this figure, 35 million were from developing countries (De-Onis et al., 2010). Worldwide prevalence of childhood overweight and obesity also increased from 4.2% in 1990 to 6.7% in 2010 and it may increase further by 2020 (De Onis et al., 2010).

It is clear that obesity may result in health risks or consequences if not controlled at an early stage. The literature recognises the link between physical activity, diet and obesity, asserting the increased potential to develop a range of serious diseases, as a result of being overweight or obese (Health and Social Care Information Centre, 2014). This is worsened in the case of childhood obesity as, children who are diagnosed as obese risk a greater likelihood of developing illnesses, experience repeated absence from school, struggle with health-related limitations and require constant medical attention than their normal weight counterparts (Health and Social Care Information Centre, 2014). Additionally, obese and overweight children are more likely to have adult obesity and develop obesity related conditions such as morbidity, disability and adult premature mortality.

According to the NHS (2012) childhood obesity is a health risk to the younger generations because it can cause physical changes that can lead to a number of critical and potentially life-threatening conditions, namely type 2 diabetes, stroke, coronary heart disease, cancer (breast and bowel cancer), sleep apnoea, hypertension and more. In addition, obesity affects the body in two major ways, first the apparent physical change it exerts on the body as a consequence of the accumulated mass of fatty tissues, and second the cellular and metabolic changes due to increased production of various products by enlarged fat cells. Most other effects of overweight and obesity are rooted in 'invisible' changes, for example increase of fat in blood and an altered response to insulin. Furthermore, obesity can have indirect effects observed through lifestyle factors connected to obesity, this can include poor diet and sedentary lifestyle, which as the National Obesity Observatory asserts "have an independent impact on health" (Health and Social Care Information Centre, 2014). Thus, childhood obesity affects the quality of life of children; and may result in psychological problems such as low self-esteem and depression which can hinder their development. It is also apparent that an increase in the prevalence of childhood obesity translates into an increase in obesity-related health risks posing a public health risk. These health risks make it a critical area to

address in public health research. This feasibility study discusses childhood obesity in the author's country of origin, Saudi Arabia.

1.3. Overview of the Kingdom of Saudi Arabia

Saudi Arabia (Figure 1), officially known as the Kingdom of Saudi Arabia (KSA), is approximately 2,150,000 km square and considered the largest state of the Arabian Peninsula (World Factbook, 2013). KSA was established in the 18th century and its modern laws are Sharia-based given that the country is the birthplace and home to Islam's two holy cities, Mecca and Al-Medina (Figure 1). The country's administration is divided into thirteen provinces, which are further subdivided into governorates. KSA has a terrain of fairly barren and harsh gravel plains, salt flats and sand deserts. Nevertheless, KSA has emerged as an underdeveloped desert country to one of the wealthiest and developed nations in the region because of its oil resources (World Factbook, 2013).

Figure 1. KSA map with regional divisions shown, (Image adopted from globalsecurity.org)

KSA's population is estimated to be 26.9 million including about 10 million non-nationalised immigrants. The ethnic composition of KSA citizens is reportedly 90% Arab and 10% Afro-Asian (Saudi Embassy, 2013). As of 2013, 21% of the KSA population was made up of foreign nationals and there were more than 100, 000 westerners in KSA (World Factbook, 2013). Based on a general population survey, about 97% of the KSA population is Muslim (World Factbook, 2013; Saudi Embassy, 2013). The official language is Arabic, although English is widely spoken in urban centres. The KSA culture is derived from Arab traditions

and civilisations and it influences both social and legal behaviour and practice (Saudi Embassy, 2013). The daily life of Saudi Arabian people is dominated by Islamic observance (World Factbook, 2013).

1.4. Statement of the Problem

Study reports indicate that KSA childhood obesity prevalence is increasing. The Centres for Disease Control and Prevention in 2000 reported that obesity affected about 17,825 (20.4%) of children aged between 5-18 years in KSA. In 2004, a KSA national survey conducted in rural areas argued that diabetes (associated with obesity) prevalence in children is increasing and that this might put additional pressure on the KSA health sector (Amin et al, 2008). In 2007, the World Health Organisation (WHO) reported that more than 19,317 (23.9%) KSA children between the age of 5 and 18 years were obese or overweight (El Mouzan et al., 2010). Al Shehri and colleagues (2013) have also argued that based on the latest KSA national data, rates of overweight and obesity among school-age children have reached 23% and 9.3% respectively. The Saudi Gazette (2013) claimed that obesity rates among Saudi children are about 18%. Those recorded findings depict a worrying trend that calls for necessary actions to prevent a further increase of childhood obesity and its consequences in KSA. Because child obesity is a behaviour-driven disease, it is important to understand the link between obesity and the KSA sociocultural behaviour history.

KSA's last four decades have experienced rapid economic growth that has resulted in a remarkable increase in living standards and the adoption of a 'westernised lifestyle', that is arguably characterised by the unhealthy dietary patterns and decreased physical activity generally associated with obesity (Saudi Gazette, 2013; Midhet et al., 2010). Al Shehri and colleagues (2013) commented that there had been a transition in nutrition in which KSA people shifted towards a diet high in energy-dense foods and a sedentary lifestyle, which represent a remarkable deviation from the commonplace dietary practices and lifestyle in Saudi Arabia in the 1970s and 1980s. In attempting to link child obesity to KSA social behaviours, an empirical study conducted on 2,906 secondary school children (aged 14-19 years) across KSA schools indicated that the increasing prevalence of obesity among Saudi youth was related to profound changes in lifestyle factors (Al-Hazzaa *et al.*, 2012). These factors included inadequate physical activity, and less frequent consumption of breakfast, vegetables, fruits and more sugar-sweetened beverages (Al-Hazzaa *et al.*, 2012).

Based on the study findings about childhood obesity in KSA indicated above, it is possible to envisage challenges posed by childhood obesity that go beyond health risks. There are economic implications including increased healthcare costs derived from an overly obese KSA population in the long term, subsequent poor quality of life of citizens and children, as well as poor school attendance and performance owing to health problems associated with obesity. Obesity is therefore a major concern for KSA public health…that requires a reliable and long-term solution. As Al-Hazzaa and colleagues (2012) concluded; "primary prevention of obesity by promoting a healthy diet and active lifestyles should be a national public health priority". This research study focused on exploring a reliable solution to preventing and controlling childhood obesity in KSA through an education-based intervention programme.

1.5. Significance of the Study

Childhood obesity has been cited as "one of the most serious public health challenges of 21st century" (WHO, 2011: 1). Examining childhood obesity and its prevention is significant as such a condition can harm nearly every system in a child's body (heart, lungs, kidney, digestive tract, muscles, skeleton and hormonal control), and can have a detrimental effect on their social and emotional life, ultimately intensifying their risk of disease and disability later in life (Chan, 2013). The menace of obesity cannot be downplayed as it represents a major public health crisis nationally and internationally (James et al., 2008) given its long-term impact on the population health and the cost of health care (Karnik & Kanekar, 2012).

In KSA, the higher childhood obesity occurrence in Saudi females has turned into a serious public health risk. It is already the case that obesity's associated risk factors such as coronary artery disease are high among females who have an obesity prevalence rate of 44% compared to their male counterparts who scored a prevalence rate of 26.4% (Al-Nozha et al., 2005). It is observed that childhood obesity often persists into adulthood, which makes it an important predictor of adult obesity (Bauman et al., 2009). Therefore, the importance of conducting research within this particular topic lies in the need for finding solutions to childhood obesity and its associated health risks.

Devising a research study based on a school-based intervention spells the necessity of aiming to implement viable strategies that highlight the problems and arrive at potential solutions that will result in health gains which will have lasting-effects on the quality of life of the target population. A study of this nature would also focus on assessing outcomes for their

effectiveness as a means of attaining significant positive behaviour change following nutritional knowledge imparted through obesity education. By giving consideration to the association of childhood obesity and lifestyle behaviour, the study is important as it attributes to education a decisive role marked by its capacity to inform and achieve a voluntary behaviour change in children. The study further assesses how obesity education results in optimum voluntary behaviour change. According to Sharma (2011), optimum behaviour change depends on how a planned education results in children's perceived difference of healthy and unhealthy lifestyle practices. The study is influential for identifying the strengths and weaknesses of education based childhood obesity interventions, thus creating avenues for improving childhood obesity prevention and saving health costs.

Alhazaa (2012) recommends a number of factors for the prevention of childhood obesity which emphasise critical role lifestyle modifications, such as moderate physical activity, decreased TV viewing time and computer usage, reduced fast food intake and sugar-sweetened beverage. The study concludes that promoting active lifestyle and increase accessibility to healthy foods in Saudi Arabia should be a national public health priority. While the assertion made in this study by Alhazaa (2012), and found widely elsewhere in research by advocates the importance of making healthy diet options more readily available to counter obesity, this study contends that such measures can only be effective when coupled with efforts to address the problem with the inclusion of a multi-component approach and sociocultural considerations. As such, herein a unique contribution to this area is offered by implementing the recommendations for the prevention of childhood obesity in Saudi Schools. This research study will make a contribution to knowledge in the following ways:

- It will fill a significant gap in the existing Saudi empirical literature on this topic, in that it will incorporate the use of an intervention programme that differs from others given its multi-component approach, which combines the core factors of dietary habits, physical activity and sedentary activity. According to Sharma's (2011) review of school-based intervention studies, the majority of previous school based intervention studies focused on two lifestyle factors while this study examines the influences of three factors (dietary habits, physical activity and sedentary activity).
- The study design and development are driven by considerations of Saudi sociocultural and Islamic rules, and by doing this it aims to increase and build basic nutritional awareness in accordance with the cultural and religious context of the schoolgirls.

It is assumed that this research study will contribute to knowledge through furthering understanding of the feasibility and effectiveness of this school-based intervention programme; in particular, when designed as a multi-component procedure henceforth taking into account the diverse factors pertinent to societal norms and culture. Realising the importance of such an approach to deepen understanding of the problem, this study adopted the following intervention factors: sedentary activities, dietary habits and Physical activity.

A thorough literature review of existing studies about childhood obesity among Saudi children found no previous attempts to implement a school-based intervention programme within Saudi girls' schools in order to raise awareness of healthy dietary practices and lifestyle choices.

By addressing this, this study is expected to provide an insight for KSA's public health practitioners, policy makers and nursing students in respect of childhood obesity prevention both at home and in the school setting.

1.6. Motivation for the Study

As the author of this thesis, I chose this subject matter for multiple reasons. As a Saudi woman, I felt the responsibility of pointing out the extent of childhood obesity prevalence in my country, considering that existing KSA studies showed the severity of obesity among Saudi children. Furthermore, having served as a primary school teacher, I observed that school canteens offered unhealthy foods, which most students purchased. In addition, with a Master's Degree in Food Science and Nutrition and currently undertaking Doctor of Philosophy degree in Public Health Nutrition, I wanted to contribute knowledge towards preventing and reducing childhood obesity in KSA. I believe that by conducting this study I would help raise nutrition and physical exercising awareness among students, parents and teachers, hence, improving children's health. I also felt that an educated and aware KSA community can avoid the causes of child obesity, resulting in a healthier Saudi generation. My personal interest in the topic stems from the fact that my family history had experienced some cases of obesity and its health consequences: stroke, hypertension and CVD to be specific. Overall, I am interested in evaluating the short-term effects of an obesity education-based intervention and then recommending similar longitudinal education interventions to establish the long-term impact on preventing childhood obesity in KSA.

1.7. Research Aim and Objectives

This feasibility study sought to design and implement a school-based intervention programme as well as assess improving healthy lifestyle among school girls. This study was the first to be conducted in Madinah, Saudi Arabia. Thus, the aim of the intervention was to change behaviour to prevent obesity in the future. The emphasis of this prevention-oriented intervention programme was to apply culturally appropriate means to foster awareness and encourage the adoption of healthy lifestyle behaviours and choices. Therefore, the specific objectives were as follows:

1. To assess the current lifestyle behaviours of KSA schoolgirls aged 9-16 years at Taibah School in Madinah City in terms of dietary habits, physical activities, and sedentary activities.
2. To describe the contextual factors and the ways through which school girls are supported to or discouraged to conduct a healthy lifestyle, especially enhancing opportunities for healthy eating and noncurricular physical activity.
3. To determine the impact of the intervention in preventing or reducing obesity prevalence.
4. To identify potential components for designing and implementing an education intervention programme.
5. To pass certain recommendation based on the study findings to the authorities with the hope of translating the findings into practice.
6. To evaluate the intervention and the study methods with a view to conducting a large-scale RCT of the educational intervention with a large population after this study.

1.8. Research Questions

The following research questions were formulated to address the central themes of the study:

1. What type of physical and sedentary activities do KSA schoolgirls engage in at home and at school?
2. Does the environment provide adequate choices for healthy foods, physical activities and facilities?
3. Does healthy eating and physical exercise awareness result in decreased overweight or obese cases?

1.9. Structure of this Thesis

There are six chapters in this thesis: Introduction, Literature Review, Methodology, Results, Findings and Discussion, and Conclusion and Recommendations.

Chapter 1 presents a comprehensive introduction of this current study and its context. The chapter starts by describing obesity and the geography of KSA. It also explains the importance of conducting this study, the purpose and key objectives and sets out the questions that this study seeks to address. Chapter 2 covers a review of the literature that was carefully selected using a search strategy and then subjected to detailed analysis to confirm the relevance of the studies. The literature focused on critical subjects of childhood obesity including causes of childhood obesity, health implication of childhood obesity, global childhood obesity prevalence and combating childhood obesity using nutrition and physical activity. Chapter 2 further focuses on The studies summarised in (Table2) and key areas include: the aims of the study, the study design, the impact of the intervention and the most important findings. Using these key areas as a measure of quality and rigorous practice, the studies will be critically appraised to understand the effectiveness of a school-based intervention in the prevention of childhood obesity, school-based education intervention studies and their beneficial effects, the theoretical framework they used, the methods they applied and their merits and limitations for informing the design and implementation of this study's primary research.

Chapter 3 presents the methodology employed to complete this study. Chapter 3 starts by exploring the research paradigms and philosophy, research methods and their suitability in this thesis. The mixed method is applied using a sequentially explanatory design and the analysis is set to triangulate the data results. Chapter 4 is about the results from the study grouped into, quantitative and qualitative results. The qualitative results were used to explain the quantitative findings. Chapter 5 explores and discusses the key findings from the study and how they link to the literature review. Key findings were drawn and discussed in detail to elicit an in-depth understanding of collected evidence and to inform the drawing of conclusions and recommendations. Chapter 6 is about the conclusion and recommendations drawn from this thesis report, including a dissemination plan of the report.

1.10. Summary

The Introduction chapter has detailed the main coverage of this thesis starting with the significance of conducting this study, the location where the study will be focused, and the problem it seeks to address. The main purpose and objectives that the study is designed to achieve are presented. The chapter has also presented the research questions that it seeks to address. It ends with an overview of this thesis structure.

Chapter Two: Literature Review

2.1. Introduction

In order to establish an effective childhood obesity intervention, as part of the feasibility study, the current Chapter focuses on the concept of the theoretical framework related the current project. It starts with an explanation of the search strategy employed in the research process. It then identifies and describes childhood obesity prevalence, contributing factors such as nutritional transition, and health and psychological impacts in relation to Saudi Arabia. The chapter ends by critically reviewing school-based interventions and their role in preventing childhood obesity. Appraisal and quality assessment of included studies .Blanchette et al, (2005) defined literature review as a process of identifying and analysing existing literature and information that is related to the topic of study. Theories Used in School-based Obesity Interventions. Boote and Beile (2005) postulate that reviewing the literature enables the highlighting of gaps in previous research, elicits critical observations, and allows the researcher to re-focus or change study topic. Therefore, literature highlighted the childhood obesity, publicised as a health concern that is linked with serious health complications and increased risk of premature illness (Haines et al., 2007, WHO, 2010).

2.2. Search Strategy

In order to ensure accurate facts were collected towards establishing evidence from this study, this chapter used a search strategy that enforced strict obedience to inclusion and exclusion criteria when selecting studies for review. This helped to develop the current feasibility study. An effective search strategy is necessary to facilitate the process of defining and formulating a research question, and can further help enhance the translatability of a question into searchable terms. For the purpose of this study and using the Centre of Review and Dissemination (CRD) recommendations for literature search and selection, this thesis employed the Population, Intervention, Comparison, Outcome and Study design (PICOS) framework according to University of York, Centre for Reviews and Dissemination (2009). The PICOS framework places an emphasis on setting comprehensive, unambiguous and focused review questions and that the review is rigorous and comprehensive. Therefore, with the help of this framework the question can be broken down into five key components/elements.

Population is comprised of the target group from which the sample of study was drawn. This review was concerned with Saudi schoolgirls aged 9-16 years old. *Intervention* refers to the

nature of the intervention utilised in a study, which for this study was a school-based education intervention programme for preventing obesity through increased nutrition and physical exercise habits. The type of intervention considered for this review was a school-based education intervention programme for preventing obesity with particular emphasis on increased physical activity and healthy nutrition habits.

Comparison involved comparing interventions to establish their effectiveness. School-based interventions applying different components and general practice, and studies with no intervention were analysed.

Outcome describes the desired results of the intervention(s). Of the interest to this review is the variables/ determinants the study measured which included physical measurement, food intake, and physical exercise.

Study design represents the method applied in studies and for this review, quasi-experimental studies, cross-sectional studies, randomised controlled studies, and longitudinal studies were included. The PICOS set review question was: *what benefitting effects result from school-based obesity prevention education programmes **(I)** by increasing knowledge, hence altering perception and behaviour **(O)** of schoolgirls of age 9-16 **(P)** when measured after a period of time **(S)** compared to post intervention **(C)** used?*

2.2.1. Searched Databases

The searched databases contained large numbers of journal and peer reviewed articles. In order to filter search results and aggregate only those that met the inclusion criteria, the researcher used advanced searching and filtering tools. The searched databases include Cumulative Index of Nursing and Allied Health Literature (CINAHL), Database of the National Library of Medicine (MEDLINE), Saudi Medical Journal (SMJ), US National Library of Medicine (NCBI), Saudi Journal for Health Sciences, Cochrane Central Register of Controlled Trials (CENTRAL), Cochrane Database of Systematic Reviews (CDSR) and Google Scholar.

2.2.2. Extra Sources

Because this study was not a systematic review, but utilised a systematic approach to gaining credible information, the review included publications and reports from credible organisations. This was done to address the scarcity of KSA childhood obesity-specific articles and to ensure completeness and comprehensive coverage in addressing the study objectives and eliciting facts that will help address research questions.

2.2.3. Search Terms

According to the University of Twente (2012) developing search terms based on a particular concept requires the use of different sources including own experience, general dictionaries, manual handbooks, thesauri and others. In order to retrieve the most relevant studies that align with the review search set question using PICOS, the keywords were established based on the PICOS components. The initial list included the following terms: *adolescent obesity, Saudi Arabia childhood obesity, school physical activity, school diet, school nutrition, school-based intervention, children diet exercise, children obesity in Saudi, childhood obesity prevalence, Saudi Arabia, school-based intervention theories, obesity diet, obesity prevention, BMI.*

Two Boolean operators AND and OR were then applied in conducting the search. The AND operator that is used to retrieve search results that include both terms, narrows the search and applied for terms that are not related, and the OR operator that retrieves search results that include either of the terms, will produce wide search results and applied for related search terms (University of Twente, 2012). This generated search terms like *Obesity and childhood, childhood obesity and Saudi Arabia, childhood obesity prevalence and Saudi Arabia, school-based intervention and childhood obesity, exercise or physical health and obesity, childhood obesity and diet or nutrition, and more.*

2.2.4 Inclusion and Exclusion Criteria

Inclusion and exclusion criteria were developed in order to select the evidence relevant to the main question. The inclusion criteria for this review were as follows:

Types of studies:

- Primary quantitative research studies;
- Study designs including quasi-experimental studies, cross-sectional studies, randomised controlled studies, and longitudinal studies, studies of which the outcome is measured before and after the intervention or an intervention is studied against another intervention with baseline or control group;
- Primary quantitative research studies. Study designs including randomised controlled trials (RCTs), non-randomised controlled trials, controlled before-after studies, controlled interrupted time series studies; and
- Studies that evaluated interventions, policies or programs in place for twelve weeks or more.

Populations of interest: Schoolchildren of normal weight, overweight or affected by childhood obesity aged 6-16 years old.

Data type(s): Must include primary data.

Date of intervention and publication: Studies published from 2005- onwards.

Publication language: Studies must be in English to be considered for inclusion.

The following criteria were used to exclude studies from this review:

- Publications with no specific health intervention and no outcomes or outputs;
- Publications written in languages other than English;
- Publications focused on diseases caused by obesity;
- Review papers; only references listed in review papers were screened to find more primary data sources; and
- Interventions conducted in community-based settings.

2.2.5. Search Results

The initial search of articles resulted in 2229 items. Once the outlined inclusion and exclusion criteria were applied, 2223 of the identified items were eliminated. At the start of the search, titles of retrieved publications were reviewed for relevance. 2104 were eliminated for irrelevant citations; duplicates were also identified and excluded. These publications were excluded for various reasons, above all is that they did not meet the inclusion criteria. Next, the content of abstracts of the remaining items were screened of which (75) were excluded. The detailed reading of abstracts and the introductory sections of shortlisted articles resulted in the selection of specific references. A further 44 were eliminated as a result of this full-text assessment.

The final outcome of the search is the exclusion of 2223 from the original number of 2229, leaving 6 publications that adhere to the designated inclusion criteria and thus were reviewed herein.

2.2.6 Quality of Studies

In order to extract literature that was relevant, reviewed studies were evaluated using a checklist. The checklist outlined guidelines for evaluating the quality of the qualitative, quantitative and mixed methods research used in those studies. The key check components were appropriateness of data collection methods, appropriateness of analysis methods with

regards to the study topic and context, how accurate was the analysis executed and the accuracy and applicability of results from the study (Long et al., 2002).

2.3. Causes of Childhood Obesity

The literature does not indicate a specific cause of children becoming overweight or obese, but it documents a variety of possible reasons. Ebbelling and colleagues (2002) postulate that the most common causes are genetic, unhealthy eating patterns, lack of physical activity or a combination of these factors. The Canters for Disease Control and Prevention (2011) categorises the causes of childhood obesity as genetic, behavioural and social factors (Centre for Disease Control and Prevention (2011. Daniels (2007) explains that if a child is born to a family of overweight people then he or she is genetically predisposed to the condition. Behavioural factors causing obesity include dietary patterns, physical activity, inactivity, medication use, inadequate sleep and other exposures (Centre for Disease Control and Prevention, 2011). Social or community environment factors refer to actions that promote increased consumption of unhealthy foods and encourage inactivity such as advertising of less healthy foods, lack of safe and appealing places for children to play, limited access to healthy affordable foods, availability of high energy dense foods, and increased portion sizes (Centre for Disease Control and Prevention, 2011; Daniels, 2007). Medical conditions that result from hormonal disorders may also predispose a child to obesity (Ebbelling et al., 2002). Research reports also indicate that children reported to be sleeping less than the recommended amount of time (about 13 hours at the age of 2), are more likely to be obese at age 7, because fatigue modifies the levels of appetite-regulating hormones causing them to eat more (Franks et al., 2010).

Childhood obesity studies conducted in Saudi Arabia report a wide range of issues linked to overweight and obesity in school-aged children. Khalid (2008) and Al-Rukban (2003) claim that social determinants, such as gender, lifestyle (physical activity, eating habits, sedentary lifestyles), inadequate education about the role of fitness in girls schools, unhealthy school canteen meals, and poor quality physical activities are documented as causes of obesity in KSA. Al-Shehri and colleagues' (2013) points out that it seems the main underlying cause of overweight and obesity in Middle Eastern countries may be poor knowledge of food choices and low physical activity, in addition to cultural and social norms for diet such as body image. Al-Enazy and colleagues (2014) and Dehghan and colleagues (2005) suggest that family and home environment are often implicated in the development of childhood obesity

through environmental factors that relate to sedentary lifestyle such as time spent watching TV or computer screens and playing video games among school-aged children in KSA.

2.4. Health Implications of Childhood Obesity

Childhood obesity can have serious implications on children's health. Wijga and colleagues (2010) postulated that childhood obesity is associated with serious health complications and increased risk of premature onset of illness and affected children have a higher risk of morbidity, disability and premature mortality in adulthood. Generally, childhood obesity is associated with psychological, physiological, and social consequences that manifest during childhood or later in life (Wang et al., 2008). Health risks that may manifest in childhood include high blood pressure and high cholesterol which are risk factors for heart diseases (cardiovascular diseases); increased risk of impaired glucose tolerance resulting in insulin resistance and type 2 diabetes; breathing problems such as asthma and sleep apnoea; fatty liver diseases such as gastro-oesophageal reflux (heartburn) and gallstones; and joint problems or musculoskeletal discomfort (Bariatric and Metabolic Institute, 2016; Centre for Disease Control and Prevention, 2014). Health risks that may occur later in life include diabetes, heart diseases and some cancer types (Bariatric and Metabolic Institute, 2016). Further classification of these health consequences is summarised in Table 1.

2.5. Global Childhood Obesity Prevalence

The WHO Commission on ending childhood obesity reported that in 2013, 42 million infants and young children were found to be overweight or obese worldwide, and 70 million children are predicted to be overweight or obese by 2025 if the same trends continue (WHO, 2015). In the past, various studies conducted in the United Kingdom (UK), Europe and other parts of the globe indicated that the childhood and adolescent obesity epidemic has been increasing at an alarming rate (Livingstone, 2001; Rudolf *et al.*, 2001; Flynn *et al.*, 2006).

The International Obesity Task Force (IOTF) reported in 2006 that 10% of the world's children are overweight or obese (Malterud & Tonstad, 2009). In 2007, WHO statistics indicated that the prevalence of childhood obesity is increasing steadily and that the rate is ten times that of the 1970s (WHO, 2007). The prevalence of obesity among children and adolescents is significantly increasing in developing and developed countries (Lobstein *et al.*, 2004). The WHO further claims that obesity is a global problem that is steadily affecting many low and middle-income countries and is more concentrated in urban settings.

Table 1. Categorisation of health consequences of childhood obesity adopted from Mayo Clinic (2014) and Food Research and Action Centre (FRAC) (2015)

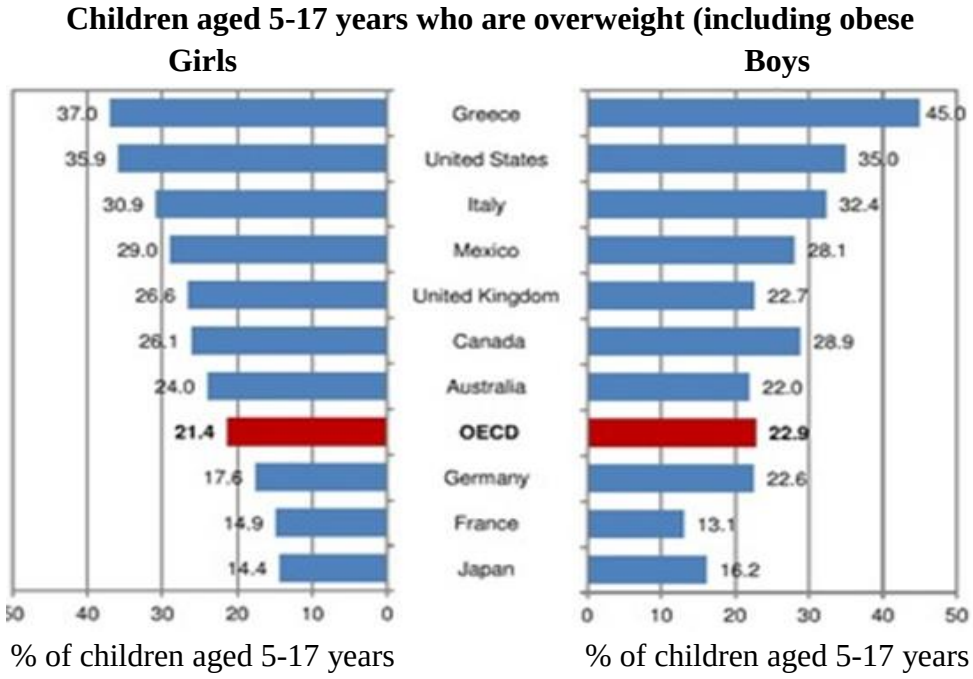
Health Consequences of Childhood Obesity	**Psychological and Social Consequences of Childhood Obesity**
• Results in type 2 diabetes affecting how a child's body metabolises glucose (sugar). • Metabolic syndrome that puts the child at risk of developing heart disease, diabetes or other health problems. • High cholesterol and blood pressure that may result in plaques in the arteries leading to heart attack. • Asthma and breathing problems because weight gain causes problems with development of child's lungs. • Sleep apnoea in which a child snores. • Early menstruation or puberty caused by hormone imbalance in a child. • Iron deficiency. • Orthopaedic complications.	• Low self-esteem that results from teasing and bullying from other children because they are overweight (peer victimisation). • Behaviour and Learning problems because overweight children tend to be anxious and have poor social skills or may be socially withdrawn (poor academic performance). • School absenteeism. • Depression that eventuates from low self-esteem or loss of hope that their lives will improve. • Feelings of worthlessness or inferiority • Negative stereotyping, teasing and stigmatisation. • Body dissatisfaction or often disorderly eating and unhealthy weight control behaviours.

According to a WHO (2014) report, the number of overweight children under the age of 5 in 2013 was estimated to be over 42 million, and close to 31 million of these are living in developing countries. KSA is one of the developing countries that has recorded increasing trends in overweight and obese children who are likely to grow into obese adults, exposing them to serious health risks such as cardiovascular diseases and a likely reduction in life expectancy of Saudi adults in the future (Al Saleh, 2013, Al Shehri *et al.*, 2013).

Because obesity in childhood is strongly predictive of obesity in adulthood (Levy *et al.*, 2012), without intervention, overweight or obese children will likely continue to be overweight during adolescence and adulthood (Singh et al., 2008). Dashti and colleagues' (2014) study reports that in 2008, approximately 1.46 billion adults globally had a BMI of 25 or greater and of these 297 million women and 205 million men were obese. Another report prepared by IOTF to advise WHO on the global burden of obesity, purports that the mean body weight in a larger portion of populations will continue to increase and by 2030, half of the entire adult population could be obese in most countries (James *et al.*, 2004). These adulthood statistics critically explain the importance of interventions in minimising the prevalence of childhood obesity from increasing adulthood obesity prevalence and becoming a public health menace.

It is important to observe in this study that even though globally, the prevalence of childhood obesity has been increasing, recent trends in some countries such as the UK and USA have followed a tendency of levelling off or a decrease (Figure 2). The observed change is linked

to the considerable media attention that obesity issues have received recently and the establishment of interventions through national anti-obesity policies that have set out strategic targets for relevant stakeholders (Malterud & Tonstad, 2009).



Source: International Association for the Study of Obesty (2011)

Figure 2. Obesity rates in different countries for 5-17-year-old children (Source OECD.org; Scollan-Koliopoulos 2011).

In the USA, prevalence rates of obesity among children of 2-5 years of age decreased significantly from 13.9 per cent in 2003/4 down to 8.4% in 2011/12, however the prevalence rate of children aged 2-19 years of age remained the same at 17% (Centre for Disease Control and Prevention, 2014). In the UK, the NHS argues that the rise in childhood obesity has started to level off and that although childhood obesity increased between 1994 and 2003, annual rates did not increase significantly between 2004 and 2013 (NHS, 2015). It therefore indicates that the application of interventions in preventing childhood obesity, particularly those interventions that educate and inform the public about the risk of obesity may help to prevent obesity health risks.

2.6. Childhood Obesity Prevalence in Saudi Arabia

The multitude of studies that exist in the public health literature presents overweight and obesity as the most prevalent nutrition-related problem in developed and increasingly in developing countries. Such studies show that the increase happens at very different rates and

in various patterns, yet, despite such discrepancies, childhood obesity is now a global epidemic (WHO, 2016).

Precisely, there are no up-to-date and definitive national statistics for the prevalence of obesity in Saudi Arabia (Murphy, 2010; Al Shehri et al., 2013), therefore, making it difficult to follow up on current KSA childhood obesity using reliable national data and time trends. However, obesity studies are frequently conducted through cross-sectional surveys covering several or specific Saudi Arabian cities. The available statistics show that the rising incidence of overweight and obesity among school children is startling.

The WHO (2006) documents that in the period from 1988 to 2005 the prevalence of obese adolescents increased significantly. Other studies also argue that obesity among Saudi children and adolescents over the last three decades has been increasing (Abalkhail, 2002; Al-Hazzaa, 2007b, 2007c). Studies link this increase in prevalence of obesity among Saudi children and adolescents to 'westernised' transformation in the social and economic lifestyle that accompanied the economic boom (Musaiger and Al-Mannai, 2001; Alsaif *et al.*, 2002; Al-Riyami and Afifi, 2003; Carter *et al.*, 2004; Al-Kandari, 2006).

Studies conducted between 2005 and 2008 found that more than one in ten (11.1%) of Saudi children and teenagers were obese (Murphy, 2010).

Earlier studies are further indicative of the steady development during the past decade. A survey by Al-Nuaim and colleagues (2001) involving 9,061 male school children (aged 6-18 years old) from different regions in KSA indicated that 11.7% were overweight and 15.8% were obese. From the study, the highest rate of childhood obesity at 18.0% was recorded in Riyadh (Al-Nuaim et al., 2001).

Local survey studies have also documented the childhood obesity epidemic in Saudi Arabia. Al-Rukban (2003) conducted a local survey study on males aged 12-20 years collected from public schools in Riyadh and found that 13.8% of boys were overweight and 20.5% were obese. Another survey among Riyadh females aged 8-12 years found that 14.9% of the girls were obese (Alam, 2008). Riyadh, the capital of Saudi Arabia and arguably the most developed city in Saudi Arabia, was featured in all these studies; this reinforces the notion that urbanisation is closely associated with the rise of obesity rates (Alqarni 2016). This can be readily explained by a fundamental cause represented in the shift in nutrition and a trend towards increased consumption of energy-dense foods that are high in sugars and fat but low in vitamins, minerals and other healthy micronutrients, coupled with extended periods of

physical inactivity. Other potential causes include: frequent snacking, skipping breakfast, eating unhealthy premade food outside the home frequently, long TV viewing time, video gaming, phone usage, massive marketing and promotion of high-fat foods, perceived body image, cultural elements and food subsidise policy (Alam, 2008). Nonetheless, KSA's eastern region is documented to have the highest rates of obesity and overweight children and adolescents, and the highest survey record was 1998 with an overweight rate of 27% (El-Hazmi & Warsy, 2002). The regional differences may well be a consequence of various environmental or genetic factors. The type of diet, extent of physical activity and climatic conditions, all play a role in influencing overweight and obesity prevalence.

A study investigating the 2005 Saudi countrywide dataset reported that the overall prevalence of obesity in children and adolescents of ages 5-18 years was 11.3%; it further indicated that among the age group 5-12 years the prevalence of obesity in female children was 11% while for male children it was 7.8% (Musaiger, 2011); whereas for the age group 13-18 years the prevalence of obesity in females was 12.1% and in males 13.8% (Musaiger, 2011). Seemingly, a study conducted in 2009 consisting of 7,056 children with a mean age of 8.7 and of which 79.4 % were of Saudi nationalities revealed that 19.0% of the children in the study were overweight and 23.3% were obese (Al-Dossary et al., 2010). This study on Saudis shows a steady increase in overweight with age. However, it is not clear from these statistics whether obesity and overweight are more prevalent in males or females. The sedentary social roles of females and hence decreased physical activity, may suggest a higher prevalence of obesity and overweight. More research is needed to better examine the extent to which gendered social roles can cause variability in male-female differentials in obesity and overweight. Although such existing data is not consistent to provide trends in childhood obesity, it indicates that the prevalence of childhood obesity is in the increase in KSA. Therefore, children will be at high risk of health consequences if no serious measures are taken to counter childhood obesity. These statistical evidences warrant high priority, thus, any serious attempts to address and counter the problem of obesity in Saudi Arabia must approach it holistically, in that considerations should be made regarding the provincial differences, differences in age, gender, socioeconomic and educational level of parents. Further studies are required at different time periods to assess whether or not overweight and obesity prevalence is changing in Saudi children. Some other factors that are plausibly related to the emergence of obesity and they demand further investigation, such factors include: multiparity, domestic environment, socio-psychological factors, school environment, beliefs

and attitudes and cultural factors. Most of the published data were not nationally representative and were more focused on specific areas in the country. It is worth noting that some data includes a wide age range for adolescents (i.e., 6 to 18 years) without taking into consideration the pre- and puberty stage which has a significant influence on weight gain. What remains to be seen is more comprehensive studies which target both rural and urban areas, as the majority of the studies report findings arising from the larger metropolitan areas, and therefore may be underestimating the urban-rural influence on obesity-status.

2.7. Tackling the Childhood Obesity Problem in Saudi Arabia

Research evidence shows that childhood obesity persists into adulthood (Singh *et al.*, 2008), and that obesity is associated with serious health problems (e.g., diabetes, hypertension, cardiovascular) (Young, 2003). This may have long-term implications on children and the socio-economic welfare of KSA. Solutions need to be sought for this health epidemic in view of the fact that treatment for obesity-related diseases is expensive, and the direct and indirect economic cost increases with the increased prevalence of obesity (Mazzocchi *et al.*, 2009). Studies indicate that treating and controlling obesity and obesity related conditions cost billions of dollars annually (Hoffman, 2005). The USA reportedly spent $190 billion on obesity related healthcare expenses in 2005, which was twice as much as its previous estimate (Chan, 2013). The costs of obesity to the UK economy reportedly exceed £3 billion per year (University of Birmingham, 2016).

Obesity costs to a country are grouped into direct and indirect costs. Direct obesity costs result from outpatient and inpatient health services while indirect obesity costs refer to resources forgone as a result of the health condition, including days lost from work, job absence resulting in lower wages, premature death, higher life insurance premiums and others (Chan, 2013). In Europe and the USA studies unequivocally indicate that obesity negatively associates with people's productivity and work performance and that it is an economic drain on the health care systems of developing countries (Hoffman, 2005). Therefore, for a developing country like Saudi Arabia, obesity will impose challenges among families with members suffering from obesity related health risks, especially financial challenges. Preventing childhood obesity is important in KSA considering that KSA is a developing nation with limited health resources and no advanced healthcare when compared with the UK and USA. Furthermore, preventing obesity will result in a decrease in obesity linked to public health risks such as heart, lungs, kidney, digestive tract, muscles, skeleton and hormonal control diseases, and risk of disability (Chan, 2013); and a reduction in economic loss

resulting from those not able to work due to obesity linked health issues and health costs of treating obesity and associated diseases (Karnik & Kanekar, 2012). Therefore, tackling childhood obesity in KSA is critical for both health and socioeconomic reasons.

In order to intervene in the increasing prevalence of childhood obesity in KSA, strong measures that prevent causes or influence the obesity epidemic must be addressed. Sahoo and colleagues (2015) argue that developed societies have slowed down childhood obesity prevalence by focusing on its cause by ensuring parents enforce healthier lifestyles at home and educate children to eat healthy, exercise and make the right nutritional choices. Studies indicate that the USA, Canada, UK and other developed countries use communities, schools and parents to work together and help children to make good healthy choices by supporting healthy school nutrition plans, developing school physical activity programmes and maintaining free and safe neighbourhoods for physical activities (Lindsay et al., 2006). Critical causes of childhood obesity in KSA involve lifestyle choices (Al-Hazzaa, 2006) such as eating overly abundant diets rich in fats and carbohydrates; lack of physical activity, poor concept of healthy lifestyles, and gender inequality coupled with few and costly 'ladies only' indoor gyms (Murphy, 2010; Mazzocchi et al., 2009). Obesity causing factors are integrated into children's surroundings, for example, sociocultural practices that affect eating behaviours. They thus require involvement of government through the Ministry of Education, parents, educators, children, health experts and stakeholders to facilitate inclusive understanding of the underlying causes, and dominant obesity factors.

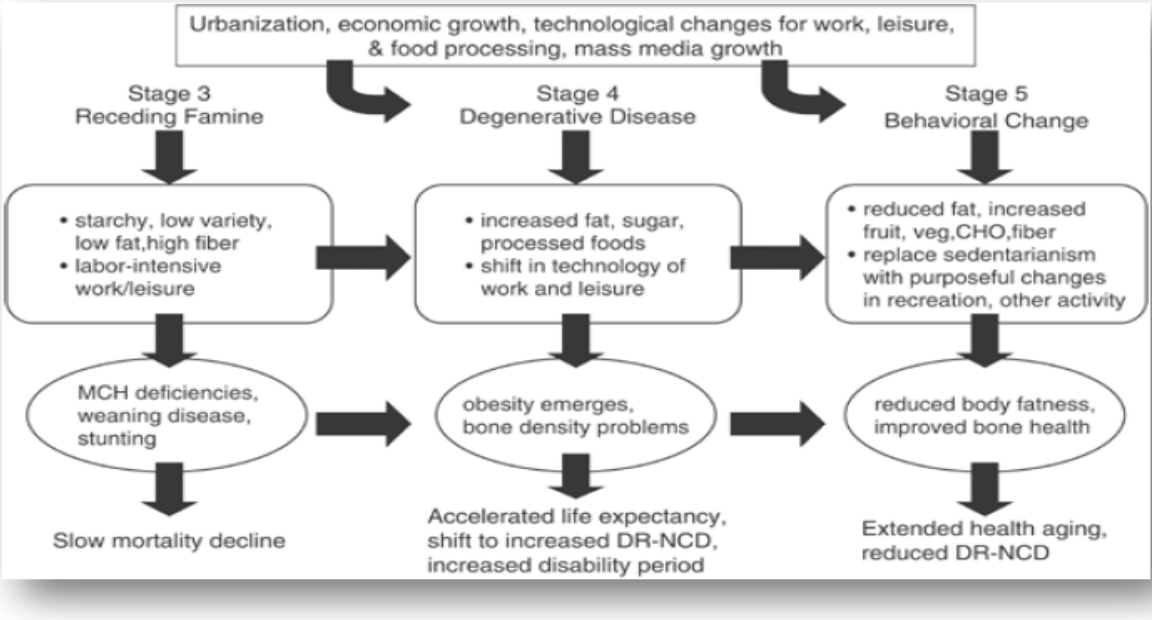
In order to tackle childhood obesity, it is critical to understand the dominating factors. They include the dietary or nutrition shift involving reliance on an increased consumption of processed foods, edible oils and sugar-sweetened beverages (Popkin et al., 2012). Studies also explore physical activity, emotions, mood, and eating patterns concerning childhood obesity.

2.8. Nutritional Transition and Childhood Obesity

Nutritional transition comprises dietary and physical activity changes within a population that are reflected in average stature and body composition (Saibul et al., 2009). Nutritional shift is linked to disease patterns in populations that include childhood and adult obesity (WHO, 2002). Popkin and colleagues (2012) postulated that modernisation, economic development, urbanisation, and increased wealth result in a shift in diet that is associated with nutritional transition. The transition has been categorised into five patterns. The first pattern

is associated with the gathering and hunting period in which food was rich in fibre and high protein from lean wild animals (Quercia et al., 2014). Pattern two involved early agriculture where famine was common resulting in slowing individual growth and decreased body fat, while pattern three involved receding famine as income rose and nutrition improved (Quercia et al., 2014). Pattern four encompassed the industrial revolution that altered methods of food process, production, distribution and storage, thus resulting in high calorific foods and less physical activity because people worked, consequently increasing obesity and the emergence of other chronic diseases (WHO, 2002, Floros et al., 2010). Pattern five is behavioural change in response to the increasing prevalence of obesity and obesity related conditions in order to prevent the emerging health risks (Popkin & Gordon, 2004).

Popkin's study suggests that shifts in diet patterns are consistent with rapid changes in child and adult obesity, and are associated with increased income (Popkin, 2001). The last three stages of nutrition transition as described in Figure 3 critically associates nutritional transition with an obesity epidemic. According to Popkin and Gordon (2004), at stage 3 countries start to experience decrease in famine as income increases while at stage 4 changes in diet and activity patterns result in the emergence of new diseases and increased disability. Importantly, studies show that low and middle-income countries like KSA are rapidly moving from stage three (receding famine) to stage 4 (degenerative diseases or consuming more energy dense diets) and that shift has been a major contributing factor to the obesity epidemic in those countries (Misra & Khurana, 2008; Popkin, 2006). Nutritional transition therefore places physical activity and diet as crucial childhood and adult obesity factors that require action. Additionally, stage five of nutritional transition indicates that KSA can make use of behaviour change to tackle and reverse obesity by supporting her people to adopt ways that prevent childhood and adult obesity (Misra & Khurana, 2008; Popkin & Gordon, 2004).



Source: Popkin and Gordon-Larsen, 2004

Figure 3. Nutrition transition diagram.

2.9. Diet, Physical Activity and Childhood Obesity

Diet and physical activity are widely discussed as implicating factors in obesity epidemics. Increased consumption of energy-dense foods and a decline in physical activity are associated with obesity (Warren et al., 2003). Boddy *et al.*, (2012) argues that children's food intake (particularly energy-dense foods and energy containing beverages) and eating behaviours, along with insufficient physical activity, have been cited as key contributing factors in the obesity epidemic. Outstandingly, intakes of fruit and vegetables and regular physical activity have been associated with reduced risk of obesity or associated health risks (Holt *et al.*, 2009).

2.9.1. Diet

A decade-long longitudinal assessment of obesity in Saudi Arabian youth has associated obesity with current eating and lifestyle choices (Al-Hazzaa, 2006). Studies report tremendous changes in the dietary habits of children and adolescents including skipping breakfast (Barton *et al.*, 2005); increased food portion sizes (Ello-Martin *et al.*, 2005); lower consumption of fruit and vegetables; increased consumption of snacks and fast food; and increased consumption of sugary drinks; all of which are regarded as obesity risk factors (Bray *et al.*, 2004). Increased obesity in Saudi children results from overly abundant diets rich in fats, carbohydrates and processed food including excessive eating of junk food e.g., three to five times a day (Murphy, 2010). Other studies found Saudi teenagers and school-

aged children becoming used to eating high calorie ready-made meals, fast food, high sugar sweets, cakes, and chocolates, all of which are readily available (El- Hazmi, and Warsy, 2000, Al-Nozha et al., 2005, Al Dhaifallah et al., 2015). Additionally, Saudi children are becoming increasingly accustomed to personal entertainment, in the form of television, videos, computer games and music television (Sherry *et al.*, 2006, Farghaly *et al.*, 2007). Therefore, children are increasing their daily calorific intake while they are decreasing their overall physical activity levels thus promoting obesity (Young, 2003) in Saudi Arabia, an observation that is similar to that made in developed countries like Canada, USA and UK.

A study conducted in the USA and Canada to determine the association of sedentary behaviour and diet among inactive and active children postulates that low active-high sedentary children were more likely to be overweight than high active-low sedentary children (Wong & Leatherdale, 2009). Tremblay and Willms (2003) postulates that the Canadian childhood obesity epidemic is related to sedentary behaviours and diet; they further report that sedentary behaviour like watching TV and video gaming coupled with poor eating habits or consumption of energy dense foods are risk factors for being overweight or obese. Wilkie and colleagues' (2016) UK study on multiple lifestyle behaviours including eating (diet), screen times (watching), and physical activity of children aged 9-11 years old revealed that there is an association between overweight/obesity among children with diet and its role in adiposity and sedentary behaviours. This therefore indicates that as KSA experiences socio-economic and nutritional shifts like Canada, USA and the UK, it should recognise that diet is not an isolated cause of obesity but integrated with other factors like sedentary or physical inactivity.

In order to prevent childhood obesity, eating lifestyle should be comprehensively addressed in the current intervention so that it informs and motivates new dietary habits that prevent childhood obesity. Popkin and colleagues (2012) postulated that countries like the USA, China, Japan, Canada, UK, Brazil and others have embarked on private sector voluntary initiatives to reduce calorific content of their food products; used schools to promote diet change; restricted unhealthy food marketing targeting children; developed better health food service policies that place emphasis on the quality of food served, and food nutrition labelling of food products.

Informing the Saudi public about the role of healthy and unhealthy meals in childhood obesity is critical because unhealthy foods are readily accessible to children and uninformed parents. Saturated fats are largely found in animal products, such as meat and dairy products,

and trans-fats are artificially created through the hydrogenation of oils used in a wide variety of margarine and fast food products (Jaminet, 2013). Allardyce (2012) argues that healthier eating comprises of higher intakes of fruit and vegetables, which provide unsaturated fats and fibre, and low saturated fat protein foods like fish and meat. Conversely, unhealthy eating is composed of low intake of fruits and vegetables combined with high intakes of saturated fat via fast food, red meat, eggs and dairy products (Jaminet, 2013), and high intakes of sugar via processed cakes, biscuits, chocolates, and sweets, etc. (Allardyce, 2012). These fats can accumulate in the human body at different rates that are determined by the type of foods (foods with saturated or unsaturated fat) consumed with time. As a result, saturated foods will result in weight gain thus affecting the BMI of an individual.

According to a study conducted by Epstein and colleagues (2001) to evaluate the effect of children's dietary changes and the percentage of overweight cases found that over one year, fruit and vegetable intake significantly resulted in a decrease in the percentage of overweight cases. Hesketh and colleagues' (2005) research on healthy eating, activity and obesity reports that consistent intake of healthy foods and correct choice of activity across the study population was core to preventing childhood obesity. Another study conducted in the US also suggests that schools offer opportunities to develop and implement childhood obesity prevention strategies by creating environments in which children eat healthily (Story et al., 2009). Results from these studies suggest that focusing on increasing intake of healthy food can be a useful approach in preventing obesity among children.

2.9.2. Physical Activity

Physical activity is defined as "any bodily movement produced by skeletal muscles that requires energy expenditure" (Caspersen et al., 1985: 126). One study argues that there is a lack of physical activity among the majority of the Saudi population as cars are commonly used to travel even locally to nearby places, such as Mosques and community centres. Saudi culture that require females to stay at home or remain separated from men coupled with few 'women only' gyms that are expensive and not a priority for families with children and lower incomes results in higher levels of obesity in Saudi females (Murphy, 2010). According to Madani (2000), insufficient vigorous physical activity is a risk factor for higher BMI levels in adolescent Saudi boys and girls because their physical activity levels have drastically reduced; and time spent watching either television, videos and/or playing computer games has substantially increased (Abalkhail, 2002). These factors contribute incalculably to weight gain among Saudi children (Al-Hazzaa, 2006). Research conducted with obese and non-

obese Saudi school boys aged 8 to 12 years old concluded that the prevalence of obesity and inactivity among Saudi boys was high (Al-Hazzaa, 2007). The study further showed the importance of physical activity by arguing that boys classed as active showed significant lower body fat percentages and BMI than their inactive peers, while obese boys were significantly less active than non-obese boys (Al-Hazzaa, 2007).

Conventionally, physical exercise is considered a remedy for burning extra fat with the intention of losing weight. The theory emerged from empirical studies that suggested that weight gain is caused mainly by an energy imbalance, between energy-out (energy expended by the body to maintain life and perform physical work) and energy-in (energy content of food eaten) (Wright & Dean, 2007; Hall *et al.*, 2012).) As such, obesity or becoming overweight will occur over time if one takes in more calories than they can use (Rendo *et al.*, 2009) or engage in very little physical exercise (Wright and Dean, 2007). This theory can be observed amongst Saudi children who are now spending more time on TV and video games as opposed to conducting any physical exercises like running or playing ball games, and yet consuming energy-dense foods (Al Hazzaa, 2004, Harris and Bargh, 2009; Al Saleh, 2013, Al Shehri *et al.,* 2013). A study conducted in Switzerland argues that every hour the children played video games or watched television doubled the likelihood that the child was obese (Warner, 2004). Another study conducted in China also suggests that watching TV represents an important risk factor for obesity in school aged children (Al-Ghamdi, 2013). In the USA, studies following children over long periods of time have consistently reported that the more TV children watch the more likely they are to gain excess weight (Chan, 2013). Contrary, TV reduction trials delivered in school to help cut back on TV and video game time combined with healthy eating and more activity resulted in lower rates of obesity (Chan, 2013). Rey-Lopez and colleagues' (2008) study on sedentary behaviour and obesity in children and adolescents argue that the time that children are devoting to sedentary activities has increased drastically in the past few decades.

Al-Nakeeb *et al.* (2012) conducted a study about the differences in weight status and patterns of physical activity from two culturally, environmentally, and geographically diverse countries. The study involved a total of 2,290 males and females (15-17 years old) from the UK and 1,138 participants from Saudi Arabia. The study consisted of the participants completing a validated self-report questionnaire containing 47 items which questioned their eating habits, and patterns of physical and sedentary activity. It was found that Saudi youths were significantly less active than their UK counterparts, and that they had higher

percentages of overweight/obesity (36.5%) and sedentary time than the UK participants (Al-Nakeeb *et al.*, 2012). The results of the study indicated that higher levels of physical activity led to lower BMI levels and higher BMIs were evident among those who reported greater computer-usage time (Al-Nakeeb *et al.*, 2012).

2.9.3. Relationship of Diet, Physical Activity and Childhood Obesity

Al-Nakeeb and colleagues' (2012) study linked diet and physical activity by arguing that high overweight/obesity levels might be due to lifestyle factors or dietary habits (e.g. regular use of saturated fat in traditional cooking in Gulf countries, and a staple diet of rice, bread and meat for Saudi youths) (Al-Nakeeb *et al*, 2012). Saudi youths are not undertaking enough weekly physical activity, they are spending more time undertaking sedentary activities and they are eating a carbohydrate and saturated fat-rich diet which is the possible cause of increased weight gain and obesity levels in children and youth in Saudi Arabia. The study adds that low levels of physical activity seen among Saudi youths might be due to the lack of available sports grounds, parks or facilities for undertaking physical activities or sports, or because of the Saudi's harsh desert climate (Al-Nakeeb *et al.*, 2012).

Several other studies also suggest a close relationship between diet, physical activity and obesity in relation to 'fat' in the human diet (saturated fats, monounsaturated fats, trans-fatty acids, and polyunsaturated fats) and human body fat deposits (Wechsler *et al.*, 2000; Reader's Digest, 2002; Popkin & Mendez, 2006; Weil, 2008; Jaminet, 2013; Pinnock, 2013; Stephens *et al.*, 2014; Viitasalo *et al.*, 2016). Humans require adequate levels of fat consumption for healthy energy levels and functioning, but excessive consumption results in diseases (Weil, 2008). Wolin and Petrelli (2009) claim that healthy eating involves the intake of monounsaturated and polyunsaturated fats (found in vegetable, sesame, soy, olive and peanut oils) that can lower overall total blood cholesterol and triglyceride levels, which can help keep the body functioning healthily. In contrast, unhealthy eating or consumption of too many saturated fats can elevate cholesterol levels, cause obesity, and build arterial plaque that leads to vascular diseases (Allardyce, 2012). It is therefore important to adequately create awareness in Saudi of the dangers around the intake of food high in saturated fats (unhealthy eating), especially among children. In order to deal with unhealthy lifestyle, the involvement of parents, teachers and community is required to ensure that children can access healthy food and to educate them about basic nutritional information and the risk of unhealthy habits.

Healthy eating and physical activity appears to have both positive and negative effects on obesity because diet can cause obesity in children and when that occurs, healthy eating and

physical activity can be used to intervene (Bleich *et al.,* 2007). As such, a decline in the levels of physical activity in children and adolescents poses serious health implications related to obesity (Rendo *et al.,* 2009). Physical inactivity has been implicated in the development of many chronic diseases including Type 2 diabetes (Rendo et al., 2009), coronary artery disease (Hall et al., 2012), hypertension (Weil, 2008) and strokes (Katzmarzyk et al., 2000). Those chronic diseases are associated with a person being obese (Nestle et al., 2000; Bleich et al., 2007; Al Shehri et al., 2013; Al Dhaifallah et al., 2015). It can be concluded that there exists a relationship between diet, physical exercise and obesity that is critical in tackling childhood obesity in KSA.

2.9.4. Emotions, Social Setting, and Eating Behaviour and Childhood Obesity

According to some studies, human emotional reaction and social environment have some effect on children's eating behaviour. Weiner (2013) suggests that motivation is anything – social or psychological (emotional) – that pushes us, eagerly or reluctantly, to act (eat). Gross (2010) commented that hunger is not always necessary for eating, but certain psychological mechanisms can produce sensations of hunger or a desire to eat. Thus, there can be psychological (e.g., happiness associated with eating), social (e.g., peer pressure to look thin and diet), or motivational reasons (e.g., loss of weight desired through dieting) for a lack of eating or an excess of food intake (Ebbeling *et al.,* 2002). This is critical to childhood obesity interventions, because children are susceptible to more intense emotions, i.e., they have not yet learned to fully control behavioural motivations (Gross, 2010). Children are less in control of their lives thus cannot independently change their dietary and lifestyle choices (Nader *et al.,* 2006). Additionally, children ordinarily have a set schedule, for example going to school, eating what has been cooked or provided for them, and they may not be granted 'free time' to do as they choose. This implies that tackling obesity in children has to extend beyond the children and involve parents, teachers and any contact that influences their psychological feelings, hence affecting eating behaviour.

School aged children depend on their families and teachers. Lindsay and colleagues (2006) research suggests that parents affect their children's development of food and activity related behaviours and therefore can develop and maintain healthy eating and physical activity habits that will help prevent overweight and childhood obesity. This implies that successful intervention efforts require involvement and working directly with parents in order to support children to develop healthful practices. Schalkwijk and colleagues (2015) study also indicates that lifestyle behaviour interventions also require parental support and help from extended

family, peers and friends to work effectively. However, parent's restriction and pressure regarding diet with the hope that children will select healthful alternatives has often had the opposite effect, therefore a self-regulated approach and rewarding children for healthy eating is most appropriate for well-intentioned parents (Gibson et al., 2012). Elliasen (2011) suggests that teachers and caregivers become role models to children by engaging with children at mealtimes and by eating with them. One study conducted in the USA suggests that in schools where teachers head activities aimed at decreasing sedentary behaviours, results are often better than in those schools where teachers are not the heads (Timmons et al., 2007). However, Yager and O'Dea's (2006) study on importance of teachers and other educators in the prevention of eating disorder and child obesity points out that specific training or assistance may be required in order for them to influence effective preventive behaviour.

Mood which is a long lasting feeling or emotion is seen by many scientists as having a role to play in the type of food an individual will like to eat as the state of feelings continue. A sad mood may increase one's desire to consume food classed as unhealthy including carbohydrates such as ice-cream and cake and one reason for that is because foods high in carbohydrate and sugar increase levels of *serotonin*, a brain chemical that elevates mood (Werthmann *et al.,* 2014). And as rightly pointed by Werthmann and colleagues (2014), several models exist that provide insight into the impact of negative emotions on excessive food consumption and its linkage to overeating and the risk of obesity. Eating in response to stress or a sad mood is seen as a maladaptive emotion regulation mechanism, which affects eating behaviour and obesity. Goldschmidt and colleagues' (2011) study around mood and binge eating patterns in overweight children aged 2-12years (n = 46) in the USA suggested that emotional eating behaviours like sad mood may be associated with high energy intake.

Children's depression or stress resulting from life circumstances is also implicated to affect childhood obesity. AAP (2015) argues that overweight children may seek emotional comfort in food resulting in them increasing their calorific intake at the time when parents or paediatricians are urging them to eat less. They may also seek emotional comfort in food when stressed from life situations like divorce, moving to a new community, the death of a parent or difficulties in school (AAP, 2015). Hearth Math Institute (2009) adds that obesity control programmes should not neglect the number one cause of overeating and obesity: emotional eating, which is the unchecked habit of using food to cope with feelings. The organisation further confirms that in today's high-stress society, children and adults eat high fat or high sugar foods to soothe their emotions or temporarily relieve their stress and anxiety

(Hearth Math Institute, 2009). Research conducted in the US involving 660 adolescent students revealed that perceived stress and worries are associated with emotional eating therefore suggesting that interventions can bring benefits by incorporating stress reduction techniques or motivating positive moods among children (Nguyen-Rodriguez et al., 2010). D'Autume and colleagues (2012) also assessed emotional symptoms as linked with eating behaviour in a population of children and adolescents with a mean age of 11 years, they found that emotional eating and emotional symptoms (depression and anxiety) were strongly associated in children and adolescents with being overweight. Research by Puder and Munsch (2010) also postulates that the prevention of and intervention in childhood obesity requires early detection of psychological factors that contribute to its development and maintenance, including internalising (depression and anxiety) behaviour problems that relate to uncontrolled eating behaviour.

Michels and colleagues (2012) studied the impact of psychological stress and the adoption of unhealthy dietary choices, which contribute to weight gain. The study's aim was to investigate the relationship between several stress measures, emotional eating behaviour and dietary patterns of participants aged 5-12 years (n = 437). The findings showed that stress plays a vital role in influencing emotional eating behaviours. However, the association between emotional eating and participant dietary pattern was not ascertained. American Psychology Association (APA) (2014) postulates that obesity is frequently accompanied by depression or stress and the two can trigger and influence each other; it further outlines that depression causes people to change eating and activity habits such that when people are in difficulty they unknowingly start eating too much of the wrong foods and/or forgoing exercise and before long these become habits that are difficult to change. This is supported by other studies that postulate that stress or emotions distract attention from healthy eating plans, while impulsivity during negative mood states can lead to grabbing unhealthy foods even if one is not hungry (Nguyen-Rodriguez et al., 2010). Atabek and colleagues (2004) suggest that during stressful moments children tend to eat food that has more calorie and fat content that promotes weight gain, and have greater levels of tryptophan that helps to boost mood.

2.10. Childhood Obesity Prevention Interventions

Clinical investigations into obesity have not provided conclusive evidence on the underlying causes of obesity, but they link it to multi-factorial conditions such as demographic, genetic and lifestyle factors (Barlow, 2007). Investigation has also indicated that the alteration of lifestyle factors including dietary intake (Vanselow *et al.*, 2009),

sedentary behaviours (Lazarou and Soteriades, 2010), and magnitude and type of physical activity (Croezen *et al.,* 2007) can impact on the prevalence of obesity. According to Wang and colleagues (2013), interventions to reduce and prevent childhood obesity largely aim to modify diet, sedentary activity and physical activity, but differ substantially depending on setting. Nevertheless, obesity interventions are aimed at preventing children from gaining excessive body weight and reducing the risk of them developing obesity, and it includes modifying children's local setting and social and cultural aspects (Al Dhaifallah *et al.,* 2015). Obesity interventions are classified according to the settings where they take place i.e. school based interventions, home-based interventions, primary care-based interventions, childcare-based interventions, community-based and environment-level interventions, and consumer health informatics-based interventions (Wang et al., 2013). This study selected a school-based intervention setting as the most suitable.

2.11. School-Based Interventions for Preventing Childhood Obesity

School age and setting are considered to offer strategic benefits to preventing childhood obesity. Krebs and colleagues (2007) assert that school-based interventions are vital for obesity prevention strategies because preventing obesity at that stage impacts on adulthood obesity cases. This assertion is supported by Williams and colleagues' (2002) systematic review that documents evidence that there is clear relationship between increased BMI in childhood and overweight or obesity in adulthood. Other studies also indicate that interventions to reduce BMI in childhood result in reduced childhood and adult obesity (Williams *et al.,* 2002; Christakis & Fowler, 2007; Krebs *et al.,* 2007; Monasta *et al.,* 2010). There is also empirical evidence that school-based obesity prevention interventions that allow multi-component approaches such as increasing the physical activity levels that children practice (Cochrane-Dobbins 2013, Nixon 2012, Demetriou 2012), can have an impact on their weight status (Khambalia 2012, Katz 2008, Waters *et al,* 2011), and improve their dietary habits (Van Cauwenberghe 2012, Cawley 2011, Kropski 2008). A Mexican study on school-based obesity prevention in schools targeting health behaviours, conducted by Lopez-Olmedo and colleagues (2013), suggests that the intervention improved the school food environment and child healthy behaviours. This study was therefore confident that the school-based intervention was suitable for assessing effectiveness of obesity-prevention education intervention.

Introducing an intervention in the early years of life can have a significant effect in preventing, controlling and reducing obesity. According to Golan and Crow (2004)

introducing an intervention early in life, particularly for 9 to 12 years old children, is important because this age group are developing autonomy for making decisive choices with regard to diet and physical activity. Additionally, children at ages 9 to 18 can learn from education intervention programmes about how to make independent decisions about purchasing food without parental presence, particularly when they are in school (Flurry & Burns, 2005). According to Hughner and Maher (2006) childhood is a critical time in which health behaviours, whether negative or positive, can be achieved given that at this stage, children are still in their learning and development process and can be influenced easily.

At an early-age, children are learning life essential skills, and teaching them to make effective decisions about diet and exercises will have a long-term effect. An Australian study revealed that teaching children positive eating behaviours during childhood can set them up with healthy eating habits for life, help them to develop a balanced approach to eating and result in better health outcomes in the long-term (Brown & Ogden, 2004). According to Brown and colleagues (1996) learning at child age requires active and constructive involvement, and has to be primarily a social activity in which children participate in activities perceived to be useful in real life and culturally relevant. Importantly, children learn well when new information relates to something they already know (knowledge), understand or believe (Boekaerts et al., 2000). Child age is strategic because children are curious to understand, eager to explore and find reason, have high ability to memorise and solve problems and transfer learned skills and knowledge into real life application (Bereiter, 1997). This study, therefore, believed that child age was strategic and will have long-term impact on obesity prevention in KSA.

The major reasons for selecting a school-based intervention for this study include: (1) childhood age population presents the best responsive stage to intervene on childhood obesity, (2) a school setting offers a common gathering convenient for education based interventions, (3) it offers room for intervention to educate persistently through children's adolescent age to overcome expected transformation in children's attitude and personality as they grow and allow them to keep a healthy lifestyle (Flurry and Burns, 2005). Additionally, previous research studies on school-based intervention also indicated that it was having beneficial effects on preventing childhood obesity regardless of differing methods and implementation. School-based intervention studies that are applied below to contribute to the knowledge of this study are those that took place primarily in school, even though they will also involve parents, community and other home activities such as the role of parents in

children's behaviour. This section analyses the effectiveness of school-based intervention studies by organising them into culture, school setting, role of parents, teachers, and family, intervention duration and behavioural change.

2.11.1. Culture

In order for this study's school-based obesity prevention intervention to be appropriate for use with a Saudi Arabian population, it must comply and operate within Islamic rules that are integral to Saudi Arabian culture. According to Al Dhaifallah and colleagues (2015), consideration of social norms and culture must be integrated appropriately in developing interventions that target the Saudi Arabian community, in order to avoid conflicts between health messages the study aims to deliver and sociocultural values. This is important because sociocultural values have a significant role in Saudi lifestyle and its exclusion can result in poor uptake of health information offered by an intervention (WHO, 2001, Littlewood et al., 2000). Therefore, this study planned, designed and implemented its school-based obesity prevention intervention to integrate fundamental Islamic requirements that are integral to Saudi Arabian culture including recruiting participants only from girl's schools because it was against culture to interact with boys as a female researcher.

Checkley and colleagues (2014) also suggest that culture is an important consideration in school-based intervention studies because it determines the social norms and behaviours that play a key role in childhood obesity prevention, control and reduction. Considering cultural aspects and implementing them in the design and planning of an intervention will benefit this study by minimising resistance from participants and school administration. Additionally, a study by Fitzgibbon and Beech (2009) on the role of culture in the context of school-based BMI screening suggests that programmes related to child weight status must consider culturally-defined aspects of body size and shape, as it would yield an insight into parental and community perception of such information.

Within the Saudi context, certain cultural practices can explain to a certain extent the development and perpetuation of some unhealthy eating habits which can affect the perceptions of schoolgirls about food and cause the emergence of obesity among this population.

2.11.1.1 Dietary traditions

Saudi diet can be full of excesses, from the generous portions, to rich sauces and side dishes. Saudi food mannerisms can further worsen this, an example of this includes serving

big portions, indulging in all the food served and until the plates are cleaned. The combination of these seemingly unhealthy habits of eating embedded in the culture are coupled with the lack of control of portion size, which unarguably can aggravate the problem.

2.11.1.2 Ramadan and Eid

Fasting during the month of Ramadan can have positive implications on one's health if it is done correctly; this means that if the proper diet is not followed then this can possibly worsen health. The deciding factor is not the fast itself, but rather what is consumed in the non-fasting hours. Irregular eating and overeating after ending the fast as well as eating foods rich in carbohydrates and fat and in large portions when breaking the fast are risk factors for diabetes and obesity. Eating food during the pre-dawn and dusk meals can also contribute towards weight gain. Food intake during fasting periods should be simple and not differ too much from normal diet. It should contain foods from all the major food groups.

Part of the Saudi culture during Ramadan is to cater for large numbers of people at one's home, cooking for numerous people would usually mean using oversized pots on gas stoves, which can cause (NHS, 2014).

2.11.1.3 Religiously motivated claims and bans

To date Saudi Arabia is the only country that authorises a policy which denies access to physical education in state-run girls' schools. Although demands have been repeatedly issued to lift the ban and allow girls to participate in sports no reforms have been yet made. This means that this applies exclusively to girls in public schools, while girls in private schools have been allowed to partake in sports with the prerequisite that they adhere to decent dress codes and rules of Sharia (e.g. gender segregation) (Atalebi, 2016).

This strict interpretation of Sharia has initially been propagated and advocated by Wahhabi clerics, who control the judiciary and parts of the education system. Such policies evidently have negative consequences on girls' health as they promote physical inactivity and lack of an awareness of healthy lifestyle.

2.11.1.4 Inequality of curriculum between boys' and girls' education

Gender inequality is what has caused the aforementioned ban on sports for girls. This means while boys get given hours of physical education per week as well as learn about the importance of sports and its consequences for health, girls' schools' curriculum are not equipped with such contents, hence the lack of awareness that some girls have or interest.

2.11.1.5 Housemaids

Commonly, working parents in Saudi Arabia rely heavily on the help of housemaids for childcare and cooking as well as other aspects of housekeeping. This means that when a household has children, it is the responsibility of the housemaid to directly feed them and clean their rooms, and offer other care services. The reliance on domestic workers has caused negative impacts, one of which is that the absence of parental care for long hours during the day combined with the handing over of care to untrained maids has resulted in children consuming unhealthy foods in larger quantities than when under the monitoring of their parents. This maid culture in Saudi Arabia which involves parents delegating reasonability of preparing meals and eating to house-maids, can be one of the reasons underlying unhealthy consumption of foods and hence weight control which ultimately leads to obesity in schoolgirls.

2.11.1.6 Lack of supervision

Lack of supervision on the part of parents is mostly observed in the assigning childcare and meal preparation tasks to housemaids. In this study, we further clarify that parents of overweight or obese children in some cultures have often failed to correctly perceive their children as overweight (Fitzgibbon & Beech, 2009). Thus, this study ensured participating parents understood that overweight or obesity is a preventable and treatable health condition. This was necessary to motivate their effective contribution to this study.

Within the Saudi context, certain cultural practices can explain to certain extent the development and perpetuation of some unhealthy eating habits which can affect the perceptions of schoolgirls about food and cause the emergence of obesity among this population.

2.11.2. The School Setting

Several of the obesity intervention studies that have been carried out in Saudi Arabia in an attempt to successfully combat childhood obesity, have occurred in a school setting (Al-Nozha et *al.*, 2005, Abuzaid, 2012, Al Dhaifallah et *al.,* 2015). The school setting offers several benefits that are appropriate for studying obesity in Saudi children. Brown and Summerbell (2008) enumerate these benefits to include: (1) The intervention reaches a large population of Saudi children who attend school because education is free; (2) Integrating healthy eating and living education in curricula has more effect as children spend a significant amount of their time at school; (3) Schools provide a greater health supporting

environment through food choice and access to active sports and physical leisure time than home.

Jones and colleagues' (2013) study on the practicalities and considerations of school-based obesity prevention interventions postulates that the school setting represents a popular setting for interventions because most children attend them and most of schools (but not all) have an existing infrastructure that supports the implementation of childhood obesity prevention intervention. Additionally, the school setting generally has the necessary personnel, curricula and facilities that promote physical activity and teaching healthy eating habits. In this study school setting or environment was seen to be appropriate because it offered facilities like play grounds, food facilities like a canteen, existing curricula like PE and necessary support from teaching staff and a school nurse to complete the study. However, according to Jain and Langwith (2013) semi-structured interviews conducted in the USA involving those participating (including school nurses and wellness coordinators) in childhood obesity school-based interventions in 6 districts, indicated that real-world implementation of obesity interventions in schools intended to create sustainable change required flexibility in the design, timing and personnel.

Another study by Pearson and colleagues (2012), conducted in the UK to review research and experience in implementing health promotions in schools, suggests that schools are considered to be key sites for the implementation of health promotion programmes because of the potential they offer to reach the whole population in particular age groupings and they support the installation of healthy patterns of behaviour early in life. Indeed, school settings in a country like Saudi Arabia are a central point where children could conveniently be accessed within the age group criteria for this study. Furthermore, school settings promoted the education and learning that are the main focus of this study with regard to intervening and preventing childhood obesity in Saudi Arabia.

It is important also to note that regardless of the school setting offering benefits that will significantly contribute positively to this study, school-based obesity prevention intervention success also depends on other school environmental factors e.g. outdoor temperature, availability of sporting facilities, and the socio-economy. According to Leger (2004), for behaviour change interventions through school-based programmes to be more effective, one needs to consider some influences such as the media that children watch at home or elsewhere, peer pressure, and family. Empirical studies have shown that children's health is

also affected by social determinants such as family and socioeconomic status (Braveman, *et al.*, 2011).

Within the context of Saudi Arabia, some studies concluded that socioeconomic status indicators are associated with the occurrence of overweight and obesity among Saudi children and adolescents (Al-Agha et al, 2015; Alam, 2008; Al-Saeed et al, 2007). In these studies not only the socioeconomic status of the parents were shown to be risk factors, but also whether they were highly educated or not also played a role (Al Alwan, 2013; Al-Saeed et al, 2007), the effect of SES is recognised as indirect in that children of high-income families in Saudi Arabia have more accessibility to unhealthy food choices, hence the high (and sometimes unsupervised) consumption of fast food, soft drink and high-energy foods, which are common practice among this particular group. Improved economic conditions further mean high prevalence of sedentary behaviours and decreased physical activities (Al Alwan, 2013; Alam, 2008).

Differentials according to region were also examined for their relevance to the prevalence of obesity and excess weight among Saudi youngsters. The detected variations reveal that the Eastern region of Saudi Arabia present higher occurrences of overweight and obesity compared to other regions where higher socioeconomic status and different lifestyles are predominant (Amin et al., 2008; Al-Saeed et al., 2007).

The Canadian Institute for Health Information (2003) argues that school-based interventions should provide health services and programmes to children and link other settings like home by involving parents.

2.11.3. Parent's and Teacher's Role

School-based interventions also result in improvement of parent's health awareness as they offer a significant point of contact for both the children and their families (Al Dhaifallah et *al.*, 2015). Providing families with a proportion of schoolchildren nutrition services promotes a collaborative approach in reducing the impact of obesity (Al Dhaifallah et *al.*, 2015). A systematic review of school-based obesity interventions by Sharma also postulates that most interventions reviewed were implemented by teachers and besides curricular instructions, parental and family involvement was applied in most of the interventions (Sharma, 2011). Another review conducted by Guerra and colleagues (2016) regarding school-based interventions aimed at reducing childhood obesity reports that parental involvement is critical in attaining behavioural change. These studies point out that an

effective school-based intervention will require collaboration with parents, teachers and family to achieve significant results.

A study on the importance of parents and teachers as stakeholders in school-based healthy eating programmes conducted by Middleton and colleagues (2014) argues that considering parents and teachers as influencing agents or enablers in the process of creating change is critical for an effective school-based intervention. The study continues to explain that parental perceptions and teachers' insights are critical in underpinning intervention feasibility, acceptability and performance; more importantly, their perceptions and understanding can provide grounding and highly applicable expertise that may motivate children (Middleton et al., 2014). Another study conducted in the UK reports that parental and teacher involvement are key ingredients for success in promoting consistent messages that lead to healthier lifestyles (Clarke et al., 2015). However, Kipping and colleagues' (2012) study on developing parent involvement in school-based obesity interventions claims that very little is known about the effectiveness of parent involvement in school-based obesity prevention. School-based interventions engage parents through homework and school newsletters and parents consider it a practical way to involve them, while increasing their awareness of healthy diet and physical activity (Kipping et al., 2012). It was thus important for this study to recognise the role of parents and teachers as stakeholders with critical input to planning, implementing and evaluating the obesity prevention education in a KSA School.

2.11.4. Duration of Intervention

School-based intervention studies have been conducted for different lengths of time based on multiple factors. A literature review by Shaya and colleagues (2008), focusing on school-based interventions from 1986 to 2006, indicated that intervention duration ranged from 4 weeks to as long as 8 years and that the majority of studies exclusively used education models, behaviour modification strategies or both. Seemingly, Flodmark and colleagues' (2006) review of studies on children or adolescent obesity interventions, using inclusion criteria of 12 month follow up on BMI, found that 8 out of 24 interventions indicated a positive effect on obesity through increased physical activity and healthy lifestyle. However, their study does not explain whether the positive effect is associated with the 12-month duration. Nevertheless, Shaya and colleagues (2008) reveal that the duration of studies is determined by varying factors including time available for the researchers, financial resources, scope of the study and personnel and collaboration from school-based intervention

stakeholders. Due to limited time and resources, this study established a shorter duration for its intervention of 12 weeks.

Sharma's (2011) systematic review on school-based interventions designed to prevent obesity in childhood and adolescents by modifying dietary behaviour between 2000 and 2009, documents that in terms of duration, thirteen interventions lasted longer than six months, eight had a duration of between one and six months while four were less than one month (Sharma, 2011). Sharma concludes that in terms of duration and its impact assessment, only fourteen interventions had measured it and of that, only six reported considerable change (Sharma, 2011). This means that duration had a significant impact on the effectiveness of intervention studies and as revealed by Shaya and colleagues (2008), studies that employ long-term follow-up were effective in reducing obesity in school age children. Nonetheless, there is controversy about duration with different studies indicating divergent results.

Consider Farris and colleagues' (2011) study that involved a 12-week interdisciplinary intervention programme for obese children with an aim of improving their health. The study involved 25 children with a mean age of 8.1 years and BMI>98th percentile and the parents were also involved by completing a 12-week (3 days per week) intervention covering aerobics and exercise relevant to age and developmental levels. Their study collected data through the pre- and post–measurement of BMI, body fat percentage, waist circumference, glucose, and cholesterol. The results of the study showed that the interdisciplinary intervention programme had positively affected the fitness and health status of the children who were obese (Farris et al., 2011). Even though the study does not indicate the significance of the impact, it does indicate that even short-term interventions can have an impact on reducing and preventing overweight and obesity in children. This indicates that the intervention duration of this study can be effective in evaluating the impact of an education based obesity prevention that is school-based.

Gonzalez-Suarez and colleagues' (2009) meta-analysis on the effectiveness of school-based interventions on childhood obesity prevention, focusing on studies between 1995 and 2007, revealed that interventions that were done for more than one year had a higher standard mean for decreasing the prevalence of obesity, but were not effective in decreasing BMI. The meta-analysis showed convincing evidence; that school-based interventions are effective at least in reducing the prevalence of childhood obesity (Gonzalez-Suarez et al., 2009). One can therefore draw from these studies that longer duration intervention programmes are likely to be more effective than shorter programmes. According to Amini and colleagues' (2015)

review of the effectiveness of school-based intervention from 2001 to 2011 that targeted children and adolescents, intervention duration is a crucial determinant of effectiveness. Nonetheless, none of these studies that establish duration as a critical determinant of intervention effectiveness have assessed the optimum length of time required for a childhood obesity intervention to be more effective.

Overall, studies have not documented or determined the long-term efficacy of school-based interventions and have not identified the critical contributors to changes in student BMI with increased duration. A review on global school-based obesity interventions involving studies published between 2002 and 2013 indicates that for the 20 interventions analysed, most were less likely to be implemented for two or more years in duration, but they resulted in positive outcome including change in student BMI (Ickes et al., 2014). The review argues that analysed interventions showed that there is no one-size-fits-all approach to childhood obesity and that successful school-based interventions are those that integrate culturally specific intervention strategies, environmental components, and include parents where possible (Ickes et al., 2014). It was apparent then, that the short-term duration of 12 weeks for this study based on limited time and resources, was still appropriate for completing the study.

2.11.5. Behaviour Change

On determining and evaluating how school-based interventions improve children's eating habits and thereof preventing childhood obesity using curriculum and extra-curricular activities, Scott's (2012) study in the UK involving 9 primary schools for a period of 6 months argues that nearly third of 350 participants were either overweight or obese and most exhibited signs of body shape dissatisfaction. Scott (2012) showed that after the intervention there was a change in eating habits with increased vegetable intake and reduced consumption of snacks, however there was no impact on body shape dissatisfaction. Story and colleagues (2006) observed similar findings by claiming that school-based obesity interventions have attained success in modifying eating and physical activity behaviours but have been less effective in changing body weight or fatness. While these studies indicate the impact of improving children's eating habits, they have not measured the significance or the impact attained by that change in habit relative to weight gain or weight loss, for overweight or obese children.

Kriemler and colleagues (2011) sought to establish the effect of school-based interventions on physical activity and fitness in children and adolescents, by summarising recent reviews

from 2007 to 2010. The review strongly indicated that 47-65% of trials from the studies were found to be effective, but most effective interventions were those focused on physical activity in school, while the application of multi-component interventions was the most consistent and promising intervention strategy. The study further claims that there was controversy regarding the effectiveness of family involvement, duration and intensity of intervention (Kriemler et al., 2011). The study points out the critical role of school physical activity in preventing childhood obesity as deduced from the studies, however, it does not indicate or recommend the number or range of hours of physical exercise or specific physical activities found to be more significant from the studies. It also does not show if the duration of study had any implication in the trials or if sporting culture and facilities were critical contributors, particularly on those studies that found physical activity to be more effective.

According to Karnik and Kanekar's (2012) study on childhood obesity as a global public health crisis and ways to prevent that crisis using school-based, community based, play based and hospital based interventions, school-based interventions were found to be targeting physical activity along with diet education. Additionally, the study postulates that childhood obesity can be tackled at population level using education on the prevention of obesity through healthy nutrition practices and physical activity promotion (Karnik and Kanekar, 2012). Another study by Maatoug and colleagues (2015) conducted in Tunisia to evaluate school-based intervention as a component of preventing childhood obesity by improving physical activity and nutrition–related behaviours reported that school-based intervention is successful in increasing healthy dietary habits and in reducing risks of excess weight. Li and colleagues' (2014) study conducted in China to assess the effectiveness of a 12-week school-based physical activity intervention on obesity used a multi-component physical activity intervention that included improvement of physical education, extracurricular physical activity for overweight or obese children, physical activities at home and health education lectures for children and parents. The study result indicated that a multi-component activity intervention was effective in decreasing levels of BMI and fasting glucose (Li et al, 2014). The findings provide evidence that deploying a multi-component approach that targets eating habits and physical exercises both at home and at school has a higher chance of increasing the effectiveness of an intervention.

Seemingly Sharma's (2006) study of school-based interventions for childhood and obesity from 1999 to 2004 involving children from kindergarten to high school focused on behaviour change, and found that interventions led to modest change in behaviour, with TV watching

being the most modifiable behaviour, followed by physical activity and nutrition behaviours. Sharma recommends measures of outcomes to determine the effectiveness of the intervention (Sharma, 2006). Sharma's (2011) systematic review found out that of 25 interventions analysed, the majority focused on diet and physical activity and about half of the studies focused on behaviour theory. A study evaluating the effectiveness of preventive school-based obesity interventions in low and middle income countries argues that school-based intervention have the potential to improve dietary and physical activity behaviour that are critical in preventing body weights in low and middle income countries (Verstraeten et al., 2012). Hence, this study will apply a behaviour change approach such as attempting to alter school meals and food intake (diet), and improve participation in physical exercises while avoiding sedentary behaviours.

In general, the studies analysed above about prevention of obesity using school-based interventions provided a framework and key components that this study incorporated in planning and designing the school-based intervention programme. The studies identify critical components that influence effectiveness of school-based interventions for preventing childhood obesity, to include involving and educating parents in the intervention programme, the role of teachers as implementers, the benefits of a school setting, and significance of involving the home setting to foster school-based intervention results. The study also borrowed the importance of applying theory such as behaviour or cognitive theory in an intervention programme. Additionally, studies also indicate how critical the duration of educational interventions, behaviour change and measurement of study results are in determining the overall effect realised by an intervention.

The majority of the reviewed studies utilised quasi-experimental designs in estimating the impact of school-based interventions on target populations (Sharma, 2011). Li and colleagues' (2014) randomised control trial on establishing the effectiveness of a school-based physical activity intervention on obesity in schools used a mixed methods approach in which baseline surveys and experiments were used and qualitative methods like observation and individual interviews were applied. Maatoug and colleagues' (2015) school-based intervention study reportedly used a mixed-methods approach in collecting data for both pre-intervention and post-intervention, based on physical activity that involved observation methods and nutrition that required surveys. Clarke and colleagues' (2015) study on parent and child perceptions of school-based obesity prevention in England used qualitative study focus groups. Tarro and colleagues' (2014) intervention study collected data including BMI every year by measuring and recording, while questionnaires were applied in dietary and lifestyle habits and were completed by parents, children and teachers as implementers. Jones

and colleagues (2013) argue that mixed methods in most school-based interventions targeting obesity are associated with the need to collect data on adiposity outcomes such as BMI, BMI z-scores, percentage body fat, waist circumference; and behaviour constructs such as physical activity and dietary factors. According to Branscum and colleagues (2013) qualitative and quantitative process data were collected using surveys, open-item questionnaires, field notes considering the programme's fidelity, reach, recruitment and context, while triangulation of the method was vital for understanding how the programme was implemented and received by teachers, children and parents in the programme. This outlined the effectiveness of selecting a mixed methods approach in completing this study.

The majority of existing studies on childhood obesity in Saudi Arabia are concerned with presenting a descriptive documentation of the epidemic and its prevalence. The most common determinants found within these studies are pertaining to lifestyle, dietary habits and physical activity. As such, most of the studies conducted within the context of Saudi Arabia follow this trend, and thus an effective school-based intervention is still lacking (e.g. Al-Hazzaa, 2007; Al-Dossary, et al., 2009; Al-Enzy, et al., 2014; Saleh, Al-Ghamedi, 2013; Abdulrahman, et al., 2015)

This is surprising given that the obesity issue is already extensively documented and its prevalence is well understood. The majority of these studies determine the trends in body fatness and obesity among Saudi children and adolescents, detail the various causes which lead to its being an increasing concern, as well as offering recommendations for interventions that encourage healthier lifestyles for the children which are needed at the national level.

As a result, the present review includes studies from other cultural contexts and hence the results of those studies cannot be readily used to understand the nature of obesity in Saudi Arabia and the attitudes and perceptions of Saudi school girls regarding obesity and overweight. This is especially true for eating habits which are likely to be influenced by variations in cultural practices. Nonetheless many of the findings from other studies found herein can help inform the development and implementation of a more sophisticated and comprehensive school-based intervention programmes in Saudi schools.

2.11.6 Appraisal and Quality Assessment of Included Studies

The concept of feasibility appraisal is to develop and assess the effectiveness of a research programme, such as an obesity prevention education. The feasibility appraisal of this programme was conducted for the first time in Madinah particularly to develop a plan for other leading studies that can help control the rising BMI of the children in Saudi Arabia. The general observations indicate children gain more weight due to a number of factors. These

include the spread of unhealthy foods and beverages, the dependence of children on the servants in every aspect of life increases laziness and laxity, and the tendancy of children to sit and watch television for long periods of time. The studies were summarised in (Table2) and key areas were identified as major determinants of the quality of each of the studies. These key areas include: the aims of the study, the study design, the impact of the intervention and the most important findings. Using these key areas as a measure of quality and rigorous practice, the studies will be critically appraised to understand the effectiveness of a school-based intervention in the prevention of childhood obesity.

2.11.6.1 Study Aims

The overall purpose found in the studies was to evaluate a school-based obesity prevention intervention programme (Kain, et al., 2014; Habib-Mourad, 2013; Xu, et al., 2012; Levy, et al., 2012; Lloyd, et al., 2011; Shama & Abdou, 2009). Most of the studies developed and implemented interventions which are multicomponent and comprehensive (Kain, et al., 2014; Habib-Mourad, 2013; Xu, et al., 2012). In addition, most of the studies sought to examine health behaviours and the determinants of such behaviours, nutrition awareness, impact of culture or a combination of all of these (Kain, et al., 2014; Habib-Mourad, 2013; Xu, et al., 2012). The studies also consistently focused on the following aspects as associated with health behaviour: physical activity, sedentary behaviour, dietary habits and BMI (Kain, et al., 2014; Habib-Mourad, 2013; Xu, et al., 2012; Levy, et al., 2012; Lloyd, et al., 2011; Shama & Abdou, 2009). Other variables were also featured: parental involvement (Kain, et al., 2014; Habib-Mourad, 2013) school environment (Kain, et al., 2014; Habib-Mourad, 2013; Xu, et al., 2012; Levy, et al., 2012; Lloyd, et al., 2011), curriculum (Kain, et al., 2014; Xu, et al., 2012), age (Shama & Abdou, 2009), gender (Shama & Abdou, 2009), ethnicity, culture (Habib-Mourad, 2013; Xu, et al., 2012), quality and duration of PE (physical education) classes (Kain, et al. 2014) and parental socioeconomic status (Lloyd, et al., 2011).

All the studies presented clear and precise research aims and they were particularly relevant to this current study as they were based on school-based prevention interventions.

2.11.6.2 Study Design

The specific data collection tools used in each of the studies was outlined clearly. Most of the studies employed randomised controlled trials (Kain et al, 2014; Habib-Mourad, 2013; Xu, et al., 2012; Levy, et al., 2012; Lloyd et al, 2011). Randomised controlled trials are seen as high quality evidence, given that this design seeks to establish cause and effect and reduce

bias (Sacks, 1982). One study (Shama & Abdou, 2009) applies static group comparison. This in fact represented a limitation for this particular study, as a random allocation of schools into a control group and intervention group was not possible, due to the fact that schools in the intervention group (health-promoting schools) were chosen as per their adherence to specified criteria and their willingness to take part in the initiative. However, the study eliminates this bias by selecting schools in control groups as matched equivalent for schools in the intervention group. Schools were matched as closely as possible on the basis of their location, student's gender and socioeconomic status (Shama & Abdou, 2009).

Of the 6 studies, 3 studies used questionnaires to gather data prior to the intervention (and in some cases post-intervention) (Habib-Mourad, 2013; Xu, et al., 2012; Shama & Abdou, 2009). Habib-Mourad's (2013) study uses questionnaires at baseline and post-intervention on determinants of change in behaviour, dietary habits as well as level of physical activity. The questionnaire designed by Xu, et al., (2012) collected information on a range of areas: specifically, socio-demographic characteristics of the participants and their parents, awareness of obesity and associated risk factors, intake of meat, vegetables and fruits, consumption of high-dense-energy snacks and carbonated drinks and level of physical activity. The authors specify that the short questionnaire completed by the parents concerned their socioeconomic status and demographic characteristics, educational background, family size and structure.

As for Shama & Abdou (2009) the self-administered questionnaire was completed only by the students with no involvement of parents (or teachers). The questionnaire therein served the purpose of gathering data regarding the following areas: students' socio-demographic characteristics (i.e. age, sex and school year), dietary habits and body-image (how the students perceive their own body weight). Questionnaires when used along with other methods can be useful in reducing bias, this is greatly facilitated by the nature of this method as requiring detachment and objectivity, hence little or no contact between researcher and respondents. Furthermore, self-completion and anonymity increases confidentiality, thus allowing for a greater degree of freedom to express one's views. Due to the fact that this quantitative instrument allows for large number of respondents, this increases the likelihood of representativeness (Habib-Mourad, 2013)

Only in one study, focus groups and in-depth interviews were conducted (Habib-Mourad, 2013). By so doing the study provided an in breadth and a greater depth of understanding of the problem, while offsetting the weaknesses inherent to using the quantitative approach on

its own. The focus groups and the interviews were used as a way of measuring the participating children's perception of the intervention programme, the positive and negative aspects of it and what they felt they have taken from it. Whereas the focus groups and interviews with the parents and teachers served the purpose of verifying their perception of the programme. The interviews were further instrumental in examining and providing explanation to the quantitative outcomes yielded from the intervention.

2.11.6.3 Impact of Interventions on Dietary Habits

Studies that report dietary behaviours indicated people in risk of obesity and overweight engage in on a regular basis. Inappropriate dietary behaviours are typically characterised by low consumption of fruits and vegetables with and high prevalence of fast food and sweetened drinks consumption (Kain, 2014; Habib-Mourad, 2013; Xu et al, 2012; Levy, et al, 2012; Shama & Abdou, 2009). Skipping meals is frequently cited as a common dietary behaviour (Kain, 2014; Habib-Mourad, 2013; Xu et al, 2012). Such behaviours are regarded as one of the major culprits of the prevalence of obesity and overweight among school children as well as being key factors in developing dietary inadequacies.

The reviewed studies reported different findings in regards to the effectiveness and feasibility of the implemented interventions in instilling behavioural and attitude changes towards food and eating habits. These studies further sought to measure the impact of the interventions on the students' body mass index (BMI) (Shama & Abdou, 2009; Levy et al, 2012). In Kain et al. (2014), 50% of the children brought only healthy snacks to school post-intervention, this finding was described as "the greatest improvement" of the intervention. The importance of this finding becomes apparent when we consider the initial behaviour of the children pre-intervention as almost all of the participating students (90%) brought to school a combination of cookies or crackers and juice as their snack of choice. Healthy food choices amounted to only 33% of all the food items brought by the children in the intervention.

Such a salient progress is best explained by the amount of information pertaining to healthy eating they were exposed to throughout the duration of the intervention. This finding proves that nutrition education is indispensable and crucial in achieving behaviour change which can result in dietary improvements. A similar result was concluded previously in Xu et al (2012) arguing that awareness of the potential risks (i.e. accumulating excess body fat) brought about by certain detrimental behaviours (e.g. frequent consumption of unhealthy snacks and soft drinks, reduced intake of vegetable and fruits, physical inactivity and prolonged screen time) means that the students are less likely to engage in them. This conclusion was

consistent with the behavioural pattern of the students who were identified as overweight or obese in the as they practiced healthier choices, including the consumption of fewer fried snacks and soft drinks coupled with an increased likelihood in spending more time being physically active and take active transport mode to/from schools in comparison to students identified as having normal body weight, the authors attribute this to the increased knowledge of children with excess body fat about the risk factors associated with unhealthy eating and physical inactivity and their implications on their overall weight health.

Despite this heightened awareness exhibited by the children with excess body weight, the significant influence of parents on their children's eating habits meant that these children continued to consume excessive amounts of fatty meat. This finding is important as it shows that changes in the child's behaviour cannot only be improved and maintained on the individual level but also extends to the society and eating practices prevalent on the cultural level. Albeit the fat that the authors raise the possible link between the fashion in which food is served to children in China and their persistent consumption of fatty meat, they do not elaborate beyond this point to make a case about the influence of culture on the individual's perception, attitude and consumption of food.

This was dealt with more seriously and thoroughly in Habib-Mourad (2013) where the author discusses the significance of cultural sensitivity and accordingly implements a school-based intervention which is described as culturally appropriate in that considerations were made to help the children relate the messages of the educational materials and activities to their daily life and foods found in their immediate cultural environment (referencing traditional foods and dishes, communicating in Arabic for all the purposes of the intervention, culture-specific rhymes and riddles, etc.). Given the unpopularity of integrating cultural elements specific to the population under study in the author's chosen context, her designed intervention can be regarded as a reaction to the widespread practice of adapting and translating health promoting initiatives from Western sources.

Habib-Mourad's (2013) intervention programmes were designed with a Lebanese target population in mind and thus were developed to meet the dietary health requirements of this particular group, however, the findings from her study are reflective of the effectiveness of culturally sensitive interventions to obtain the desired outcomes and objectives. The behaviour changes were noticeable across the entire category of dietary habits, including reported attempts to have breakfast regularly (e.g. waking up earlier); increased efforts to take the recommended intake of fruits and vegetables, and less resistance when offered these

kinds of food; significant decrease in the consumption and buying of carbonated drinks and artificial juice; significant decrease in consumption and buying of energy dense snacks (i.e. potato chips and chocolates).

Although, Habib-Mourad's (2013) study does not evaluate the success of integrating cultural sensitivity in the intervention programme, nor explicitly cites thee incorporated cultural elements as determinants of behavioural change (aspects such as child's nutritional knowledge, self-efficacy, parental involvement, school environment, etc. were used as outcome measures). It is worth mentioning that this study is the only reviewed study which overtly presents the role of culture in behaviour changes in relation to the consumption of food. The study by Shama & Abdou (2009) has shown that intervention initiatives in health promoting schools were effective in helping children adopt healthy dietary habits, this is represented mainly by a high percentage of breakfast intake (6-7 times per week) and regular consumption of fruits and vegetables (3 times or more per week). Nevertheless, the changes reported in this study are apparently significant only for breakfast and fruits and vegetables consumption, meaning that the remaining aspects in the dietary habits category did not see any major changes; these are namely, soft drinks and fast foods. The study detected no significant changes in the consumption of these items, as male students were found to drink soft drinks on a daily basis (up to three times) and eat fast foods more than once a week, female students on the other hand consumed less amounts of soft drinks but exhibited no great differences with the consumption of fast food. The reasons stated by the authors for school children to drink soft drinks are similar to those given in other studies (Habib-Mourad, 2013; Xu, et al, 2012) these are taste preference, being influenced by parents and peers' consumption habits, ease of availability in the home and school environments and television viewing. The study shows an overall positive dietary behaviour and that the health promoting interventions did indeed have an impact on dietary behaviour both on male and female students.

The effectiveness of the health promoting initiative in schools presented in Shama & Abdou (2009) is in line with the study by Levy et al., (2012) which also sought to implement environmental changes within a wider school based nutrition focused programme. Providing such intensive and comprehensive experiences in school setting (and home setting) is anticipated to maximise the strength of interventions. The intervention in this study is called "Nutrition on the Go" and was designed with the aim to reduce the energy contents of school breakfasts and to increase the amounts of fruits and vegetables and encourage more

consumption of water. After duration of over 6 months, the study recorded a slight yet statistically significant effect on reducing the probability of shifting from the overweight to the obesity category. This study also reported a decreasing effect on the shift from the normal to the overweight categories.

Rather than claiming to be effective in decreasing excess body weight, the intervention was concluded to be more effective for the purpose of maintaining BMI in schoolchildren. Quantitative data from the pre- and post- intervention behavioural and anthropometric measures in Lloyd, et al., (2012) showed a significant self-reported decrease in the consumption of energy dense snacks. Like most of the other studies this study incorporated a multi-component school-based intervention programme with a special focus on the following behaviours i) reduction of the consumption of sweetened soft drinks, ii) increase in the proportion of healthy snacks consumed and iii) reduction of TV viewing and other screen-based activities, within the context of a wider attempt to improve diet and increase physical activity.

2.11.6.4 Impact of Intervention on Physical activity and Sedentary Behaviour

Physical activity in almost all of the reviewed studies (with the exception of Shama & Abdou, 2009) is regarded as factor contributing to maintaining healthy body weight or weight gain in the case of lack of it. Weight gain is a result of an energy imbalance between energy out and energy in, and as physical activity levels are associated with an individual's energy output, they are an obesity risk factor. Being sedentary includes an array of activities (e.g. reading, listening to music, doing homework), yet most studies exploring its effect have looked at the relationship between TV viewing and increased risk of obesity (Habib-Mourad, 2013; Xu, et al. 2012). Upon reviewing the studies, it became apparent that even the interventions which demonstrated effectiveness in other areas (dietary habits, perception and knowledge) they were less successful in making major differences to this particular area, especially when the designated objective is to introduce changes to the PE lessons in the school curriculum.

This is presented in clear terms in the study by Habib-Mourad (2013) where a lack of positive results in organised physical activity was discussed. In particular, the intervention proved unsuccessful in providing children with opportunities for organised sports for more than times a week; the intervention nonetheless, according to the author contributed to the increased willingness in the children to take part in after school sports for a minimum of once a week (by 2.35 times). To compensate for the lack of success in the attempt to make

organised physical activity available, the intervention implemented by Habib-Mourad (2013) makes use of unorganised physical activity which proved more effective in increasing children daily physical activity habits; examples of these include enjoyable play, walking (and counting their steps) and running. The success of the unorganised physical activity is consistent with the desire shown by the students to participate in sports lessons and extracurricular sporting activities if they were made more available to them.

2.11.6.5 Reviewed Studies Summary of Key Findings

Several studies focused on obesity prevention intervention aimed at changing dietary behaviour, physical lifestyles and sedentary activity. This Section focuses on six intervention studies and their findings. Table 2 summarises the main points related to these six studies. These points included the description of the samples used, their size and the details of the participant demographics, including age, gender and country. Table 2 also summarise both the research design and the dietary components of the intervention, and Intervention strategies.

Shama & Abdou (2009), Male students in HPS (health promoting schools, henceforth intervention group) showed significant positive behaviours than those in CS (conventional schools, henceforth, comparison group) in terms of fruits consumption, eating fast food and drinking soft drinks. On the other hand, female students in the intervention group exhibited significant positive behaviour than their counterparts in the comparison group in relation to eating breakfast and vegetables. Male and female students in intervention group showed significantly higher mean total dietary behaviour score than male and female students in comparison group. Lower percentage of male students in intervention group was identified as underweight and obese compared to their counterparts in comparison group with significant difference. Positive changes in students' dietary behaviours were achieved by adopting the health promoting school initiatives with apparent difference between male and female students.

Habib-Mourad (2013), Changes were observed based on self-report measures. Daily breakfast intake increased significantly in the intervention group compared with the control group. Students in the intervention group reported consuming significantly less chips and sweetened drinks at post-test compared with controls. No difference was found in physical activity and screen-based activities and no changes were observed in BMI between groups at post intervention but not for the control group. Qualitative results from focus groups showed

a general acceptance of the programme; students benefited in an enjoyable way and exerted efforts to change their eating and physical activity habits.

Kain et al., (2014), Percentage of obesity increased in boys from both types of schools and in girls from control schools, while decreasing in girls from intervention schools, both results were non-significant. Percentage of class time in MVA decreased while remaining unchanged in classes conducted by untrained and trained teachers, respectively. In boys, BMI declined and increased in intervention and control schools, respectively. In girls, BMI were maintained with no reported changes in intervention schools, while a significant increase turned out to be the case in control schools.

Lloyd *et al.* (2011), At 18 months follow-up, children from intervention group consumed less energy-dense snacks and ate more healthy snacks. They had less 'negative food markers' and more 'positive food markers'; spent lower average times watching television; and spent more time undertaking moderate-vigorous physical activity than children in control group.

Xu *et al.* (2012), The final results of the study are still outstanding, but the intervention program cleared emphasized the complete integration of intervention components. The researchers felt that it was critical for such health intervention programmes to be used in China.

Levy *et al.* (2012), The study showed that the intervention strategy had a small but statistically significant effect on helping to maintain, or slightly improve, BMIs for fifth grade elementary school children in Mexico over a short-term period.

Table 2. Summary of Intervention Studies.

Study	Demographics (age, gender, country) Sample description and size	Research Design	Dietary components of the intervention/Intervention strategies	Duration
Shama & Abdou (2009) (Oman)	Male and female students in grades eight and nine (aged 13-16 years old)	The static group comparison design	An anonymous structured self- administered questionnaire was developed to be completed by the students to collect data about: a. Socio-demographic characteristics of students: this part included data about students' age, sex and school grade. b. Dietary behaviours of students: this part collected data regarding students' dietary behaviours (e.g. eating breakfast, fruit, vegetable and fast food consumption, and drinking soft drinks). c. One question related to the students' perception of their body weight.	One year
Lloyd *et al.* (2011) (UK)	202 school children (aged 9-10 years and of either gender). Four London primary schools (2 CG and 2 IG) based in South West of England participated.	Healthy Lifestyles Programme (HeLP), a school-based intervention	The intervention consisted of a four-phase multi-component program which used a range of school-based activities (i.e., lessons, assemblies, parents' evenings, interactive drama workshops, goal setting) to engage and support schools, children and their families in healthy lifestyle behaviour. The intervention focused on the following areas: decreasing consumption of sweetened soft drinks; increase in the proportion of healthy snacks consumed and reduction of TV viewing and other screen-based activities	18 months
Xu *et al.* (2012) (China)	The research involved a cluster randomized controlled trial in 8 randomly selected urban primary schools based in Nanjing from May 2010 to December 2013. Four schools were used for the IG and four for the CG, and all the fourth grade school children in each school participated	A cluster randomized controlled trial School-based intervention	The intervention consisted of four multilevel intervention components, including (a) classroom curriculum (physical education and healthy diet education; (b) school environment support such as posters; (c) family involvement; and (d) fun programs and events.	One year

Levy *et al.* (2012) (Mexico)	Involved 60 schools and a total of 1020 fifth grade school children of both genders.	A two-stage cluster trial. Intervention programme ("Nutrition on the Go").	The intervention strategy was using 30 schools randomly assigned to the IG and 30 to the CG. The intervention aimed to decrease the energy content of school breakfasts, increase fruit and vegetable content, increase water consumption, and increase physical activity.	Over a 6-month period
Habib-Mourad (2013) (Lebanon)	Children aged 9 to 11 years of both genders. The total number of participating students was 374, of which 193 students in intervention schools and 181 in control schools.	A pilot cluster randomised controlled trial. A culturally appropriate school-based intervention programme (Health-E-PALS-Healthy Eating and Physical Activity in Lebanese School children) and based on the constructs of the Social Cognitive Theory	The school-based multi-component intervention targeted obesity related behaviours in 9-11 year-old-children that were the following: 1. Increase consumption of fruits and vegetables 2. Favour healthy snacks over high energy dense snacks and drinks 3. Importance of having daily healthy breakfast 4. Increasing moderate physical activity 5. Decreasing sedentary behaviour	One year
Kain et al., (2014) (Chile)	The study targeted 6–8 y old low-income children. The total number of participating children was 1474	Randomised controlled study 5 intervention groups/schools and 4 control groups/ schools	This multi-component intervention included a set of activities related to healthy eating and physical activity as part of a wider programme. The intervention involved teacher training for better delivery of nutrition contents and improved quality of PE classes. Percentage of healthy snacks brought from home was determined along with children's nutrition knowledge, nutritional status, duration of PE classes, as well as percentage of time in moderate/vigorous activity (MVA).	One year

2.11.6.6 Strengths and Limitations of Studies

The studies reviewed and summarised in Table 2 in the literature review section above provided varied insight and evidence to this study. The studies reviewed above provided varied insight and evidence related to this study. One of the weaknesses is that almost all of the intervention studies (with the exception Habib-Mourad, 2013) did not explore or rather incorporates culturally sensitive measures. Reviews of school-based interventions have suggested that effective interventions must be culturally appropriate (Waters et al, 2011). Studies which reported the use of cultural elements concluded that increased exposure to a culturally adapted school-based intervention was associated with positive health related outcomes (Saksvig et al, 2005).

Moreover, most of the studies did not investigate the use of technology to improve overall diet and nutrition knowledge of children. Neither did they investigate the impact that technologies (e.g., computer, internet, video games, mobile phones, smartphones, etc.) have on the levels of physical activity undertaken by children aged between 5 and 7 years. Consequently, the relevance of the studies reviewed may not include the now technology used by children and thus will not offer ultimate insight into this field of research.

Nevertheless, there are certain areas that have become clearer owing to these types of intervention studies. For example, the intervention study undertaken by Levy *et al.* (2012) showed that there was a small but statistically significant effect on maintaining or improving BMI for fifth grade children in Mexico. The intervention was aimed at decreasing energy content of school breakfasts, increasing fruit and vegetable content, increasing water consumption, and increasing physical activity levels. The reliability of the research was high because it involved a cluster trial, control groups and a large sample of 1020 children. The significant and positive effect means that a multilateral approach may work best. This consideration is supported by Lloyd *et al.* (2011) who found that a multi-component intervention programme might be effective in changing the dietary and nutrition habits of school children aged 9-10 years old. The programme attempted a holistic approach through use of school-based activities, parents' evenings, and interactive drama workshops

Though, selected studies were of adequate methodological quality, but often not included details of training, qualifications of intervention provider, and the extent to which they followed the procedure. Moreover, the variation in school-based interventions and end points of studies, represent a significant challenge to meaningfully evaluate these interventions.

This review has revealed that multi-component interventions can be used to reduce and prevent childhood obesity. It has highlighted that incorporating strategies and approaches that involve theoretical frameworks like Social Cognitive Theory, high level of parental involvement, use of culturally appropriate programmes and use of interactive learning can potentially make an intervention effective and feasible.

2.12 Theories Used in School-based Obesity Interventions

Current health promotion employs education about health practice with effort to modify behaviour at individual, community and organisational levels. Apparently, not all health promotion programmes are successful, but accomplishing desired result is based on the understanding of health behaviours of interest and the environment in which they will take place (Redding et al., 2000). The application of health intervention theories is important because it offers an organised way of considering events and has set concepts that clarify those events by illustrating the relationship between variables (Bandura, 2004). The use of theories in research helps researchers to adequately identify the appropriate audience and means for executing change and outcomes of assessment thus ensuring effectiveness through planning.

Theories are essential tools in designing and evaluating school-based interventions because they provide the framework for the development of intervention components (Lloyd et al., 2011). Theories also assist the researcher in the selection of constructs for measure and assessing the effectiveness of an intervention (Raczynski & DiClemente, 2009). According to McEachan and colleagues (2008), school-based intervention covers a range of behavioural topics such as dietary and social aspects like sports.

2.12.1 Selecting a Health-Behaviour Theory

A review study focusing on theories used in school-based interventions suggested that the most often used theories are *social cognitive theory (SCT), the Health Belief Model (HBM), The Trans-theoretical Model/Stages of Change (TTM), the PRECEDE/PROCEED planning model and Theory of Planned Behaviour (TPB)* (National Institute of Health (NIH), 2014). Additionally, the NIH (2014) review study indicates that the interventions that used theory, or explicitly deployed theoretical constructs, were more effective than those that did not use theory (National Institute of Health, 2014). The application of health intervention theories is important because it offers an organised way of considering events and has set concepts that clarify those events by illustrating the relationship between variables (Bandura,

2004). The use of theories in this thesis helped to identify the appropriate audience and means for executing change and the outcomes of assessment thus ensuring effectiveness through planning.

This study also observed that best practices demand selecting a theory that has previously been tested in similar populations and environmental settings (school-based) as a means of effectively supporting the research process. According to Bandura (2004) theory should match the research or organisation's requirements by being consistent with the characteristics of behaviours to be addressed. With that in mind, social cognitive theory has been selected as one of the most utilised theories in school-based interventions (Sharma, 2006 & 2011; Story *et al.,* 2006; Kriemler *et al,* 2012; Maatoug *et al.,* 2015; and others).

2.12.2 Major Health Behaviour Theories

There are numerous theories that are currently applied in the field of health education, but the most common ones that may support combating and controlling obesity through school-based program are discussed in this thesis and they include:

2.12.2.1 The Health Believe Model

In this health theoretical model, it is argued that people's faith as to whether they are at risk of a disease or not and their awareness of benefits of trying to avoid that disease will influence their willingness to act (Champion & Skinner, 2008). The model has six main constructs that act as influence to people's behaviour or decisions about preventing and managing sickness. The constructs include: *perceived susceptibility*-people acting because they believe they are vulnerable to a disease condition; *perceived severity* –believe that the condition leads to serious outcomes; *perceived benefits* – taking action would reduce their vulnerability; *perceived barriers* – believe that cost of taking action is offset by benefits; *cue to action* – surrounding encourages action; and *self-efficacy* – optimism in people to successfully achieve their action (Montano et al., 2008).

2.12.2.2 (Stages of) Behaviour Change Theory

According to this theory, behaviour change is a process that undertakes five stages namely pre-contemplation, contemplation, preparation, action and maintenance (West, 2005). Pre-contemplation occurs after developing awareness of a condition then people begin contemplating taking action. People then will seek social support as they plan or prepare for action. They will then act by adopting the new behaviour in the action stage (West, 2005). The model is circular because people may fall back to the old behaviour thus creating cycle resulting from lapse and relapse. The inclusion of lapse this model makes it benefiting in

most health programs with regard to human habits in which people will return to old behaviours.

2.12.2.3 Theory of Reasoned Action

This theory is based on intentions, attitudes and beliefs and assumes that behavioural intentions determine one's action (Hansen et al., 2004). The model also argues that people's behaviour change is influenced by intention and beliefs about the people who are important to that individual and depends as to whether they will approve or disapprove of their behaviour (Hansen et al., 2004).

2.12.2.4 Social Cognitive Theory (SCT)

This theory is based on behaviour and social environment and it claims that people surrounding an individual influence that individual's feeling and behaviour through their thoughts and opinions and that the individual has a reciprocal effect on those people. The social environment in this context includes teachers, friends and family members. According to Bandura (2004) SCT is the most used among health behaviour theories and stemmed from social learning theory. Its constructs include: *reciprocal determinism* – that is dynamic interaction with environment, personal factors and behaviour; *behavioural capability* – performing behaviour requires one knowing what and how to do; *observational learning* – learning from associate's behaviour through observation; *expectations* - individual prediction results after action; *self-efficacy* – ability to take action and overcome challenges; and *reinforcement* - reward that motivates replicating of a behaviour.

2.12.2.5 Health Behaviour Theory

Selecting a theory that will be used in school-based intervention programs can be problematic. Best practices demand selecting a theory that has been tested before in similar populations and setting to support research. However, a theory should match the research or organisation's requirement by being consistent with characteristics of behaviours to be addressed (Bandura, 2004). It is also suggested that employing concepts from different theories can prove to be beneficial as opposed to using single theory (Lucas et al., 2013).

According to Bandura (2004) use of behavioural theories, such as SCT, that specify determinants of behaviour while providing guidance on how to effect behavioural change is beneficial. Bandura adds that SCT does not only predict health behaviour, but also offers principles and predictors of how to change behaviour. Studies conducted about school-based intervention with aim of preventing childhood obesity utilised SCT in their approach (Burke et al., 2012). The studies claim that SCT was best suited for development of intervention

programs that target dietary change and particularly because of its two main constructs: modelling or observation learning and self-efficacy (Hatchett et al., 2013; Burke et al., 2012). Lucas et al. (2013) also postulates that SCT proved to be efficient in a number of school-based interventions, particularly, those that involve children of ages 9 and 12 years old. As such, this thesis found SCT constructs to be covering both personal and environmental factors that are significantly observable in childhood obesity. The variables of interest, such as physical activity and dietary behaviour, associate with attitude, social environment and self-efficacy and there by using social cognitive theory in this thesis to develop and assess education intervention program is significant.

2.12.3.The Social Cognitive Theory

The most commonly used theory in school-based intervention is SCT because it is based on behaviour and social environment i.e. parents, friends and society's influence on an individual child's feeling and behaviours (McEachan et al., 2008). The social environment in this context includes teachers, friends and family members. According to Bandura (2004) SCT is a health behaviour theory that stemmed from social learning theory. Its constructs include: *reciprocal determinism* (dynamic interaction with environment, personal factors and behaviour); *behavioural capability* (performing behaviour requires one knowing what and how to do); *observational learning* (learning from associate's behaviour through observation); *expectations* (individual prediction results after action); *self-efficacy* (ability to take action and overcome challenges); and *reinforcement* (reward that motivates replicating of behaviour).

According to Bandura (2004), the use of behavioural theories, such as SCT, that specify determinants of behaviour while providing guidance on how to effect behavioural change is beneficial. SCT does not only predict health behaviour, but also offers principles and predictors of how to change behaviour (*Burke et al.,* 2012). Studies suggest that SCT is best suited for the development of intervention strategies that target dietary change, particularly because of its two main constructs: modelling or observation learning and self-efficacy (Hatchett *et al.,* 2013; Burke *et al.,* 2012). Lucas and colleagues (2013) postulate that SCT proved to be efficient in a number of school-based interventions, particularly, those that involved children of ages 9 and 12 years old.

SCT was found suitable because food and nutrition specific knowledge and skills are human thought and associate with modelling and self-regulation for taking and maintaining action

(Nooteboom, 2009). Furthermore, SCT provides guidelines for researching, analysing and understanding the human thoughts, motivation and action (Contento, 2006). It is also one of the most utilised models in designing nutrition education and health promotion programmes due to its conceptual framework for understanding determinants of behaviour (Nooteboom, 2009). SCT describes mediators and mechanisms of behaviour change that a researcher can utilise in designing strategies that can assist people to take action in modifying their behaviour (Nooteboom, 2009). According to Contento (2006), SCT presents important organising principles for understanding behaviour that encompasses personal, behavioural, and environmental factors that work in a dynamic and reciprocal fashion to influence health behaviour.

From the school-based obesity intervention studies reviewed in the previous section, SCT was appraised as an effective behavioural theory for use in school-based interventions. According to Scott's (2012) study, SCT was reported to be an effective model from which to explore influential constructs of health behaviour, particularly, on improving dietary self-efficacy among children. Sharma's (2011) review postulated that out of 25 interventions published between 2000 and 2009 that met the criteria, six of the interventions were based on SCT. According to Verstraeten and colleagues (2012) behaviour change theories were found to be an essential component of school-based health promotion interventions and SCT was common. Story and colleagues (2006) also postulated that SCT was widely used model for developing school-based elementary nutrition education programmes; however, the study argued that there were few instruments available to assess the impact of such programmes on the main constructs of SCT. Li and colleagues (2014) also reported that lessons based on SCT to improve the outcome expectations that the adolescent population places on healthy lifestyle practices may assist in developing the knowledge and skills needed to self-regulate on energy dense foods and staying physically fit.

This study therefore found SCT and its constructs to be an appropriate theory to apply in conducting this research study. SCT was selected given that it covers both personal and environmental factors that are significantly observable in childhood obesity. The variables of interest, such as physical activity and dietary behaviour, associate with attitude, social environment and self-efficacy, which are linked to social and cognitive aspects, justifying the importance of using SCT in this study.

2.12.4 Constructs of Social Cognitive Theory

2.12.4.1 Personal Factors

SCT stipulates that individuals are influenced by a number of self-referent thoughts and beliefs and have the ability to translate their experience into internal models that can guide their future action (Contento, 2006). People demonstrate forethought and are therefore capable of intentional or purposive action; the model argues that people's cognitive representations allow them to be self-reflective and able to evaluate their action and to exercise influence over their behaviour. Thus, outcome expectation regulates our behaviour in which people will choose to perform an action such as eating fruits and vegetables for good body functioning or reduce risk for cancer (Bandura, 2011). In addition, self-efficacy offers individual's confidence in carrying out the intended behaviour successfully or to act effectively to overcome barriers while engaging in new behaviour. Examples include the confidence to select and prepare vegetables, choosing to run 3 miles, or eating patterns (Contento, 2006). From this point of view, SCT tends to view children and parents as agents that are capable of taking charge of their lifestyle behaviours and exercising self-control over their own behaviour.

2.12.4.2 Behavioural Factors

These factors include food related knowledge and the skills needed to engage in desired behaviours like eating low fat foods. Behavioural factors combined with personal factors determine the initiation and maintenance of behaviour for the long-term. Knowledge and skills influence behavioural capabilities such as knowing how to use information about fats, carbohydrates, proteins, vitamins and minerals (Contento, 2006). For this study, knowledge or cognition is important for supporting children or people who intend to alter their behaviour through knowing how to do it and the effects of such a decision on their life.

2.12.4.3 Environmental Factors

This comprises of objective factors that influence behaviour but are external to the person. SCT categorises environment into imposed, selected and created (Nooteboom, 2009). The imposed environment refers to physical and social-structural environments over which people have no control such as the physical availability of food (e.g. availability of fruits and vegetables at home, workplace and school environment). The selected environment represents the notion of potential and actual environments and that potential becomes actual depending on how we act in that environment. The created environment describes what was not there but has been created by an individual such as having a nutritional committee in

school that will influence the environment and make supportive nutrition provision. The environmental factors are critical in studying children's diet, physical and sedentary behaviours and influencing factors like family, media and others.

2.13. Gaps in Theory, Knowledge and Practice

There are significant gaps worth noting from the literature review:

1. Based on the work so far reviewed, it was evident that research has not conclusively established the primary cause of obesity. It has now been observed that there exists only robust evidence from cross-sectional and longitudinal studies to support energy-dense, high-fat diet and physical inactivity as attributed causes of obesity.
2. From the studies examined, there is a lack in efficacy of accounts about the feasible relationship between physical activity and diet in preventing obesity; as well as in determining which of these lifestyle factors is the most effective in combating obesity.
3. The literature supports the theory that schoolchildren who adopt a healthy diet with increased physical activity levels are less likely to develop obesity, but it is not conclusive why such a discovery has not been implemented to control obesity.
4. There is no framework that stipulates the standard physical activity magnitude that will reduce obesity or help avoid obesity in children or adults.
5. There is limited discussion about the extent to which geography or terrain influence physical activity or obesity development.
6. It is not clearly defined what is the average time that an intervention programme should take to be considered standard and likely to sustain effectiveness.
7. Most studies used were conducted outside KSA, therefore they do not provide a true representation of the problem in KSA, even if they have covered a wider childhood obesity spectrum.

2.14. Summary

This chapter has identified the criteria applied in selecting contributing studies. The main areas of focus included childhood obesity prevalence, the causes of childhood obesity and the health implications of higher obesity prevalence in children. The review has then focused on tackling overweight and obesity in children through prevention and controlling and reduction interventions in a school-based environment. Reviewed studies indicated that multi-component interventions (those that involve physical activities and diet strategies targeting both school and home by involving parents and teachers), can be used to prevent

childhood obesity. In this chapter, the concept of Nutrition Transition has been discussed. As we saw the concept is important in understanding the shift in dietary consumption and energy expenditure that corresponds with changes in the domains of economy, demography and epidemiology. The studies were summarised in (Table2) and key areas were identified as major determinants of the quality of each of the studies. These key areas include: the aims of the study, the study design, the impact of the intervention and the most important findings. Using these key areas as a measure of quality and rigorous practice, the studies will be critically appraised to understand the effectiveness of a school-based intervention in the prevention of childhood obesityThe review has highlighted that incorporating strategies and approaches that involve theoretical frameworks like Social Cognitive Theory, high level of parental involvement, use of culturally appropriate programmes and use of interactive learning have the potential to make an intervention effective and successful.

Chapter Three: Methodology

3.1. Introduction

This chapter discusses the methodological issues for performing and designing the current feasibility study. The theoretical frameworks for this feasibility study were designed to address research questions and the methodological techniques, including questionnaires and interviews for collecting the quantitative and qualitative data respectively. These two methods aimed to identify the obesity-related behaviour factors in school girls living in the Madinah area. These methods will help to understand the actual level of body mass index first and the possibility of continuing research in this field in the future. So this chapter describes the nature of qualitative and quantitative research approaches and their significance in addressing the main aim of the thesis. It also presents a justification of adopting the mixed method approach in this study and its execution. The chapter further explains the role of the Medical Research Council (MRC) framework in guiding the development of this study's intervention; offers a description of the study site, details validity and reliability of the quantitative questionnaire as well as the quality criteria of the qualitative method; describes the research sample, pilot study, ethical and cultural considerations; provides and account for the organisation and planning of the intervention; and finally outlines the data collection tools and techniques applied herein, and the selected data analysis methods.

3.2 Research Paradigms and Philosophy

Research paradigms and philosophy are important when conducting research. Creswell (2008) argued that research paradigms and philosophy present a set of concepts, rules and principles for conducting research efficiently. According to Taylor et al. (2007, p. 5) *'paradigm offers broad view or perspective of the social world as linked to connected sources of information'.* Weaver and Olson (2006, p.460) reported that research paradigms and philosophy provide *'patterns of beliefs and practices that regulate inquiry within a discipline by providing frames, lenses and processes through which investigation can be accomplished'.* Williams (2011) postulated that a paradigm is a functional guide of how the researcher thinks about the development and nature of knowledge. It is therefore important to explore them in order to choose an appropriate research approach and relevant data collection and analysis methods and techniques.

Mackenzie and Knipe (2006) suggested that the common and major paradigms are positivism, interpretive, post-structuralism and a critical approach. According to Creswell (2003) positivism, which is based on quantitative assumptions and interpretivism which is based on qualitative assumptions are two major paradigms used in public health research. According to Dash (2005), the positivist paradigm is used to explore social reality and is formed on philosophical ideas of observation and reason as a way to understand human behaviours. However, positivism is criticised because it removes context from meaning in the process of pursuing quantified measures for phenomena and does not interpret collected data (Mackenzie & Knipe, 2006). The interpretivist paradigm, however, suggests that reality is socially constructed, thus, it relies upon the participant's views, experiences and background of the case study (Creswell, 2008). Furthermore, the interpretivist paradigm concerns understanding of human experiences by imposing knowledge and meaning as acts of interpretation (Mackenzie & Knipe, 2006). Both positivism (quantitative) and interpretive (qualitative) paradigms have strength and weaknesses when applied to research studies. The following section discusses the association between paradigms and methodology, highlighting the strengths and limitations of each method and combining them for optimal findings. Table 3 summarises the paradigms and their relationship with the research methodology.

Table 3. Summary of Research Paradigms and their relationship with methodology adopted from Locke et al (2000).

Characteristic	**Positivist view**	**Interpretive view**
Purpose	The researcher will predict and explain changes in nutrition knowledge of participants	The researcher will interview the children and recognize the value and depth of individual content
Beliefs	One truth exists Must be objective	Many truths and realities Different people have different perceptions, needs and experiences.
Research methods	Quantitative	Qualitative
What study data is based upon	Measurable outcomes from questionnaire data	Descriptive, explanatory and contextual words of interview data
Study sample	Clear and precise inclusion and exclusion data	Representatives who are able to provide expertise from different points of view.

3.3. Paradigms and Methodology

3.3.1. Quantitative Methodology

Curry and colleagues (2013) explain that the purpose of quantitative research methods is objectivity, because quantitative research applies objective measures in controlling and eliminating extraneous variables through assessments, while using standard tests and parametric tests. Locke and colleagues (2000) argued that quantitative research is described through the concepts of empiricism and positivism, which are used in the physical sciences. Creswell (2003) suggested that objectivists observe empirical evidence as being important in establishing knowledge about phenomena by exploring facts and causes of human behaviour through observable, objective and quantifiable data. This means that quantitative research uses objectivity to establish topic-based questions with quantifiable answers from which analysis can produce quantifiable and statistically significant data. Because quantitative research attempts to identify objective truth that is applicable in all similar situations, its results are intended to be generalised making it highly applicable in public health and the natural sciences (Howden-Chapman et al., 2007; Locke et al, 2000; Wight & Abraham, 2000).

According to Thomas (2003), quantitative research offers two approaches, experimental and non-experimental. The experimental approach tends to manipulate and control study variables (Cormack 2000), and experimental and quasi experimental studies used within this approach provide measurable objective evidence in order to explain the mechanisms of relationships between the variables, by manipulating the independent factor to measure its effect on the dependent factor (Carr 1994). Non-experimental research of quantitative design is typically designed to build up an image of an observable phenomenon or to explore events, persons, and situations (Lobiondo-Wood and Haber 2006). Experimental and quasi-experimental designs rely on control and randomisation as a mechanism of reducing various forms of bias thus increasing confidence and the reliability of such a research study (Thomas, 2003). According to Plano and Creswell (2008), bias is a major problem in any quantitative study and is caused by an error that may occur during the design, conduct and analysis of a research project causing erroneous estimation of outcomes. Control also helps a quantitative researcher to separate irrelevant variables and focus on associations that are in the research question.

The main strength of the quantitative approach is the ability to preserve an independent view by understanding research facts based on collected data (Plano & Creswell, 2008). This

allows the researcher to preserve independence and objectivity of view in an attempt to understand the facts (Locke et al., 2000; Duffy, 1985). Such a method sometimes requires no direct contact with participants as self-administered or questionnaire surveys can be deployed. Tashakkori and Teddlie (2008) explain that in quantitative research an investigator is not involved in the collection of data which reduces bias and increases objectivity. Quantitative results can also be generalised to the entire population. Seemingly, the objectivity of quantitative methodology is derived from the ability to control or eliminate extraneous variables, and the data generated by this approach can be assessed using parametric and standard tests (Locke et al., 2000). However, quantitative parametric tests make quantitative methodology less flexible and not applicable in natural settings (Carr 1994).

Using a quantitative approach is useful in describing the relationships between the different variables involved in childhood obesity among KSA schoolgirls and offering data on their events and situations. In addition, quantitative data was suitable for the collection of further information and evidence about meanings, beliefs, and values associated with healthy eating and physical activity (Parahoo, 1997). A quantitative approach was also significant for this thesis by making the results more generalisable to entire KSA schoolgirls aged between 9 and 16.

3.3.2 Qualitative Methodology

Creswell (2003) articulates that a qualitative study is an inquiry process aimed at understanding social or human problems by building a complex and holistic picture from words and the detailed views of informants, and conducted in a natural setting. According to Guba and Lincoln (1994), the qualitative philosophical approach is inspired from interpretive and constructivism paradigms. Tashakkori and Teddlie (2008) elaborate that qualitative research is interpretive because it examines phenomena from people's experiences and interactions with each other and/or the wider social context. Newman (2006) postulates that qualitative research is a naturalistic approach that seeks to understand situations in an uncontrolled and context specific setting. This means that qualitative research is dependent on the units of analysis such as the subject's words and/or behaviour making it subjective rather than objective. The qualitative method is attractive in developing concepts and theories that will help understand a social perspective.

Guba and Lincoln (2005) postulated that qualitative methods are inductive in nature and offer an in-depth exploration that is critical in health studies. Therefore, a qualitative approach was

fundamental for understanding meaning and the perceptions of children about the relationship between obesity, dietary and physical activity. According to Mays and Pope (1995), a qualitative approach allows experiences, thoughts, perceptions and attitudes to be applied in the social sciences and health disciplines. According to Mackenzie and Knipe (2006), a qualitative approach that integrates an interpretivist perspective focuses on social factors that impact on nature and social sciences where human beings can interpret themselves or their surroundings. This is important in addressing the 'why' and 'how' questions that are related to child obesity or lifestyle behaviours. Qualitative research is important in health studies because it allows subjects in the study to express themselves freely and communicate their insights and experiences such as diet and physical exercise.

The major strength of qualitative research emerges from the ability to study and explore social or other subjective phenomena in natural settings (Avis 2003). Observing participants in a natural setting increases the researcher's awareness about their views, experiences and meanings (Mays & Pope 1996); this is because the researcher in a qualitative approach is closely connected to the phenomenon under investigation (Avis 2003). This relationship is fundamental in order to define the social group and to interpret and understand their behaviour within a particular social or cultural group (Avis, 2000). In this thesis, the qualitative approach will help address the research question regarding schoolchildren's views about sedentary behaviours, healthy eating or dietary and physical activity. The children's views are analysed as textual data rather than as numbers. The textual data is considered as the true language by which persons can express their beliefs and thoughts and consequently facilitate the understanding of the meaning (Avis, 2000). A critical drawback of using qualitative research is that the results cannot be generalised to the entire population.

Due to the nature of this study, it was not possible to use a single research methodology and address the research questions adequately. Quantitative methods would deal with a definition of lifestyle and behaviour variables and their relationships only. Qualitative methods would address experiences and reaction to specific actors independently in specific circumstances. As a result, combining the two methods in a mixed methods approach was necessary in order to collect and analyse data effectively.

3.3.3 The Mixed Methods Approach

Creswell (2008) explains that the mixed methods approach is a research method that provides an alternative to qualitative and quantitative methods. Rihoux and Grimm (2006) argue that mixed methods essentially neutralise or minimise limitations that are associated

with each of those methods. Mixed methods research therefore is used for a complementary purpose between the quantitative and qualitative methods, helping to explain differences and similarities between both approaches (Sandelowski, 2000). This clearly means that mixed methods support confirmation and triangulation of the data in order to develop theories which in turn help to further understanding of the phenomenon under study. Mixed methods were necessary because this study encompassed different aspects of behavioural and environmental factors that would best be inquired into through triangulation.

Mixed methods combine the strengths of qualitative and quantitative research approaches (Murphy and Dingwall, 2003), making it an appropriate approach that offers an in-depth understanding of this thesis topic. Ritchie and Lewis (2003) articulated that using both methods allow comprehensive analysis and suits research problems that include either quantitative or qualitative data while requiring a holistic picture. The selection of this approach was based on the nature of this research given that quantitative approaches that are based on questionnaires and surveys leave no room for participants to express their views and reactions (Curry *et al*. 2014), whereas, the technique followed in data collection when using a qualitative approach provides contextual information in order to interpret the meaning of individual experience (Avis, 2003). Timing was also a key player in selecting the design as it refers to pacing and implementation of the selected methods. According to Ritchie and Lewis (2003) timing relates to the period of time the datasets are collected which can be expressed as concurrent, sequential or multiphase combination. Also, a mixed methods approach offers sequential, concurrent or transformative strategies of inquiry, which permits the researcher to employ open-ended and closed questions, use both emerging and pre-determined approaches, and both quantitative and qualitative data and analysis (Creswell, 2008).

Moreover, the advantages of triangulation informed the decision to consider the mixed methods approach as an apt methodological choice for the purposes of this study. Triangulation of consecutive data from both qualitative and quantitative sources within this study was seen to help increase depth of understanding and confirm the completeness of evidence gathered from research (Murphy & Dingwall, 2003). Triangulation also contributed to increased research validity through convergence of multiple sources of information and themes while complementarity helped to further develop findings through illustration or explanation (Salehi & Golafshani, 2010). However, while mixed methods combine qualitative and quantitative approaches, it is important to establish the level of interaction between qualitative and quantitative methods used together because the level of interaction

provides the extent to which the two are kept independent or interact with each other (Thomas, 2003). Establishing the level of interaction is vital for selecting suitable research design for the mixed method approach.

3.4. Research Design

Mixed methods research offers six design strategies that include sequential explanatory, sequential exploratory, sequential transformative, concurrent triangulation, concurrent nested and concurrent transformative (Creswell, 2003). For this study, a sequential explanatory design, which is characterised by collecting and analysing quantitative data followed by the collection and analysis of qualitative data using two consecutive phases within a single study was used (Clark & Creswell, 2008). According to Morse (2003) identifying the level of interaction assists in determining priority which refers to weighting the importance of quantitative and qualitative methods in answering the study's question. For this thesis report a quantitative approach was prioritised because the quantitative data had priority to answer the study questions first and then qualitative methods were used for a secondary role of validating and explaining quantitative findings. Using a sequential explanatory design, allows qualitative data in this context to help explain the initial quantitative results (Creswell, 2008). Quantitative data that was collected from children participating in the research would help to identify a significant prediction of childhood obesity in KSA girls while qualitative data collected from interviews would describe the association and validity of identified obesity factors. This means that qualitative data and its analysis could refine and explain the quantitative statistical results by exploring participant's views in more depth through interviews (Ivankova et al., 2006).

There are two variants of sequential explanatory design, the follow-up explanations model and the participant selection model (Mingers, 2003). Creswell (2003) argues that though all the models have quantitative as the initial phase followed by qualitative, the models are distinct in the connection of the two phases with the follow-up model focusing on results to be investigated in detail and the participant model focusing on the appropriate participant to be selected. This thesis report used the follow-up model in which qualitative data explains and expands on quantitative results (Mingers, 2003). The follow-up model was also seen as a means to help the study to identify specific quantitative findings that needed further explanation like children who may start to gain weight during the intervention regardless of them claiming to have implemented what the intervention had taught them.

A sequential explanatory research design offers different advantages to this study. According to Creswell (2003) explanatory design is one of the most straight forward designs to implement because the phases are conducted and one type of data is selected. The design also offers flexibility in writing the report because the final report can be written in two phases thus offering clear delineation for readers (Clark & Creswell, 2007). Ivankova et al. (2006) also argue that sequential design in general lends itself to multiphase investigations and Neuman (2006) adds that the design appeals to quantitative researchers because it starts with a strong quantitative orientation. However, the sequential design also posed challenges to this study including the fact that it required a lengthy amount of time for implementing the two phases (Creswell, 2008), and the school administration were not willing to provide that period of time given their schedule.

3.4.1. Implementation Sequence

This study's research design was conducted in two phases with quantitative research being the first followed by qualitative research as explained before. Figure 4 below shows how the sequential explanatory research mixed methods design was carried out. The diagram shows that in the first phase quantitative research was conducted, the data were collected and analysed and the results were used to identify follow-up in the second phase using qualitative methods. The results from both methods were then used to interpret and discuss the findings of this current study.

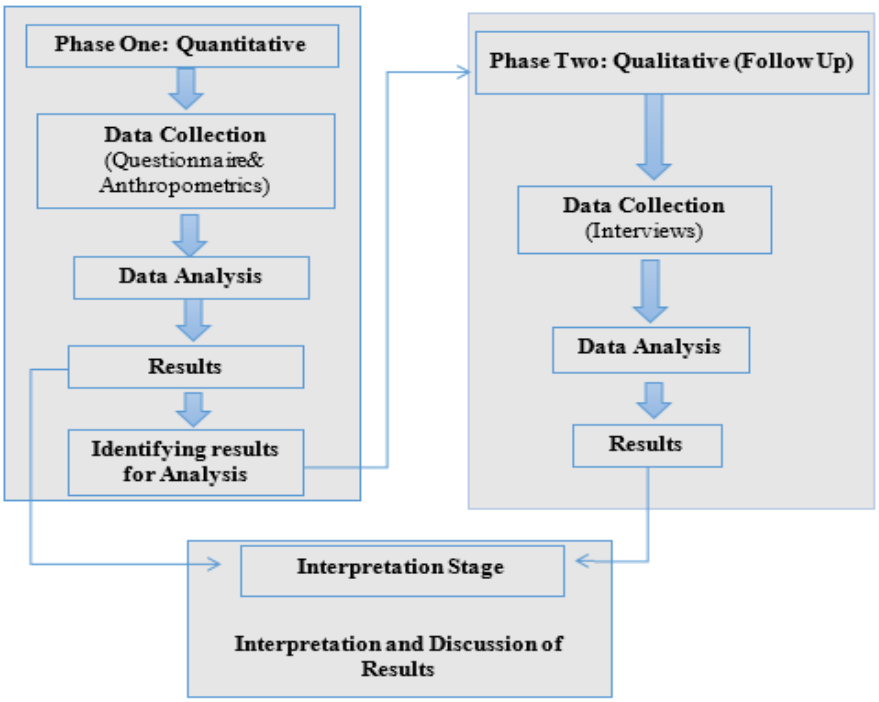


Figure 4. Illustrates how the current research implemented the research design.

3.5 Medical Research Council (MRC) Framework

Childhood obesity is a public health related topic associated with the discipline of medicine. As such, applying an established and commonly used framework by other researchers in the same field was considered appropriate because it would evidently support reliability of the research findings. According to Craig and colleagues (2008), the Medical Research Council (MRC) Framework is commonly and frequently used for development and evaluation of complex interventions that are aimed at improving health. Higgins (2008) has suggested that the MRC Framework's sequence levels make it easy to evaluate the process of a complex intervention. Campbell and colleagues (2007) have argued that the best practice is to develop interventions systematically using best available evidence coupled with appropriate theory, followed by carefully phased testing that is based on a series of pilot studies, each focusing on key uncertainties of the design.

This thesis focused on designing, piloting and testing the feasibility of the intervention; the next step in line with the MRC framework would be to conduct a Randomised Controlled Trial (RCT) over a longer period of time and on a large population covering different Cities of KSA in order to measure the outcomes. This study therefore is an evaluation stage of the full-scale study, as a recommended feasibility work to ensure that, the full-scale intervention will have a significant positive impact. This evaluation phase was developed according to the MRC (2007) new guidance that involves develop ling, evaluating and implementing complex interventions.

3.5.1 Developing complex interventions

At this phase, the researcher should start with identifying existing evidence and being sure that an intervention is likely to have a worthwhile effect. This is done by identifying what is known about similar interventions. This is then followed by developing a theory that will support understanding of the new change process (MRC, 2007). The research should then model the complex intervention before attempting a full-scale evaluation. As postulated before, this thesis report used sequential explanatory mixed methods design to collect data. The MRC framework guided the establishment of prior information about obesity prevention intervention from published cross-sectional survey reports, meta-analysis reports, government and organisation facts and figure articles, and reviewed school-based obesity intervention studies conducted in similar settings to KSA. As such it has identified critical information for modelling a complex intervention. Reviewed school-based intervention studies on obesity interventions, both in KSA and internationally, provided insight on selecting appropriate data

collection tools, designing effective data collection tools and optimising response from participants. This allowed identification of suitable ways to measure and predict long term outcomes (Higgins, 2008). The SCT theoretical framework was considered to be the most suitable for understanding behaviour variables under observation in similar studies, thus it was selected as the appropriate theoretical framework for this study.

3.5.2 Assessing Feasibility

This stage allows checking feasibility, which is necessary for avoiding problems of acceptability, delivery of the intervention, compliance, recruitment and retention. Feasibility testing enables understanding of the context in which the intervention takes place (Campbell et al., 2007). This study developed and piloted the planned intervention to ascertain feasibility as per the MRC framework (Figure 5). Using the SCT theoretical framework, sample data collection tools were designed and pilot tested using sample students in a selected primary school in Madinah, KSA. The trial was aimed at assessing the efficacy of data collection tools and acceptability of the intervention among KSA schoolgirls, their parents/sponsors, teachers and school administration. In this study, feasibility revealed that gender and privacy restrict the study to some extent. It was noted that some families might have concerns about the weight status of their children, while schools could only accept females involved in this intervention exercise because of the Arab culture. The outcome of the current study model will also be used in planning a large-scale education intervention that can be extended across KSA to help control and prevent the childhood obesity epidemic.

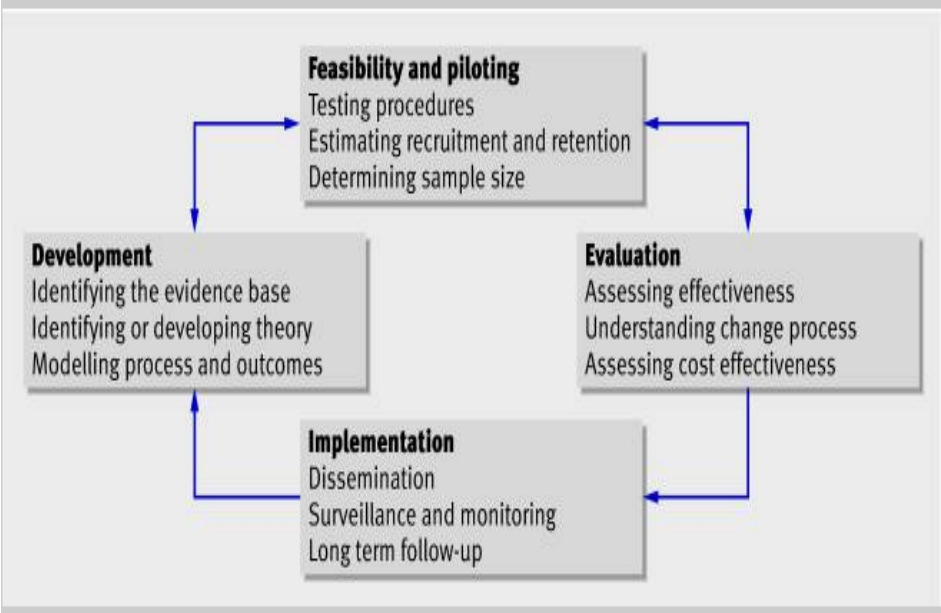


Figure 5. The MRC framework adopted in this study (MRC, 2007).

3.5.3 Evaluation

Evaluation is an important aspect in an intervention because different questions and circumstances require different approaches. The researcher should understand what designs are suitable for what kind of intervention and select a design based on the characteristics of the study, anticipated effect and likelihood of bias (MRC, 2007). Because this study was on evaluation phase and owing to limited time, the study did not conduct a Randomised Controlled Trial (RCT). However, the implementation in future works should factor in an RCT because randomising is the most robust method for preventing selection bias (Higgins, 2008). Nonetheless, analysing studies that had deployed an RCT contributed to evaluating planning, design and implementation of this education intervention by identifying key areas that needed improvement before implementation.

3.5.4 Implementation

Following the completion of this study the next phase would consist of evaluating the outcomes in order to allow for the refinement of the intervention and to conduct a longitudinal RCT to test effectiveness before planning to implement the intervention in schools across KSA and to see whether the RCT results show significant long-term impact on childhood obesity levels (Higgins, 2008).

3.6 Study Site

This study was conducted in Al-Madinah, the capital city of Al-Madinah Province, KSA. Al-Madinah had a population of about 1,100,093 people in the 2010 census (World Population Review, 2014), and ranked the fourth largest city and town based on population (KSA Central Department of Statistics and Information, 2011). The city, being the second holiest city in Islam, is largely dominated by Muslims. This study targeted a sample of schoolgirls of 9 to 15 years old. Taking into consideration Saudi culture mentioned earlier, where schools are segregated based on gender; the study focused on female child intervention and thus informed the selection of the study site with the mind that it provides similar trend with other schools around Madinah.

3.7 Pilot Study

In line with feasibility under the MRC framework, a pilot study was required to fulfil a range of important functions and to provide valuable insights for this thesis. According to Tishelman and colleagues (2000), a pilot study is crucial for pre-testing a research instrument such as a questionnaire or interview. Conducting a pilot study when investigating a phenomenon provides advanced warning about where the main research might fail; It all

server as a point to whether the proposed methods or instruments of research are appropriate or too complicated; where research protocols may require adjustment or flexibility to allow research to continue, and an opportunity to identify and mitigate research risks that may occur (Teijlingen & Hundley, 2002; Robinson et al., 2000). The key objectives of conducting a pilot test included determining the feasibility of the study in KSA, identifying whether the study population would cooperate and identifying any reserved views if any, establishing if extra resources would be required, and using the results to convince the school administration about the research.

In the case of the present study, a pilot questionnaire conducted involved 12 pupils recruited from a local primary school in Madinah with the permission of the schools' administration. To ensure validity of the questionnaire, the criteria used in selection of the group piloted included their family background. Participants were asked to think out loud whilst completing the questionnaire. This helped in identifying practical problems with implementation.

Considering the age of participant, the researcher ensured a clear introduction to the study and its purpose and importance was delivered in Arabic language to the participants. Where further clarification was needed, including an explanation of what was required of them was provided and followed by the distribution of the questionnaire to each individual. Considering that, the questionnaire pilot study testing session was allowed before children break for home, this meant that, the survey testing was conducted simultaneously. This pilot study as was observed from the response provided by the participants did impact on the quality of response provided which helped informed necessary corrective measures adopted during the main data collection process. Since reaching each parent during the close of school was not possible each participant was given a questionnaire pack for their parent/sponsor to complete. To ensure success of the process, the class teachers helped by asserting the importance of the parents engagement with the survey. All the questionnaires that were distributed to parents in the pilot study were handed to the class teacher the following day.

The process for conducting the pilot study involved an introduction to the study and its purpose and importance, an explanation of what was required of them as participants and then the distribution of questionnaires. Time limitations, considering that the pilot study was allowed before children break for home, meant that pilot study was conducted as a preliminary study to test the visibility of the current research in a small scale. This means to

pre-testing research design and instrument. After conducting the interview with children in school, teachers were requested to distribute a questionnaire to the children's parents. They also requested to collect the questionnaire from parents. The class teacher asserted the importance of ensuring the parents complete and returns it the next day.

The pilot study results indicated that most of the parents responded to the questionnaire. The group interview showed lack of understanding of key concepts that were targeted by this study. There is the possibility that children hurriedly completed the questionnaire to rush home and therefore they did not pay attention. Nevertheless, it informed this study on selecting an appropriate time for collecting data. The results also called for the importance of having an interactive session that details and clarifies important terminologies and concepts to aid understanding of the study before data collection. The pilot study also highlighted of the risk of time in completing data collection particularly executing interviews. These findings shaped the planning of the main data collection exercise by identifying risks and strengths of the data methods selected.

3.8 Study Sample

To ensure validity, accuracy, reliability and credibility of the research determining the right sample size plays important role Reis and Judd (2000) indicated that a sample is a subset of the population that is selected based on probability or non-probability methods. Rubin and Babbie (2010) referred that sampling is aimed at studying the unit and then fairly generalising the unit's results back to the population. Sampling was a significant component of this research study because it had a crucial role in the quality of results and findings (Rubin & Babbie, 2011). Additionally, sampling was important because studying the entire population was not only impractical, but also costly in terms of time and resources (Reis & Judd, 2000). To determine the sample size appropriate for detecting the effect of a selected size with a given degree of confidence, a pre-study power analysis was conducted to estimate the same size. According to Brier and colleagues (2004), power analysis is a hypothesis test that informs a study the probability of results occurring if the null hypothesis is true. The power analysis approach argues that if the probability is lower than a pre-specified value (usually 0.05) then it is rejected (Brier et al., 2004). It was estimated that there are about 10,000 children aged 9-16 years in the Al Madinah region of KSA and that about 13% of these are obese (Al Hazaa 2004). However, this population represents children of both genders and not exclusively girls, who were the focus of this study. To reach 80% power with a significance level of p=0.05, the minimum sample to ensure results are statistically

significant would be 35. The major reason of using power to evaluate the statistical significance is to avoid type I and type II errors (Brier et al., 2004). However, for the study to explore the lifestyle factors among the age groups and to enhance comparison of children's perceptions to those of parents, a sample size of 90 schoolgirls and 90 parents was planned, a total sample of 180 participants

Simple random (probability) sampling was used for the quantitative aspect of the study (World Trade Organisation, 2004). In addition, adoption of simple random sampling allows selecting *n* units out of *N*, fairly allowing an equal chance of a unit(s) being selected (Rubin & Babbie, 2011). Hence a simple random sampling method was adopted to enable effective generalisation of the results. Practically, the procedure involved selecting a list of children from each class, then generating random numbers, and selecting one person per random number. This resulted in a whole class being selected from each relevant group. A class was chosen from each academic year to represent the target age groups, namely 9-10 year olds (**Class 1**), 11-13 year olds (**Class 2**), and 14-15 year olds (**Class 3**). Each class typically consisted of 30 schoolgirls who claimed they were permanent residents of Madinah.

For the qualitative phase, purposive sampling based on the researcher's judgement was selected considering that it allow the selection of participants based on pre-selected criteria drawn from the research questions (Rubin and Babbie 2011). In addition, the approach takes in to consideration factor important characteristics of the study sample such as age, class, family background, income (parents only), eating of energy dense foods and watching TV in relation to research questions. The approach also allows the study to focus on population size that it perceives to most likely have experience and insight about the area of the study (Neergaard and Ulhoi 2007). Thus, schoolgirls were drawn based on age, nutritional intake awareness and level of engagement with physical activities, to provide more insight into the research topic and explain the quantitative results.

3.9 Data Collection

3.9.1 Quantitative Data Collection

Quantitative data was collected through a cross-sectional survey involving use of survey questionnaires (Appendix 1) and quantitative physical measurements (anthropometric measures). To ensure ethical compliance at the onset, the researcher introduced themselves and provided an explanation around the study purpose and participants role in the research. In addition, the participants were asked to sign a consent form if they were willing to participate

in the study. To maintain confidentiality all sensitive issues pertaining to participant attributes i.e. weight, meal type consume etc. were kept electronically and paper version used during the data gathering kept in a folder after each participant completed the survey. The data was kept in a locked filing cabinet accessible only by the researcher. No participant was identified by name to maintain anonymity.

3.9.1.1 Questionnaire Development

Griffee (1997) explains a questionnaire as a tool or instrument for obtaining study information from respondents. For questionnaire efficacy, this study established main variables for integration in the questionnaire and how they are measured. Using MRC guidelines, a literature search on previously used and validated questionnaires that were administered in a similar setting was conducted. The use of a literature search was crucial for capturing significant variables and their measure (Parsian, 2009). The literature search was specific to school-based obesity interventions and prevention conducted at school and/or home, involving children and/or parents and covering diet/nutrition and/or physical activity. Shepherd (2003) suggests that if a questionnaire is found that can serve the investigator's purpose, there may be no need to test it for reliability. However, the questionnaire must be administered in a similar manner to the original questionnaire, otherwise a new questionnaire will need to be developed, pilot tested and validated (Shepherd, 2003).

From the search, previous questionnaires were not available to support the aim of the current study report and the interests of the reviewed questionnaire literature did not match those of this current study. Therefore, a new questionnaire was developed which evaluated by pre-pilot test before collecting the final data. The main items developed in the questionnaire and the areas explored in relation to obesity included physical activity with focus on activity types, frequency and duration on a weekly basis; sedentary behaviours such as daily time spent watching television, internet use, and playing video games. In addition, the participants dietary habits that include food type eaten and frequency, healthy and unhealthy food intake were also considered (see Appendix 1 for the whole questionnaire).

3.9.1.2 Validity and Reliability of Developed Questionnaire

According to Shepherd (2003) questionnaire surveys are appropriate for collecting data from large populations and where self-reporting is needed along with convenience and lack of intrusiveness. The questionnaire method is considered useful in obtaining data at low cost, but it lacks reliability and validity (Prince *et al.*, 2008). According to Jones et al. (2001), validity can be described as the degree to which an assessment effectively measures what it is

designed to measure. Parsian (2009) postulated that the purpose of validating a questionnaire is to make sure that it accurately measures what it aims to do, regardless of the responder. Thus, validating this study's questionnaire was aimed at collecting quality data with high comparability, and reducing errors while increasing the credibility of the results.

The common characteristics that were used as best practice in developing the questionnaire for this thesis include: simplicity and viability, capability to measure change, reflecting underlying theory, wording reliability and precision, and adequacy for the problem intended to measure (Parsian, 2009). The questionnaire was developed to be at the level understandable and perceivable to participants: children and parents. Questionnaire wording was constructed in a simplified manner for parents or sponsors to easily understand after factoring the possible educational levels and culture factors that would influence the response to the items in the questionnaire. In order to achieve that, this study used the Collingridge questionnaire validation procedure as outlined by Krishnaswamy and colleagues (2012), shown in Figure 6.

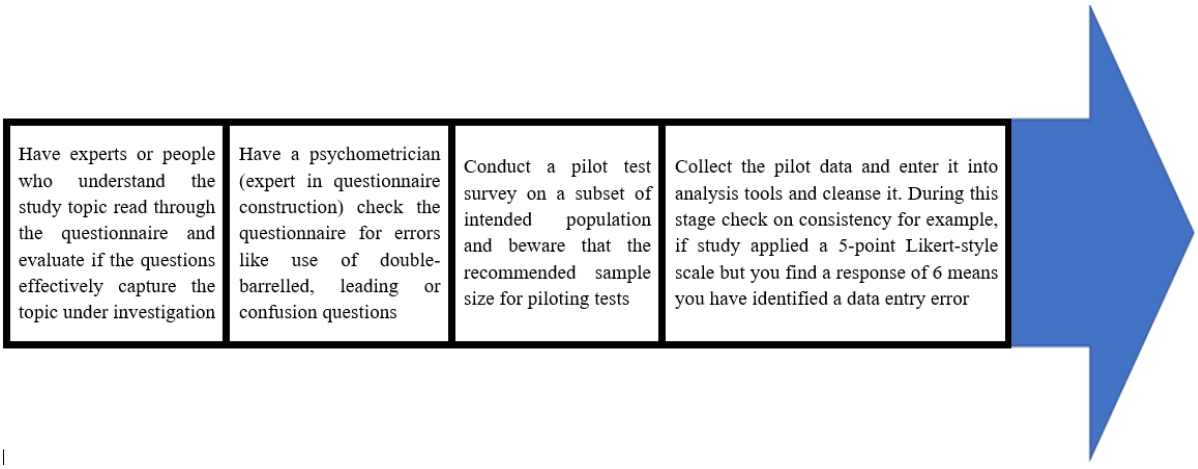


Figure 6. Colling ridge questionnaire validation procedure and process adopted from Krishna Swamy and colleagues (2012).

This thesis report was validated based on the Collingridge procedure. Mr Mahmoud Nahhas an academic expert in the field of obesity from the University of Edinburgh helped to convene three panel members with knowledge and experience in obesity related cases from Taibah University in the College of family sciences. Among the key aspects of their role was to evaluate the item structure and compare it with theoretical concepts and to check the adequacy of the items used to evaluate the effectiveness of an education intervention programme on childhood obesity. They were also asked to provide feedback on the clarity of the questions and the language, precision of instruction and order of items and responses. In addition, the professionals were asked to rank each item for its clarity and representativeness

based on an ordinal scale: (1) Item not representative/not clear (2) item requires major revision to be representative/clear (3) item requires minor revision to be representative/clear (4) item is representative/clear.

The three-member panel rating of items was captured onto a spreadsheet, with each member's rating against the ordinal scale and the overall rates summed. 'Item requires minor revision to be representative/clear' was found to have the highest index, indicating that the questionnaire was averagely satisfactory according to the panel. After a discussion meeting with the panel, the items were amended according to the recommendations to meet a satisfactory outcome. Some items were also suggested to be re-arranged in order to offer better effect and reliability in the research were also affected. Further, to ensure the internal reliability of the questionnaires and the diet and nutrition statements, Cronbach's Alpha tests were carried out using The BMI SPSS statistic software in order to check for internal reliability. The Cronbach's Alpha values for the internal consistency of the scale and the items were all above standard agreed measures for good internal consistency (i.e., greater than 0.70) (Jones-Smith & Popkin, 2010). A pilot study was conducted by collecting data with the improved questionnaire and there were no data entry errors or measures observed.

3.9.1.3 Children's Self-Reported Questionnaires

Questionnaires issued to children included questions about their nutrition and obesity-related knowledge; dietary intake and assessment; physical activity and sedentary behaviour; and behavioural change (Appendix 1). These self-report questionnaires included 54 items in total, with three sections, as described in the form.

3.9.1.4 Parent's Self-Report Questionnaires

Self-reported questionnaires were also used with the parents of the participating children, and included questions relating to diet, nutrition and household surroundings (Appendix 2). The questionnaires were translated into Arabic prior to distribution. As a means of checking answers of participating children, the parents were asked to respond to a questionnaire that would validate on their children's responses. The parents were asked questions regarding their perceptions of their daughter's physical activities, sedentary behaviour and dietary habits (Appendix 2). This included comparisons of the parents' perceptions of daily time spent by their daughters on watching television, on the computer, internet use, and playing video games.

3.9.1.5 Anthropometric Measurements

Measurements included the weight and height of participants. Children were weighed barefoot and with minimal clothes on. A calibrated measuring scale with an accuracy of ±100 g was used. The height of participants was measured to the nearest centimetre using a tape measure. Participants were asked to stand straight, bare foot and with shoulders in a relaxed position. The recorded weight and height was used to calculate **BMI** (the ratio of the weight in kilograms and the height in meters square) (James, 2004). Cut off-points standard for BMI for obesity by sex recommended by **IOTF** (Cole *et al.*, 2007) were adopted for identification of obese participants (Appendix 3).

3.10 Qualitative Data Collection

3.10.1 Interviews

When collecting qualitative data, it has a varied and non-numeric nature. According to Creswell (2008), interviews, review of documents and observation are major methods of gathering qualitative data. Creswell (2003) extends the list by adding audio-visual material as a qualitative method. For this study, interviews were selected as the most suitable qualitative data collection method. Schostak (2006) suggests that interviews are more effective in a follow-up mixed method approach because they support probing the respondents. Furthermore, the interviews were asking planned questions, meaning that the interview questions are instrumental when further investigating quantitative findings. Gill and colleagues (2008) explain that interviews are effective research tools for exploring views, beliefs, motivations and experiences of individual or grouped study participants. Additionally, interview data can be collected through stenography, video recording, audio recording and writing notes (Schostak, 2006). It was therefore seen that interviews would be effective in further probing participants' responses, while clarifying quantitative findings on diet/nutrition and physical activity with regards to childhood obesity.

Types of interviews include structured, semi-structured and unstructured (Kvale, 1997). Gill and colleagues (2008) describe structured interviews as verbally administered 'questionnaires' where an interviewee is asked a list of predetermined questions. However, Seidman (2013) warns that structured interviews have no scope for follow up. Contrary to structured interviews, unstructured interviews are not planned or organised in nature neither do they reflect any preconceived theories (Schostak, 2006). Unstructured interviews will simply start with an opening question and will then progress based primarily on the initial response of the responder, which makes them time consuming and difficult to manage

(Seidman, 2013). Semi-structured interviews combine structured and unstructured interviewing techniques, by comprising several predefined questions that help describe the phenomenon and support further probing on responses to predefined questions (Gill et al., 2008). Semi-structured interviews allow the interviewer and interviewee to digress and obtain more detail or response on ideas (Gill et al., 2008). As such, semi-structured interviews are more effective for conducting a follow-up on quantitative findings in this study and support eliciting more details on the dietary and physical exercise behaviours of the study participants. Seidman's (2013) study argued that semi-structured interviews are suitable for healthcare studies because they provide participants with some kind of guidance on what to talk about. In the context of this study, the participants were children and guiding them was crucial.

Collecting data from interviews requires adequate planning. For effective data collection, important factors like length of the interview, understanding of the respondents and ethics were considered when developing the interview schedule. Schostak's (2006) study suggested that healthcare interviews require 20 to 60 minutes. However, this study scheduled 30 minutes because of limited resources like helpers and the time constraints of a school setting. Planned interview questions were semi-structured, neutral and understandable (Kvale, 1997). Three sets of interviews were conducted with each having a sample (n=6) of females from each age group, namely 9-10 year olds (**Class 1**), 11-13 year olds (**Class 2**), and 14-15 year olds (**Class 3**). To build rapport and confidence for participants, interviews started with easy questions. Data from the interviews was collected through audio recording.

3.11 Ethical Considerations and Data Protection

All distributed questionnaires included comprehensive information sheets along with informed consent forms to be signed by participants in the study (children and parents). No information was collected without first confirming that the child's parents had given full informed consent to participate in the study. The project information sheet that was developed contained details about who was being asked to participate, what the aim of the research was, what the child was being asked and if they wanted to take part in the research, and what the parents would be asked to do if they took part in the research. The sheet also contained information about who was conducting the research and how confidentiality of the research would be maintained. To view the information sheet, see Appendix 4. All research packages provided to parents also contained a separate research withdrawal form, which

allowed the participants to withdraw their participation from the research at any time and for any reason (Appendix 5).

Ethical clearance for conducting the research was obtained from the University of Salford, School of Nursing, Midwifery, Social Work & Social Sciences Research Ethics Committee (see Appendix 6). This process involved the submission of a research ethics application form, followed by sending answers to questions asked by the Research Ethics Committee. Final research approval was obtained in February 2013. Permission was also obtained from KSA's Ministry of Education. KSA's regional Education Directorate of School Education and School Health Authorities, together with teaching and administration staff of schools, who were informed about the study objectives and methods. Finally, in relation to data protection issues, all questionnaires completed by the research participants were kept in a locked case and all electronic data were stored on a password-protected laptop.

3.12 Cultural Considerations

KSA is an Islamic country whose laws are *Shari'ah*-based and has strict rules regarding gender, use and dissemination of information. KSA has a gender separation culture that influenced this study to only focus on females because the author as a female would not be permitted to come into contact with male children. Additionally, gymnasiums and sports centres also enforce a strict gender separation policy, such that if a local gym is a male gym, then she would have to locate another female gym. Furthermore, Saudi girls and women are expected to be accompanied by a male when they venture outside or go out to exercise because of an existing ban on women driving vehicles. Islamic culture also has strict clothing traditions that require specific dressing for females. KSA female are required to cover themselves when they go out in public, usually with a *hijab* (head covering), *niqab* (face veil), and an *abaya* (full black cloak). In practice, this makes it particularly difficult for females to undertake exercise or to play outside in what is usually very hot weather. Muslim practices for food such as not eating pork, or products containing pork, such as ham slices, bacon crisps, and pork sausages meant that these were not to be included in the study. While the study language was English, all materials used and activities carried out in KSA had to be translated into Arabic.

3.13 Organisation of Data Collection

Data collection was conducted at the beginning of the research (**Stage 1**) and then again at the end of the research (**Stage 3**). The education intervention plan was implemented in

between these two stages and is described as **Stage 2** in this study. The Baseline Date was taken at the start date of the study when the first measurements were taken and at the End Date when final measurements were made and questionnaires were done. Table 4 summarises organisation of data collection.

Table 4. Research Time Plan

STAGE	DESCRIPTION	STEPS
Stage 1	Baseline (28th March 2014)	▪ Anthropometric measures ▪ Interviewer-assisted 50 item questionnaire surveys for children. ▪ Parent/Guardian 24 item questionnaire survey ▪ 3 semi-structured group interviews (sample of children from each group (n=6)
Stage 2	Start Date (18th April 2014)	▪ 3-month Intervention Strategy ▪ Regular weekly meeting to check if participants need any help
Stage 3	End Date (18th July 2014)	▪ Anthropometric measures of the children. ▪ Interviewer-assisted 50 item questionnaire surveys for children.

Stage One

At this stage, permission to conduct research from relevant organisations such as the KSA Ministry of Education was obtained. Permission was also sought from the head teacher of the school in which research was conducted. The head teacher was introduced to the research topic and the procedures of data collection. She then convened a meeting with teachers, after which the study aims and the practical steps involved with the research including explanation of the research idea, research objectives, and what data was to be collected from the research participants was explained. After the meeting, the head teacher requested the school nurses to help with taking and recording of anthropometric measurements. She further directed class teachers to facilitate the processes involved. The dates to conduct the research were agreed upon by the head teacher, class teachers and the author of this thesis.

On the day the research was conducted, participants' BMI data was recorded alongside their name. Participants were then issued with questionnaires and administration processes was explained to them. Participants were then allowed to ask questions or to ask for clarification. They were also given the research authors direct contact details for any further inquiry.

Participants were also issued with a questionnaire each to distribute to their parents/sponsors who in return responded. Participants were given clear instructions on how to return the completed questionnaire to the school. Interviews (Appendix 7) were then conducted with permission to record provided (see consent forms Appendix 8), and an example of a transcript can be seen in Appendix 9.

Stage Two

Distributed questionnaires were collected by the class teachers on the next day and safely secured into numerical folders. With the help of activity teachers, the date to undertake the intervention at the school theatre hall was set. The education session on diet or nutrition and physical activity was planned to take around 70 minutes. The education session was organised into **introduction (*10 minutes*), children's presentation (*30 minutes*), children's interactive session (*20 minutes*), and plenary (*10 minutes*).**

- ***Introduction***

The purpose and importance of the intervention were briefly explained along with introduction of the researcher. The nature of the intervention procedures and processes were clarified.

- **Children's Presentation**

The aim of presentation was to increase participant's awareness about the risks of obesity, its consequences and the benefits of the intervention programme. The presentation featured the food pyramid, benefits of 5-a-day fruit and vegetables, children's daily calorie intake, recommended food portions, the dangers of fast food, and effects of healthy dietary and activity habits and lifestyle. The presentation was a 30-minute oral presentation to the children, accompanied by visual aids and a PowerPoint. The presentation explained to the children the energy balance in terms of food intake, physical activity and obesity risks. Measures of BMI with examples and the aid of a BMI chart were showed to participants. Additionally, participants were made aware that genetic cause of obesity cannot be modified, but lifestyles linked causes can be modified (Barlow, 2007). Pictures were used to visualise what can be considered a right or wrong eating habit in relation to weight gain or obesity. Examples highlighted included watching TV or playing games on the computer for a long time, eating too much cake, fast food or taking sugary drinks. The importance of taking an energy balanced meal, taking breakfast and physical activities were emphasised. The presentation ended with a 10-minute question and answer session.

- **Children's Interactive Session**

The children's interactive session comprised three activities or workshops namely healthy eating and tasting, healthy eating colouring, and healthy quizzes and games. Each activity was envisaged to inform participants about healthy lifestyle.

Healthy eating tasting: this group were provided with variety of healthy kinds of food on plates and trays. Each plate had a graphic plaque that highlighted the positive healthy attributes of the food such as qualities, the calorie content, a breakdown of what the food is made up of, and its benefits. The plaques also explained why the foods are healthy. Additionally, healthy 'nibbles' such as healthy dips along with peeled and sliced carrot or celery sticks were also presented and their plaques informed children of the differences in calorie content of these types of nibbles compared to high calorie dips with crisps or nachos.

Healthy colouring: this group used colouring pens and pencils to colour a number of different printed pictures or posters that highlighted healthy eating or healthy activities that they could engage in at home and school.

Healthy eating quizzes and games: children took part in different healthy eating quizzes and games using flash cards which are designed around their knowledge of the impact of healthy eating and physical activities. Additionally, children matched a series of different photographs showing different foods or meals, to their category as healthier or unhealthy. The backs of the photographs showed a breakdown of the actual calorie content so that the children could learn while playing.

- **Plenary**

In the Plenary session, a summary of what the children had completed and what would be coming up next was discussed. A final question and answer session with the participants followed. Booklets about obesity risk and relevant information in (Appendix 10) and the diet plan table approved from a Doctor (Appendix 11) were issued to participants followed by a vote of thanks.

Stage Three

The weight of participants was measured again in order to assess the effectiveness of the intervention by recording any changes in participant lifestyle (food habits, activity level, weight, and BMI). Also, the questionnaires were distributed to the participants to help compare and evaluate their responses in order to assess effectiveness of the intervention.

3.14 Development of the Intervention Programme

The development of this intervention programme consisted of reviewing the literature and carrying out a comprehensive search into a variety of resources on educational programmes (i.e. especially those documented in books, theses, journal articles, PowerPoint slides) both in the English and Arabic languages. According to Campbell and colleagues (2007), the development of a public health intervention critically demands the researcher, scholar, and practitioners to evaluate, identify and synthesise the existing body of knowledge recorded in different literature publications using systematic, explicit and reproducible methods. Moreover, this programme was designed keeping in mind the cultural, social and environmental factors. According to Linnan and Steckler (2002), interventions must consider sensitive influences from elements of the structural, physical, social and/or cultural environment such as food beliefs, religion restriction on foods or certain activities, gender equality issues, the climate and the availability of physical exercising space in relation to the epidemiology of obesity.

3.14.1 Precede Model for Education-Based Intervention

To develop an effective intervention, the study adopted Green and colleagues' (1980) health education planning model that follows a diagnostic approach. The model is a seven-stage approach encompassing predisposing, reinforcing, and enabling causes in educational diagnosis and evaluation, commonly referred PRECEDE. PRECEDE education planning model holds that (1) health and health behaviours are caused by multiple factors, and (2) because of those multiple health factors, health education efforts to affect behaviour must be multidimensional (Green et al., 1980).

Using the model, Phase 1 in developing this intervention involved assessing the quality of life of the population, specifically by examining kinds of social problems that the community experiences. The author of this thesis, as a Saudi citizen, understood that health challenge is a critical social problem in her country. In Phase 2, health problems that appear to contribute to the noted social problem were identified and listed. The author related lifestyle and behaviour factors as contributing towards those health problems. This understanding was informed by her educational background and further research as indicated in the literature chapter. Phase 3 involved identifying specific health behaviours linked to those identified health problems in phase 2 and since the author of this thesis had public health knowledge from her previous studies, the health problem was already identified as obesity. The factors identified included

lifestyle and behaviour factors such as eating habits, physical exercise and sedentary behaviours.

Phase 4 of the intervention development focused on categorising those factors from Phase 3 that appeared to have direct impact on behaviour into predisposing factors, enabling factors, and reinforcing factors. In phase 5 cross examination of factors from phase 4 allowed the author to decide that nutrition, physical activity and sedentary activity factors were important to focus on in the intervention. At phase 6, the author started the actual development and implementation of the education intervention by selecting setting, assessment and metrics to use, administration and required resources to complete the intervention. The last stage of developing the intervention, Phase 7, was evaluation of the whole process which was integrated continuously from phase to phase and then an overall evaluation conducted at the end. Because this study was using the MRC framework, the evaluation included piloting the developed intervention to determine if it was feasible. This was also important in validating the intervention before implementation. Twelve students piloted the intervention and weaknesses were identified such as some slides not being clear enough, some participants could not understand some vocabularies, and some content was lengthy. These weaknesses were used to enhance the designed intervention before implementation to achieve high and positive impact.

Furthermore, the study examined similar programmes and their components. By doing so it was able to identify limitations and strengths from prior programmes. Higgins and Green (2008) have argued that identifying intervention limitations and strengths from relevant literature helps a public health researcher to counter limitations and to adopt strengths to make an intervention more effective. Investigating the different school-based intervention programmes led the programme to include three main lifestyle aspects, namely eating habits, physical activities and sedentary lifestyle as critical behaviour factors linked to obesity. The primary nutritional concepts which were integrated into this programme are the following: Food Pyramid (Salas-Salvadó et al., 2011), Energy Balance (Ammerman et al., 2002), BMI Chart (Woolford et al., 2008), Healthy Plate (Michie et al., 2009) and Food Labels/Nutrition Facts.

3.14.2 Children's Dietary Intervention Plan

The objective of the intervention was to assess the impact of interventions that promote healthy eating on Saudi schoolgirls aged 9 to 16 years old. The intervention was scheduled to

take place over a three-month period, followed by anthropometric measurements and semi-structured interviews. The parts of the intervention included (a) introduction (*10 minutes*); (b) children's presentation (*30 minutes*); (c) children's interactive session (*20 minutes*) covering healthy eating tasting, healthy activity colouring, and healthy eating quizzes and games; (d) plenary (*10 minutes*) that involved summary, a question and answer session, distribution of booklets on obesity and BMI charts, and distribution of an approved diet plan table.

3.14.3 Programme Objectives

Based on the current feasibility study, the objectives of obesity education intervention programme are:

1. To understand the effectiveness of school-based obesity education intervention on children behaviour.
2. To elucidate eliciting facts that help address the children-diet and nutrition behaviours.
3. To integrate walking and physical exercise into regular routine.
4. To increase awareness about healthy eating among schoolgirls.
5. To grasp the nature of sedentary activities of schoolgirls.

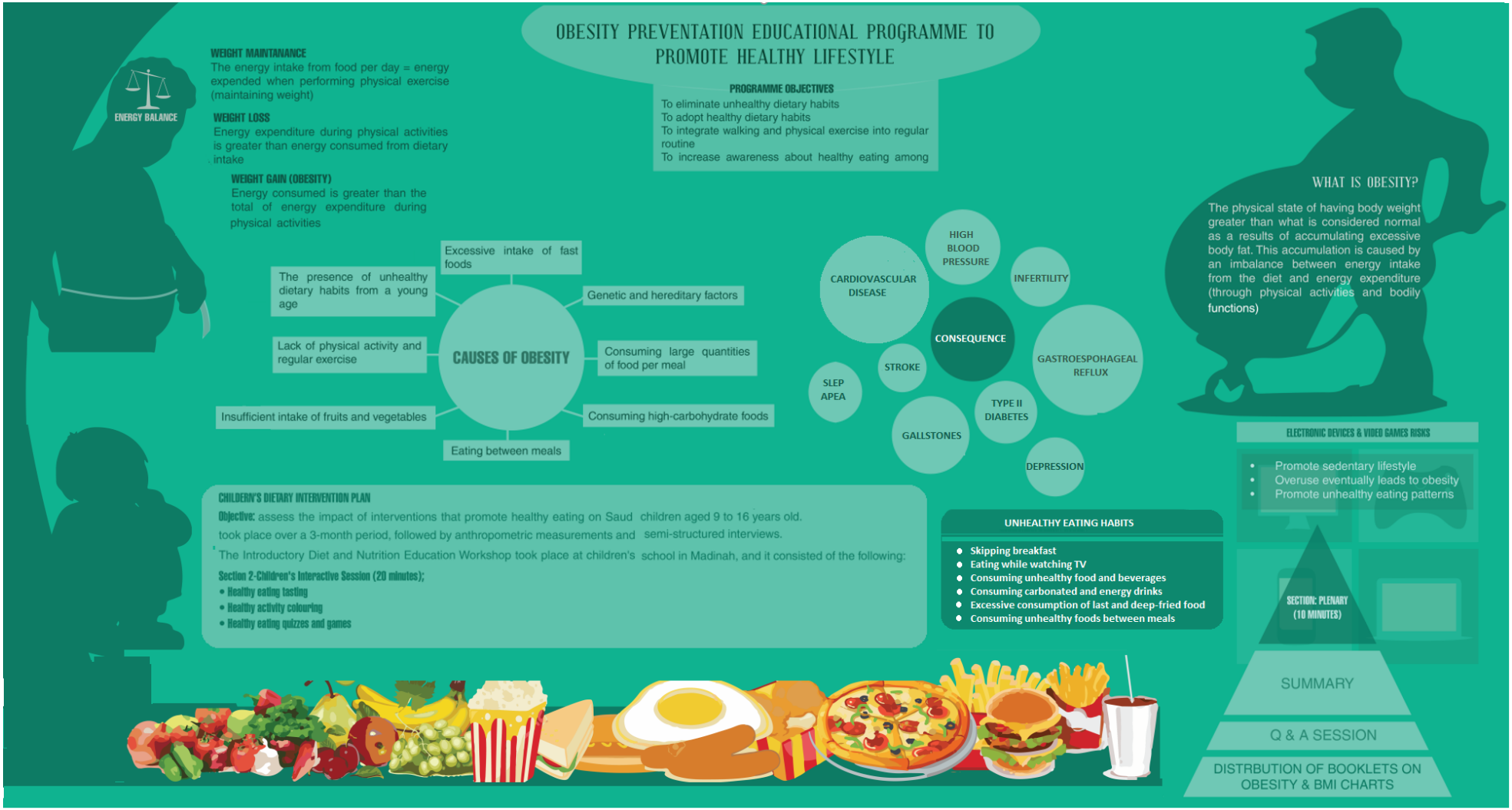


Figure 7. Obesity prevention educational programme.

3.14.4 Major Content

- **What is obesity?**

The definition of obesity was adopted from Daniels' (2007) study that described obesity as the physical state of having body weight greater than what is considered normal as a result of accumulating excessive body fat. This accumulation is caused by an imbalance between energy intake from the diet and energy expenditure (through physical activities and bodily functions) (Daniels, 2007).

- **How do you determine your healthy weight?**

This was aimed at describing BMI which is the method used to determine the weight and height for a given age (Canters for Disease Control and Prevention, 2011). Important points with regards to attaining a healthy BMI were maintaining balance between energy intake and energy expenditure through: (1) weight maintenance – the energy intake from food per day= energy expended when performing physical exercise (maintaining weight); (2) weight loss - energy expenditure during physical activities is greater than energy consumed from dietary intake; and (3) weight gain (obesity) – energy consumed is greater than the total of energy expenditure during physical activity (IOTF, 2006;Canters for Disease Control and Prevention, 2011; WHO, 2015)

- **Causes of obesity**

The causes of obesity include: (1) genetic and hereditary factors, (2) consuming large quantities of food per meal, (3) consuming high-carbohydrate foods, (4) eating between meals, (5) insufficient intake of fruits and vegetables, (6) lack of physical activity and regular exercise, (7) the presence of unhealthy dietary habits from a young age, (8) excessive intake of fast foods (Al-Rukban, 2003; Khalid, 2008; Ebbelling et al., 2002; Daniels, 2007;Canters for Disease Control and Prevention, 2011).

- **Consequences**

The literature identifies the consequences of obesity to include cardiovascular diseases, infertility, high blood pressure, type II diabetes, gastroesophageal reflux, gallstones, sleep apnoea, and depression (Canters for Disease Control and Prevention, 2014; Bariatric and Metabolic Institute, 2016).

- **Unhealthy dietary habits and development of diseases**

They involve (1) *consuming foods rich in fat* eventuating to high cholesterol; the pancreas stops producing insulin causing diabetes and/or obesity; (2) *Consuming high-sodium foods that* result in high blood pressure;(3) *consuming sugary foods and beverages* that cause higher risk of diabetes and/or obesity (Young, 2003; Mazzocchi et al., 2009; Murphy, 2010).

- **Some unhealthy eating habits among schoolgirls**

The poor dietary habits identified included skipping breakfast, eating while watching TV, consuming unhealthy foods and beverages at the end of the school day, consuming carbonated and energy drinks, excessive consumption of fast and deep-fried foods, and consuming unhealthy foods between meals (Al-Hazzaa, 2006; Al-Dossary et al., 2010)

- **Danger of energy drinks**

One can contain 10 spoons of sugar, enough to destroy Vitamin B which leads to indigestion, weak physique, headaches, short-temperedness and depression (Al-Hazzaa, 2006); caffeine that results in heart palpitations (Wong & Leatherdale, 2009); causes brittle and fragile bones (Jaminet, 2013).

- **Healthy dietary habits**

They include eating breakfast regularly, eating sufficient amounts of fruits and vegetables, eating less sugary foods, eating less salted and spicy food, reducing consumption of carbonated and energy drinks, reducing consumption of tea and coffee, drinking milk and consuming sufficient amounts of dairy products, and maintaining regular physical exercise (Ludwig, 2008; Wong & Leatherdale, 2009; Murphy, 2010).

- **Healthy dietary requirements**

Healthy dietary requirements include a balanced diet, sufficient food intake, regular exercise, and healthy cooking methods such as steaming and grilling (Ludwig, 2008).

- **The importance of breakfast**

Consuming breakfast is associated with better study performance as it improves concentration and understanding, improving mood as a result of sufficient intake of carbohydrates and improved activity reflecting positively on understanding and social interaction (Krebs et al., 2007).

- **Things to do before going to shop for food**

To facilitate the purchase of healthy food it is advisable to prepare a to-buy list, read the nutrition facts labels (Food labels) of foods to buy, and calculating the calories of food before buying (Agostoni et al., 2011).

- **Ways to lose weight**

Good practices that result in weight loss include: (1) allocate fixed times for the three main meals and consume sufficient amounts of fruits and vegetables between meals; (2) walking for half an hour daily; (3) regular exercise; (4) choosing healthier cooking methods such as steaming or grilling and staying away from foods rich in fat; (5) consuming only 2 spoons of sugar per day or replace it entirely with fruit; (6) eating sugary desserts in moderate quantities; (7) drink plenty of water, (8) and consume herbs that help with fat loss, e.g. green tea, camomile, ginger (Ebbeling *et al.*, 2002; Nemet et al., 2005).

- **Benefits of raw (unroasted) nuts**

The health benefits of eating raw nuts include improved concentration and attention, rich in fibre and healthy fat, rich in vitamins and minerals, e.g. magnesium and zinc, eating nuts before meals helps with consuming less quantities of food (Ludwig, 2008). Fibre reduces feelings of hunger, reduces sugar levels in the blood, reduces the risk of developing haemorrhoids and colon cancer, and reduces body absorption of fat (Ebbeling *et al.*, 2002).

- **Healthy alternatives**

Some foods that have high calories, sugar or fats can be substituted by other foods that are considered healthier. Examples of the foods are listed in the table below.

Table 5. Substitution in favour of healthy foods.

Unhealthy	**Healthy**
White bread	Whole meal bread
Whole milk	Skimmed milk
Ice cream	Yogurt
Sweets	Dates
Cakes	Fruit salads
Carbonated drinks	Fresh juice
Bakeries	Homemade sandwiches

- **The importance of physical exercise**

The benefits of regular and high levels of exercise include (1) weight gain + physical activity = healthy lifestyle, (2) helps in maintaining healthy body weight, (3) reduces risks of diabetes and high blood pressure, (4) reduces risks of anxiety and depression, (5) helps maintain healthy bones, muscles and joints, (6) increases self-esteem (Ebbeling *et al.,* 2002; Nemet et al., 2005).

- **Portion size**

For healthier recommended lifestyle, one should consume a fistful of carbs and proteins while filling the rest of the plate with vegetables or fruits (Ludwig, 2008).

- **Prophet Muhammad (PBUH) on eating**

  "*The son of Adam does not fill any vessel worse than his stomach. It is sufficient for the son of Adam to eat a few mouthfuls, to keep him going. If he must do that (fill his stomach), then let him fill one third with food, one third with drink and one third with air*" (Cited in Abdul-Rahman, 2004: 258).

3.15 Data Analysis

3.15.1 Quantitative Analysis

The BMI SPSS statistic software tool was used to analyse collected quantitative data. This statistic software was selected because (1) the researcher had skills to use it, (2) the software is user friendly, and (3) it supports a variety of statistical functions and associated tools for analysing quantitative data, including descriptive statistics, inferential statistics, and quantitative functions (Ellis, 2010). Means with ± standard deviations and median were applied on data like age, height, weight and others to measure central tendency of variables like age. Percentages and frequencies were used for comparison of data against underweight, normal, overweight, and obese children. Correlation, such as Pearson's correlation coefficients (r), was applied to determine the strength and direction of line relationships between BMI and a number of variables such as eating habits, magnitude of physical activity and sedentary behaviours (Appendix 12).

Fisher's exact test was used as an alternative test to Chi-Square tests which measures the association between two categorical variables like quantity of food eaten and BMI. Since the data is considered somehow small Fisher's exact test can be used as an alternative test to measure the associations in a contingency table (Field, 2013). Paired sample t-test was used to examine the impact of the intervention on different variables related to the study including testing whether or not any significant differences ($p<0.05$) existed between the two times

(pre- and post-intervention). In other words, t-test was used to confirm if the intervention had a significant impact on results after the intervention (Field, 2013). One-way ANOVA was used to examine associations between variables such as BMI and hours spent on each activity (see Appendix 13). ANOVA test was applied in measuring the effect of independent variables (with three levels or more) on a dependent variable. It confirms whether or not the IV has a significant effect ($p<0.05$), or if the groups are significantly different from each other (Field, 2013). Statistical significance (p) was set at $p <0.05$ according to universally accepted standards of measuring the level of significance (Anholt & Mackay, 2009).

Descriptive statistics were used for the purpose of describing the frequency an event occurred within the sample population and comparing results to establish findings. Thompson (2009) indicated descriptive statistics is an analysis of numbers that summarise data with the purpose of describing what occurred in the sample. Anholt and Mackay (2009) (2009) explain that descriptive analysis is used to compare samples with one another and helps to detect sample characteristics that may influence study conclusions. The descriptive analysis findings provide an independent method for comparing the results (Bowling, 2005).

3.15.2 Qualitative Data Analysis

According to Creswell (2003) qualitative data analysis is based on interpretive philosophy in which the idea is to examine the meaningful and symbolic content and establish material evidence. Smith and Firth (2011) postulate that qualitative analysis approaches include: (1) socio-linguistic methods that seek to explore the use and meaning of language (e.g., discourse and conventional analysis); (2) methods that focus on the development of a theory (e.g., grounded theory approach); and (3) methods that seek to describe and interpret participants' views (e.g., content analysis or thematic analysis). Because this study's 'raw' qualitative data was in verbatim transcripts from the interview, a thematic analysis approach was selected as the best way of converting the data into patterns that would support explaining quantitative results.

3.15.3 Thematic Analysis

Thematic analysis was suitable for the identification of main, recurrent and important issues as themes arising from the body of evidence collected (Ritchie and Lewis, 2003). Additionally, thematic analysis tended to work with, and directly reflect the main ideas or conclusions across the body of evidence, and show what was prominent (Smith and Firth, 2011). The thematic analysis in this thesis took a deductive approach because the themes were going to be directed by existing concepts or ideas from quantitative (Gale et al., 2013). The

existing concepts included diet or nutritional knowledge and sedentary and activity level. Additionally, thematic analysis through deductive approach appeared to be suitable for organising and summarising the findings from a large body of research to what fits areas such as health research, policy development and programme evaluation (Dowrick et al., 2009). The following diagram adopted from NatCen Learning (2012) describes thematic process in developing themes from collected evidence (Figure 8).

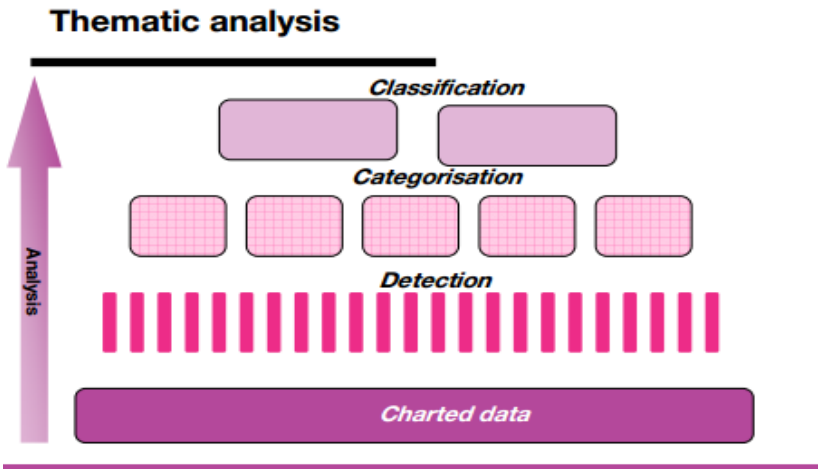


Figure 8. Thematic Analysis Diagram adopted from NatCen Learning (2012).

3.15.4 Framework Method

Ellis (2010) postulated that the framework method is an important tool for supporting thematic analysis because it offers systematic modelling for managing and mapping collected data. A thematic framework was considered suitable for analysing qualitative data collected from this study because study can utilise its metric forms offer an intuitive structured synopsis of data. A thematic framework also was important for comparing and contrasting interview data by themes across cases. According to Ritchie and Lewis (2003) thematic framework is a method used to organise and manage research by defining the process of summarising results in a robust and flexible matrix output that enables analysis according to case or theme. The framework approach to analysis is most applicable when dealing with synthesis of text-based evidence (Smith & Firth, 2011). Additionally, Gale and colleagues (2013) study suggests that the framework method is a popular approach for the analysis of qualitative data in multi-disciplinary health studies. Using the thematic framework method, collected data was taken through seven stages.

Stage 1- transcription: transcription of the recorded audio from the interview was completed. Transcription sheets had wide margins for the purpose of taking notes during analysis and coding.

Stage 2- familiarisation with the interview: The recorded interview audio was re-listened to and reflective notes made during the interview were read to develop thoughts and impressions of the responses and also to be familiar of whole interview results with regards to nutrition knowledge, sedentary and physical activity, and obesity (Polit, 2010). This was significant to get acquainted with the type of responses given by the participants.

Stage 3- coding: the researcher carefully read the transcripts line by line noting and labelling (coding) what is interpreted of the transcripts. Having used a deductive qualitative approach, the codes were already pre-defined and included diet, nutrition, healthy eating, unhealthy eating, and sedentary and physical activity levels.

Stage 4- developing a working analytical framework: after coding the first 5 interviews, the author compared the established labels to consider if they could be applicable to the remaining transcripts. The main codes were grouped together into categories: 'diet and nutrition knowledge' and 'sedentary and activity level'.

Stage 5- applying the analytical framework: the identified codes were indexed in such a manner that the full names of the codes will not be re-written in subsequent analysis. This was crucial to save time and to enhance readability.

Stage 6- charting data into matrix: to summarise the voluminous data, a table matrix with labels, categories, and with reference to interesting illustrative quotations from participants was drafted. This was done cautiously to ensure that the summary retains original meaning and the ‘feel’ of the participant’s words.

Stage 7- interpreting data: at this stage, major characteristics and differences between data were identified, prior theoretical concepts and typologies and connections to quantitative findings were interrogated to present description and explanation of identified themes (Pope et al., 2007). Connections between the identified categories (themes) were further analysed to ensure that the developed themes uniquely explained quantitative results.

3.16 Rigour in Qualitative & Quantitative Research

Different strategies exist within research to protect from bias and enhance and ensure the soundness of a research study. Rigour presents itself as one of those strategic means through which a given study can be said to be trustworthy. The visibility of rigour is

established by adopting and employing appropriate research tools, which meet the delineated research objectives.

Although traditionally rigour is associated with hypothesis-driven and confirmatory research endeavours, criteria of rigour are increasingly set for descriptive and exploratory research. In fact, rigour in all types of research should be understood as inherently desired in-and-of-itself and hence should not be confused with notions of generalisability, measurement precision and quantification. Within the context of quantitative research, rigour is determined by the instrument construction (Golafshani, 2003), whereas in qualitative research "the researcher is the instrument" (Patton, 2001:14) meaning that the ability and effort of the investigator become the tools whereby rigour is measured.

The idea of reliability is used in all kinds of research. In quantitative research, it signifies "*the extent to which results are consistent over time…*" (Joppe, 2000 cited in Golafshani, 2003) and indicates of an accurate representation of the population under study. Reliable test results in quantitative terms are also measured in their ability to remain stable, meaning that upon replication (or repetition) the same research results can be re-obtained under similar methodology (ibid). In this sense, the more stable a test result is the more reliable it is, which indicates replicability. Having said that, the reliability of a test measurement instruments -as evidenced through its consistency and replicability -does not imply in and of itself the validity of those instruments.

The simplest way reliability is measured in qualitative research is by evaluating the quality of the information elicited; accordingly, an adequate qualitative study can better our understanding of "...a situation that would otherwise be enigmatic or confusing" (Eisner, 1991: 58). Reliability as approached in this sense would serve different purposes depending on the kind of research, thus, the quality concept in a quantitative study would serve the "purpose of explaining" whereas in a qualitative study it would serve the "[purpose of] generating understanding"(Stenbacka,2001:551). To Patton (2001) the task of measuring reliability (and validity) is extended to all stages of the study i.e. when devising the study, analysing findings and assessing the overall quality of the study. This perspective is further embodied in the following question: "*How can an inquirer persuade his or her audiences that the research findings of an inquiry are worth paying attention to?*" (Lincoln & Guba, 1985: 290).

3.16.1 Validity

Validity in quantitative research concerns the dual factors of accuracy of measurement instrument and the actual measuring of what is intended to be measured (Joppe, 2000 cited in Golafshani, 2003). Wainer & Braun (2013) define validity in quantitative research in terms of "construct validity" in which construct signifies the initial concept, question or hypothesis that guides the nature of the data to be collected and the manner in which it is collected. They further warn against the involvement of the researcher during the research process purporting that such involvement can potentially reduce the validity of the test.

Validity in qualitative research is not as clear-cut as in its counterpart this is because validity within the domain of qualitative research has no unified definition; one reason is that validity is influenced by the researcher's own perception/judgment of what makes a study valid (Creswell & Miller, 2000). Hence, it is not uncommon for a researcher to have come up with their own concepts for validity; this also entails the adoption of what they regard as more apt terms, including: trustworthiness, quality and rigor (Davies & Dodd, 2002; Seale, 1999; Stenbacka, 2001).

That being said, certain principles can be put to test to ascertain the degree to which rigour is established in a given qualitative research. These principles are analogous with the aforementioned concepts of validity and reliability, they are: credibility, dependability, conformability and transferability.

3.16.2 Criteria of Trustworthiness

3.16.2.1 Credibility

Addressing credibility involves presenting a genuine portrayal of the phenomenon under scrutiny. In so doing, the research engages in the question "*how congruent are the findings with reality?"* (Merriam, 1998). To Lincoln and Guba (1985) establishing credibility is one of the most critical factors when approaching trustworthiness in a qualitative endeavour as it equates to the confidence that can be placed in the truth of the research findings (Holloway & Wheeler, 2002; Macnee & McCabe, 2008).

According to Credibility as a quality criterion contributes to a conviction in the trustworthy nature of the data by making the following possible provisions: (i) the use of appropriate, well-established research methods in the qualitative research enterprise; (ii) a familiarity with the culture of the participating parties (usually by means of prolonged engagement) developed early on and prior to conducting preliminary data collection; (iii) triangulation which can be

employed as a strategic means of validation of the procedures and findings, serving therefore the objective of observing the research issue from more than one angle (Flick, 2004); (iv) the examination of findings of past research to evaluate the extent to which the findings at hand are congruent with previous ones. Silverman (2000) recognises the ability to relate findings to an existing body of knowledge as a key criterion for assessing attempts of qualitative inquiry; and (v) member checks which as per the request of the researcher engages the participants in reviewing the collected data as well as the interpretations inferred by the researcher. Considerations made on the basis of ethical, religious and cultural issues contributed to the credibility of this study. In addition, credibility was established through implementing a carefully-thought out research method. The researcher set out to understand and examine the effectiveness of a multi-component intervention on dietary behaviour of schoolgirls; the twin factors of the truth of the research data as well as the manner in which data was interpreted helped in assessing the effectiveness of the intervention. Moreover, triangulation of data by means of mixed methods increased the credibility of the study through enhancing the integrity of the findings.

3.16.2.2 Transferability

Transferability is defined as the ability of the outcomes obtained from qualitative research to be applied or transferred to different contexts with the involvement of other populations; in this sense, transferability is taken to be "the interpretive equivalent of generalisability in quantitative research" (Anney, 2014: 277). As specified in Bitsch (2005), the "researcher facilitates the transferability judgment by a potential user through 'thick description' and purposeful sampling" (ibid: 85). Which points to the importance of the provision of detailed background description of the enquiry as well as the purposive selection of participants to allow for thorough understanding of the phenomenon under study and the availability of a range of perspectives, respectively? In addition, sufficient data of the phenomenon and the context of fieldwork, allows for comparisons to be made and enables the reader to make judgements as to the similarities between the prevailing environment and another setting with which they are familiar (Shenton, 2004); to verify transferability the reader would then set out to draw conclusions concerning the justifiable grounds for the findings to be deemed applicable to the other setting(s).

The prospect of transferability has been questioned on the basis of the futility of attempting to show that findings and conclusions can be transferable to other situations and respondents, owing to the fact that all observations are context-specific (Erlandson,1993) and do not seek

to generalise. This view is not shared by Stake (1994) and Denscombe (1998) who argue that in spite of the uniqueness of each individual case, they remain examples within a larger group, hence transferability should not be dismissed immediately on these grounds.

3.16.2.3 Dependability

Dependability refers to the "stability of findings over time" (Bitsch, 2005: 86). This particular criterion can prove a difficult quality standard to achieve in qualitative research, nonetheless qualitative investigators should at least "strive to enable a future investigator to repeat the study" (Shenton, 2004).

When verifying dependability, participants are asked to engage in assessing the findings of the study, interpretations and the recommendations produced by the researcher. This process reinforces and ensures that findings, interpretations along with the recommendations are supported by the data collected from the informants (Cohen et al., 2011; Tobin & Begley, 2004). Dependability as described above is closely tied to credibility as stressed by Lincoln and Guba (1985) who further maintain that, a display of the former goes a long way towards ensuring the latter. This being said, certain provisions can go some distance in achieving dependability when addressing qualitative inquiry; for instance, providing a comprehensive description of the methodology to allow for the replicability of the study findings, this further has the advantage of permitting the reader to evaluate the degree to which appropriate research practices have been adhered to (Shenton, 2004). To do this, some supporting sections can be included into the research which are dedicated to the following (adopted from Shenton, 2004):

1. a research design and its implementation, outlining what went into the planning and what was performed on a strategic level;
2. a functional detail of data collection, addressing the minutiae of what was done in the field; and
3. a reflective appraisal of the project, assessing the effectiveness of the process of inquiry undertaken

In addition, conducting a qualitative research study engages the researcher from the initial stages, through the collection of data, to the analysis of data stages on a subjective level. Thus, for the researcher it was important to recognise her role and the extent to which she influences the processes concerned with the gathering and analysis of data and by extension the resulting outcomes. The reflexivity section included within this study addresses how the researcher's own beliefs, values and (pre-) judgments impacted the various stages of the

research process. Herein, the researcher perceives her position as a mother and a former primary school teacher as influences, this was further coupled with her belief that her cultural and religious background also had an integral role in her understanding and interpretation of the responses obtained from the research respondents. This may also have affected the quality and credibility of the information the participants shared with her.

3.16.2.4 Conformability

Conformability in qualitative research is met when precautions are taken to ensure that it is the findings that emerge from the collected data rather than the researcher's characteristics (Shenton, 2004). In other words, the researcher should ensure to the best of their abilities that the findings of the study are derived from the experiences and ideas of the respondents, and not as a result of the researcher's preferences and predispositions, hence minimising the effect of researcher bias.

Previous studies show that conformability can be attained through an audit trail, reflexive journal and triangulation (Bowen, 2009; Koch, 2006; Lincoln & Guba, 1985). Other provisions could be made to account for conformability of qualitative inquiry, such as: providing an in-depth description of the methodology to allow the reader to make judgments about the degree to which the data and constructs deriving from it may be approved of as well as enabling the integrity of the findings to be subjected to scrutiny; and the illustration of audit trail using diagrams.

This study used triangulation as one way to bolster conformability in research. For this purpose, the researcher should acknowledge shortcomings of the methodological choices and their possible effects; while the underpinnings for showing preference for a certain approach over other potential ones should be recognised and admitted too (Shenton, 2004; Miles and Huberman, 1994).

Given that this criterion is concerned with utilising obtained data to confirm findings, conclusions and recommendation (Denzin & Lincoln, 2005) the researcher proceeded carefully in maintaining an agreement between the proposed interpretations and the given outcomes. To this effect, the researcher carried out all the interviews herself, recording the interviews increased the credibility and conformability of the data collection process. The same process involved reading of the transcripts and identifying emerging themes from the interviews, this was followed by a thorough interpretation of the data, which at times required

the researcher to seek clarification from and checking with interviewees as to whether what they wanted to express has been understood successfully.

3.17 Summary

This chapter has discussed a broad range of research design and methodology concepts and theories applied in this thesis, along with the research paradigms and philosophy and how they influenced this research study. Qualitative and quantitative research paradigms were explored and it was concluded that combining the two in a mixed methods approach would have significant results rather than utilising a single method. The chapter also introduced the design of the intervention programme and the main components used. The chapter covered how the intervention was planned to deliver awareness to participants by indicating how to determine obese status, causes of obesity, and consequences, unhealthy dietary habits, health dietary requirements, things to consider before buying food and ways to lose weight. As part of this chapter, we outlined the role of the MRC Framework in guiding the development and evaluation of complex interventions that seek to improve health. We have also reviewed PRECEDE model and its phases, and how as an evaluation framework it can assist in analysing situations and devising efficient health programmes. The procedure and justification of using mixed methods in collecting and analysing data has been presented. The quantitative tools used, such as questionnaire surveys and anthropometric measures and the semi-structured interview as a qualitative tool were discussed along with their significance. The process of carrying out both quantitative and qualitative data collection was also explained. Methods for analysing quantitative and qualitative data were further provided and the study's results will be presented in the next chapter.

4.1. Introduction

This chapter presents the quantitative and qualitative results which were obtained by collecting the data by the questionnaire and interviews respectively. These data were then analyzed using the BMI SPSS statistic software. The quantitative results are presented in structured segments starting with pre-intervention, post-intervention, comparison between pre- and post- intervention, and comparison of pre- and post- intervention on overweight and obese participants. The questionnaire item developed into key variables along with weight and BMI data are analysed using descriptive and inferential statistics. Descriptive statistics are reported in the forms of mean/average (M), frequency (N), percentages (%) and standard deviation (SD). Graphs (bar charts) and tables are also used essentially to illustrate inferential results along with descriptive statistics.

4.2. Quantitative Data Results

The quantitative results were grouped into five segments, as presented in Table 6. Results presented in segments 1, 2 and 3 are descriptive in their nature. Segment 1 presents analysed data in the Pre-Intervention Phase (phase 1); Segment 2 presents data for the post-intervention phase (phase 2) while Segment 3 contains results comparing pre- and post-intervention data generated by children.

4.3. Pre-Intervention

4.3.1. Children's Questionnaires

This part focused on descriptive analysis of data collected from children before the intervention. The results were grouped into personal details, activities and lifestyle, and diet and nutrition. The main aim of this part was to provide an indication of the children's nutrition awareness and health before the intervention.

4.3.1.1. Section A: Personal Details

This entailed socio-demographic data (age and who the child lives with) and physical measures (weight, height and BMI) for all 90 participants.

Age Distribution of the Participants

The mean age of the total sample was 11 years (SD=1.86). The 10-year old group accounted for 30% of the whole sample. The remaining age groups were roughly equally distributed (between 10 and 16), the results showed that the distribution sufficiently reflected the full

spectrum of age views within the range of 9–16 years old. A more detailed examination of the distribution of age is presented in Table 7.

Table 6. An overview of the results structure in Chapter Four.

Segment 1	**PRE-INTERVENTION**
	These included personal details and activities of the children. Section A: Personal Details Section B: Activities and Lifestyle Section C: Diet and Nutrition Parents questionnaires: Section A: Parent's Education and Employment Status Section B: Parent's health Section C: Parent's perceived child's BMI and sedentary activity Section D: Child's Diet and Nutrition
Segment 2	**POST-INTERVENTION**
	Children questionnaires Section A: Weight and BMI Section B: Activities and Lifestyle Section C: Diet and Nutrition
Segment 3	Comparison between pre and post intervention for children
	Section A: Weight and BMI Section B: Activities and Lifestyle Section C: Diet and Nutrition
Segment 4	Comparison between pre- and post- intervention for overweight and obese children.
Segment 5	Conclusion

Table 7. Frequency distribution for age.

Age	N	%
9	4	4.4
10	27	30.0
11	12	13.3
12	12	13.3
13	15	16.7
14	10	11.1
15	9	10.0
16	1	1.1

Ages were categorised into three groups and they appeared to be roughly proportional. Therefore, there was a fairly good fit for the age group categories of the participants. Results in Table 8 present information about the frequency and relative frequency distribution for different age groups.

Table 8. Frequency and relative frequency distribution of Age groups

Age in groups	N	%
(9-10)	31	34.4
(11-12)	24	26.7
(13-16)	35	38.9

Child Lives with both Parents or alone Parent

The participants were asked to provide information about the person/s they live with. From the results, the majority of the respondents reported a typical family relationship where they live with both parents (93.3%), whereas a very small number of respondents live with either their mother alone or father alone. The outcome from the result reflected that the majority of the participants enjoyed a normal or typical family relationship. Table 9 provides the frequency of children who live with both parents, only with their mother, or only with their father.

Table 9. Frequency of children living with either parents or alone parent

Live with	N	%
Both Parents	84	93.3
Mother alone	5	5.6
Father alone	1	1.1

Physical Measures

To determine obesity among the participants, their height, weight and BMI were measured. Table 10 presents the mean height, weight and BMI recorded.

Table 10. Descriptive statistics for height, weight and BMI for children

	Mean	SD	Minimum	Maximum
Height (m)	1.48	0.10	1.00	1.72
Weigh (kg)	52.04	11.19	40	112
BMI (kg/m^2)	23.81	5.20	14.88	50.45

The BMI was further classified into three categories according to WHO standard for children in which underweight (BMI≤18.50); normal range weight (18.51≤BMI≥24.99); overweight

(25.00≤BMI≥29.99); obese (BMI≥30.00). The frequency for each BMI category was analysed and presented in Table 10. 28.9% of the participants were found to be overweight and obese.

Table 11. Frequency distribution for BMI categories

BMI categories	**N**	**%**
Underweight	7	7.8
Normal weight	57	63.3
Overweight	21	23.3
Obese	5	5.6

4.3.1.2. BMA as a function of Age

To understand BMI as a function of age, Table 12 reports BMI observations among the younger group (9-10) and the older group (14-16) the result shows a higher mean score among those two groups compared to the 11-13 years old children.

Table 12. Descriptive statistics for BMI for different age groups

Age in years	N	Mean	SD
(9-10)	31	24.73	4.78
(11-13)	39	22.47	3.51
(14-16)	20	24.99	7.72

4.3.1.3. Section B: Activities and Lifestyle

This section aims to examine the level of sedentary activity and physical activity the girls were involved in. For every activity, descriptive statistics were first presented and then inferential analyses as to whether these activities are associated with BMI followed.

Sedentary Activity

Results showed that playing video games was not a common activity among the girls in this sample. From the result, 77.8% claimed they played video game for less than an hour a day. On the other hand, a significant portion (28.9%) reported spending at least 3 hours a day using their smart phones or tablets while 41.1% claimed to spend between 1 to 3 hours daily playing video games (see Table 13).

Table 13. Frequency distribution for daily hours children are involved in sedentary activities

Number of hours spent on daily sedentary activities	**< 1 hour**		**1-3 hours**		**>3 hours**	
	F	**%**	**F**	**%**	**F**	**%**
Watching TV	33	36.7	40	44.4	17	18.9
Working on computer or internet	42	46.7	33	36.7	15	16.7
Smart phones and tablet	27	30.0	37	41.1	26	28.9
Playing video games	70	77.8	16	17.8	4	4.4

No significant differences were found in

BMI as a Function of Hours Spent Watching TV

A series of one-way ANOVA tests were carried out to examine whether the number of hours spent on each activity has an impact on their BMI. Specifically, the research set out to test whether the mean BMI differed across the number of hours spent in each activity. The descriptive statistics upon which the analyses were based are summarised in Table 4. The results ranged between 4,4% and 77.8%. The highest BMI (77.8%) was related to playing video games within less than 1 hour. The statistical analysis of BMI for children who spend less than an hour, between 1 to 3 hours and more than 3 hours watching TV were ($F_{(2,87)}$=0.13, p=.879), on the computer ($F_{(2,87)}$=1.50, p=.230), using their smart phone/tablet ($F_{(2,87)}$=2.29, p=.107) or playing video games ($F_{(2,87)}$=0.076, p=.927).

Table 14. Mean (M) and standard deviation (SD) for BMI for each category of each activity

Variables parameters	Statistical test	< 1 hour	1-3 hours	> 3 hours
Watching TV	M	24.12	23.75	23.33
	SD	5.85	5.49	2.87
Computer	M	24.35	22.60	24.95
	SD	5.20	2.95	8.2
Smartphone or tablet	M	25.56	22.89	23.30
	SD	7.20	2.71	5.21
Video games	M	23.85	23.89	22.81
	SD	5.48	4.42	3.66

Physical Activity

To find out the relationship between physical activity and obesity, the participants' responses were analysed. From the data gathered, we can see the frequency at which participants are

involved in sports and other forms of physical activities. Household work (54.4%) and walking (54.4%) were the most common source of physical activity observed among the participants as shown in Figure 9.

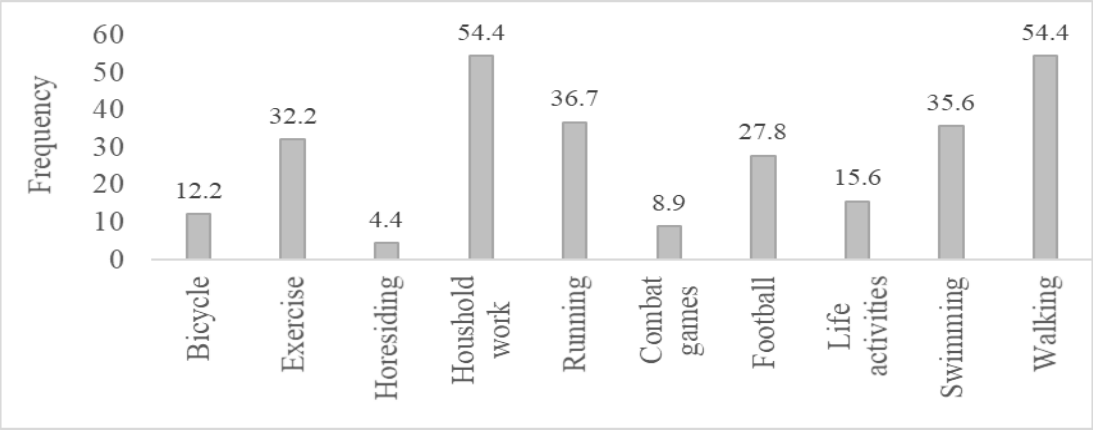


Figure 9. Mean of participation in each sport/activity

BMI as a Function of Hours Exercising a Week

Figure 10 shows a trend for a healthier BMI as the number of hours dedicated to exercise increases. The highest BMI was when the participants spend more than 6 hours a week of exercise. These results show that the differences between hours of exercise per week not more than 2.10%. The total sample combined spent, on average, 182.82 minutes per week (SD= 294.69) (3.05 hours/week) exercising.

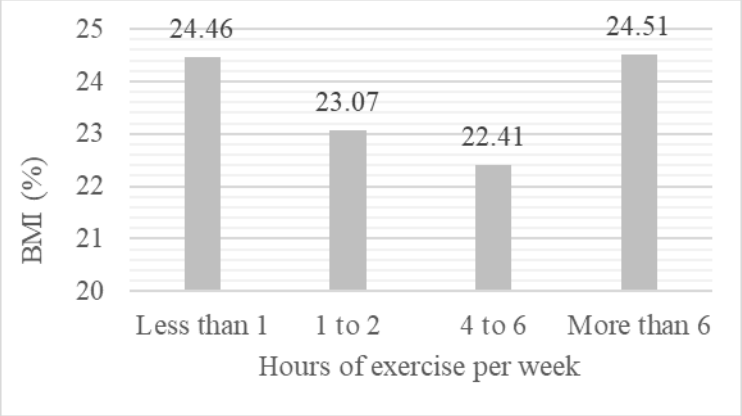


Figure 10. Mean BMI for each category of hours of exercise per week.

A one-way ANOVA was conducted to examine whether BMI varied significantly depending on the number of hours per week dedicated to exercise, using the BMI as the dependent variable and the number of hours of exercise as the independent variable after categorising it into four groups (<1 hour per week; 1-3 hours per week; 3-6 hours per week; more than 6

hours per week). The results did not show significant differences ($F_{(3, 86)} = 0.77$, $p = 0.512$) in BMI between the four groups.

A closer look at the number of hours participants of each BMI category spent on average, exercising indicated that participants classed as overweight spent less hours exercising (Figure 11).

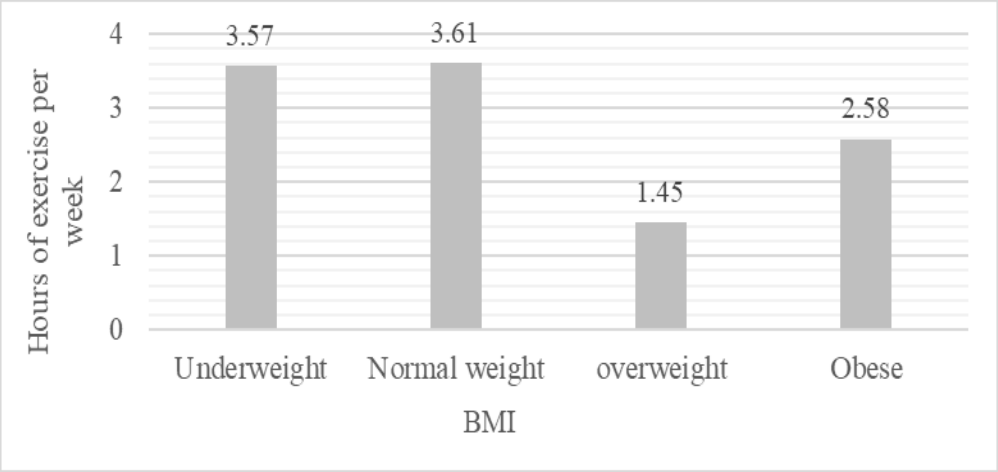


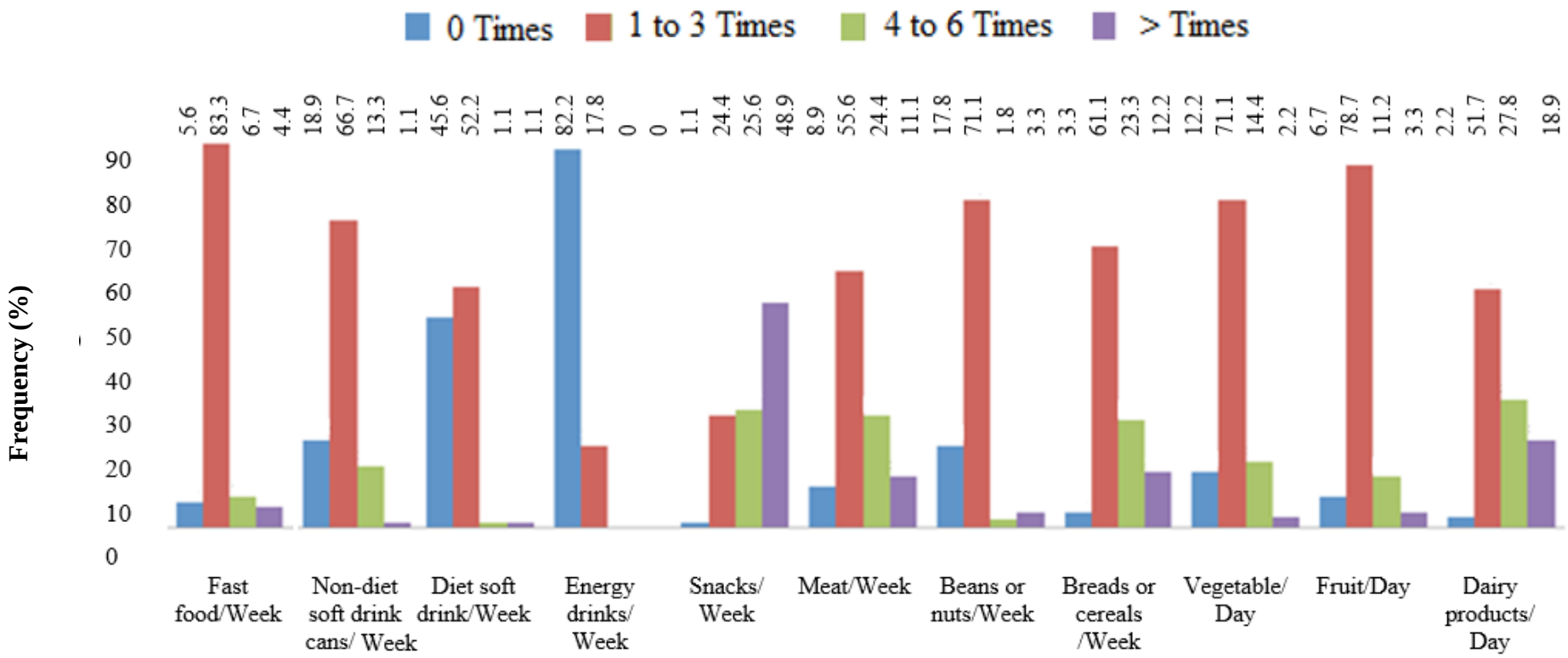
Figure 11. Mean number of weekly hours spent exercising for each BMI category

4.3.1.4. Section C: Diet and Nutrition

This section present results of the participant's dietary habits and nutrition intake

Participant Food Intake

Overall, the vast majority of the participants (83.3%) reported eating fast food between 1 to 3 times per week. In addition, more than half of the participants claimed to consume non-diet (66.7%) and diet (52.2%) fizzy drinks between 1 to 3 times per week respectively. Furthermore, nearly half of the sampled population said they ate snacks at least 6 times a day (48.9%). A significant portion of the girls claimed to eat meat (55.6%), beans or nuts (71.1%) and bread or cereals (61.1%) between 1 to 3 times per week. In addition, the vast majority of the sample said they ate vegetables (71.1%), fruit (78.7%) and dairy products (51.7%) daily. However, it was found that 12.2% do not eat vegetables, 6.7% do not fruit and 2.2% do not have dairy products on daily basis. Descriptive statistics for each type of food intake are shown in Figure 12.



Note: *Non-diet soft drinks, soft drinks and energy drinks are in 350ml cans. Dairy products include cheese, milk and yoghurts. Meat products include beef, camel, chicken, goat, fish and lamb. Beans or nut products include fava beans, lentils and nuts. Bread or cereals include corn, oats, rice and wheat.*

Figure 12. Frequency of the number of times a week or day of dietary intake of fast food, non-diet and diet soft drinks, energy drinks, snacks, meat, beans or nuts, bread or cereals (week) and vegetables, fruit and dairy products (day)

Association between Quantity of Food intake and BMI

In order to analyse the association between quantity of food intake and BMI, Fisher's exact test was applied. A significant association was found between the number of cans of non-diet soft drinks consumed by the participants and BMI (F=28.18, p= 0.008) and a significant association was also found between the number of times vegetables were consumed per week and BMI (F=15.47, p= 0.035).

Table 15. Frequency and Fisher's Exact Test for the association between BMI and quantity of food intake

Diet and Nutrition statements		BMIP of Children Under-weight	%	Normal weight		Over-weight		Obese		Fisher's Exact test	p
		N		N	%	N	%	N	%		
Number of cans of non-diet soft drinks per week	0 cans	0	0	9	15.8	8	38.1	0	0	28.18**	0.008
	1–3 cans	6	85.7	44	77.2	9	42.9	1	20		
	4–6 cans	1	14.3	3	5.3	4	19	4	80		
	> 6 cans	0	0	1	1.8	0	0	0	0		
Number of cans of diet soft drinks per week	0 cans	3	42.9	24	42.1	12	57.1	2	40	9.57	0.576
	1–3 cans	4	57.1	32	56.1	8	38.1	3	60		
	4–6 cans	0	0	1	4.8	0	0	0	0		
	> 6 cans	0	0	1	1.8	0	0	0	0		
Number of times vegetables consumed per day	0 times	0	0	6	10.5	3	14.3	2	40	15.47*	0.035
	1–3 times	5	71.4	45	78.9	13	61.9	1	20		
	4–6 times	2	28.6	5	8.8	5	23.8	1	20		
	> 6 times	0	0.0	1	1.8	0	0.0	1	20		
Number of times fruit consumed per day	0 times	1	14.3	4	7.0	0	0	1	20	12.77	0.090
	1–3 times	5	71.4	45	78.9	17	81.0	4	80		
	4–6 times	1	14.3	8	8.0	1	4.8	0	0		
	> 6 times	0	0	0	0	3	14.3	0	0		
Number of times beans/nuts products consumed per week	0 times	2	28.6	10	17.5	4	419.0	0	0	5.50	0.783
	1–3 times	4	57.1	40	70.2	16	76.2	4	80		
	4–6 times	1	14.3	4	7.0	1	4.8	1	20		
	> 6 times	0	0	3	5.3	0	0	0	0		
Number of times breads/cereals consumed per week	0 times	0	0	1	1.8	1	4.8	1	20	8.39	0.418
	1–3 times	4	57.1	37	64.9	13	61.9	1	20		
	4–6 times	2	28.6	12	21.1	5	23.8	2	40		
	> 6 times	1	14.3	7	12.3	2	9.5	1	20		
Number of times snacks consumed per week	0 times	0	0	1	1.8	0	0	0	0	6.52	0.839
	1–3 times	2	28.6	11	19.3	8	38.1	1	20		
	4–6 times	1	14.3	16	28.1	5	23.8	1	20		
	> 6 times	4	57.1	29	50.9	8	38.1	3	60		

Fast Food Intake

A closer look at the type of food the participants usually eat in fast food restaurants showed different frequencies across the food types consumed, the highest was for chicken burger (74.4%) followed by french fries (71.1%) and pizza (65.6%) which were amongst the most common types of food chosen as presented in Figure 13.

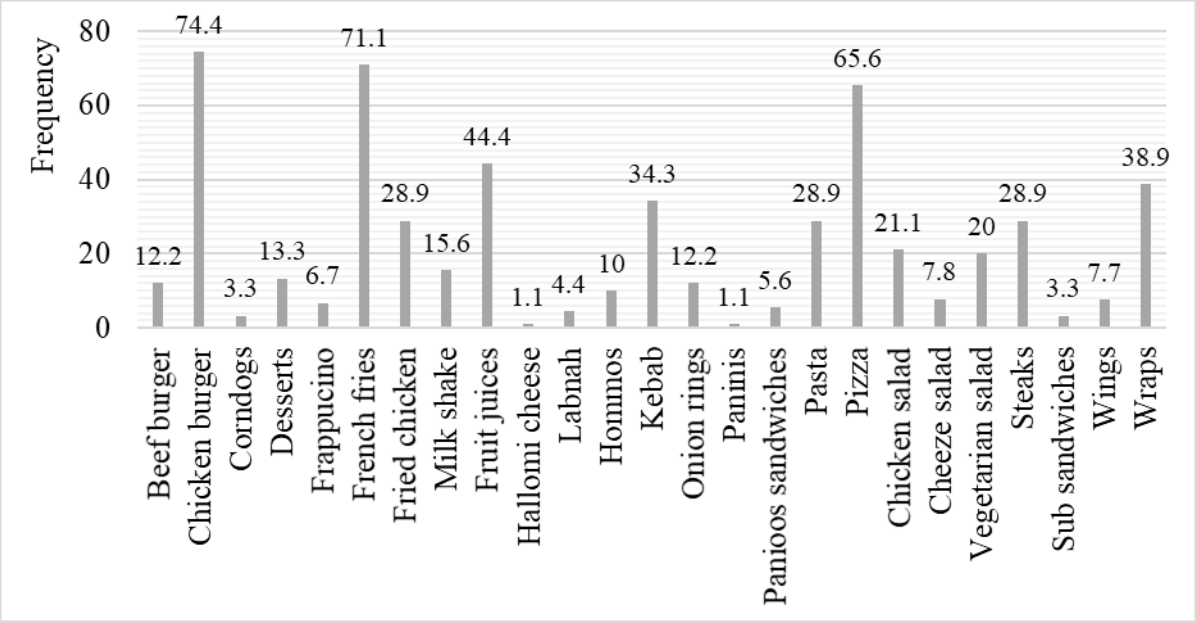


Figure 13. Frequency of participants for each type of fast food

Snacks Consumption Pattern

As for the types of snack consumed by the participant, the analysis (based on mean number) showed that the most common snacks consumed by children were crisps (M=3.12) followed by chocolate bars (M=3.29) and biscuits (M=2.69) as shown in Table 16.

Table 16. Mean and standard deviation for the number of food intakes per week for each type of snack

	Mean	**SD**
Biscuits	2.69	2.64
Sweet pastry	0.97	1.38
Cake	0.94	1.29
Chocolate bars	3.29	3.20
Crisps	3.12	2.80
Donuts	1.08	1.73
Frozen yogurt	0.47	1.05
Ice cream	1.96	2.03
Pastry	1.44	2.27

Breakfast Consumption Trend

When asked to state whether or not they take breakfast and the content of their breakfast, the majority of the participants claimed to have breakfast at home before going to school (78.9%). The types of food, for those who report having breakfast at home showed that bread (52.2%), cheese (46.7%) cereal (41.1%), were the most common foods consumed during breakfast. See Figure 14.

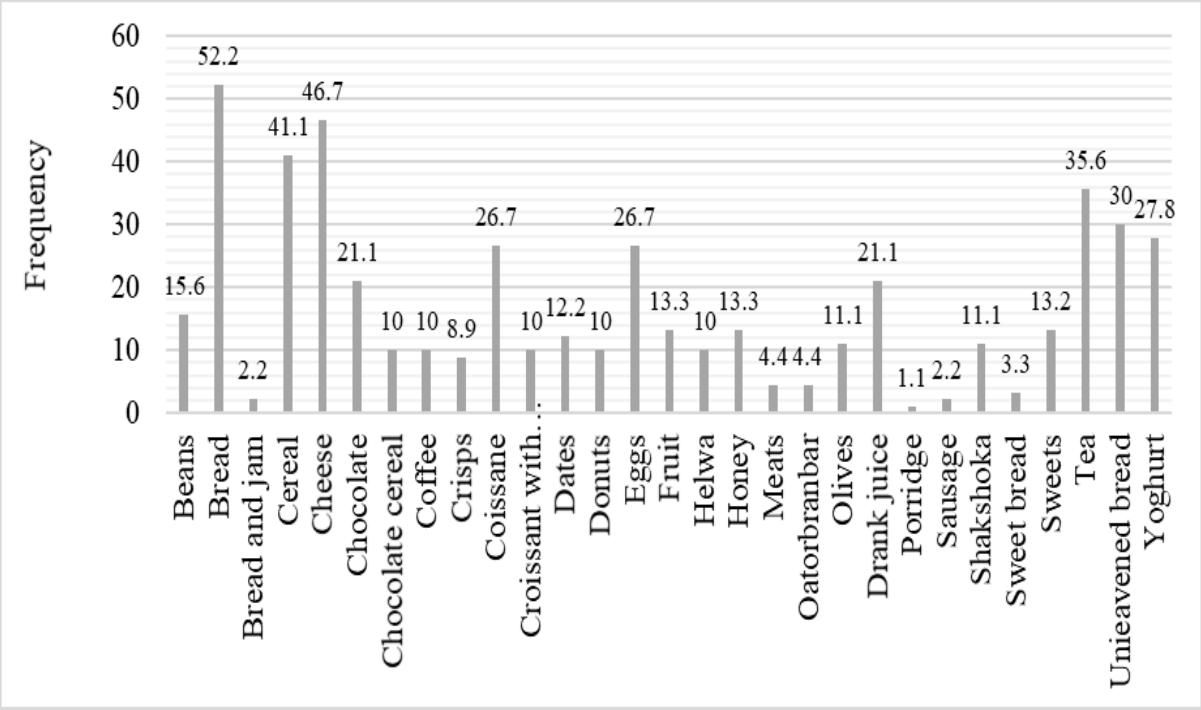


Figure 14. Frequency of participants who eat each type of food for breakfast

4.3.2 Parent's Questionnaire

This section looks into the responses of parents on their beliefs about healthy weight and perception of their children's diet and nutrition.

4.3.2.1 Section A: Parent's Education and Employment Status

This section analyses the level of education and employment status of the participating mothers and fathers.

Parents Education Level

Out of those who responded 86.7% were fathers and the level of education of the parent was similar for both parents. From the data, the largest portion of the parents surveyed it was found that 43.6 % of the male parents and 44.9% of the mothers claimed to hold a bachelor's degree (Figure 15).

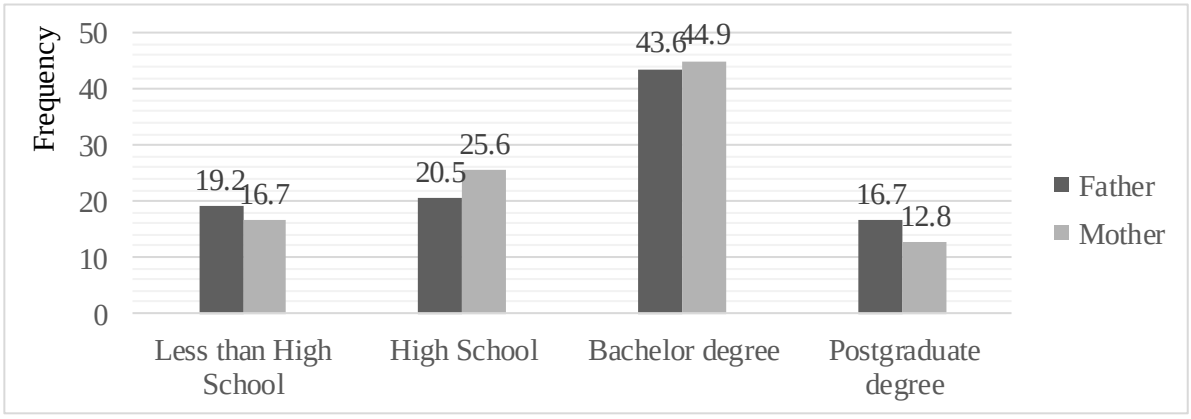


Figure 15. Frequency of education level for father and mother

Employment Trend

The proportion of mothers and fathers who were employed and unemployed was analysed and results showed 74.4% of the male parents claimed they were employed while only 41.1% of the female parents are claimed to be employed as shown in Figure 16.

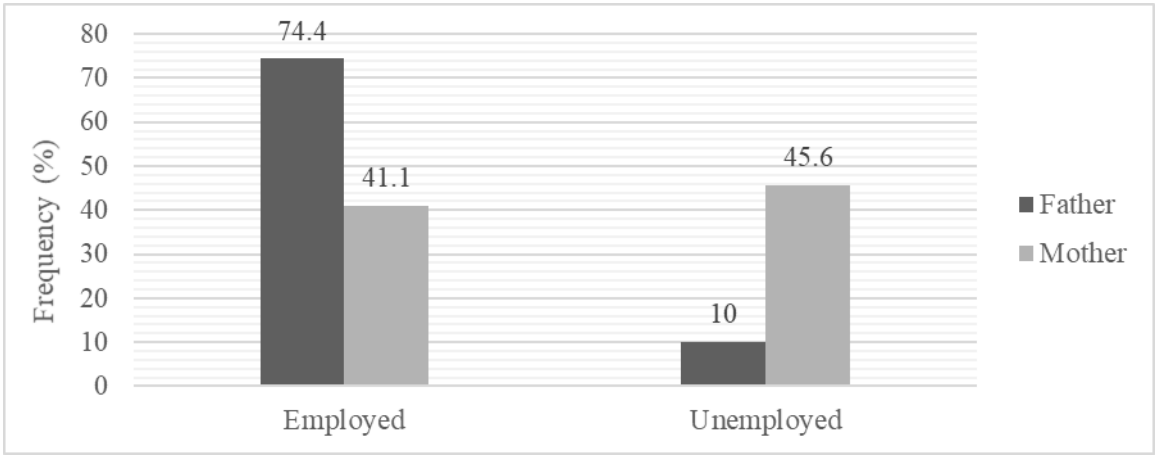


Figure 16. Employment for fathers and mothers

4.3.2.2. Section B: Parent's Health

Parents were asked to provide information about their height, weight and BMI as well as their general medical history.

Height, weight and BMI

The parent's height, weight and BMI measurement was analysed and it showed that an average BMI on the upper limit for overweight (Fathers: M=29.72; Mothers: M=28.51 see Table 17). Thus, fathers showed a higher BMI average compared to mothers**.**

Table 17. Mean and standard deviation for height, weight and BMI for fathers and mothers

	N	Mean	Std. Deviation
Father height	41	169.2	0.08
Father weight	41	83.10	4.78
Father BMI	37	29.72	4.79
Mother height	55	161.00	0.06
Mother weight	54	73.5	14.90
Mother BMI	52	28.51	5.65

Family Medical History

On family medical history, a significant portion of the families had a family history of high blood pressure (42.2%) and a quarter of the sample has a history of joint problems (25.8%). None of the participants reported having anyone in the family with sleep apnoea (Table 18).

Table 18.Frequency for each family history health problem

Family history health problem	Frequency
Asthma	14.6
High Blood Pressure	42.7
Diabetes	9.0
Joint Problems	25.8
Heart Disease	1.1
Sleep Apnoea	0.0

4.3.2.3 Section C: Parent's Perceived Child's BMI and Sedentary Activity

This section reports how parents perceived their children's weight and their sedentary activity through direct questioning, and by contrasting their answers against previous results regarding the children's weight and sedentary activity.

Parent's Perceived Child's BMI

Assessment of parents' perception of their children weight as either underweight, normal weight, overweight or obese revealed a varied result. Most parents are of the view that their children were in the normal weight range (57.8%) and no parent said their child was obese

(Table 19). These findings were subsequently found to have contrasted with the actual children's BMI measured (Figure 17).

Table 19. Parent's report of child's weight status

	Frequency
Underweight	6.7
Normal weight	57.8
Overweight	18.9
Obese	0.0
Total	100.0

When these results were compared with the observed children's BMI (Figure 5.8), it revealed that the parents were quite accurate at classifying their children's weight; the only exception noted was on obese category. The results show a largest difference between real measurement of weight and BMI of the participants and parent responses. This difference may be due to the personal perspectives of parents.

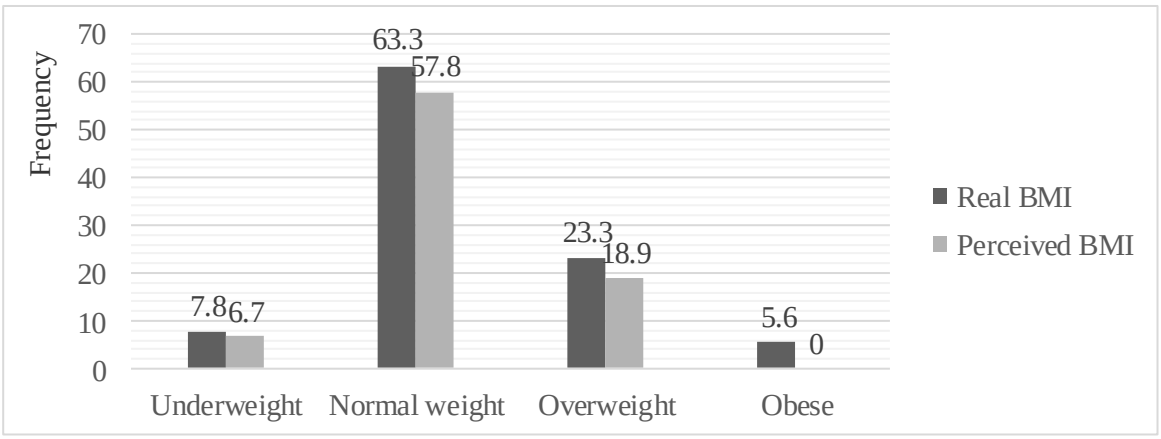


Figure 17. Bar chart contrasting the proportion of children in each BMI category and the proportion of parents who reported their children in each BMI category

Parent's Perceived Child's Sedentary Activity

Parents were also asked about the number of hours per day they thought their children spent watching TV, on the computer, and playing games. From the results (Table 20), the majority of the parents perceived their children as spending on average between 1 to 3 three hours a day watching TV (56.4%), on the computer (47.1%) and playing video games (40.6%).

Table 20. Frequency distribution of children's sedentary activity and sleep, per day, from the view of their parents

Activities and Lifestyle statements	< 1 hours		1-3 hours		> 3 hours	
	F	%	F	%	F	%
How many hours watching TV	24	30.8	44	56.4	10	12.8
How many hours spending on computer or on the internet (excluding games)	21	30.9	32	47.1	15	22.1
How many hours playing video games	26	40.6	26	40.6	12	18.8

These results were also contrasted against the previous calculated frequencies for the number of hours the children reported spending watching TV, on the computer, and or playing video games (Figure 18). Overall, there appeared to be some agreement between parents and children in relation to the amount of time their children spend on sedentary activity, except for the amount of time spent playing video games where the children seemed to have underestimated the amount of time they dedicate to this activity. However, the personal perception of parents might be influenced somehow by social perspectives.

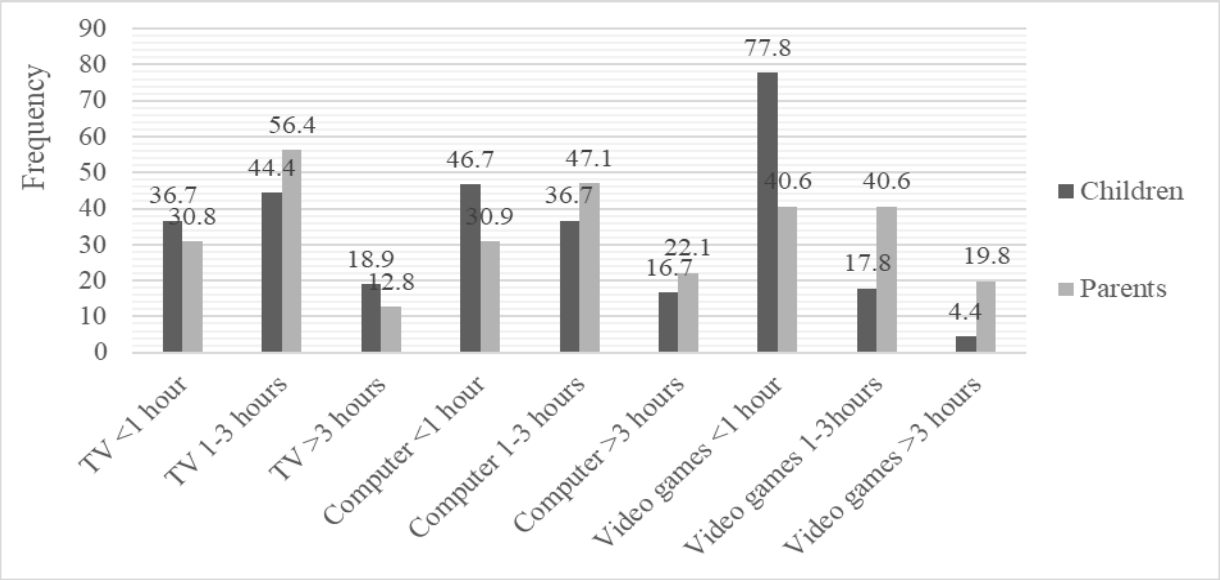


Figure 18. Bar chart showing children's and the parents' answers regarding the amount of time children spend in each activity.

4.3.2.4. Section D: Child's Diet and Nutrition

This section aims to examine the parents' beliefs about healthy weight and their opinion about their children's diet and nutrition. Table 20 summarises these results.

Beliefs about Weight and Health

Overall, parents reported being well informed about diet, nutrition and health outcomes. Most of them acknowledged that being overweight or obese is considered unhealthy, but 11.2% disagreed with that argument. Interestingly, 33.7% of the parents believed that being underweight is not considered unhealthy.

Children Physical Activity and Diet and Nutrition Intake

Over a third of the respondents (38.2%) reported that their children undertake sufficient exercise. 37.1% also claimed they believed their children do not have a healthy diet. In addition, between 26.9 and 39.4% of the parents consider their children as consuming snacks, fast food, sweets or soft drinks in excess which comes with health problems. The vast majority of parents reported that it is important to them that their child has a healthy diet and weight.

Parents were further asked if they discuss with their child about not eating enough healthy food (Figure 19). The results suggest that, although most parents insist that their children eat healthy food products, not so many insist that their children should refrain from eating unhealthy food products. Theoretically, if parents and children argued about eating habits, it would seem logical that they discuss healthy food and unhealthy food consumption equally. Yet, it would seem to be the case that more parents are concerned about their children insufficient healthy food intake. One possible explanation is that the lower level of discussion about children eating too many unhealthy food products may in fact relate to more overweight or obese children. In effect, the parents only notice that their child is eating too many unhealthy food products when it has been brought to their attention, because their child is showing signs of being overweight or obese.

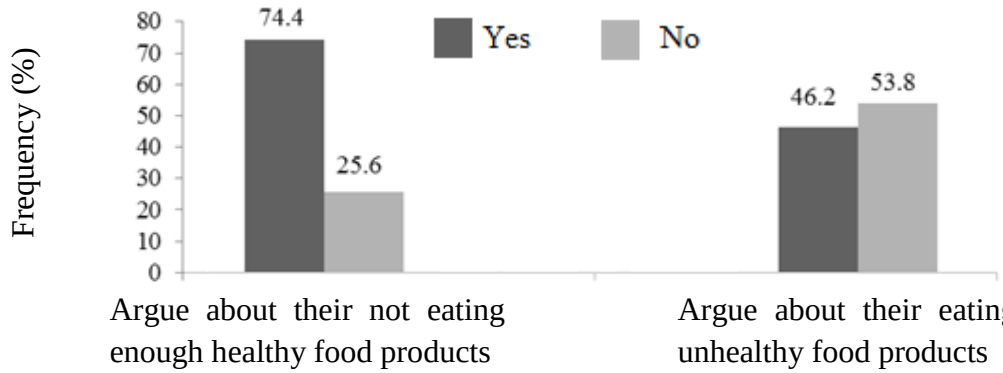


Figure 19. Frequency of parents who reported having arguments about their children's eating habits

Table 21 shows the frequency distribution for each question about the children's diet and nutrition questionnaire. The mean neutral responses to the statement "underweight children are unhealthy" would seem to indicate a lack of comprehensive knowledge on the part of parents. Underweight children may be at risk of developing complications such as anaemia, bulimia nervosa, and anorexia nervosa. Therefore, an average neutral response is somewhat worrying, as it indicates that parents do not possess sufficient diet, nutrition, and medical knowledge to be able to identify their child as being underweight also poses a potential significant risk to children. However, the strong agreement in relation to two statements ("obese children are unhealthy" and "it is important for my child to have a healthy weight") are reassuring, because they show that parents do at least have knowledge of the most pressing issues relating to overweight and obesity in children. However, for the neutral results, it indicates that many parents did not know the answers to these questions and therefore could not be sure of their answers. This would indicate lack of awareness of their child's daily dietary habits.

Table 21. Frequency for each question about the children's diet and nutrition questionnaire

	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**	**Mean**	**Overall**
	%	%	%	%	%		
I am well informed about diet and nutrition	11.5	67.9	11.5	9.0	0.0	2.18	Agree
Underweight children are unhealthy	9.0	27.0	18.0	28.1	5.6	2.94	Neutral
Overweight children are unhealthy	30.3	30.3	15.7	9.0	2.2	2.12	Agree
Obese children are unhealthy	42.7	34.8	4.5	5.6	0.0	1.69	Strongly Agree
Family members are supportive in making lifestyle changes to correct my child's unhealthy thy weight	33.3	43.6	16.7	4.4	1.3	1.97	Agree
My child undertakes sufficient exercise	10.1	28.1	18.0	20.2	11.2	1.97	Agree
My child eats healthily	3.4	19.1	28.1	33.7	3.4	2.94	Neutral
My child eats too many snacks	7.9	31.5	21.3	22.5	4.5	3.17	Neutral
My child eats too much fast food	2.2	24.7	28.1	24.7	7.9	2.82	Neutral
My child eats too many sweets	6.7	32.6	23.6	21.3	3.4	3.13	Neutral
My child drinks too many soft drinks	4.5	22.5	16.9	33.7	10.1	2.79	Neutral
It is important for my child to eat healthily	53.9	29.2	0.0	1.1	3.4	3.26	Neutral
It is important for my child to have a healthy weight	69.2	29.5	0.0	0.0	1.3	1.35	Strongly Agree

4.4. Post Intervention Results

In this section, the results or scores obtained after the intervention are presented. The

results were collected by offering the same questionnaire to child participants after the intervention. Therefore, the structure here is similar to that of the results section for data obtained before the intervention. First, the new weight and BMI were analysed, followed by the scores for the questions regarding sedentary activity and physical activity. Finally, the new results for diet and nutrition are also analysed.

4.4.1 Section A: Weight and BMI

As shown in Table 22 the participants mean height was found to be 1.48 (m) and maximum BMI among the participants was 50.45 (km/m^2).

Table 22. Descriptive statistics for height, weight and BMI after the intervention

	Mean	**Std. Deviation**	**Minimum**	**Maximum**
Height (m)	1.48	0.10	1.00	1.72
Weigh (kg)	44.97	15.72	20	112
BMI (kg/m^2)	23.81	5.20	11.3	50.45

The frequency for each BMI category is presented in Table 23. The vast majority of the children recorded normal weight (70%), while 18.9% of the children were overweight, and 4.4% obese and 6.7% were underweight.

Table 23. Frequency distribution for BMI categories

	N	**%**
Underweight	6	6.7
Normal weight	63	70.0
Overweight	17	18.9
Obese	4	4.4

4.4.2. Section B: Activities and Lifestyle

4.4.2.1. Sedentary Activity

The number of children spending less than an hour, between 1 to 3 hours, and more than 3 hours a day, on several sedentary daily activities were estimated (table 23). The majority of the girls reported spending less than an hour a day watching TV (50%), on the computer (65.4%), using tablets or smartphones (52.2%) and playing video games (86.6%).

4.4.2.2.BMI as a Function of Hours Spent Across Activities

In order to test an association between BMI and the participants time spent in each

activity, a set of one-way ANOVA tests were performed, to examine whether the BMI was significantly different depending on the number of daily hours dedicated to each sedentary activity this is summarised in Table 24.

Table 24. Frequency distribution for the number of daily hours children are involved in daily sedentary activities

Number of hours spent on daily sedentary activities	< 1 hour		1-3 hours		> 3 hours	
	F	%	F	%	F	%
Watching TV	45	50	36	40	9	10
Working on computer or internet	58	65.4	32	35.6	0	0
Smart phones and tablet	46	52.1	39	43.3	5	5.6
Playing video games	78	86.6	11	12.2	1	1.1

No significant differences were found in BMI for children who spend less than an hour, between 1 to 3 hours and more than 3 hours watching TV ($F_{(2,87)}$=0.98, p=.379), on the computer ($F_{(2,88)}$=1.01, p=0.752), using their smart phone/tablet ($F_{(2,87)}$=1.14, p=0.323) or playing video games ($F_{(2,87)}$=0.20, p=.823), but there was an observed difference between each variables compared.

Table 25. Mean and standard deviation for BMI for each category of each activity

		< 1 hour	**1-3 hours**	**> 3 hours**
Watching TV	M	23.20	24.69	22.88
	SD	5.16	5.60	2.30
Computer	M	23.89	23.53	-[1]
	SD	4.82	5.79	-[1]
Smart phone or tablet	M	24.44	23.20	21.57
	SD	5.92	4.07	4.99
Video games	M	23.74	24.21	20.87
	SD	5.29	4.43	-[2]

[1] *No mean or standard deviation was estimated because there were no participants.*
[2] *No standard deviation was estimated since there was only one participant*.

4.5 Participant Involvement in Physical Activity

Figure 20 shows the degree to which the participants engaged in physical and sporting activities. From the data obtained, 42.2% said they take part in swimming, 65.6 % reported to walk to various destinations in order to reach their daily exercise goal. In addition, 58.9% of the participants also said they take part in various household chores which they deem fit as a form of exercise due to its physical demand.

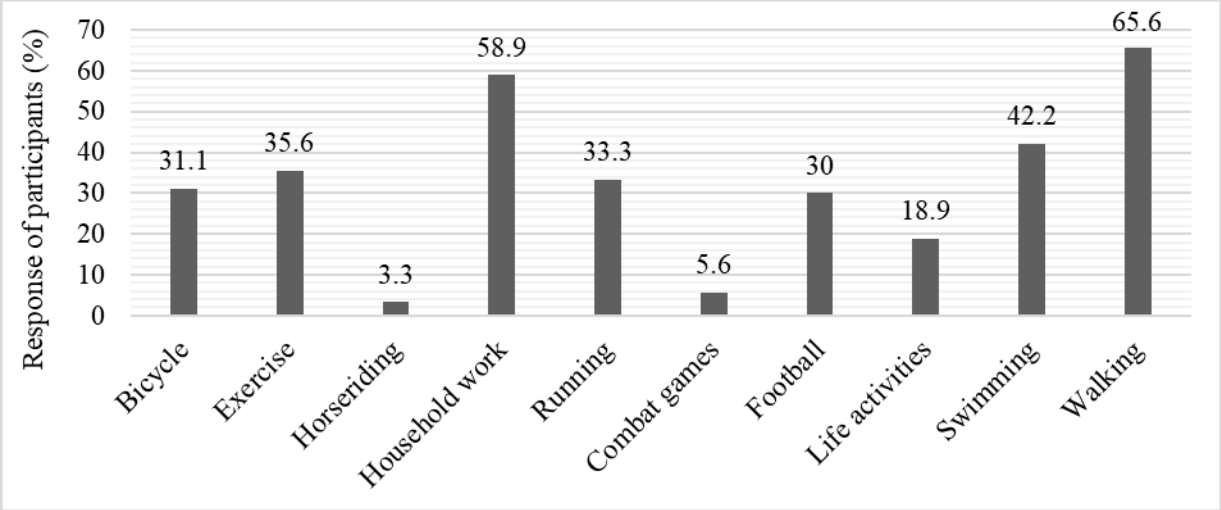


Figure 20. Frequency of participants involved in each Sport/Activity

On average, the participants reported to spend an average time of 269.22 minutes per week (SD=265.59) (4.49 hours/week) exercising. A one-way ANOVA was conducted to examine whether BMI varied significantly depending on the total number of hours per week dedicated to exercise (<1 hour, 1-3 hours, 3-6 hours and >6 hours). The result indicated the BMI between the four groups did not show significant differences ($F_{(3, 86)} = 0.45$, $p = 0.716$).

The mean BMI for each group of exercise are shown in Figure 21. The results indicated that the BMI was found to decrease from an almost overweight BMI in girls who exercise less than one hour a week to a BMI closer to the normal range as the number of hours of weekly exercise increases. Overall it was observed that there was an observable impact of the number of hours spent exercising and levels of BMI among children. It was clear that if those who exercised more than 6 hours are removed then a significant difference might have resulted between the three categories.

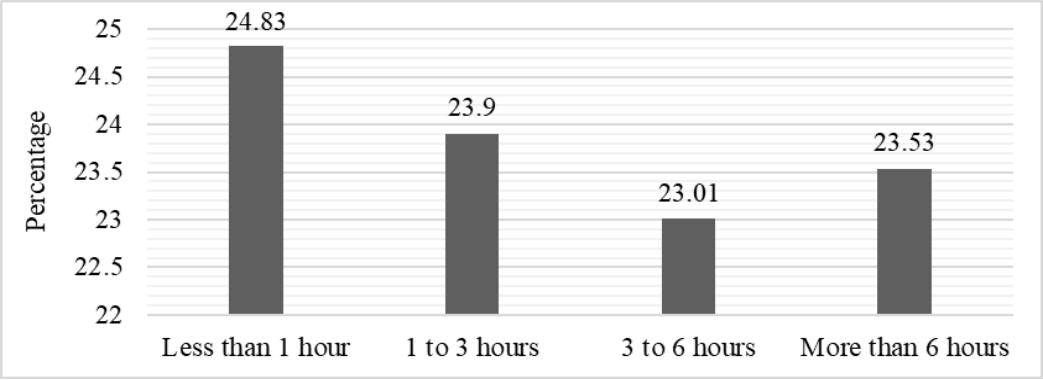


Figure 21. Mean BMI for each category of hours of exercise per week

Upon a closer look at the number of hours participants for each BMI category spend on average exercising (Figure 22). The results showed that obese category gained the highest hours of exercise (7.58) compared to other categories.

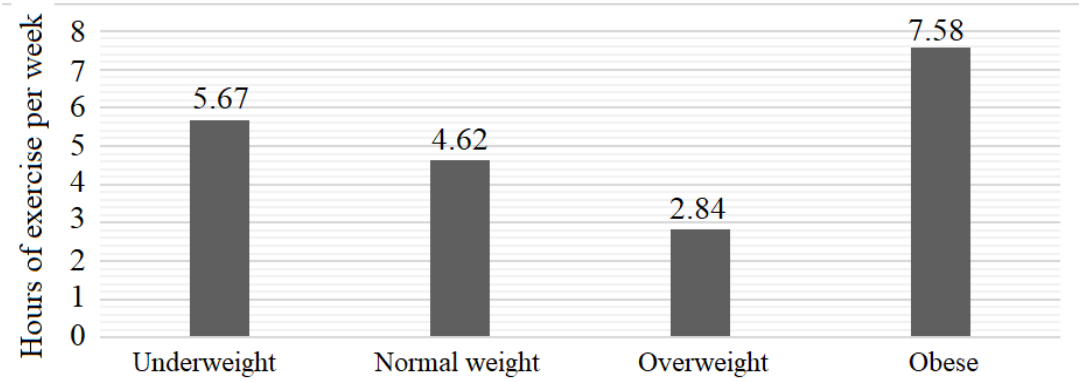


Figure 22. Mean number of hours a week spent exercising for each BMI category.

4.6. Section C: Diet and Nutrition

4.6.1. Food Intake

Frequencies for each type of food intake are presented in Figure 23. From the outcome, more than half of the participants (58%) reported eating fast food between 1 to 3 times per week. In addition, 50% of the participants claimed to drink non-diet drinks between 1 to 3 times per week while 62% consume diet drinks. Most of the girls said they did not consume energy drinks (87%). Meat consumption was found to be moderate among the participant as 42% said they eat meat weekly, while other forms of protein such as beans and nuts only 53% indicates their intake. Similar trend was also observed in bread or cereals with 52% reported to having it between 1 to 3 times per week. In addition, around half of the sample claimed to have vegetables (42%), fruits (51%) and dairy products (42%) daily.

A series of Fisher's exact test was used to examine the association between food intake and BMI. The results recorded in Table 26 show no differences between the frequencies of food intake across the different BMI groups.

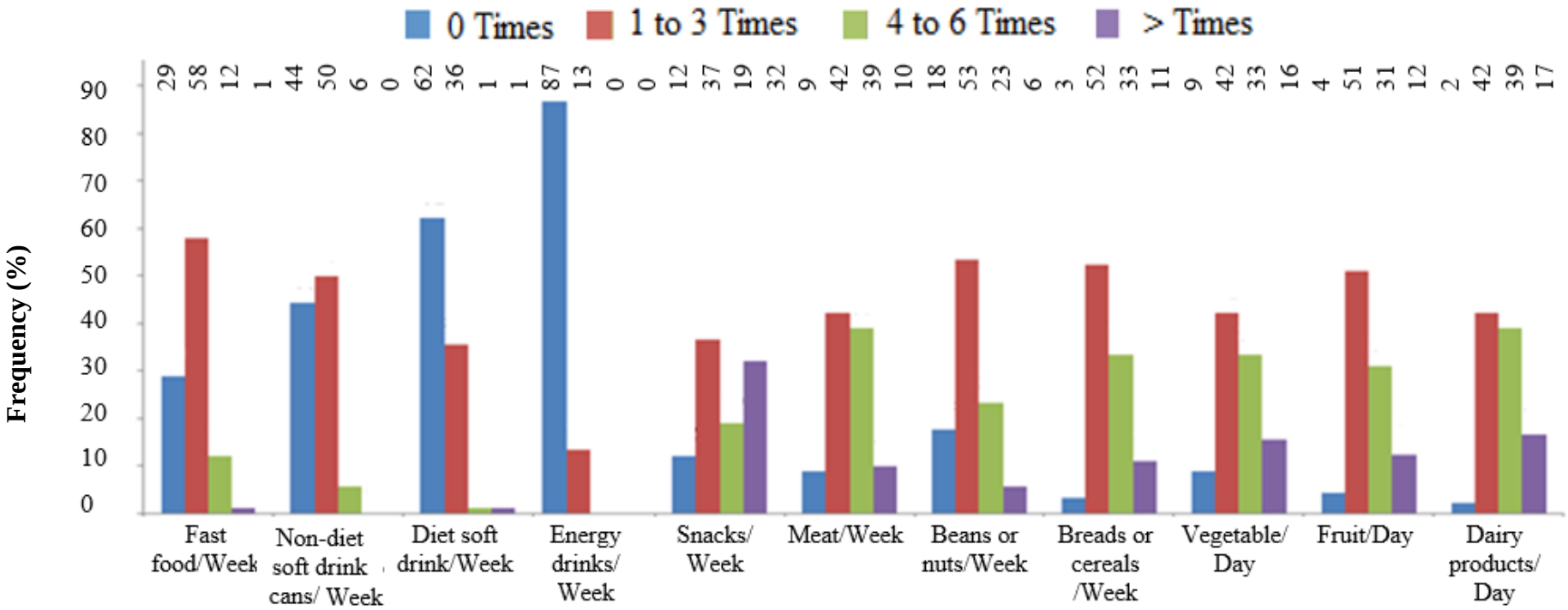


Figure 23. Frequency of the number of times a week or day of dietary intake of fast food, non-diet and diet soft drinks, energy drinks, snacks, meat, beans or cereals (week) and vegetables, fruit and dairy products (day)

Table 26. Frequency and Fisher's Exact Test for the association between BMI and quantity of food intake

Diet and Nutrition statements		BMIP of Children Under-weight		Normal weight		Over-weight		Obese		Fisher's Exact test	*p*
		N	%	N	%	N	%	N	%		
Number of cans of non-diet soft drinks per week	0 cans	3	50	29	46	7	41.2	1	25	5.36	0.459
	1–3 cans	3	50	32	50.8	8	47.1	2	50		
	4–6 cans	0	0	2	3.2	2	11.8	1	25		
	> 6 cans	0	0	0	0	0	0	0	0		
Number of cans of diet soft drinks per week	0 cans	5	83.3	39	61.9	10	58.8	2	50	10.15	0.572
	1–3 cans	1	16.7	23	36.5	6	35.3	2	50		
	4–6 cans	0	0	0	0	1	5.9	0	0		
	> 6 cans	0	0	1	1.6	0	0	0	0		
Number of times vegetables consumed per day	0 times	0	0	5	7.9	3	17.6	0	0	11.57	0.144
	1–3 times	2	33.3	26	41.3	8	47.1	2	50		
	4–6 times	3	50	25	39.7	2	11.8	0	0		
	> 6 times	1	16.7	7	11.1	4	23.5	2	50		
Number of times fruit consumed per day	0 times	0	0	2	3.2	2	11.8	0	0	11.27	0.170
	1–3 times	1	16.7	34	54.0	9	52.9	2	50		
	4–6 times	4	66.7	20	31.7	2	11.8	2	50		
	> 6 times	1	16.7	7	11.1	4	23.5	0	0		
Number of times beans/nuts products consumed per week	0 times	2	33.3	11	17.5	3	17.6	0	0	4.87	0.866
	1–3 times	2	33.3	32	50.8	11	64.7	3	75		
	4–6 times	2	33.3	16	25.4	2	11.8	1	25		
	> 6 times	0	0	4	6.3	1	5.9	0	0		
Number of times breads/cereals consumed per week	0 times	0	0	1	1.6	1	5.9	1	25	13.79	0.070
	1–3 times	2	33.3	37	58.7	8	47.1	0	0		
	4–6 times	2	33.3	20	31.1	6	35.3	2	50		
	> 6 times	2	33.3	5	7.9	2	11.8	1	25		
Number of times snacks consumed per week	0 times	0	0	10	15.9	1	5.9	0	0	10.93	0.185
	1–3 times	3	50.0	17	27.0	9	52.9	4	100		
	4–6 times	0	0	14	22.2	3	17.6	0	0		
						4	23.5	0	0		

While having a meal out either alone or with their parents, the participants were asked what type of fast food they usually eat in fast food restaurants (Figure 24). 60% reported preference to chicken burger followed by French fries (54.4%) and pizza (51.1%) as the most common types of food chosen.

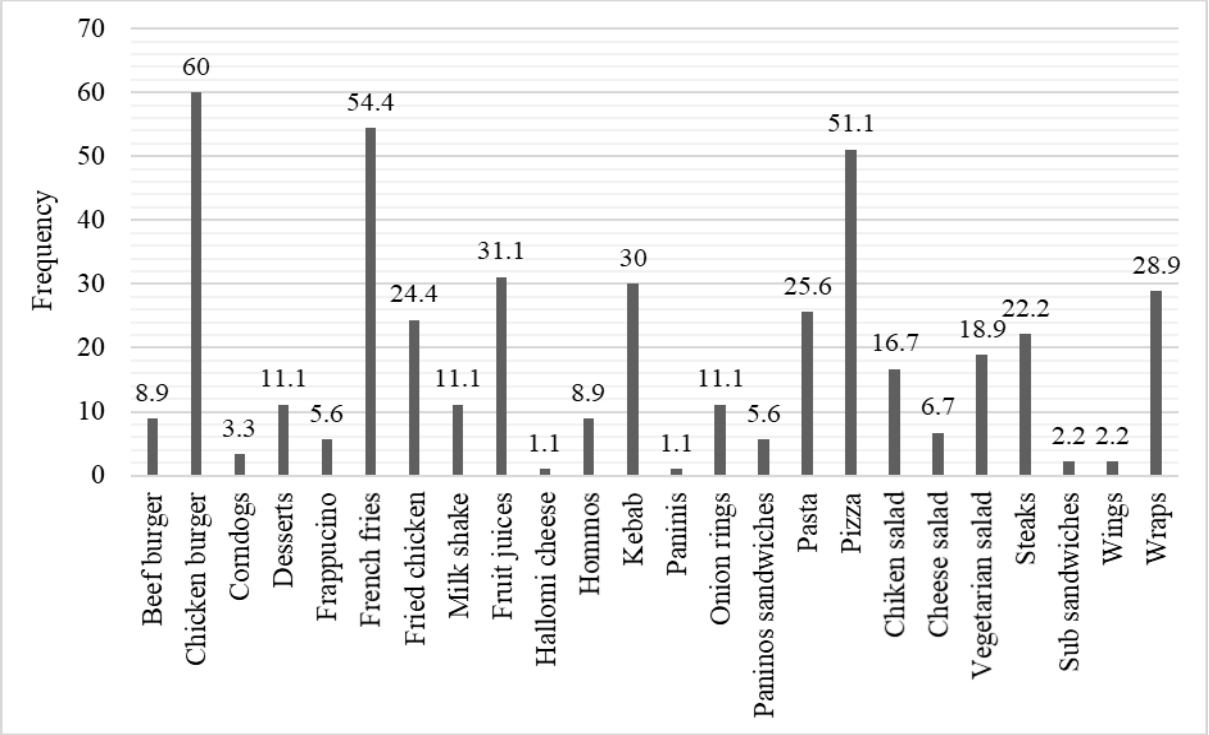


Figure 24. Frequency of participants for each type of fast food

4.6.2. Breakfast Intake

To assess the participant's breakfast eating habit before leaving to school, the finding revealed that 91.1% of the participants claimed to have breakfast at home before going to school. Figure 25 presents the food type according to preference reported eating at home include bread (56.7%), yogurt (47.8%) and Cheese (46.7) cereal (46.7).

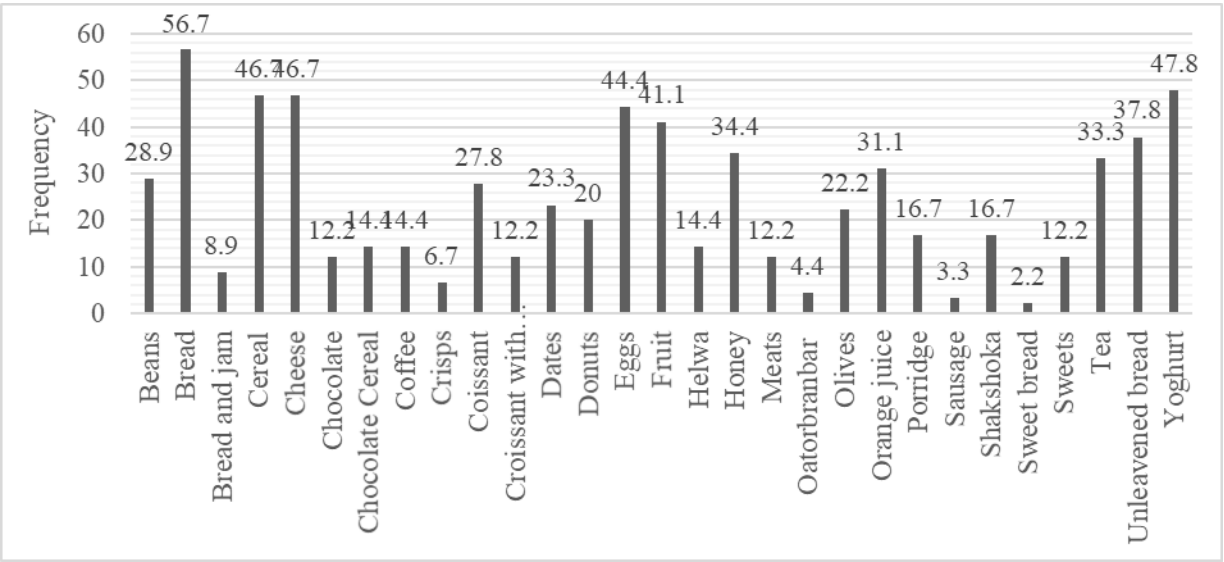


Figure 25. Frequency of participants who eat each type of food for breakfast

4.6.3. Snacks Consumption

Based on the participant's response on their snack's choice, the outcome is presented in Table 27. The average of each snack consumed per week was determined. Crisps scored (M=3.10), followed by biscuits (M=2.09) as the most preferred snacks among the participants.

Table 27. Mean and standard deviation for the number of food intakes per week for each type of food

	Mean	**SD**
Biscuits	2.09	2.21
Sweet pastry	0.70	1.04
Cake	0.88	1.20
Chocolate bars	1.22	1.88
Crisps	3.10	2.77
Donuts	0.86	1.61
Frozen yogurt	0.58	1.13
Ice cream	1.57	1.81
Pastry	1.84	2.30

4.7. Comparison between pre- and post- intervention

In this part, comparisons were made to elicit impact of the intervention. It was expected that the interventions would show improvement from the baseline measurements (pre-post intervention). A series of paired samples t-tests were carried out to measure these differences. Furthermore, descriptive statistics (bar charts) were used to provide information around any observable differences.

4.7.1. Section A: Weight and BMI

This section looks at whether or not weight and BMI measurements were improved as a result of the intervention. To examine that, two repeated measures t-test were performed to test for differences in weight and BMI before and after the intervention. Using t-test indicated that the difference values of schoolgirl's weight [$t_{(89)} = 0.43$, $p = 0.669$] and BMI [$t_{(89)} = 0.86$, $p = 0.856$]. before and after intervention were not significant. Figure 26 indicates that the distribution of the participants across the different BMI categories changed after the intervention and observable change in the results especially in the normal weight and overweight categories was evident, where post intervention results showed more normal weight and less overweight children.

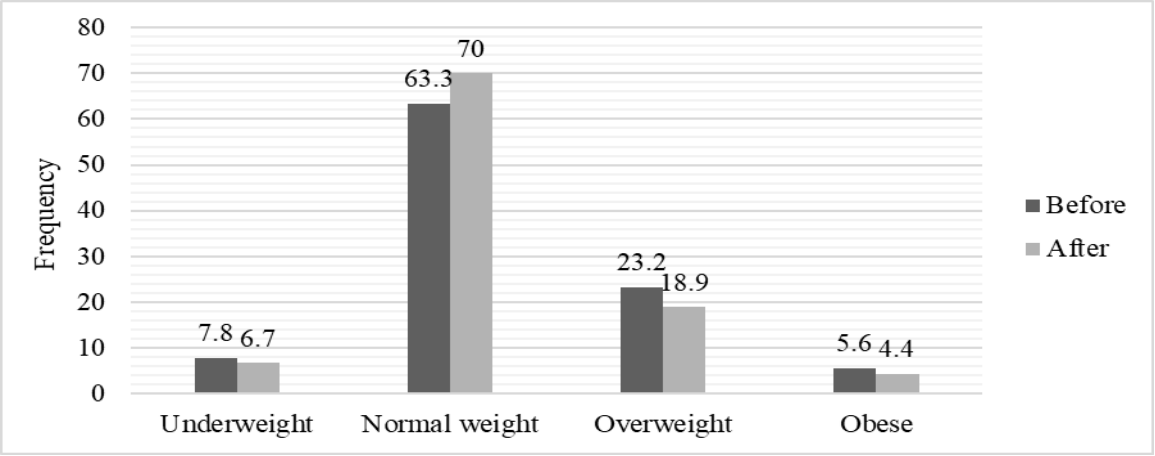


Figure 26. Frequency for BMI categories before and after the intervention

4.7.2. Section B. Activities and Nutrition

This section aims to see whether or not the intervention helped in increasing nutritional awareness and motivation towards taking more exercise and eating a healthier diet amongst the study participants, using a specially designed dietary intervention plan (objective 2 of the study).

4.7.2.1. Sedentary Activity

The impact of the intervention was analysed by examining the difference in the number of hours spent in sedentary activities before and after the intervention. Figures 27 through Figure 30 show the number of girls who spend less than 1 hour, 1 to 3 hours, or more than 3 hours a day in each activity before and after the intervention. Overall, the number of participants who spend more than 1 hour in each activity decreased and the number of participants spending less than 1 hour increased. From these outcomes, it was found that the intervention had potential impact among the participants. Major observable change was the number of participants watching more than 3 hours of television each day decreased significantly from 18.9 to 10 (Figure 27). It is possible that this observable trend was simply due to external moderating factors. For example, the period was when there was less television shows on or the girls were more willing to go outside to play because of the weather. However, the corresponding decrease in the 1-3 hours and the greater than 3 hour's categories supports the significant positive impact of the intervention on the participants. This is true for both the number of hours spent watching television and for the number of hours spent on the computer (Figure 28). Although the number of hours spent using smartphones (Figure 28) or tablets and playing video games (Figure 28) categories followed somewhat similar patterns, they were not identical.

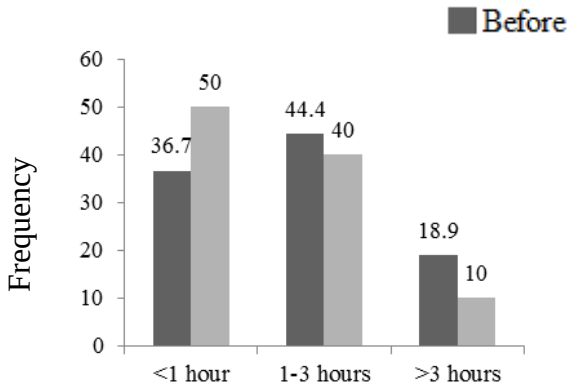


Figure 27. Frequency of the number of hours watching TV before and after the intervention.

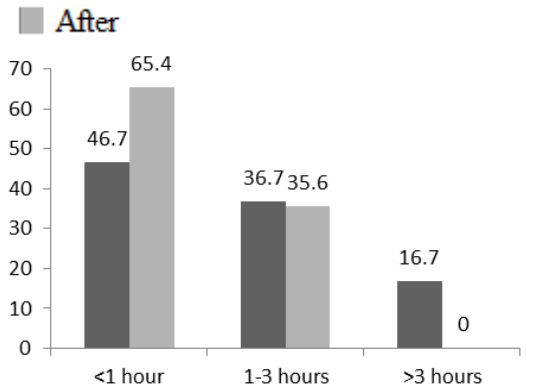


Figure 28. Frequency of the number of hours spent on the computer before and after the intervention.

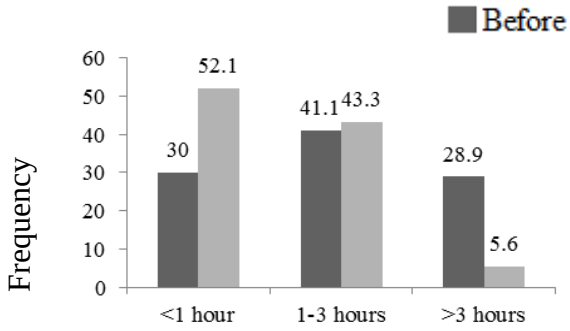


Figure 29. Frequency of the number of hours spent using smartphones or tablets before and after the intervention

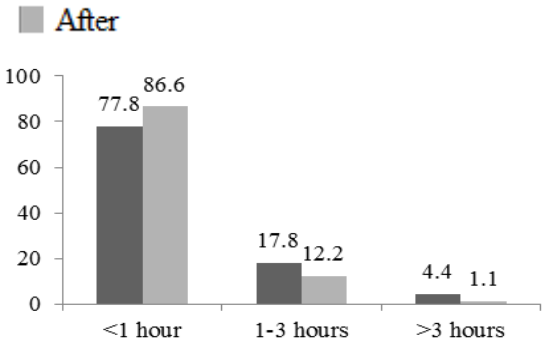


Figure 30. Frequency of the number of hours spent playing video games before and after the intervention.

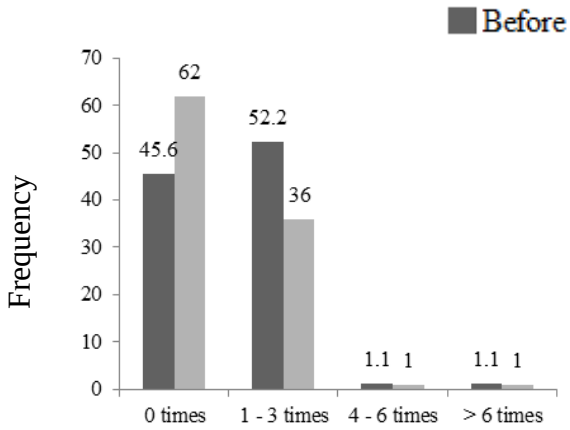


Figure 31. Frequency of fast food intake before and before and after the intervention.

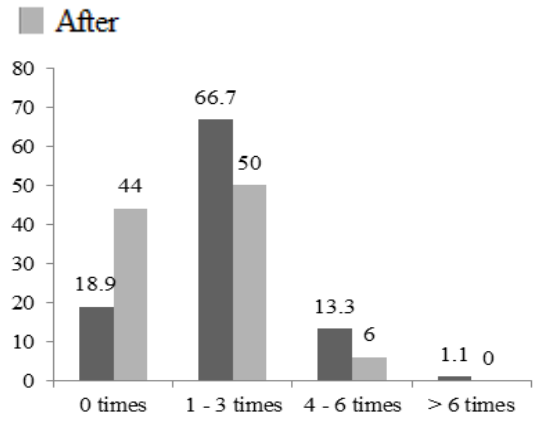


Figure 32. Frequency of non-diet drinks before and after the intervention.

4.7.2.2. Physical activity

Figure 33 shows the means of physical activities before and after the intervention. The difference in the level of physical activity before and after the intervention among

participants was analysed using a repeated measures t-test measuring the differences between the two times by looking at the mean hours of weekly exercise. The t-test revealed that the number of weekly hours of exercise after the intervention (M= 4.49, SD=4.42) among the participants was significantly higher than before the intervention (M= 3.05, SD= 4.91) [t (89) = -3.99, p<0.001]. It can be concluded here that the intervention had a significant effect on the exercising habits of the children where more hours of exercise were shown following the intervention.

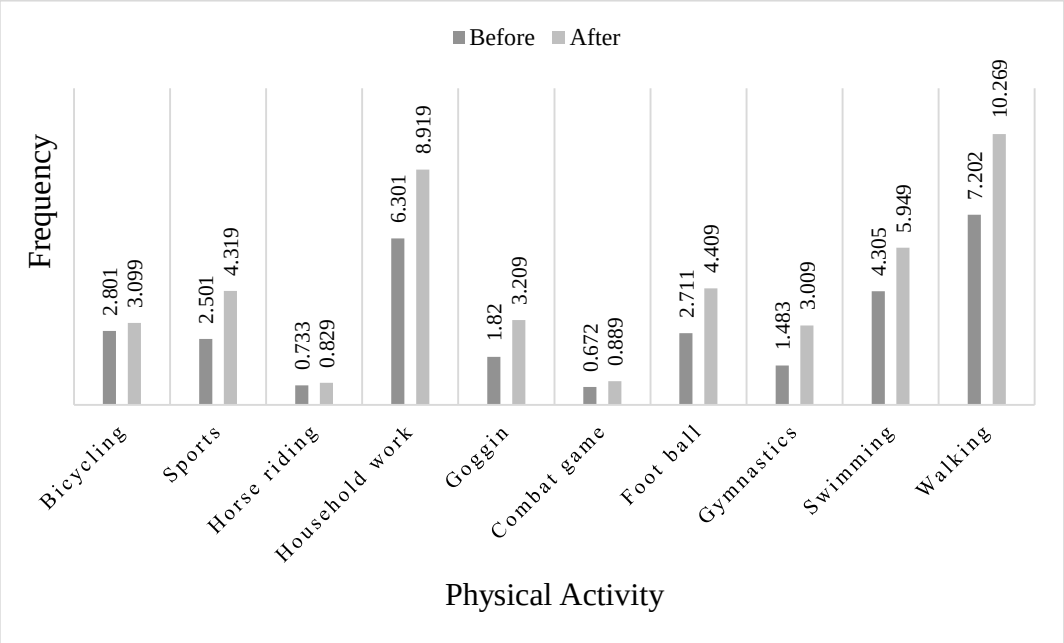


Figure 33. Frequency of the mean of different physical activities

4.7.2.3. Nutrition Intake

In order to analyse the difference in frequency of weekly food intake before and after the intervention, a series of graphs were estimated by plotting the frequency for each food product between the two time points (Figure 34 through to figure 43). Overall, a number of observable differences were noticed, it was evident that the unhealthy food products intake decreased (fast food, soft drinks, energy drinks and snacks) among the participants after the post intervention. On the other hand, healthier food products such as meat, beans or nuts, bread or cereals, vegetables, fruit and dairy products increased.

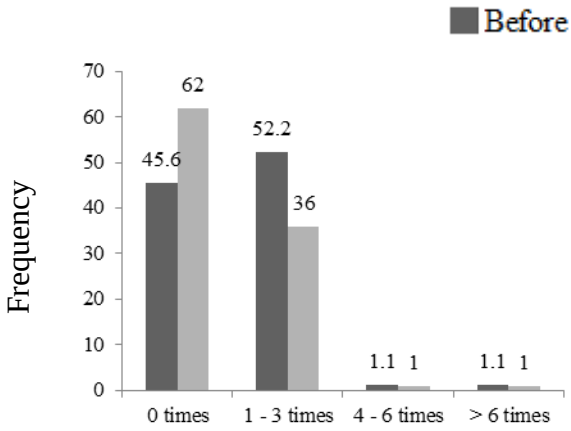


Figure 34. Frequency of fast food intake before and before and after the intervention.

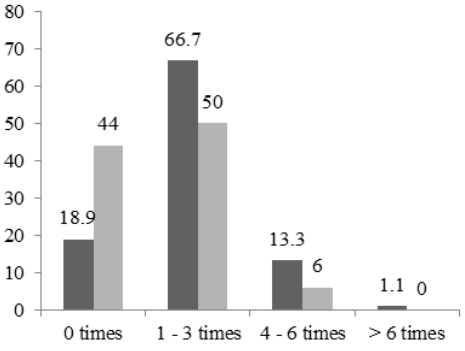


Figure 35. Frequency of non-diet drinks before and after the intervention.

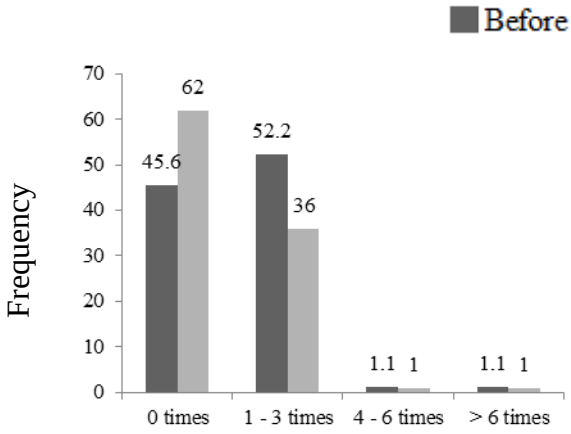


Figure 36. Frequency of diet drinks intake before and after the intervention.

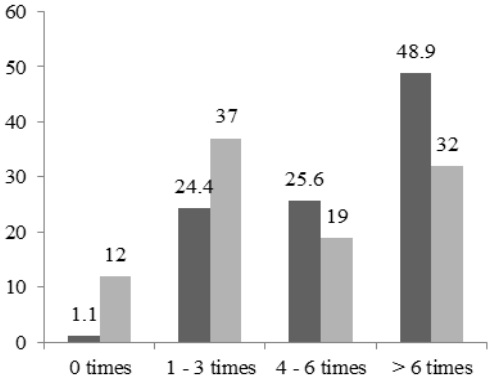


Figure 37. Frequency of snacks intake before and after the intervention

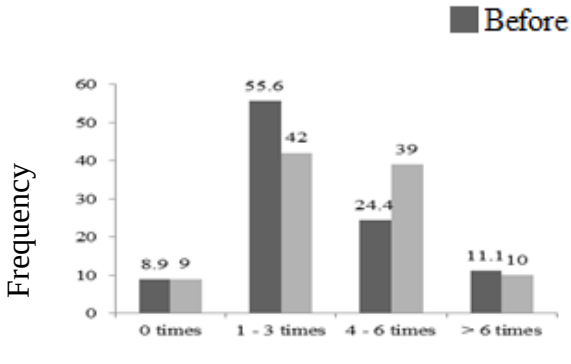


Figure 38. Frequency of meat intake before and after the intervention.

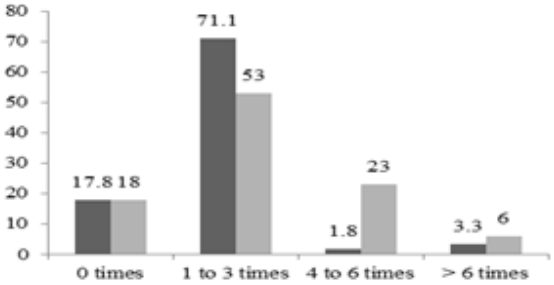


Figure 39. Frequency of beans or nuts intake before and after the intervention.

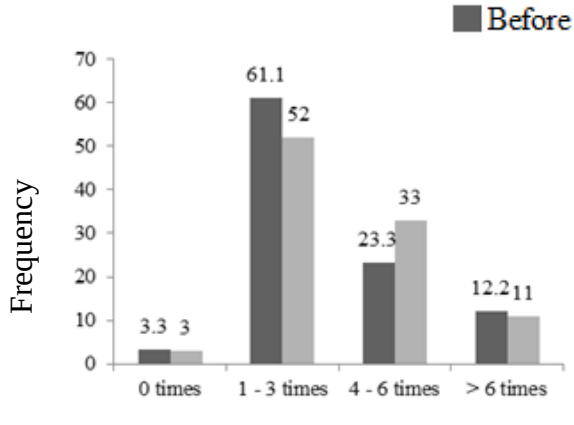


Figure 40. Frequency of bread or cereals intake before and after the intervention.

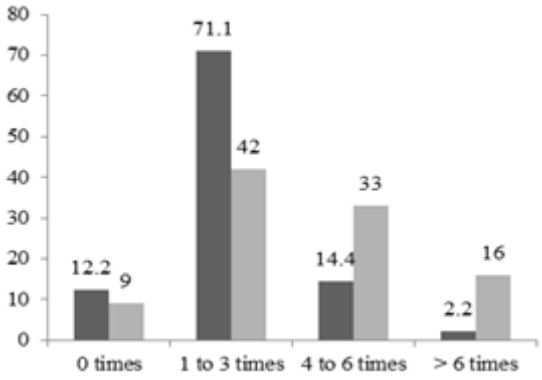


Figure 41. Frequency of vegetables intake before and after the intervention.

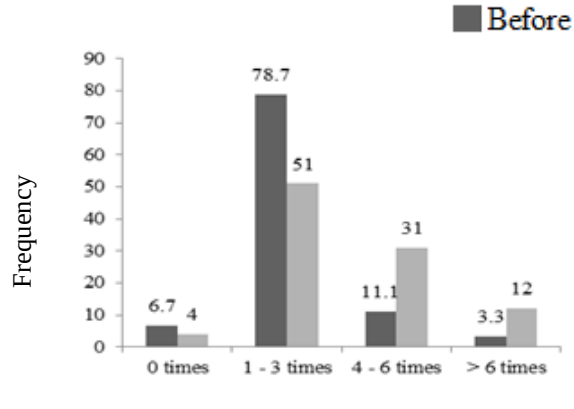


Figure 42. Frequency of fruit intake before and after the intervention.

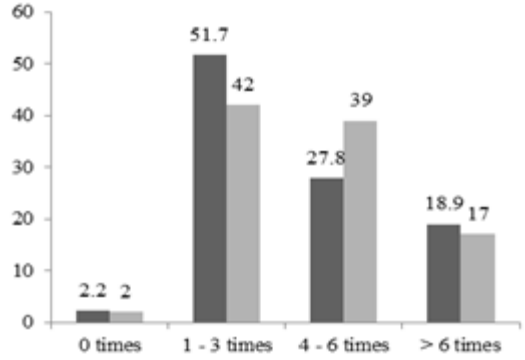


Figure 43. Frequency of dairy products intake before and after the intervention.

Overall, the intervention showed an improvement on a number of health dimensions and physical activities. It can be stated that all three indicators around sedentary activity; physical activity; and nutrition showed changes in favour of the intervention with the number of participants spending more than one hour watching TV, on the computer and watching video games to have decreased. In addition, the intervention also had an effect upon the level of exercise as the average number of exercising hours increased by more than one hour a week. Finally, the frequency of food intake decreased across all unhealthy food and increased in all types of food considered to be healthy.

4.8. Impact of the Intervention on Overweight and Obese Children

In this section, the focus was solely on the overweight and obese participants. The aim was to examine changes in BMI, exercise, sedentary activity and nutrition before and after

the intervention, specifically within this group (objective 1). Except for the differences in BMI, the changes in the number of hours of sedentary behaviours, exercise per week and nutrition habits were examined after combining the overweight and obese children in the same group.

4.8.1. BMI

The BMI of overweight and obese children was calculated and compared before and after the intervention. A paired/repeated samples t-test did not show significant differences for BMI ($t_{(24)} = 1.04$, $p = 0.304$) before and after intervention had no significant. However, after the intervention the participants showed relative signs of being in control of their weight. Figure 44 shows the difference in the number of overweight and obese children before and after the intervention.

Figure 44 illustrates the BMI for each overweight or obese participant before and after the intervention. From the result, 48% of the sampled population BMI had decreased after the intervention. From these results, one participant could no longer be classified as obese, since she has now fitted into the overweight classification. Figure 45 and Table 28 respectively show the BMI before and after intervention and the five children who lost weight during about three months. The average of BMI value for the five schoolgirls before and after intervention was 25.72 and 24.26 respectively. Generally, the differences between before and after intervention ranged between 1.2 and 2. These results may highlight the effectiveness of the current educational programme.

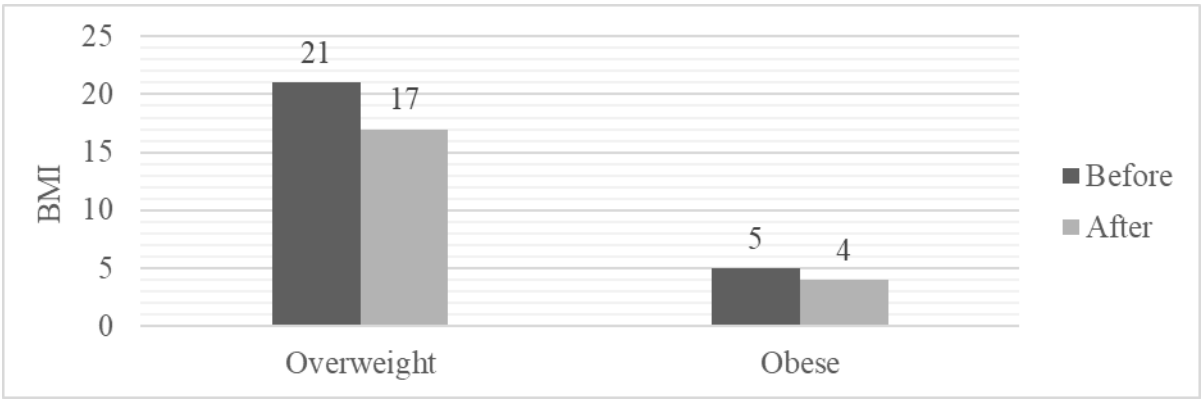


Figure 44. BMI categories before and after the intervention

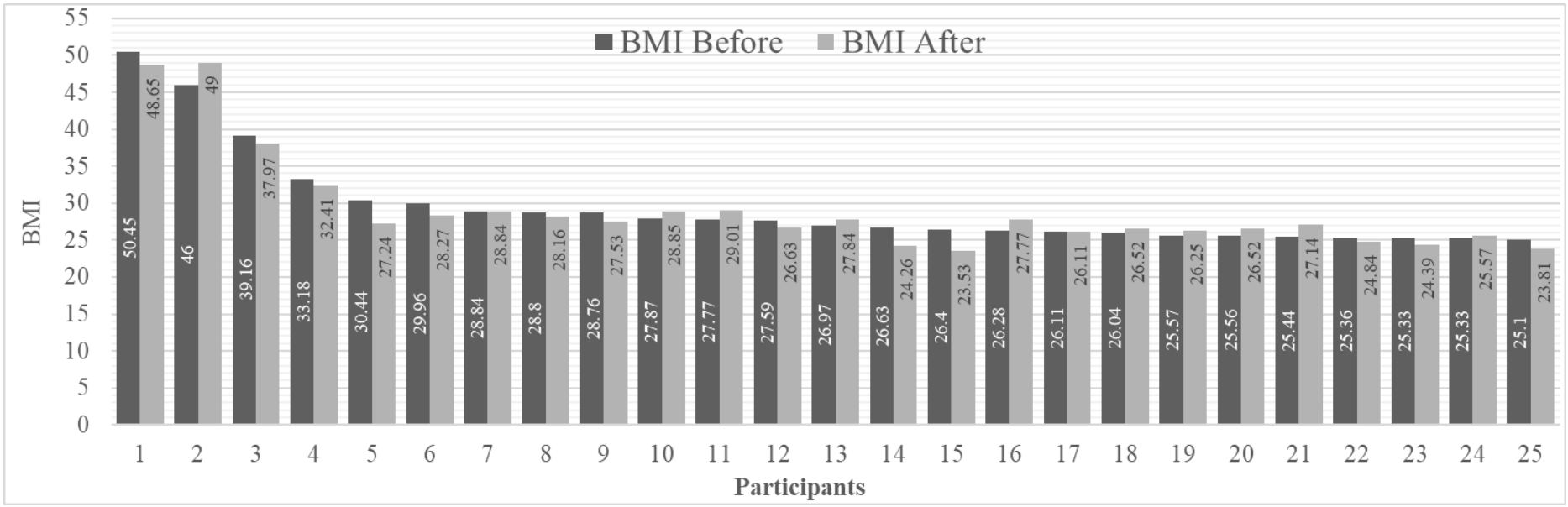


Figure 45. BMI before and after the intervention

Table 28. The five children who lost weight after intervention

			Before intervention		After intervention	
Child	Age	Hight	Weight	BMI	Weight	BMI
PR1	15	159	65	25.7	60	23.7
PR2	13	161	68	26.2	65	25.0
PR3	15	159	64	25.3	61	24.1
PR4	14	156	61.5	25	58	23.8
PR5	13	145	55.6	26.4	52	24.7

4.8.2. Sedentary Activity

It was expected that the intervention will enhance positive activities and promote better health among the participants. To test the difference between the variables; before and after intervention, the research relied on descriptive data. Figures 46 to Figures 48 present a series of graphs which are presented to show the difference in the proportion of girls who spend less than 1 hour, 2 to 3 hours, or more than 3 hours a day watching TV, using electric devices or playing video games. The study findings (Figures 5.32- 5.37) report a significant decrease in the number of participants spending more than 3 hours a day either watching TV, using their computer, tablets or smartphones or playing video games activities.

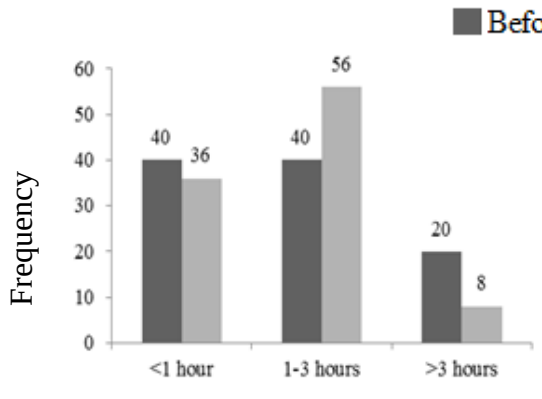


Figure 46. Frequency of hours spent on watching TV.

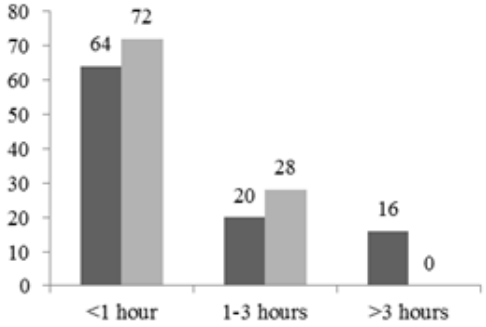


Figure 47. Frequency of hours spent using a Compute.

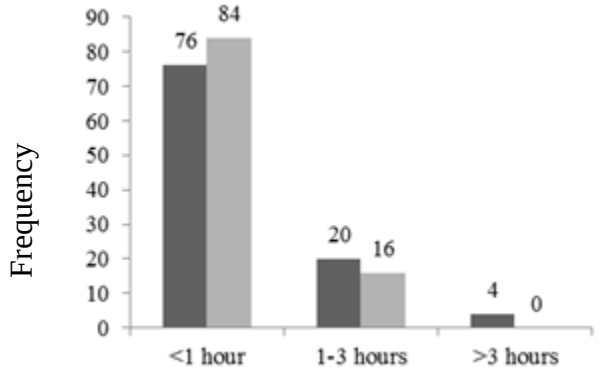


Figure 48. Frequency of time spent on Tablets/smartphones.

4.8.3. Physical Activity

With respect to the participant engagement with physical activity, the effect of the intervention upon the level of physical activity within the group classed as overweight and obese was tested using a paired t-test. The results revealed an observable difference between

the hours the girls spend exercising before (M=1.71, SD=1.96) and after (M=4.64, SD=0.90) the intervention.

4.8.4. Nutrition

Nutrition habits were examined in the overweight and obese children by looking at the frequency of food intake of different types of food before and after the intervention. Figures 46 to 54 show this difference for each type of food. Overall, observable differences were found around the intake of unhealthy food such as fast food and all types of drinks decreased while the intake of healthy products including meat, vegetable and fruit increased after the intervention.

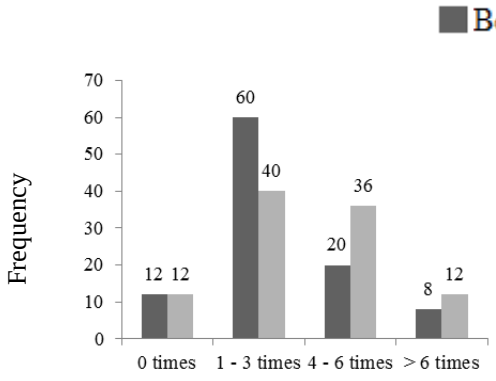


Figure 49. Frequency of times of non- diet drink intake weekly.

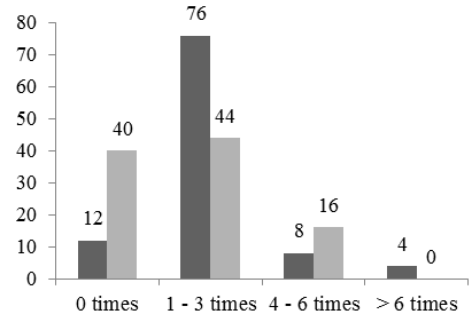


Figure 50. Frequency of times of fast food intake weekly.

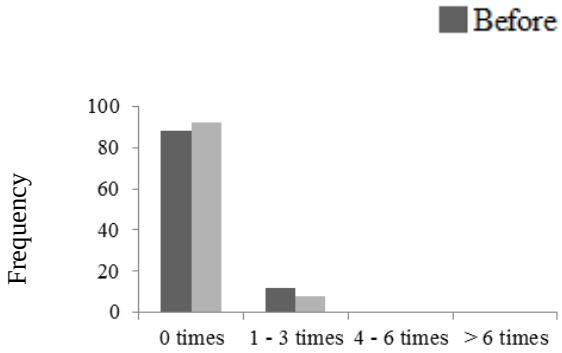


Figure 51. Frequency of times of energy drinks intake.

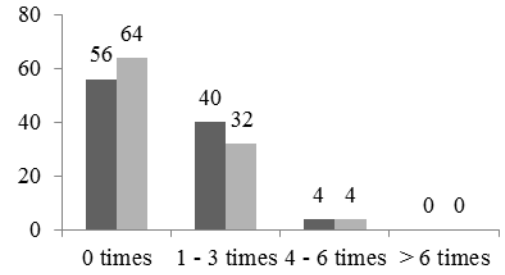


Figure 52. Frequency of times of diet drinks intake.

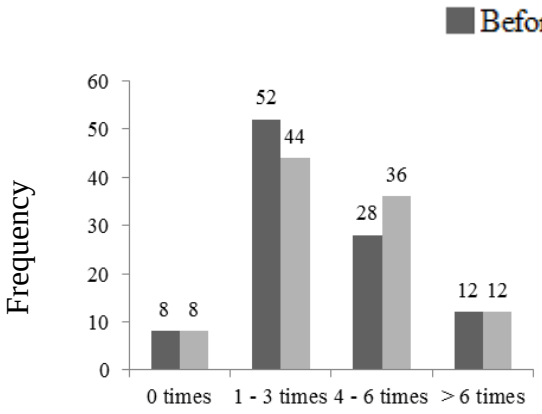


Figure 53. Frequency of times eating bread or cereals.

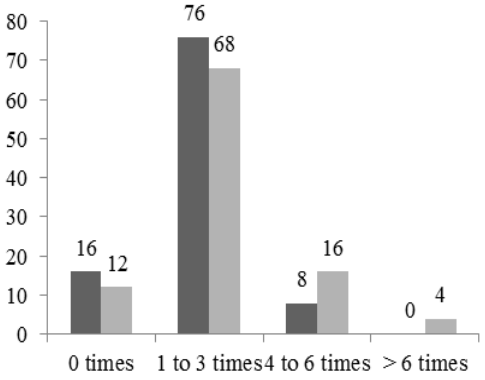


Figure 54. Frequency of times of eating beans and nuts.

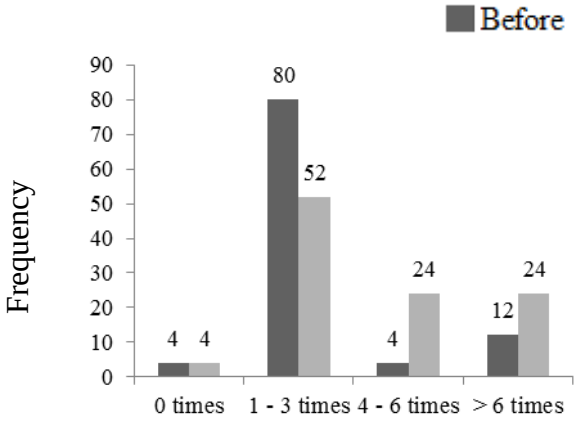


Figure 55. Frequency of times eating fruit.

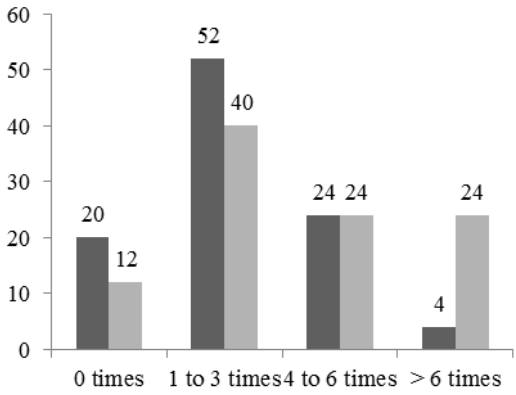


Figure 56. Frequency of times eating of eating vegetables.

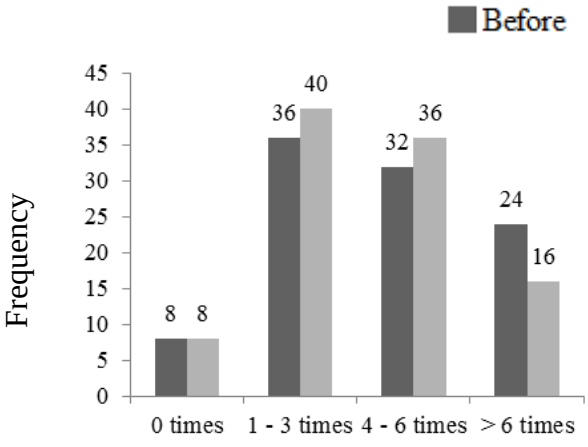


Figure 57. Frequency of times of eating dairy products

4.9. Quantitative Results Summary

Based on the outcomes of the current feasibility study, it was observed that, almost half of the participants presented an overall decrease in BMI post-test and 3 months after the intervention. A positive shift in BMI was evident with overweight cases decreasing and normal weight cases increasing. Hence, the intervention can be seen to have had a positive effect on the types of food eaten. The intake of unhealthy food and drinks (e.g., fast foods, soft drinks, energy drinks, and snacks) was also found to have decreased after the intervention, whilst at the same time the intake of healthy food, such as meat, beans, nuts, vegetables, and fruit increased following the intervention. The statistics analysis among sedentary activity; physical activity; and nutrition factors did not show significant differences.

In addition, a positive change of behaviour among the participants was observed after the intervention was introduced considering that the number of participants spending more than one hour watching TV, on the computer and watching video games has significantly decreased. At the same time, more participants stated that they watched less than one hour of television daily after the intervention while their engagement with physical activity has greatly improved. The results showed that less girls selected the 'more than 3 hours' option for using smartphone or tablets. The intervention also had an effect on the level of exercise, as the average number of hours participants spent exercising increased by more than one hour a week. Following the intervention, both the prevalence of overweight and obese participants decreased, and the number of girls within the normal weight range increased. It was also noted that the number of weekly hours spent on exercise by the participants significantly increased after intervention. Taking all these results together, there is evidence that supports a short-term positive effect of the intervention on changing behaviour or lifestyle in terms of eating healthily and staying physically fit.

Although the statistical analysis did not show significance differences before and after the intervention, few girls showed some changes in the average BMI. The number of overweight and obese children decreased in about three months. The observable change and evidence showed that the intervention had considerable impact. Based on the study's findings it is evident that with the right interventions strategy, the promotion of healthy dietary intake and

engagement in physical exercise had an effective impact in improving healthy lifestyle practices as a means to preventing obesity.

4.10. Qualitative Data Results

4.10.1 Introduction of Themes

The aim of the qualitative data analysis was to follow-up on the quantitative findings as part of a mixed methods approach used in this thesis (Cassell & Symon, 2004). Using a thematic framework, the analysis tended to work with, and directly reflect the main ideas and conclusions across the body of evidence in order to show what was prominent (Smith and Firth, 2011). Themes or analytical categories were used to describe and explain social phenomena (Morse & Richards, 2002), by identifying patterns of meaning across the data from interviews (Braun and Clarke, 2006). Qualitative themes were used to capture imperative and decisive responses from interviewees (Davidson, 2009). Codes that reflect and describe a meaningful and coherent pattern in the data in relation to the aim of the study were grouped into particular categories. Thus, these patterned categories were transformed into specific themes to explain the phenomenon under study (Braun & Clarke, 2006). Furthermore, the observed relationship between the respective analytical themes derived from the data and their connection to obesity prevention could be discussed in exploratory terms and applied to develop an understanding of how they could be implemented in interpreting the data analysis.

4.10.2. Developed Study Themes

Based on the participant's responses, three major themes were developed (Table 29). These themes will be described further in the findings relating to the participants' approach to understanding obesity and how to tackle it through the participation in active exercise. Hence the themes constituted the primary framework for the findings; i) Psychological factors that impact on obesity ii) Environmental, place and cultural factors iii) Influence of knowledge and believe of existing obesity prevention strategies.

4.10.2.1. Theme 1: Psychological Factors that Impact on Obesity

Food was used as a coping mechanism among the participants, particularly when they were anxious, stressed, lonely, or frustrated during the course of watching either the television or involved in playing with video game console. This was emphasised in the response of PR8:

"*whenever I eat it makes me feel better even if I'm not hungry, when I am upset I like to have some chocolates or fast food, this always makes me happy or at least it kind of takes my mind off whatever I was thinking about*".

Table 29. Themes developed based on the interview data generated.

Theme	Category
1. Psychological factors that impact on obesity i. Mood ii. Self-perception	1) Nutrition awareness and obesity avoidance among participants i. Healthy food choice ii. Access to unhealthy food and perception
2. Environmental, place and cultural factors	1) School environmental factors i. Food supply-fast food access ii. Impact of physical activity 2) Home environmental factors i. Access to physical activities ii. Influence of electronic media- tablets, video games 3) Role of religion, culture and school curriculum
3. Influence of knowledge and belief of existing obesity prevention strategies	1) Knowledge of the diet to manage weight/obesity 2) Perception of exercise and obesity reduction and awareness of strategies to tackle obesity

A similar view was mentioned by PR15 when interviewed:

"*I do really enjoy eating especially when I'm unhappy. Food does make me happy…Mmm in fact yes I feel much better, my mood changes as well".*

Further insight into this problem revealed that the participants all expressed individual perceptions of their own personal dietary habits, as well as how these are related in relation to the general dietary habits of their peers aged between 9 and 16 years old.

This was reflected in the response provided by PR3 on her perception of food types consumed especially when engaged in sedentary activities:

"Yes. I enjoy eating when I am watching or playing games. I love eating lots of things like crisps and sweets, sugary things like donuts and cakes or biscuits, any kind of desserts really. But I also eat other things like chicken and rice, and curry too".

Psychological perceptions of participants around obesity included perception of health food choice, perceptions of unhealthy food, mood and food consumption, and self-perception regarding eating different foods. These were then discussed in detail as themes.

4.10.2.1.1. Perception of Healthy Food Choices

It can be inferred from the participants' responses that in general, they perceived precisely what constitutes healthy eating habits. Hence, the development in the implementation of obesity awareness should be aided by this prior knowledge and understanding of the usefulness of possible intervention. There was some level of awareness

around the health benefits of consuming fruit and vegetables regularly among the participants interviewed. One of the participant (PR2) stated that:

"*eating things like tomatoes, oranges, apples, bananas, carrots and cucumbers is [considered] good [for one's health]";*

while another noted:

"*eating vegetables with every meal was vital".*

Moreover, a separate answer for what is viewed as healthy food was given as:

"*fruits such as banana, oranges, mangos and kiwi; then there are vegetables such as broccoli, potatoes and carrots*",

as affirmed by PR14 during the interview. Meanwhile, another interviewee (PR9) specifically opined by adding that:

"*yes, eating lots of vegetables is necessary because they are good for you and they contain vitamins***."**

This affirmation is a demonstration that there was, to a certain degree, knowledge among the participants on what constitutes a healthy diet but what remains unclear at this point is their degree of willingness to regularly consume these types of foods**.** Accordingly, another student interviewed (PR16), was more specific in their answer and stated that healthy dietary habits consist of:

"*moderate eating of brown bread and cheese for breakfast, low fat cheese, and for lunch, something boiled or grilled, something like eggs or chicken. I think that would be a healthy diet*".

From this comment, it is obvious that some of the participants possess some degree of knowledge of low fat food and how they are prepared and what the participant considered to be a healthy meal**.**

This demonstrates that although the participants appeared to have knowledge around what constitutes a healthy diet, it is not reflected in their habits. The source of the knowledge and perception is not clear at this stage, but it might have originated from diverse sources such as parents, television programmes or from social media resources. In addition, what is salient but considered important here as earlier elaborated by Roberts and Marvin (2011) is the role that the social environment plays in the consumption of an unhealthy diet and, in particular, the influence of peers on behaviour. In addition, the link between frequency of food intake and obesity is also another factor that has emerged (Ma et al., 2003, Toschke *et al.,* 2005, Kaisari *et al.,* 2013)

In addition, the participants demonstrated knowledge about food types that should be avoided, or the reduction of their consumption. A common concern pointed to the removal of fatty foods such as pizza, burgers, fried chicken and french fries and sugary products like fizzy drinks. To expand on this, one of the individuals noted:

"*I mean that food that you eat has healthy parts, like vitamins or no fats"*.

Likewise, another participant (PR1) stated that:

"*reducing the intake of fatty and sugary product especially cutting down on the amount of fast foods consumed would help*".

Aside from the quality of what is consumed, the quantity is viewed as an important aspect to the participants as a means of a weight reduction approach, as voiced out by another interviewee (PR2) who stated:

*"I think a healthy diet would mean that the person is noticing the amount of food that they are eating by making sure they are constantly keeping watch on how much food they are eating***.**"

While the findings revealed that the participants held a certain level of awareness of food choices and their health impact, it further demonstrates the need for an effective educational message that not only emphasises limiting the consumption of foods high in energy density, but also encourages the consumption of those with a low energy density, such as fruits and vegetables among school age children in Saudi Arabia. However, the type of food was not the only part of this particular theme to be deduced, as the timing and frequency of the participants' eating habits was also deemed to be important. Just as one of the interviewees (PR3) holds the opinion that: "*a healthy diet is achieved by eating the main meals of the day at a specific time*," and another interviewee is of the belief that the consumption of "*three main meals every day to keep a balanced diet and be healthy is good*", is considered a good choice in defeating weight gain. Additionally, one respondent noted: "*for tea I would say something small*". Hence, these call on the need for the participant to understand and accept the importance of eating reasonable portions for better health**.**

One challenge to the promotion of healthy food choices in school is the availability of competitive foods from vending machines, which considered unhealthy and challenge the nutritious selections available in school meals. In addition, it was found that a key setback to encouraging fresh fruit eating among the participants is attributed to the short life of the produce under the high Saudi climate, hence the fear of food poisoning means that unhealthy choices are always made available to the children while in school. This was further elaborated

in Al-Mazrou (2004) who highlighted the scale of the problem with seasonal variation in the occurrence of food poisoning outbreaks, with the peak of these accidents occurring during the hot summer months of June to August.

4.10.2.1.2. Perceptions of Unhealthy Food

Results from a previous study on children's perceptions of the meaning of healthy eating was largely based on diet composition, however this perception did not translate into eating choices, with no differences in the intake of fried foods/snacks, fizzy drinks, fast foods, sweets and chocolates (Swaminathan et al., 2009). Participants in the present study showed a clear perception of what determined healthy eating habits and how they should be applied; their answers also indicated a thorough comprehension of unhealthy eating habits but there was no demonstration of how their perception related to their eating behaviour. This particular theme was evident throughout the answers provided. In fact, an interviewee (PR1) noted that: "*eating lots of chocolate, doughnuts and sweet sugary foods*" would increase the chance of obesity. Meanwhile, another respondent (PR3) noted that fast food such as: "*pizzas and burgers and other types of fast foods*" would be the worst.

Similarly, fizzy drinks consumption was also mentioned as a 'bad' food choice more frequently; as affirmed by another participant (PR6) that:

"*I find drinking fizzy drinks like Cola not a healthy habit*".

What is more, the places at which an individual eats were also understood to prove effectual, as PR12 elaborates in her response:

"…*eating at restaurants regularly meals such as fries, donuts, wraps, burgers and milkshakes can lead to weight gain which in the long run is not healthy***".**

Considering the large number of fast food restaurants within neighbourhoods, it is easy now for a family to choose dining in such places rather than eating at home where what goes into the preparation of the meal is known. In addition, the change in family status over time means that disposable income is readily available (Burns, 2004), and the participant can now access meals and snacks using their pocket money which may go unnoticed by their parents, thus contributing to the ever-growing problem of poor diet and lack of exercise among the participants.

Eating habits, nevertheless, were not restricted to the content of the food, but the respondents also noted the timing, routine and frequency of unhealthy eating habits. For example, one respondent answered that: "*eating throughout the day*" would be harmful for a person; while

another added that, "*an unhealthy person wouldn't eat the main meals of the day and they would eat a lot of snacks*". In accordance with this theme, another student stated that it would be bad to, "*have food before going to sleep*". As a result, it is possible to view that the participants were aware of both healthy and unhealthy eating habits prior to the intervention, just as further mentioned by PR16,

"*Eating from restaurants and having takeaways, having food before going to sleep and eating lots of sweets all the time. I don't think eating before bed is good because you wake up in the morning with a stomach ache*".

Therefore, as the students were sufficiently aware of what was required to constitute a healthy diet, it can be deduced that there were reasons that serve as a detriment in their everyday lives that deterred adherence. Hence, the understanding and beliefs of healthy and nutritious eating should be recommended to the school health unit at the Ministry of Education (MOE).

4.10.2.1.3. Mood and Food Consumption

Foods are represented as having a long-term influence on mood and wellbeing because of the impact they can have on the structure and function of the brain, in addition to the direct link between the consumption of junk food i.e. processed food that is high in sugars and fats, and subsequent levels of depression (Macht & Simons, 2000; Singh, 2014, Maddock, and Hill 2016).

The aforementioned results revealed an understanding around the basis of healthy dietary habits among the interviewees, however there were other factors that could override this knowledge or logic. Their own individual mood or feeling on a specific day could influence the choice of food type that they would decide to consume. For instance, one student mentioned:

"*Yes, I enjoy eating very much and it makes me very happy. I enjoy eating lots of different things, but I also enjoy eating the same things again and again depending on how I am feeling or what I feel like eating at the time. I would say that I enjoy eating a lot*".

Furthermore, other negative associations between mood and food, was highlighted as another participant (PR15) stated that:

"*I do really enjoy eating especially when I'm unhappy. Food does make me happy…Mmm in fact yes I feel much better, my mood changes as well".*

This claim signalled the role mood played in her dietary habits, as found elsewhere (Maddock, and Hill, 2016). It is also possible that the participants' understanding of food is

much more multi-dimensional. This was further elaborated by PR9's response when asked their preference around meals as a special treat,

"I really like going to McDonalds and sometimes Herfy. I love the combos and the wraps there, and the chicken wings, they are really good. I like the Oreo cool ice cream drink it is a mixture of ice cream with Oreo cookies blend together with ice. It is just like milkshake".

Considering that fast food meals are regularly advertised on TV, the role of the media, especially television cannot be ruled out around the eating habits developed among the interviewees (Coon & Tucker, 2002; Harris & Bargh 2009).

Similarly, this notion could be transferred to understand individual mind-sets when diet control was undertaken. One particular answer stated that: "*when you are dieting you do not enjoy eating*". Meanwhile, a different participant also mentioned how eating could result in feelings of guilt: "*yes, because it* [eating] *makes me feel a little sad, a little guilty*". This was associated with the fact that it might lead to weight gain if not properly controlled. Therefore, it can be deduced that the way one feels can be affected by food and that eating habits are affected by personal emotions**.**

With regards to eating and human feelings, Christensen (1996) postulates that in terms of the relationships between food and mood, a common consensus within the literature concerns the relationship between the large neutral amino acid (LNAA) tryptophan and depression. For example, dietary tryptophan drives the process of biosynthesis of the neurotransmitter serotonin (5-HT) (Spring et al., 1987; Cowen, Parry-Billings and Newsholme, 1989; Wurtman and Wurtman, 1989; Young, 1993; Maddock, and Hill, 2016). This means that it is possible that a change in the level of plasma tryptophan triggered by dietary habits may consequently prompt changes in 5-HT levels which are intrinsic to the process of mood regulation. With regard to carbohydrates, the majority of studies do not seem to validate any direct relation between carbohydrate-rich meals and mood or behaviour; however certain studies (Lieberman et al., 1986; Caballero, 1987; Wurtman and Suffes, 1996) purport that strong craving for high carbohydrate food is common amongst a significant subgroup of obese individuals. It is therefore possible to conclude that while certain foods may indeed influence mood and behaviour such as chocolate, milkshakes, pizza, burger, and fizzy drinks etc., given certain conditions the effects of food cannot be said to be grounded on similarities between or likened to those propelled by drugs such as alcohol or nicotine (Haddock & Dill, 2000: 17).

4.10.2.1.4. Self-perception and Food Consumption

The overall eating habits that were described by the respondents were solidified in understanding through the classification by a vast majority into what they termed to be healthy and normal food options against unhealthy options. The students spoke categorically about the need for fruit and vegetables, while also stating that sugars, fats and takeaways were detrimental to a person's health. Da Costa and Alves (2015) opined that self-perception of dietary quality, or the way individuals characterise their eating habits, is affected by socio-demographic characteristics and varies between genders. Therefore, factors such as age, marital status, family income, gender, stress level and physical exercise influence this self-perception. This response from PR1 demonstrated the role of mood in relation to choice of activity which in turn could impact on the food choice made:

" *Yes, of course. I like playing video games specially racing and action games. I like fighting games but it's quite easy for me to get bored of them then move on to another thing or I would try to find something to do but I could easily return back to the console again, especially when there's nothing to do which can make me feel happy. However, my parents decide the time but I would say I play games for about 3 hours or 5. Sometimes it would be two hours. I don't keep track of time when I do so this, I'm just guessing*".

With regards to the type of food consumed, some of the most common answers that were stated include: "*rice, chicken and salad*", as the dishes that were eaten most frequently, whilst others said: *I usually eat rice and curry*", this reflect cuisine types of Saudi customs of having rice as a main meal every day where it is usually served with chicken curry or lamb curry besides salad. However, the real problem is around the quantity of food usually served especially as families gather for lunch or dinner. Recent studies in KSA revealed an increasing consumption of animal products and refined foods in the diet at the expense of vegetables and fruits (Al-Nozha *et al.,* 2005).

In addition, it was demonstrated throughout the answers by the participants that they all understood what unhealthy dietary options would constitute, as the terms "*takeaways, sugary products and fatty fried food*" were all commonly referred to as the bad options for people to eat. However, a frequent finding within the statements was that the participants would still eat the unhealthy options, even though there was a degree of awareness within them around the harmful effects that they would cause, as PR4 stated:

"*I eat chocolates almost every day. Yes, I eat a lot of chocolates. I like eating other things too like sandwiches, burgers or chicken with rice or salad, or pizza. But the most I think is chocolates".*

A similar comment was also made by another participant (PR14):

"I eat crisps as snacks, takeaway food for my meals and sweets also just to snack on, as well as both white and dark chocolate, cookies and buns. I like plain crisps as well as salt and vinegar crisps. I prefer plain though".

The need for education cannot be over-emphasised if the danger of obesity needs to be tackled ahead.

It was evident that the environment these respondents found themselves in and the type of meal readily available to them could affect their individual dietary habits, considering that one of the respondents (PR3) confirmed that:

"*when I am in school, I eat a lot of things like crisps and sweets, all the unhealthy stuff, but in terms of food I usually eat rice and curry"*.

This further demonstrates the place, where children find themselves, plays an additional role in determining –partially- to what they consume (Caprio et al 2008).

Education programmes are important to be conducted for the parents as well which will make a notable difference to their knowledge and then reflect on their behaviours in terms of choosing the food and how to cook it and how to serve it to their children and their family. The degree of knowledge these parents have around the health implication of poor diet intake of their wards is not certain, especially the mothers, but a previous study by Farghaly and Colleagues (2007) and Ahmad and colleagues (2015) did demonstrate the need for healthy diet education awareness among Saudi parents**.**

As a result, it can be interpreted that the participants understand as a whole what their bodies require through personal diet, although it has not been clarified to what extent this knowledge is adhered to. Thus, potential intervention and obesity prevention education in this manner could prove highly beneficial in the long term especially in relation to perception of healthy diet and behaviour change to commit to more frequent physical exercise. Thus, the implementation of better food standards within schools needs to be controlled by school health units at the MOE**.**

4.10.2.2. Theme 2: Environmental Factors, Place and Culture- Influence on Diet

A previous study by Roberts and Marvin (2011) affirmed the role the environment plays as key determinant of dietary behaviours and physical activity levels among individuals. In addition, low levels of education provide greater restriction on opportunities for parents to provide the needed guidance on the right dietary choice for their children (El- Hazmi and Warsy, 2002). Until recently, the focus has been on individual-level determinants, such as a person's diet and level of engagement in physical activities, perception, knowledge, and

motivation to lose weight. However, these individual-level factors do not take into account the many complex environmental influences on a person's behaviour (Abuzaid, 2012; Al Dhaifallah et al., 2015).

As was shown through the understanding of dietary habits, participants generally expressed individual perceptions of how daily physical activities can also help improve their body shape and general health while also decreasing obesity, which was demonstrated to be a major contributing factor in 9-16 years olds' obesity problems. This knowledge and subsequent responses were presented through three very specific subcategories that all contributed to the greater foundation of children's perceptions on daily activities that could affect their own weight and health. These subcategories were as follows: firstly, personal daily physical activities; secondly, physical activities at school; and thirdly, physical activities outside of school.

4.10.2.2.1. Access to Physical Activities

It is possible to argue that having knowledge of what exercise one's body requires and the levels considered unsatisfactory can have some impact on obesity prevention. According to Al-Hazzaa, (2007) the insinuation is that individual perception would enhance and make possible the sustainment of obesity awareness and the efficiency of possible interventions. It may also help in maintaining health development, and hence can be implanted within school health units using the MOE. Within this study all the participants indicated that they were potentially knowledgeable of what exercise their bodies required and what amount would constitute an unsatisfactory level of physical activity. Indeed, walking, running and the going to gym were commonly stated throughout the answers as the most beneficial forms of exercise that a person could undertake on a regular basis. Accordingly, one respondent (PR3) noted that:

"*an active lifestyle needs to include engaging in active exercise and walking too. One needs to be involved in lot of physical movements and not too much lying around*",

while a separate remark showed that in order to be fit, "*a person does need to engage in a lot of running*". Meanwhile, another comment stated that it was highly beneficial to "*exercise a lot during the day* ."

Indeed, other statements demonstrated the participants were already aware of the need to undertake certain forms of exercise, which showed a perception of what was most beneficial. They provided statements indicating their willingness to engage in exercises such as, "*going to the gym about two or three times a week and doing exercises at home when you don't go to*

the gym," was one provided answer that detailed an understanding of what the human body requires in relation to physical activity. Likewise, a separate statement said that "*walking and running, and by doing that more than once a week*" would also help a person's health and weight. Whether their assertions reflect what they really do is something that has not been explored further during the course of the interview with each participant.

4.10.2.2.2. Physical Activities and School Environmental Factors

With the amount of time spent at school for any child between the ages of 9 and 16, it is imperative that they are presented with the possibility to exercise their bodies as well as their minds during their school days (Hills, et al., 2011). It would be a way of stimulating obesity awareness and implementing physical intervention and development that could remain registered and not relied upon at home. In a previous study by Taha (2005) looking at knowledge and patterns of physical activity among school children, it became evident that the majority of the respondents demonstrated good knowledge on the health benefits of physical activity.

The participants stated that "*basketball and football*" are the main forms of physical activity, while one particular student stated the most popular as, "*basketball and football in school as they do different activity lessons each week*". However, another respondent stated that, "*it* [exercise] *is usually different every day*". Furthermore, a major factor that emphasised the need for the implementation of physical awareness and understanding in obesity awareness stemmed from the detail regarding the duration of time spent undertaking physical activity. Most of the responses point to the relatively short time of involvement in exercise ranging from…….: "*45 minutes a week on average*", "*ten minutes every day*", "*these are about 45* [minutes]'. These three particular answers were specific examples of a general trend that described insufficient time dedicated to physical activity**.**

Nonetheless, even though many students refrained from stating whether they perceived this amount of time to be sufficient for the development of their bodies, others did state that there were specific reasons why they would not do it, "*I don't spend any time on this because it's too hot to do this at school*". This was one reason that could be understood in a hot country such as Saudi Arabia. However, students at such a young age can prove to be highly self-conscious, which makes it difficult for them to exercise in front of their counterparts. For instance, one provided answer was, "*I don't like playing sports at school; I don't like when other people look at me*". However, many students do understand that the amount of time

spent on physical education is not enough, as they stated many times, "*no it* [the amount of dedicated time] *is not enough*."

Accordingly, schoolgirls within Saudi Arabia struggle to take part in enough physical exercise while at school, as their schools lack the necessary resources and relevant classes/qualifications in contrast to the boys' schools (Al Hazzaa, 2004). This is mainly due to the religious Islamic beliefs in the country that stop women from actively participating in physical exercise (Al-Rukban, 2003). Hence, factors such as dress codes, restrictions on going outdoors, and conservative norms are the main reasons for the female low physical activity which is reflected among the present study participants.

Based on the submissions from the participants, for those who took part in one form of exercise, positive self-ratings of health as affirmed in their previous response seemed to play some form of influence in their action. Hence there is the need to engage school children in Saudi especially amidst the context of concerns about obesity in society. While the participants hold a positive view about active lifestyle and its need, another view to consider is the role that school-based breakfast and lunch programmes have in promoting healthy eating among children.

4.10.2.2.3. Physical Activities Outside School

Due to the fact that the students are fully aware that they are not completing enough physical activity in school, it would be beneficial if they would compensate for this with exercise outside school. Unfortunately, added interventions for the majority of students in Saudi Arabia appear to be necessary with regard to obesity awareness and fitness development, as most of the respondents noted that they are not sufficiently active; although others did remark that they would be active when they determined it to be necessary. In fact, the progressively active students answered, "[I do] *a lot of walking for things like shopping*", and, "*sometimes I do cycling*", and to expand on this, one of the participants PR16 said,

"*I like walking maybe about an hour in total as I like to play outside with my friends, and they make up games which I play. Sometimes I go for long walks on my own and sometimes with friends. Maybe about an hour in total as I like to play games with my friends and sometimes I go on a walk. I like going on a walk because it allows me the opportunity to see different things*".

The participant's responses indicate willingness towards active lifestyle and in general the vast majority of the participants are not completing a recommended level of physical exercise.

The duration of physical activity was commonly referred to by the respondents and it was always seen to be insufficient and below the 180 minutes recommended for what a developing body requires to curb obesity and improve fitness levels (Trost et al., 2001). Nearly all of the participants stated, "*about an hour*" as the maximum amount of time a day they spent doing any form of exercise. One of the participants (PR1) specifically mentioned, "*I spend about 15 minutes daily on these physical activities*", while another stated, "*sometimes it's different but usually about an hour*". However, it was a frequent response that no physical activity was undertaken during the week, as it was mostly only done at weekends. The school curriculum does not take into consideration the provision of physical education, especially in girl's schools Khalid (2008) and Al-Rukban (2003). This is seen as another setback as to why the respondents reported low engagement in physical activity, especially while in the school environment.

Part of the reason given by many participants for not taking part in any form of active sport outside the school environment is attributed to the weather. For example, PR 13 stated:

"I sometimes take part in outdoor activities, but really not that much because of the weather condition that's most of the time is very hot for outdoor activities."

PR3 also opined that the weather is also a factor that hinders activity outdoors,

"*Well, not really, not that much. I don't like it. I don't like to do it because of the hot weather, I think it's too hot to do these activities*."

While several hold the view that weather is a hindering factor, there is the need to encourage positive long-term lifestyle changes as early as possible in every child's life, which include physical exercise in order to curb against the early development of obesity and cardiovascular risk factors (Datar and Nicosia, 2012).

It must be added that although the students did not partake in physical exercise on a regular basis, they still possessed great awareness of its benefits and requirements. Therefore, the implementation of potential interventions could be developed from this knowledge. One particular participant remarked in relation to their own understanding that their physical activity was: "*not long; I would say about an hour or just under*". In addition, the majority of students attributed excuses for a lack of exercise as "*tiredness*", "*homework*", or "*gaming*", which would increase their levels of sedentary time**.** Here, the lack of physical activity is a key factor facilitating sedentary lifestyle practices and can be a principal contributor to the prevalence of obesity. Hence this demonstrates that work needs to be done with schools to develop approaches to enable students to exercise under varied conditions.

4.10.2.3 Theme 3: Influence of Knowledge Attitude and Belief in Existing Obesity Prevention Strategies

The participants described their individual personal sedentary activities and how they believed this contributed to their overall health, fitness and obesity levels. Overall, this comprehension and perception was shown through two specific subcategories: time spent watching television and time spent gaming. Hence, it has been stipulated quite conclusively that these two individual activities alongside other personal lifestyle factors are what contribute most to low levels of fitness and increased obesity. In the words of one of the participants (PR5):

"*Yes, I like watching television. I like watching comedies, horrors and actions. I feel comfortable when I'm in front of the T.V. ….in addition I enjoy playing video games a lot, I spend quite a lot of time playing than spending time outdoors doing any physical activity under the hot weather***".**

The view posited above shows the impact time spent viewing television and or playing video games had on the participant's energy intake and energy expenditure. However, not all participants felt that exercise was a strategy to curb weight gain, as PR2 stated:

"*I am between the two views. I think that sometimes doing a lot of exercise can help you lose some weight but maybe also sometimes this will not help you as well, and you can still get fat*."

This view does present the need for a review of the existing interventions directed at changes in sedentary behaviour and food choices especially as the consumption of snacks between meals was found to be high among the participants during sedentary activities because it is readily available at any time.

Knowledge of the Relationship between Time Spent Watching TV and Diet for Managing Weight/Obesity

The amount of time spent watching television for children and adolescents is not exclusive to any specific country, as it has become increasingly popular throughout the world (Dietz and Gortmaker, 2001). However, the current study focuses purely on school children attending the same primary school in Madinah, Saudi Arabia, and the findings from the qualitative data have distinguished that a substantially large percentage of time is spent engrossed in sedentary activities among the participants in comparison to undertaking physical activities. This could lead to an increase in overweight children and a decrease in fitness levels. Thus, the percentage of overweight children will ultimately increase and fitness levels will decrease. One participant stated, "*I spent roughly between 2-4 hours watching TV, but it can be different depending on the days***".**

Similarly, another participant (PR2) mentioned:

"I watch television sometimes for more than two hours every day. Sometimes it may be different but I think this is average";

and one more participant (PR11) stated: "*Probably, um, nearly 3 hours every day I think*.".

In accordance with this theme, a different student (PR14) added that:

"*I like watching different programmes like comedy and action mostly. Each programme is half an hour and I watch about 8 to 10 different programmes per day*".

Consequently, it is evident that more time is spent watching television than in participating in physical activities. To expand on this the participant (PR14) affirmed that:

"*I do not do any form of activities either in school but sometimes I play games outside which involve running and playing at home. I would say about an hour or just under."*

This again is an indicator the participants do not engage much in physical activity and these patterns reflect individual values and beliefs and involve what, how much, and when an individual chooses to eat and spend time on exercise. This supports Farghaly and colleagues' (2007) findings that health education and physical education programmes are recommended to promote healthy life styles and dietary habits among school children.

However, this range of more than 2 hours (Farghaly *et al.*, 2007) was not shown throughout the respondents, as one stated, "*sometimes a little longer than an hour if something I like is on TV"* in addition they hold a positive view around diet:

"I think diets work. This can be done by making a record of what you have eaten throughout the week and sticking to a daily plan."

While this may sound positive, the ability for the interviewee to keep a record of their diet is considered unrealistic. Therefore, there are children within the study group who do not necessarily just watch television every time, although many who do not state that they would do more gaming than watching TV**.**

Perception of the Relationship of Time Spent Playing Video Games and Obesity Reduction

Video gaming has increased in popularity throughout the world in modern times (Sherry et al., 2006) and this is also true with respect to Saudi Arabia. Students aged between 9 and 16 are commonly found to spend their free time playing video games, as the qualitative data findings signify. As affirmed by one of the interviewees (PR5): "*I enjoy playing video games a lot, and I think that I spend a lot of time playing games."* While another participant (PR3) gave an insight into the time spent playing games: "*I play them all the time, I play them on my phone*" and another respondent stated that, "*maybe roughly around three hours every*

day". However, another student (PR5) noted that they can spend an excessive amount of time on gaming each day, "*just over 5 hours*" and "*about 5 hours or so because time goes by quick when I'm playing a game; I get too involved in the game*". Moreover, a different example by PR7 was: "*so I would say in total about three hours; on weekends I play on my iPad a lot more***."**

Based on the participants' responses it is clear that excess time is now spent on electronic devices and video games which is associated with a range of adverse outcomes (Tobin and Grondin 2009, Thorne *et al.,* 2014). Hence the capacity for video gaming to increase total screen-time and promote high levels of inactivity is evident. It is worth considering that, whether video games have a positive or negative impact (or both) on gamers, the fact remains that based on the interview responses, it can be assumed that this scenario is a reflection of what is happening on a wider scale; the amount of time spent on gaming is high and it leads some to become dependent thereby increasing their sedentary time.

Nevertheless, additional education into the detrimental effects of unrestricted sedentary activities has been shown to be a possibility for developing upon current awareness and knowledge, as most students acknowledged the requirement to reduce their gaming hours. For instance: "*too much; I spend the whole day* [gaming]", was one statement, while another answer was said in jest to define the excessive amount of gaming: "*I would say that I'm usually playing video games about 24 hours a day*!"

As a result, it can be deduced that although the respondents are focusing more on sedentary activities than physical ones, they remain aware of obesity prevention techniques.

Accordingly, youngsters within Saudi Arabia struggle to refrain from excessive sedentary lifestyles, as the extreme hot weather can keep people indoors, while modern lifestyles are usually focused around visual entertainment, such as television, movies and video gaming (Al Hazzaa, 2004). Moreover, Saudi Arabian families often hire house maids or nannies to look after the children of the house, which means it is not the parents who commonly shape the youngster's attitudes towards exercise (Al Hazzaa, 2004). Therefore, for a true measure of implementation, it would be imperative to develop the Ministry of Education (MOE) for future development in schools, and the understanding of the house maids and workers who frequently interact with the children in their domestic life**.**

Awareness of Strategies to Tackle Obesity among the Participants

As has been determined through the previous subheadings, many students who participated in the qualitative interviews presented inadequate dietary habits, insufficient physical activity within their daily lives, and too much sedentary time, which resulted in obesity and a lack of fitness and health.

However, it needs to be duly noted and analysed that the participants possessed the knowledge and awareness in obesity prevention. Just as the PR15 stated that:

"*I think if one eats less of the right food type that will help in weight loss, or if you follow a specific healthy diet recommended by the doctor it may also help with weight management."*

Thus, it would be feasible to initiate further prevention and intervention techniques among the target population. This particular theme of awareness is further presented using three individual sub-themes: perception of diets to reduce weight; belief in exercise to help lose weight; and suggested solutions for losing weight.

4.10.2.3.1. Perceptions of Diets to Reduce Weight

Overall, defined and restrictive diets were also understood to be helpful in improving a person's weight. This sentiment can be seen from a variety of statements that were presented that constitute this common theme through the answers. For instance, "*Yes; I think all diets work for different people*", was one particular answer. Likewise, another participant stated:

"*eat less and you would lose weight, or if you create some sort of plan or record of what you eat every day*".

"*I think it is possible to make a diet work if you follow it regularly*", was a different answer that adhered to the common theme, and "*because diets take time and you have to stop eating fast food and drinking soft drinks because they have a lot of sugar*", was also noted from a separate student. Despite the positive views held, there are others that are unsure of the benefits of eating a healthy diet, as confirmed in the submission made by PR16:

"*I don't know. It depends on the type of diet. Mostly when on a diet you would cut down on a lot of the food you eat and what you eat but sometimes that doesn't work*".

The vast majority of students within the interview understood that personal diet plays a vital part in the balance of a person's weight and fitness. Therefore, overall, diet was perceived to be most beneficial in reducing weight.

All the participants interviewed stated that they believed and understood that exercise was greatly beneficial in the process of helping a person lose weight and maintain a sufficient level of fitness. Just as one of the respondents (PR3) said:

"*I think doing exercises twice per week or more would help one lose weight. I don't mean taking part in short distance running or exercise but I mean spending long time exercising like an hour or so*".

This was one specific response that showed the common knowledge of beneficial exercise. Additionally, another respondent stated that: "*by doing exercise on a weekly basis, such as going to the gym, sports and running and doing activities* [it would be possible to lose weight]". It was even mentioned in terms that would highlight that most students would perceive exercise to always be beneficial: "*if you do it a lot I am sure it will stop you getting fat. I think everyone knows that*". This was the same with regard to the answer: "*I think it would help as you would stay active*".

This showed that, taking part in daily physical exercise was significantly low among participants and they recognised that involvement in a moderate physical activity regularly has health benefits. As judged by the girls in the present study, physical exercise should be encouraged among the girls in schools and there is a need for a physical education programme to be adopted as early as possible so as to build up this healthy habit.

In addition, the participants were knowledgeable of the fact that a balance is required for any individual between healthy physical activity and healthy eating, as one would not work without the other (Haskell et al., 2007):

"*I think that if the person eats unhealthy foods and is also doing exercises, it will not work; but if the person is eating healthy foods along with exercising, then it will work*."

Likewise, another student stated, "*exercise can help you lose some weight but maybe also sometimes this will not help you as well, and you can still get fat*". As a consequence, it was possible to denote a variety of potential solutions for weight loss from this general understanding.

It was clearly evident that a great percentage of the students did not adhere to their own recommendations of healthy dietary habits or quality physical activity. However, it was possible to draw from the information provided that the participants had awareness of potential solutions for weight loss and methods to decrease obesity. One statement made (PR1) suggested that: "*organise meal times, and then secondly by doing exercises regularly*", whilst another stated a healthy solution is "*where the person eats fruit, vegetables and nuts*". Additionally, "*reducing the amount of food you are eating*" was also emphasised as an effective way to assist in weight loss. Accordingly, another respondent (PR6) said that it would be beneficial to "*make a list of what you are going to eat during the week and keep a record of what you eat***."**

In accordance with what an individual should do to improve his/her health and decrease the chances of obesity, there were also restrictive measures to which a person would need to adhere. Hence, one student stated that "*eating fewer takeaways*" was a way to reduce weight, whilst another individual noted, "*stop drinking soft drinks, because they have a lot of sugar*". In the same manner, a different participant (PR16) mentioned: "*It's necessary to cut down on takeaway foods and sweets and things that aren't good for you."*

4.11. Reflexivity

According to Matelrud, (2001) "a researcher's background and position will affect what they choose to investigate, the angle of investigation, the methods judged as most adequate, the findings considered most appropriate, and the framing and communication of conclusions." (ibid: 483-484)

Reflexivity is an attitude of systematically attending to the context of knowledge construction, especially to the effect of the researcher, at every step of the research process. Reflexivity has been explored over the last 10 years (Matelrud, 2001; Popoveniuc, 2003, Cunliffe, 2009; Bolton 2010) because it is considered as an attribute of the theory, a characteristic of its author(s), a quality of the process of research, or a feature of the subjects of research (Popoveniuc, 2003). As the author of this thesis, I had a set of characteristics that helped me embark on this research study. Reflexivity requires drawing as close as possible to an awareness of the way one is perceived by others. I felt experienced in dealing with children and as an experienced mother with the ability to build and facilitate trust with pupils in order to start a conversation. Using my past experiences of primary school teaching, I carefully planned the education session content and process to be easily understood by young children. I was also well prepared in handling different pupil situations and meeting school required standards that support learning.

Reflexivity also helps prepare an individual to be able to cope with personal uncertainty, and to develop a critically informed curiosity as to how others perceive things as well as how an individual does likewise, while having the ability to consider changing deeply held ways of being (Cunliffe, 2009; Bolton, 2010). There are certain characteristics such as belief, values and the interest of the researcher that can influence the way I carry out the research, thereby influencing the content and conduct of the study, the choice of research questions and the selection of data collection and analysis procedures (Lamb & Huttlinger, 1989). I carefully planned the choice of environment to conduct the interview, the choice of words to use and the body language. I also reassured the interviewees that their information and interests were

safe and confidential allowing them to express their views freely. According to Lamb & Huttlinger (1989) and Popoveniuc (2003) the environment in which the research is conducted as well as the subjects and investigative settings adopted are all viewed to influence the researcher's prior knowledge and his or her self-appraisal and on-going critique. Hence, it becomes difficult to become deeply insightful and offer meaningful significant explanatory insight without reaching the level of self-reflexivity (Cunliffe 2009).

Procter (2013) argued that there is a need for researchers to take into consideration the role of emotion when conducting fieldwork. Considering that, emotional reflexivity is an important aspect of individual negotiations within the complex social space. Davidson and Milligan (2004) present a scenario around the interrelationship between emotion and place where they affirmed that emotions can only be understood within a context of place, which they describe as the 'emotion-spatial hermeneutic'. In addition, they conclude that, it is through reflection and through emotions that one can better recognise how the places one inhabits and the corresponding relationships built have helped to shape one's practice, and how this practice has an influence over our perception. During the interviews, I anticipated that some interviewees may be emotional over their weight, but I planned to handle such a situation in a way that will stay in adherence to the study objectives. Some interviewees were timid, making it difficult to extract information, but I ensured they were comfortable and that rapport was firmly established to keep the conversation on track. Other participants provided broader detail against what I was probing, but I was cautious not to dampen their interests as that would reduce their confidence or affect the conversation.

4.12. Qualitative Summary

The qualitative results discussed above focused on psychological factors that affected obesity, along with the environmental and cultural factors and the influence of knowledge and belief regarding existing obesity prevention strategies. There was a high level of understanding with regard to diet and nutrition, as well as knowledge about the quality and effectiveness of physical activity. It emerged that individuals appeared to undertake a low level of physical activity and essentially were not engaged with any form of activity at school. Qualitative results also show lack of Physical Education contributes to lower physical exercising levels among participating schoolgirls. The majority of the participants stated continuously that time spent doing physical activity within a week came down to around less than an hour because they lacked facilities. Interviews also appeared to distinctly indicate high levels of sedentary activity among participants, and specifically playing video games or

watching television were common among participants. The majority of the participants stated that they watched quite a lot of television throughout the week, with only a quarter of the respondents stating the contrary view, which ultimately showed unhealthy lifestyles choices. Self-perception analysis showed that three quarters stated that they were not satisfied with their current weight or body shape, as the vast majority noted that they were actively attempting to lose weight.

4.13.Qualitative Data Summary

This chapter has provided the results of the current feasibility study drawn from the analysis of data collected. Presentation of results was done in two phases namely quantitative and qualitative. The qualitative data presented was collected through questionnaires and physical measurements. The results are analysed systematically and some variables such as lifestyle factors were compared against BMI. Qualitative data indicated that an intervention can improve the lifestyle factors of participants. Quantitative results showed that after the intervention, unhealthy food intake decreased, healthy food intake increased, and more hours of physical exercise were recorded. Qualitative data collected from the interviews to help explain the quantitative results indicated that participants had considerable knowledge on nutrition and PA. Using a thematic framework, themes such as psychological factors related to food, environment factors that affect lifestyle and the knowledge and belief of obesity prevention are explored in detail.

Chapter Five: Findings and Discussion

5.1. Introduction

In order to reduce and prevent increasing cases of childhood obesity, this feasibility study aimed at improving healthy eating habits and physical activity levels among KSA schoolgirls aged between 9 and 16 years old by conducting a nutrition education intervention. The findings obtained from this feasibility study have enabled an evaluation of the intervention itself and the methods used to evaluate effectiveness in this study, to contribute to the development of a large trial of the intervention as a next stage of this research programme.

The intervention was designed to use physical, oral and documentary education methods to affect or alter existing behavioural patterns of the sample population. The study used quantitative and qualitative methods together as a mixed approach to investigate the effectiveness of such an intervention. The quantitative part of this study provided pre- and post- intervention results from the sample. However, because quantitative methods lack the ability to conduct in-depth extractions of information, qualitative methods were undertaken as a follow-through and to complement the collected evidence about nutrition and activity with regards to child obesity (Thomas & Harden, 2008). Results deduced from the study sample are discussed in this chapter in order to establish an understanding of the effectiveness of the intervention and thereafter draw conclusions.

This chapter starts by presenting the principal findings from the quantitative and qualitative results and then narrows down to the key findings of the study. Key findings are then discussed in detail reflecting on the literature review and the final study results of this thesis. The discussion will evaluate the significance of those findings in order to provide substantial evidence in drawing meaningful conclusions from this study and making relevant recommendations that may have policy implications in Saudi Arabia. The contribution of Social Cognitive Theory as this study's theoretical framework is then discussed focusing on how it shaped the findings. The chapter ends with a discussion of strengths and limitations drawn from this study.

5.2. Current Real Problem

From the qualitative and quantitative results obtained, the current real problems associated with child obesity as drawn from the study sample include: existing cases of

overweight (23.3%) and obese (5.6%) children among the participants; participants having access to energy dense foods from food service shops; participants having a good knowledge of healthier practices but not adopting them because of lack of physical activity classes and facilities; and (female) participants having limited exercise due to cultural reasons. As pointed out in the literature review, early research studies conducted in KSA have also raised concerns about cases of obesity among KSA children. Al-Nuaim et al's (2001) study on 9,061 male children of 6-18 years in KSA found 11.7% were overweight and 15.8% were obese. Murphy (2010) reviewed KSA studies on child obesity between 2005 and 2008 and also reported cases of obesity by affirming that 1 in 10 (11.1%) of KSA children and teenagers were obese. Food service shops are a major concern because of unregulated or restricted access to inexpensive energy dense foods as opposed to healthier diet like fish, fresh vegetables and fruits encourages children's intake of non-diet, a factor that increases risk of developing obesity (Epstain et al., 2008; Drewnowski & Darmon, 2005). Lack of physical activities in school encourages children to pursue sedentary activities (Powell et al., 2006, Scott et al., 2007) hence increasing their risk of developing obesity. Research studies also strongly point out that cultural environment plays a pivotal role in the rising prevalence of obesity in KSA (Deghan et al., 2005). Al-Nakeeb and colleagues (2012) highlights that Saudi's cultural norms that require girls to stay at home or not to come into contact with men decreases the physical activity levels of a girl child compared to boys, hence increasing their risk of being overweight or obese.

5.3. Quantitative and Qualitative Findings

Quantitative findings drawn from this study shows that the prevalence of overweight and obese participants decreased after the 3-months obesity education intervention. The intervention had a positive short-term effect on the types of food eaten as post intervention data showed the majority of participants practiced the intake of healthier food choices. Comparison of pre- and post- intervention data demonstrate that intake of unhealthy food decreased. Consequently, the number of hours participants spent on electronic devices and video games significantly dropped after the intervention. It was also clear that the intervention had an effect on the level of the exercise or physical activity that the participants practiced. The numbers of weekly hours spent on exercise by the participants significantly increased after the intervention. More importantly, post-intervention data are indicative of the observed increase of the number of girls within the normal weight range. While there were no

significant changes in the average of BMI after intervention, a critical change (significant drop in) in the number of overweight and obese students was observed.

Qualitative findings drawn from this study also show participants had a high level of understanding with regard to diet and nutrition, as well as knowledge about the quality and effectiveness of physical activity. The vast majority had a clear understanding of what nutritious food would be in terms of the differences between healthy and unhealthy food choices. The results show that psychological factors impact on the food choices of participants. School and home environment factors have a significant effect on the type of food and level of physical activity participants have access to. School Health Units (Ministry of Education) should adopt strategies to improve school canteens, while more regular and focused Nutrition and Physical Education classes must become a fixed part of the daily curriculum for schools of both genders. Qualitative findings also indicate that culture had an implication on the choice of food and level of physical exercises. Qualitative results also indicate that it is essential for the authority to develop national school programmes for prevention of obesity and the promotion of physical activity among male and female students alike.

5.4. Key Findings

The main findings of this thesis were drawn from the above quantitative and qualitative findings. They therefore make the main discussion of this chapter. They are as follows:

1. The impact of the nutritional educational intervention was as follows:
    a) Diet and nutrition:
        - Healthy eating behaviours were improved after the intervention.
    b) Physical activity:
        - The intervention had a positive effect on the level of the exercise taken among the participants.
    c) Sedentary activity:
        - Time consumption on electronic devices and video games significantly decreased
2. The quantitative and qualitative results indicate that:
    a) Some of the participants in this study have high level of understanding regarding diet and nutrition; however, there was a lack of access to healthy food in the school canteen.

b) In addition, there was a clear awareness of the importance of physical activity among the participants, however there were no physical education classes and no facilities available for the girls at schools.

5.4.1. Impact of Nutritional Education

5.4.1.1. Diet and Nutrition

In recent years, there has been an increasing interest in studying nutrition transition and obesity related chronic diseases. This is because diet and nutrition are significantly linked to the cause and prevention of obesity. According to Hawkes (2006), nutrition transition has been implicated in the rapid rise of obesity and diet-related chronic diseases worldwide. Other research studies by Khalid (2008) and Al-Rukban (2003) have explained that eating habits and unhealthy school canteen meals are among social determinants linked to the cause of obesity. Seemingly, Al-Shehri and colleagues (2013) postulated that the underlying cause of overweight and obesity in Middle Eastern countries seems to be poor knowledge of food choices and cultural and social norms associated with diet, such as body image. Therefore, understanding nutrition and diet and its link to child obesity was necessary for this study to help decision-makers in KSA and other countries develop policies, including food policies that will address the burden of child obesity. In this study, diet or nutrition and physical activity were considered as behavioural factors that when modified will have implications for the BMI status of participants. Dietary and physical exercising patterns drawn from both pre and post intervention were analysed in relation to BMI to establish their impact on overweight and obese cases in the study sample. Overall results show an improvement in diet or nutrition and physical activity behaviours of the.

The overall findings on diet and nutrition indicate that in the short-term, a decrease was noted in unhealthy food products (i.e. fast food, soft drinks, energy drinks and snacks) intake, while intake of health foods like vegetable, fruits and nuts increased among the participants after the intervention. According to Prentice and Jebb (2003) energy density is described as the energy content per unit weight of foods, meals or diets, which is often expressed in kJ $100g^{-1}$. In simpler terms, energy dense foods and drinks have a higher energy composition than our body requires and hence non-diet. Prentice and Jebb's (2003) study on fast foods at some typical outlets showed that the average energy density of entire menus was (~1100 kJ $100g^{-1}$), which is 65% higher than the average British diet (~670 kJ $100g^{-1}$), more than twice the energy of recommended healthy diets (~525 kJ $100g^{-1}$) and 145% higher than traditional African diets (~450 kJ $100g^{-1}$). Consuming fast foods and/or energy dense foods results in

excess energy and hence promoting weight gain and obesity (Hill et al., 2003). It was therefore important that the children reduced the intake of fast foods in order to achieve positive results with normal weight and obesity reduction.

While short-term results did not show a significant correlation between the BMI and categories of food intake including fast foods, soft drinks, energy drinks and snacks, a change in weight categories was observed corresponding thereby to a change in eating patterns (from unhealthy to healthy). This can be supported by what other studies have documented before. A longitudinal study of Euro-American samples assessed by Nicklaus and colleagues (2003) showed that sweetened beverages (58% soft drinks, 20% fruit flavour drinks, 19% tea, and 3% coffee) ($p<0.001$), sweets (desserts and candy) ($p<0.001$) and other low-quality food ($p<0.01$) were positively associated with overweight status. Nicklaus and colleagues (2003) further documented that food consumed, specifically from snacks, was positively associated with overweight status ($p<0.05$). Another study also explains that children's intake of soft drinks should be discouraged because soft drinks provide consumers 188 kcal/d beyond the energy intake of non-consumers and such an intake among children may partly explain the rise in child obesity as those drinks are associated with obesity (St-Onge et al., 2003). A similar study performed in Australia with children aged 4-12 years regarding beverages and foods including packaged snacks, fast foods and sweetened drinks affirmed that children who consumed 3 to 4 and more than 4 servings of sweetened fruit juice/drinks were 1.7 and 2.1 times more likely to be overweight or obese while packaged snacks results also associated it with overweight (Sanigorski et al., 2007). Thus, it is important to understand what influences children to consume these foods albeit their prior knowledge about the obesity risk. According to Grimm and colleagues' (2004) inquiry into what factors relate to soft drink consumption in children, they found that school-aged children are notably influenced by the taste preferences, soft drink consumption habits of parents and friends, soft drink availability in the home and school, and the adverts that they view on TV. Therefore, in addition to awareness that reducing intake of energy dense foods reduces and prevents obesity as found in this study, it is noted that the environment also has to be regulated for better results.

Increasing the consumption of healthy food products such as meat, beans or nuts, vegetables, fruits and dairy products among participants can be said to have an impact on the BMI results. After the intervention, there was an increase in normal weight cases and a short-term decrease in overweight and obese cases. The increase of healthy food types was based on findings from other research studies that diet plans rich in fruits, vegetables and dairy

products may have beneficial effects on obesity and other chronic diseases. According to Moore and colleagues' (2005) study, children who consumed more fruits and vegetables (4 or more servings per day), or more dairy products (2 or more servings per day) and fewer energy-based foods while having normal exercise, were less likely to be obese as opposed to those taking less of such foods. In Iran, a study on the frequency of eating fruits, vegetables and dairy products and snacks showed that consumption of these foods combined with physical exercise had an inverse association with BMI (R^2=0.57) (Kelishadi et al., 2007). Diet and nutrition based intervention findings from Epstein and colleagues (2001) study on increasing the intake of healthy foods among obese parents and their children for one year, revealed that increasing fruit and vegetable intake and decreasing consumption of high-fat/high-sugar foods significantly decreased the percentage of overweight/obese cases compared to those in the group of decreasing high-fat/high-sugar foods only.

The overall findings from this study therefore showed evidence that the diet and nutrition intervention was effective in contributing to reducing and preventing obesity. The results suggest that focusing on increasing the intake of healthy foods while decreasing the amount of energy dense and high sugar foods may serve as an adequate approach for nutritional change among KSA children. The nutritional change may then help to reduce the increasing child obesity prevalence and to prevent child obesity cases in KSA. However, this has to be made possible by the application of all-encompassing factors that affect diet and the nutrition of school-aged children. According to Swinburn and colleagues (2004), a broad range of strategies that influence diet and nutrition such as influencing the food supply to make healthy choices easier, reducing the marketing of energy dense foods and beverages to children and enhancing accessibility to healthier foods around schools and homes, are required to make obesity intervention strategies more effective. According to Drewnowski and colleagues (2003) there is also the importance of ensuring that diet and nutritious foods are more available and cheap as opposed to the low-cost foods that are high in fats and sweetened, making them a more available option to children compared to healthier foods.

5.4.1.2. Physical Activity

Previous research studies have argued that physical activity is a critical variable for obesity interventions because it has a direct effect on child weight status through energy expenditure (Sallis & Glanz, 2006; Steinbeck, 2001). Another study outlines that physical activity is among the four key topics (others being environmental factors, the aetiology of eating, and multiple behaviour changes) related to child and adult obesity, therefore it is

critical in developing effective child obesity intervention strategies (Wing et al., 2001). Intervention results from this study indicated a positive effect on the level of the exercise taken among the participants with a consequent decline in the number of participants in overweight and obese categories. By increasing the hours of exercise, the study was able to achieve an increase in the amount of energy expenditure. According to Steinbeck (2001) physical activity benefits child obesity because it is a discretional component of energy expenditure, such that an increase in levels and hours of PA, results in a decrease in overweight and obesity rates. From this study it was seen that participants' physical exercise in addition to their daily life routine activities impacted on their weight status. Those findings were also noted by Brown and Summerbell (2009) in their study in which they argue that adding exercise on top of routine or life-style activities has a significant impact on reducing child obesity.

The intervention had a observable impact on the number of weekly hours of exercise. The mean weakly exercising hours ($M=4.49$) among participants was noticeably higher than pre-intervention ($M=3.05$) with $p<0.001$. This clearly indicated that the intervention had a positive impact on the exercising habits of the participating children. The findings are consistent with those of previous studies such as that of Hernandez and colleagues (1999) who assessed the relationship between physical activity and other factors and their association with child obesity. They found that physical activity was related to obesity prevalence and that an increase in physical activity levels and hours decreased obesity prevalence in Mexican children aged 9-16 years. Similarly, Anderson and colleagues' (2006) study on how physical inactivity contributes to weight gain in children aged 8 through 16 years in the USA, concluded that interventions that promote lifelong physical activity among children are required in order to repel child obesity. A school-based interdisciplinary study of applied physical education classes conducted by Gortmaker and colleagues (1999) argued that increase of physical exercise among the participants had significant impact on obesity prevalence.

It is worth noting that the comparison of pre- and post- intervention BMI trends confirms the findings from the literature review that explained that weight loss can be induced by increased daily physical activity and therefore can be critical in preventing and reducing obesity (Ross et al., 2000). Intervention results that exhibited an increase in hours of exercise is associated with a decrease in overweight and obese cases indicate that it is important for schools and parents to adhere to common international guidelines on how much–physical

activity children need to practice for health purposes. As outlined by the Canters for Disease Control and Prevention (2015), "children and adolescents should do 60 minutes (1 hour) or more of physical activity each day." An evidence-based study on physical activity for school-aged youths conducted by Strong and colleagues (2005) also asserted that for an optimum health and behaviour outcomes, school-aged youth should participate in 60 minutes or more of moderate or vigorous physical activity that is developmentally appropriate and enjoyable on a daily basis. If KSA children can practice 1 hour a day, this can –and should-significantly affect child obesity prevalence thereby reducing and preventing its occurrence.

It is therefore clear that physical activity can contribute effectively in child obesity interventions; however a number of studies suggest better approaches to applying physical activity in child obesity interventions. Pate and colleagues (2004), for example, postulated that while children's physical activity levels are highly variable, policies and practices should play an important role in influencing the overall activity levels of children in schools. According to Epstein and Goldfield (2006), public health policies should draw from past research on the effect of exercise or physical activity in paediatric obesity treatment in children. There are encouraging findings that physical activity or exercising may help in child obesity treatment by implementing it in schools. Swinburn and colleagues (2004) argue that intervention strategies should influence urban environments and transport systems in a way that promotes physical activity. This should encompass the increase of exercising and sporting facilities for both school and home environments.

5.4.1.3. Sedentary Activity(SD)

Dissuading children from pursuing sedentary activities can play an important role in reducing and preventing child obesity. Pate and colleagues' (2008) study elaborates that physical activity and sedentary activity-(light and moderate-to-vigorous) activities are closely related but mutually exclusive in the way they affect health. In this thesis, the sedentary activities that were analysed focused on frequent inactivity through watching TV, playing video games and use of electronic devices (i.e. computers, smartphones and tablets). Intervention results from this study show that, overall, the time participants spent on these forms of pastimes has evidently decreased. Major change was noted in participants that used to watch TV more than 3 hours per day; this decreased significantly from 18.9% to 10%. This establishes a correlation between time spent on sedentary activities and that spent engaging in physical activities. Indeed, the decrease in sedentary activities represent an important finding for this intervention as it in line with the studies that reported similar observations and

advocated that modifying sedentary behaviour in favour of physical activity has significant effect in decreasing overweight/obesity and therefore it is critical in reducing and preventing child obesity (Wong et al., 2009; Pate et al., 2008). Additionally, Campbell and Hesketch's (2007) study conducted in the USA also showed that interventions were effective in promoting healthy weight in young children if they were capable of altering sedentary behaviour.

Watching TV and playing video games have long been associated with child obesity. According to Epstein and colleagues (2000) epidemiological studies have shown television watching to be a risk factor for the development of obesity in children. Maddison and colleagues (2011) also postulated that sedentary activities such as video gaming on computer or mobile devices, particularly inactive video games in which players do not physically interact with images on screen, are independently associated with obesity. In KSA, it is possible that today's environment has enforced an inactive lifestyle that has contributed to increased weight gain among children. However, results from this thesis show that the intervention made participants aware of those risks causing a short-term increase in their physical activity. Previous research findings also report analogous results. Rey-Lopez and colleagues' (2008) study on sedentary behaviour and obesity development in children reported that even though not all sedentary activities show the same relevance to childhood obesity, a limit to time spent watching TV for young children and playing video games and computers is linked to lower overweight or obese prevalence. A comprehensive literature study aimed at determining if emphasis on decreasing sedentary behaviours in children and adolescents resulted in behaviour change and weight control argues that though study approaches vary, all reduced sedentary behaviours and improved weight indices (DeMattia et al., 2006).

It is evident from this study and the reviewed literature that sedentary behaviours stem from environmental factors that require to be changed in order to decrease inactivity and increase physical activity among children. There is an extensive body of evidence from all the studies reviewed in this thesis showing that decreasing sedentary activities while increasing physical activity significantly impacts on child obesity. Among them, Tremblay and colleagues' (2011) systematic review focused on studies featuring children aged 5-17 years, concluding that decreasing any type of sedentary time with similar effort to increase physical exercising hours is associated with lower health risks and leads to reductions in BMI. Additionally, Tremblay and Willms' (2003) study involving Canadian children provide evidence

supporting the link between physical inactivity and child obesity. Their study further outlines important results that TV watching and video game use are risk factors for being overweight (17-44% increased risk), or obese (10-61% increased risk), while the opposite, physical activity are negatively associated with being overweight (10-24% reduced risk) or obese (23-43% reduced risk) (Tremblay & Willms, 2003). Reilly's (2008) study also presents similar findings like Tremblay and Willms (2003) by arguing that his review of the evidence presented supportive findings on the hypothesis that physical activity is protective against obesity and that sedentary behaviour, such as TV watching and playing video games, is obesogenic. However, a study conducted by Biddle and colleagues (2004) presents interesting results by concluding that physical activity levels are unrelated to TV viewing and TV viewing is not a key determinant of the number of hours children will exercise. Nonetheless, policy on education, public health, sport and recreation, and mass media should be supportive of less sedentary behaviours and increased physical activity in Saudi Arabia to help prevent child obesity. The intervention results from sedentary activity signify that efforts should be focused on facilitating active lifestyles among Saudi children in the attempt to limit or minimise the prevalence of obesity. This study therefore contends that an emphasis on decreasing sedentary behaviours is an effective way to encourage the children to be more active while simultaneously preventing obesity and its associated health risks in the future.

5.4.1.4. Combining Diet and Nutrition, Physical Activity and Sedentary Activity

Overall, the intervention showed an improvement on diet and nutrition, physical activity and sedentary behaviours. Positive results from key indicators in each of these components presents evidence that combining diet, physical activity and sedentary components increased their effectiveness on intervening in child obesity. A decrease in hours of TV watching, computer use and video gaming followed by an increase in hours of physical exercise per week for every participant, with replacement of all unhealthy food intake with healthy foods were positive implications observed from the intervention. Assessing changes in BMI, exercise, sedentary activity and nutrition, it can be argued that the positive implication marked the effectiveness of this intervention by reducing the number of overweight and obese participants from the study sample. However, the result did not reveal a significant difference for BMI ($t_{(24)} = 1.04$, $p = 0.304$). The intervention can be said to have been effective because its results indicated that some of the participants made clear changes in their weight in post intervention measurement. Past multicomponent studies also argued that combining diet, physical activity and sedentary strategies was effective on child obesity

interventions. The study by Hill and colleagues (2003) that used a multicomponent approach revealed that combining reduction in energy intake (diet and nutrition) and increase in physical activity by reducing time spent on TV and computer games, could prevent weight gain in most of the child population.

Swinsburn and colleagues' (2004) research study postulated that promoting physical activity, communicating healthy eating and supporting children to make healthy choices by avoiding sedentary behaviours, can be comprehensive in managing overweight and obese cases among children. Gortmaker and colleagues' (1999) school-based interdisciplinary intervention study that factored diet and physical activity between USA girls and boys in grade 6 to 8 also found that a reduction of TV hours and increased fruit and vegetable intake among boys and girls indicated promising results in reducing obesity among children. Similarly, Berkey and colleagues (2000) longitudinal study on activity, dietary intake and weight changes reported that strategies that prevent excessive caloric intakes, decrease time with TV/videogames and increase physical activity would be more promising as a means to prevent obesity. According to Nemete and colleagues' (2005) study results on short and long-term effects of combined dietary–behaviour-physical intervention for treatment of childhood obesity, highlighted the beneficial effects of that combination including changes in body weight and BMI, body fat percentage, serum total cholesterol level, and fitness. Most of these studies combined with findings from this study intervention highlight the importance of multidisciplinary programmes for the prevention of childhood obesity for both short and long-term effects.

5.4.2. Knowledge or Awareness of Diet and Nutrition

Pre-intervention results from this study demonstrated that some participants had an adequate level of understanding with regard to diet and nutrition. Even though there was a lack of access to healthy food supply in the school canteen, both parents and children understood the importance of healthy eating and being physically fit, but the application of this knowledge could not be verified. Nonetheless, previous research studies, have also observed similar findings. Gibson and colleagues (1998) argued that while participating children appeared aware of the benefits of a healthy diet, parental, psychosocial and environmental factors influenced children's fruit and vegetable consumption. Investigating school children's knowledge and awareness of food and nutrition in the UK, Hart and colleagues' (2002) study reveals that taste and preference were confirmed as consistent influences in children's food classification. However, their study also arrives at important findings which purport that primary school children may be receptive to food based dietary

messages based on familiarity, concrete food classification and whether the message is cognitively appropriate and possibly gender specific (Hart et al., 2002). Similarly, Ku and colleagues (2000) survey on dietary and nutritional knowledge for elementary school children in Busan South Korea reported that children had knowledge about dietary practices but they still consumed snacks, fast foods and other non-diet produce. In Australia, Hesketh and colleagues' (2005) qualitative study of parent and children's perception of a healthy lifestyle showed that a contradiction in the messages that children received with regard to myths, local environment, roles of school and family, were a barrier to a healthy lifestyle. It, therefore, can be said that while KSA children are knowledgeable about healthier foods they do not practice healthy eating habits because of environmental and psychosocial influences. Factors like availability of fruits, cost of buying those healthy foods, taste preferences, parental influence, culture and others may be possible barriers to KSA children applying the diet and nutrition knowledge they possess. However, further research should be done on the level of knowledge and how specifically this factor relates to child obesity in KSA. Thus, it can be argued that systematic education at school can be significant and critical in instilling in the children the value of a balanced diet and assist them to overcome barriers voluntarily.

5.4.3. Knowledge or Awareness of Physical Activity

This study has also observed that there was a clear awareness of the importance of physical activity among the participants. However, there were no physical education classes and no facilities available for the girls at school. This is an indication that social and environmental factors are obstructions to physical activity and child obesity prevention. Hesketh and colleagues (2005) postulated that physical activity choices among children highly depend on school exercising facilities or physical education, or supportive environment at home. Trost and colleagues' (2001) study on physical activity─and determinants of physical activity–in obese and non-obese children noted that the attempt to boost self-efficacy perception regarding exercise depends on increased access to and awareness of available facilities, and parental modelling of physical activity. As emphasised in the literature review and in this chapter, physical activity in school-based interventions has indicated that it can help in maintaining healthy weight among children.

The environment and the social environment offer support to utilisation of children's knowledge of physical activity and their health. Education policies should enforce physical education classes at primary schools. One USA research study that examined the effects of physical education (PE) instruction time on BMI change in elementary school concluded that

expanding PE programmes in schools or introducing them where they do not exist may be an effective intervention for combating obesity in the early years, especially among girls (Datar et al., 2004). Seemingly, Sallis and colleagues' (1997) study on the effects of a 2-year PE programme on physical activity and fitness in American elementary school students argued that a health-related PE curriculum can provide students with substantially more physical activity–during PE classes, hence improved PE classes could potentially benefit 97% of elementary school students. KSA children could also benefit from an introduction of PE classes at school that will have more impact on physical activity levels of school-aged children. According to Bailey's (2006) study in the UK, PE and sport in schools have the potential to make a significant and distinctive contribution to the development of children's fundamental skills including movement, physical competitiveness, and social skills, and in certain circumstances self-esteem, academic and cognitive development. Carlson and colleagues' (2007) longitudinal study in Atlanta, USA on PE and academic achievement in elementary schools concluded that among girls, spending more time on PE may be associated with academic benefit and PE did not appear to negatively affect academic achievements in elementary school students. Therefore, the introduction of PE classes in KSA will have multiple results, but most importantly it will assist interventions on child obesity.

5.5. Effectiveness of the Intervention

Childhood obesity prevention intervention studies are designed to help reverse the obesity epidemic. Assessing the effectiveness of nutrition education interventions is important for identifying what works and how best does it work in preventing childhood obesity. According to Pettigrew and colleagues (2014) an effective childhood obesity intervention should be a solution that not only works, but also delivers the best impact in the long-term at a considerable cost. According to Showell and colleagues (2013), the effectiveness of obesity prevention interventions is critical given the significant impact of obesity on acute and chronic diseases, development, well-being and general health. The current study's main aim and objectives were to assess the effectiveness of the intervention in preventing and reducing childhood obesity in KSA. The findings from the study showed that educating the children about healthy lifestyle choices had a positive change in their unhealthy behaviour, as a result a slight change in weight was observed.

Based on the results from this study, it occurs that the intervention had favourable effects. Being a multi-component education programme, that involved both the school and family or community, it is likely to indicate the importance of the choice of food, level of physical

activity and sedentary behaviour. However, because of the small sample bias, further research and evaluation designs are required to strengthen the claims pertaining to the efficiency of the intervention components, particularly in terms of delivering long-term, sustainable impact. Furthermore, future intervention could be improved by including some provisions such as healthy meals during the intervention times, healthy lunch boxes for students at schools and measuring the physical activity levels

5.6. Theoretical Framework

Application of social cognitive theory (SCT) in modelling and achieving the aim, objectives and methods of this study can be seen to be effective and instrumental as the behaviour change was observable and the intervention objectives were met. SCT theoretical framework was important for understanding and developing the intervention within a social environment, especially, in defining the role of teachers, friends, family or parents on child obesity intervention. McEachan and colleagues (2008) assert that SCT is a crucial tool for studying behaviour and the social environment of school-based interventions because the model allows the use of methods suited to engaging parents, teachers and friends in influencing children's feelings and behaviour. Rovniak and colleagues' (2002) study on the social cognitive determinants of physical activity–in children and youths using SCT argued that SCT was effective in establishing a prospective structural equation analysis of social support, self-efficacy, outcome expectation and self-regulation in relation to. In this study, the SCT structural elements were as follows: *reciprocal determinism* (interaction with environment, personal factors and behaviour); *behavioural capability* (knowing what and how to do); *observational learning*; *expectations*; *self-efficacy* and *reinforcement* were used. *Reciprocal determinism* informed the choice of research methods used to interact with the environment, such as the use of anonymous questionnaires, for assessing personal factors and behaviours. Additionally, *reciprocal determinism* and *behaviour capability* guided the use of Arabic language and complying with Islamic religion and culture in order to reduce conflict and mitigate barriers. These structural components were integrated into the study research design considering that SCT structural methods offered principles and predictors of how to change behaviour (Burke et al., 2012). According to Bandura (2004) SCT fundamentally supports a study targeting behaviour determinants and offers a foundation for how to effect behaviour change.

The *observational learning* construct was important in identifying the role of family and specifically of parents on their diet and nutrition knowledge and habit; while the *expectation*

construct served to identify whether participants could predict or anticipate results of their action, such as eating healthy foods and increasing their physical activity. The results showed that KSA children participating in this study anticipated or at least understood that practicing healthy eating habits and exercising regularly reduced the risk of obesity. From the qualitative results, some participants clearly indicated their expectations according to the lifestyle choices they made. The *self-efficacy* construct was significant in assessing if the participants had the ability to apply the diet and nutrition and physical activity knowledge they had into overcoming overweight and obesity risks. Results showed that some participants did show some effort before intervention. However, self-efficacy improved after the intervention as more participants claimed that they were practicing healthy eating habits and achieved a notable increase in physical activity–levels and hours. The *reinforcement* construct was important in assessing the way the healthy lifestyle habit can be replicated in order to ensure that the effectiveness of the child-obesity intervention is sustained. From the study and the above discussion, a reinforcement aspect is identified to include the role played by parents and family in shaping the healthy lifestyles of the children by rewarding their effort of practicing healthy actions. The role of PE classes and teachers in ensuring that KSA children are physically fit will fundamentally reinforce physical activity knowledge. The availability of sporting and exercising facilities with reduced selling of non-diet foods at school service shops including health –based education and food policies are core to reinforcement.

It can therefore be argued that SCT proved to be an efficient theoretical framework in developing and implementing this study. Its relevance and impact on this study is drawn from the fact that food or nutrition and physical activity specific knowledge and skills are human thought and associate with self-regulation which informs better actions (Nootboom, 2009). The SCT framework or guideline was also effective given the context of this study, which was behavioural and social related. SCT facilitated behaviour and social (human thoughts, motivation, barrier and action) research, analysis and understanding. It was an effective framework because the study was able to achieve behaviour change among the participants. Past studies that have used the SCT theoretical framework have also argued that SCT positively enhanced findings and conclusions. According to Lucas and colleagues' (2013) study, SCT proved to be efficient in a number of school-based interventions, particularly, those that involve children of ages below 15 years old. Eaking and colleagues' (2007) study on interventions for physical activity-and dietary behaviour change used SCT and argued that

it supported the efficacy of physical activity ~~PA~~ and dietary behaviour change interventions. However, a study on the theoretical and methodological characteristics of effective school-based interventions by Cole and colleagues (2006), postulated that some effective school-based intervention did not use SCT. Another study by Blanhette and Brug (2005) focused on determinants of fruit and vegetable consumption among 6-12 year-old children, highlighting that SCT framework was suitable because of the social and behavioural nature of child obesity.

5.7. Strengths of the Study

The strength of this study lies in combining quantitative and qualitative methods (hence the mixed method approach) which helped to understand, not just whether the intervention worked, but how and why, and for whom.

This study applied a mixed methods approach in order to gain an in-depth understanding of childhood obesity knowledge and awareness among KSA school-aged girls and its implication on preventing overweight or obese cases. According to Creswell (2013) a mixed method approach provides breadth and in-depth understanding and corroboration while offsetting weaknesses inherent when using either quantitative or qualitative individually. Mixed methods supported this study to extract information by several means including the use of questionnaires, physical measures and interviews. The triangulated data was significant in examining the effectiveness of creating awareness of healthy lifestyles among children and examining its effects. According to Hanson and colleagues (2005), through triangulation, a research study is able to identify different aspects of phenomena more accurately by looking at the topic from different angles and by using different methods and techniques. Additionally, the mixed methods was beneficial to this study because it allowed the quantitative method to inform the qualitative in important research aspects that it should follow-up on and elicit more information to explain the earlier findings (Creswell, 2013).

First, quantitative data was collected from participants and their parents followed by qualitative research (interviews) from which behaviour patterns drawn from the quantitative research were explained. The combination of the two methods provided stronger evidence for a conclusion through convergence and corroboration of the findings or triangulation. It can also be argued that reliance on a single methodological stance may not be tenable in an increasingly complex multicultural and interdisciplinary context, or in behavioural research for broader application and conditions (Curran et al., 2012).

Parents' involvement is strength, as parent nutrition and physical activity patterns significantly influence the school-age children's consumption of fruits/vegetables, junk food, level of sedentary and physical activity behaviour (Natale, 2014). The study engaged parents as co-researchers in the design, implementation and evaluation of this intervention, because it was observed that KSA parents of participating children influenced the children's healthy lifestyles and it would have been paradoxical to focus exclusively and solely on the input of the children. According to Kipping and colleagues (2012), involvement of parents in school-based obesity intervention increases awareness of healthy diet and physical activity, thus, one may contend that, without parents the intervention would be impractical and less effective. Howard-Drake and Halliday (2016) also explained that teachers' knowledge, awareness and skills about healthy lifestyles can reinforce intervention messages and have the capacity to make a meaningful and sustainable impact on reducing and preventing obesity.

Combining the home and school setting also supported this study to optimise its impact. This can be said to be critical in KSA because school and home environment significantly influence child diet and PA, hence it is important in assessing the effectiveness of an intervention. Similar arguments are made by Showell and colleagues (2013) who posit that home-based obesity intervention becomes more effective when other settings are engaged such as school, where children spend more time. According to Hendrie and colleagues (2012) the behaviour change impact of school-based interventions increases with those targeting both home and school settings. In this study, the home and school environment had possible influence on children's diet and physical activity and therefore played a key role in establishing relevant findings.

5.8. Limitations of the Study

This study also had limitations that are worth noting for the purpose of future research. The study sample size was relatively small due to the limited time period, given that the study had to finish within 3 months. The sample was also small because the process of conducting pre- and post-intervention, involvement of parents was all demanding with limited resources. Additionally, considering that the study used mixed methods and its subsequent data analysis, it was necessary that the sample be kept small in order to complete within time. It is further observed that the study would have delivered more accurate findings if the intervention was conducted for a longer duration. For instance, the short period intervention is seen as the reason why this study could not reach a significant change in the BMI of the participants.

Another drawback is that during the data collection, it was difficult to extract the answers from the children and as a result of that this study has not attained the extensive data that was anticipated. This was somewhat due to the questioning techniques employed considering that participants were children. Presumably a more feasible approach would have been the use of creative methods with children such as collecting data through play, or drawing. Data collected through self-reported questionnaires also was not reliable given that respondents may have provided answers because they believed they were desirable. Additionally, the study did not cater for other variables that may have affected participants' weight, therefore it is not possible to be entirely sure that it was the intervention that affected their weight. The study was also conducted in one school therefore making it hard to generalise the results to the entire KSA population. Albeit the mentioned limitations, this study does provide positive impacts on the participant's attitude towards the food and dietary habits.

Finally, it was observed that the mixed methods approach was strenuous and demanding as it necessitated the familiarity with multiple research skills in order to apply it effectively. Thus, the researcher had to study and explore the application of the two methods (i.e. quantitative and qualitative methods) in order to gain a vast understanding of how to execute the mixed methods approach. The process of mixed methods research was also time and resource consuming starting from planning to implementation of the study (Johnson & Onwuegbuzie, 2004). Conducting both quantitative and qualitative data collection required help from teachers and a school nurse, otherwise the study would have hardly met the time allocated by school administration. Additionally, there was a possibility that case discrepancies would emerge from comparing results from the two methods and it will pose problems when resolving their impact on interpretation of findings.

5.9. Summary

The key findings drawn from this feasibility study show that school-based obesity education intervention is effective through behaviour change. Diet and nutrition knowledge and awareness had an implication on the healthy eating habits or behaviours of participants. This study and other studies conducted before, agree in that diet and nutrition education for school-aged children improved healthy eating behaviours in favour of reducing and preventing child obesity. physical activity was also professed by other studies to be the key component of physical energy expenditure and therefore having a positive effect on the weight status. There is a collective agreement / consensus in the results of most studies and this study pointing to the observation that an increase in physical activity levels and hours of

exercising significantly impact the overweight and obese status of participants. Similarly, sedentary activities such as TV watching and playing inactive video games significantly decreased as more children turned to physical activity after the intervention. The application of SCT as the theoretical framework also contributed effectively to establishing the effectiveness of a school-based intervention. Overall, the findings of this study correspond to findings in other studies on a similar topic, that multi-component approaches to assessing the effects of school-based intervention revealed positive impacts in altering their life style behaviours in order to prevent obesity in the future.

Chapter Six: Conclusions and Recommendations

6.1. Introduction

This final chapter presents the conclusions and recommendations drawn from this study which sought to assess the effectiveness of an obesity education intervention programme in reducing weight gain among schoolgirls and adolescents aged 9-16 years. The chapter starts with a discussion of the contribution of this feasibility study to existing knowledge followed by recommendations for further research, the implications of a childhood obesity prevention education intervention programme in KSA public health policy and research are further commented upon. Next, is an identification of the dissemination strategy. The chapter ends with the author's reflection on the research experience and lessons learned from conducting this study.

6.2. Contribution to Existing Knowledge

The findings of this feasibility study provide a number of contributions to the body of public health knowledge; the key contributions are listed below, other contributions are described subsequently.

- This study is the first to create and implement a school-based intervention programme within the context of girls' school in the city of Al-Madinah, in Saudi Arabia. Designing a new programme which takes into consideration sociocultural factors which accommodate for the immediate contextual case, enhanced the effectiveness of the programme.
- Most consulted school-based interventions studies, focused on two factors: dietary habits and physical activity; whereas this study adopted multi-component intervention factors: sedentary activities, dietary habits and physical activity. The study goes as far as arguing that secondary activities are the most important risk factor, yet, it seems that only handful of previous studies covered it albeit the fact that it's a modern day problem (Al-Naqeeb, 2012)
- This study contributes to existing knowledge by providing an insight for KSA's public health practitioners, policy makers and nursing students, regarding the context of childhood obesity prevention both at home and in the school environment.

It was clear that KSA's definitive national statistics for childhood obesity, control and prevention were lacking. Those that existed showed that child obesity was an epidemic and

the prevalence was increasing (Abalkhail, 2002; Al-Hazzaa, 2007b), and that childhood obesity is associated with eating behaviours and lifestyle choices such as inactivity (Warren et al., 2003; Boddy *et al.*, 2012; Al Dhaifallah *et al*., 2015). However, there were no readily accessible studies on which are specifically devoted to assessing the effectiveness of a school-based intervention that increases knowledge and awareness of healthy lifestyle behaviours among KSA children

Considering that children, who develop obesity face serious psychological, physiological, and social consequences including type 2 diabetes, risk of heart diseases, fatty liver diseases, musculosketal discomfort, depression and others (Wang et al., 2008), the key findings obtained from this study can be used as a reference point to KSA's public health care and education, food and school regulation and practice and as a base for future childhood obesity evaluation. The findings indicate that a school-based education intervention had a positive impact on altering behaviour from unhealthy to healthy as a preventive measure of obesity in the future; also contributed to existing evidence that school-based obesity interventions have a successful impact on BMI.

This study also offers recommendations for developing and implementing a school-based intervention. As such, the study provides beneficial knowledge on how to conduct an intervention using a sequential explanatory mixed method design and SCT theory to elicit vital information that can be used in improving public health. With a small sample, this nutrition education school-based intervention's short-term findings serve as an indicator that a study of a larger scale application of a similar intervention in similar settings may have considerable effect in combating childhood obesity.

This study's use of a phased approach to completing the research activities (i.e. pre-intervention, intervention and post intervention) indicates that breaking the intervention into stages and then integrating the findings through triangulation minimises the challenges of using mixed methods. Additionally, the study contributed to the existing argument that a mixed methods approach offers a comprehensive analysis to the research problem, unlike using a single method in a study. The study also underscores the importance of planning resources, particularly time, in order to complete mixed methods research successfully. According to Ritchie and Lewis (2003) research studies that apply mixed methods are complex particularly with time and resource limitation.

The results from this intervention study have also contributed to findings that there are existing cases of overweight and obese among children in KSA. The study has also revealed that despite children having prior knowledge of healthier practices, environmental factors like access to energy dense foods, the cost of healthier foods and taste preferences affect their food choice. Furthermore, with lack of physical activity classes and facilities coupled with gender equality issues, girls have limited physical exercise. The study therefore contributes evidence that these factors contribute to increasing childhood obesity in KSA. The study has offered an in-depth understanding of child obesity in KSA, significant analysis on how food and activity associate with child obesity and how awareness can be used to achieve behaviour change among KSA children, hence helping prevent childhood obesity. The observed short-term change in BMI after the intervention also adds to existing knowledge that physical exercises combined with nutrition component have an effect on BMI. It was observed that the intervention impacted on the sedentary activities of children in the short-term while an increase in hours of exercise, increased intake of health foods like vegetables and fruits was also observed. Overall, this feasibility study contributed to the existing literature that increasing knowledge and awareness about healthier lifestyle has beneficial effects in preventing and reducing child obesity.

The study confirms that the collaboration of parents and educators in helping children develop their own healthy habits and behaviours during the intervention is necessary. Importantly, it confirms the importance of obesity prevention strategies planning; to combine diet and physical activity as an effective way of preventing childhood obesity in the future. The study also showed that regular lessons that mirror components of this intervention are required to maintain the short-term impact, hence ensuring persistence in healthy living among KSA children.

6.3. Recommendations

The following summarise the recommendations according to the findings from this study. The recommendations relate in particular to ways of improving the effectiveness of nutritional educational programme for Saudi Girls Schools.

6.3.1. Recommendations for Policy

Given the prevalence of obesity and overweight findings, there is a need for the Ministry of Education to consider the findings reported here and to integrate obesity prevention education targeting food intake and physical activity into school curricula. The

canteens at schools that were reported to be making access to unhealthy food easy for children require strict regulation that promotes availability of healthier foods compared to unhealthy foods. Thus, it is recommended to consider healthy food in the school's shops to sale for children. This will be important in influencing the food choices of children by being in favour of healthy foods. Considering that gender inequality limits the levels of physical exercise that school girls engage in, it is of utmost importance to address gender inequalities as they may lead to structural limitations in achieving health and good nutritional status for children, and in particular girls. In this respect, the Ministry of Education should implement physical exercise course for schoolgirls, the same as schoolboys. Findings also pointed to the lack of physical exercising facilities available to youngsters. Thus, an increase of physical exercise and sporting activities around residence and at school is prerequisite to the promotion of adequate levels of physical activities and hours of exercising per week for children. To ensure that children possess consistent knowledge of healthier lifestyle, school health units should deploy national evidence-based guidance to combating the potential risk of obesity and its health consequences. Furthermore, to help children put into practice the knowledge they built about healthy lifestyle, there is a need to regulate marketing of energy-dense and sweetened foods and beverages targeting children, in order to have a significant increase of intake of healthy foods compared to unhealthy foods.

6.3.2. Recommendations for Practice

Because the study has shown short-term positive effects of a nutrition education programme, schools should acknowledge and recognise the pivotal nature of educating the students about improving healthy life style, either voluntarily or as a national curricular requirement, in order to prevent obesity. Since this study suggests that increase of physical exercising impacts on BMI, schools should provide PE lessons within the curriculum, and invest in PE facilities at schools. From the study, it is clear that a combined effort from teachers and parents contributed to positive results, thus, community, educators, health practitioners, teachers and parents should persistently collaborate in promoting healthy eating and physical activity practices aimed at achieving positive health outcomes for KSA children. Since school canteens offer unrestricted access to food, therefore, supervision is required in order to encourage the children to eat healthily within the school environment. Healthy lifestyle education should be offered to all students to increase their level of awareness towards gaining weight and health consequences in order to prevent obesity and health risks.

6.3.3. Recommendations for Further Research

The current feasibility study has determined the viability of school-based intervention for promoting healthy eating and encourages physical activity for preventing the childhood obesity. The results highlighted the importance of the education obesity-related intervention programme and the effectiveness of the methods before- and after- intervention. Both questionnaire and interview techniques led to successful results by increasing the awareness on healthy diets and physical activities.

Further, some limitations in the current feasibility study can be overcome in the future study. These limitations were: the interview conducted only before the intervention, the study was included only School girls and it covered one School. Furthermore, there were not statistical significant differences obtained due to the short period of intervention. By considering the limitations of this feasibility study, it can be improved by conducting the next future study on both gender, and No covering large sample in a long-term intervention study.

The main reason for the limitations which occurred in the current feasibility study was due to time and resources constraints, in which the duration for contacting before and after the intervention was about three months. However, many literatures used between twelve to eighteen months shown in Table 2 were to conduct obesity-related intervention research. Therefore, extending the current feasibility study to a longer period of time, and delivering the intervention over a longer time period (not just one day) has the potential to positively impact on children's lifestyle and their weight and BMI which has the potential to limit child obesity in KSA. An RCT design for a subsequent trial conducted over a larger geographical area of SA and including boys and girls and multiple schools, has the potential to establish the long-term effectiveness of this intervention and potential implementation as a public health initiative.

In addition, because there was a limited time to conduct the current feasibility study, there is a need to socioeconomic factors, including parent jobs and income, as influencing child obesity risk. This will determine if socioeconomic is a key contributor to increased childhood obesity. Considering KSA culture's food examine beliefs and restrictions on females, further follow-up using home-based intervention should be undertaken regarding the context of KSA culture and child obesity to determine if the culture has any significant effect on increasing childhood obesity prevalence. Methodologically, integrating quantitative and qualitative approaches for socioeconomic-related survey work will be necessary to be developed.

6.4. Dissemination Plan

Findings from this feasibility study report will be disseminated to the school and bodies that were involved in the study. Copies will be sent to the schools' administrations that were involved in this to provide them with an overview of how important nutrition and physical activity education can be in combating childhood obesity. The Ministry of Education in KSA will also receive copies. Making the feasibility study available to local bodies will not only serve to inform the relevant offices of findings, but also act as a reference accessible to other researchers interested in exploring childhood obesity in KSA. The feasibility study will also be published in Saudi journals for obesity and other professional peer reviewed databases. The study will also be available at the University of Salford repository.

6.5. Summary

The overall purpose of this feasibility research was to promote healthy behaviours among KSA school-aged children through increased nutrition awareness and physical activity levels. The study has used a mixed methods approach to address the problem of increasing childhood obesity preference by intervening through increasing awareness on healthy eating and physical exercise. Mixed methods allowed the study to use qualitative methods, offering an in-depth understanding of quantitative findings, thus providing a comprehensive analysis of the research problem. Despite the methodology limitations that mixed methods was time and resource consuming, this study has made a significant contribution to knowledge by showing that the intervention modified eating habits and physical activity levels and hours in a way that positively impacted on the participant's weight and obese status. The intervention also achieved a decrease in sedentary behaviour (video games and TV). Overall, findings from this study strongly indicate that an education programme about nutrition and physical activity awareness among children showed positive impacts on healthy lifestyle behaviours of the children to prevent childhood obesity in KSA.

References

Abalkhail B. Overweight and obesity among Saudi Arabian children and adolescents between 1994 and 2000. de sante de la mediterranee orientale. 8(4-5) , 70-479

Abdul-Rahman MS. Islam: Questions and Answers-Jurisprudence and Islamic Rulings: Transactions. MSA Publication Limited; 2004 Oct 21.

Abuzaid OI. Eating patterns and physical activity characteristics among urban and rural students in Saudi Arabia. The University of Nebraska-Lincoln; 2012.

Agostoni C, Braegger C, Decsi T, Kolacek S, Koletzko B, Mihatsch W, Moreno LA, Puntis J, Shamir R, Szajewska H, Turck D. Role of dietary factors and food habits in the development of childhood obesity: a commentary by the ESPGHAN Committee on Nutrition. Journal of pediatric gastroenterology and nutrition. 2011 Jun 1;52(6):662-9.

Alam AA. Obesity among female school children in North West Riyadh in relation to affluent lifestyle. Saudi medical journal. 2008;29(8):1139-44.

Al Dhaifallah A, Mwanri L, Aljoudi A. Childhood obesity in Saudi Arabia: opportunities and challenges. Saudi Journal of Obesity. 2015 Jan 1;3(1):2.

Al Dossary SS, Sarkis PE, Hassan A, Ezz El Regal M, Fouda AE. Obesity in Saudi children: a dangerous reality. East Mediterranean Health Journal. 2010, 1003-8.

Al-Enazy WH, Al Dahi SK, Al Hariri IM. Prevalence of overweight and obesity among Saudi primary school students in Tabuk, Saudi Arabia. Saudi journal of obesity. 2014 Jan 1;2(1):13.

Alqarni SS. A Review of Prevalence of Obesity in Saudi Arabia. Journal of Obesity & Eating Disorders. 2016.

Al-Ghamdi SH. The association between watching television and obesity in children of school-age in Saudi Arabia. Journal of family & community medicine. 2013 May;20(2):83.

Al-Hazzaa HM. Obesity and physical inactivity among saudi children and youth: challenges to future public health. Journal of family & community medicine. 2006 May;13(2):53.

Al-Hazzaa HM. Health-enhancing physical activity among Saudi adults using the International Physical Activity Questionnaire (IPAQ). Public health nutrition. 2007 Jan;10(1):59-64.

Al-Hazzaa HM. Pedometer-determined physical activity among obese and non-obese 8-to 12-year-old Saudi schoolboys. Journal of physiological anthropology. 2007a;26(4):459-65.

Al-Hazzaa HM. Prevalence and trends in obesity among school boys in Central Saudi Arabia between 1988 and 2005. Saudi medical journal. 2007b Oct 1;28(10):1569.

Al-Hazzaa HM. Rising trends in BMI of Saudi adolescents: evidence from three national cross sectional studies. Asia Pacific Journal of Clinical Nutrition. 2007c Sep 1;16(3):462-6.

Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO. Lifestyle factors associated with overweight and obesity among Saudi adolescents. BMC public health. 2012 May 16;12(1):354.

Al Kandari YY. Prevalence of obesity in Kuwait and its relation to sociocultural variables. Obesity reviews. 2006 May 1;7(2):147-54.

Al-Mazrou YY. Food poisoning in Saudi Arabia. Potential for prevention?. Saudi medical journal. 2004;25(1):11-4.

Al-Nuaim AA, Al-Nakeeb Y, Lyons M, Al-Hazzaa HM, Nevill A, Collins P, Duncan MJ. The prevalence of physical activity and sedentary behaviours relative to obesity among adolescents from Al-Ahsa, Saudi Arabia: rural versus urban variations. Journal of nutrition and metabolism. 2012 Jan 23;2012.

Al-Nakeeb Y, Lyons M, Collins P, Al-Nuaim A, Al-Hazzaa H, Duncan MJ, Nevill A. Obesity, physical activity and sedentary behavior amongst British and Saudi youth: A cross-cultural study. International journal of environmental research and public health. 2012 Apr 16;9(4):1490-506.

Al-Nozha MM, Al-Mazrou YY, Al-Maatouq MA, Arafah MR, Khalil MZ, Khan NB, Al-Marzouki K, Abdullah MA, Al-Khadra AH, Al-Harthi SS, Al-Shahid MS, Al-Mobeireek A, Nouh MS. Obesity in Saudi Arabia. Saudi Medical Journal. 2005 May;26(5):824-9.

Al-Nozha MM, Al-Hazzaa HM, Arafah MR, Al-Khadra A, Al-Mazrou YY, Al-Maatouq MA, Khan NB, Al-Marzouki K, Al-Harthi SS, Abdullah M, Al-Shahid MS. Prevalence of physical activity and inactivity among Saudis aged 30-70 years. Saudi Med J. 2007;28(4):559-68.

Al-Nuaim AR, Bamgboye EA, Al-Herbish A. The pattern of growth and obesity in Saudi Arabian male school children. International journal of obesity and related metabolic disorders: journal of the International Association for the Study of Obesity. 1996 Nov;20(11):1000-5.

Al-Riyami AA, Afifi MM. Prevalence and correlates of obesity and central obesity among Omani adults. Saudi medical journal. 2003 Jun 1;24(6):641-6.

Al-Rukban MO. Obesity among Saudi male adolescents in Riyadh, Saudi Arabia. Saudi medical journal. 2003 Jan 1;24(1):27-33.

Al Saleh A. Prevalence's of Overweight and Obesity among Saudi Children. International Journal of Science and Research. 2013, 765-769.

Al Shehri A, Al Fattani A, Al Alwan I. Obesity among Saudi children. Saudi Journal of Obesity. 2013 Jan 1;1(1):3.

Allardyce CS. Fat Chemistry: The Science Behind Obesity. Royal Society of Chemistry; 2012.

Alsaif MA, Hakim IA, Harris RB, Alduwaihy M, Al-Rubeaan K, Al-Nuaim AR, Al-Attas OS. Prevalence and risk factors of obesity and overweight in adult Saudi population. Nutrition Research. 2002 Nov 30;22(11):1243-52.

American Psychology Association (2014). *Mind/body health: Obesity.* [Online]. Available at: http://www.apa.org/helpcenter/obesity.aspx.

Amin TT, Al-Sultan AI, Ali A. Overweight and obesity and their relation to dietary habits and socio-demographic characteristics among male primary school children in Al-Hassa, Kingdom of Saudi Arabia. European journal of nutrition. 2008 Sep 1;47(6):310-8.

Amini M, Djazayery A, Majdzadeh R, Taghdisi MH, Jazayeri S. Effect of school-based interventions to control childhood obesity: a review of reviews. International journal of preventive medicine. 2015;6.

Ammerman AS, Lindquist CH, Lohr KN, Hersey J. The efficacy of behavioral interventions to modify dietary fat and fruit and vegetable intake: a review of the evidence. Preventive medicine. 2002 Jul 1;35(1):25-41.

Anholt RR, Mackay TF. Principles of behavioral genetics. Academic Press; 2009 Sep 21.

Anney VN. Ensuring the quality of the findings of qualitative research: Looking at trustworthiness criteria. Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS). 2014;5(2):272-81.

Apte DP. Statistical tools for managers: Using MS Excel. Excel Books; 2009.

Astrup A. Healthy lifestyles in Europe: prevention of obesity and type II diabetes by diet and physical activity. Public health nutrition. 2001 Apr;4(2b):499-515.

Atabek ME, Vatansev H, Erkul I. *Oxidative stress in childhood obesity*. Journal of Pediatric Endocrinology and Metabolism. 2004, 17(8)1063-8.

Australia AH. Is Sport Enough? The 2014 Active Healthy Kids Australia Report Card on Physical Activity for Children and Young People, pp 36-37.

Avis M. Do we need methodological theory to do qualitative research?. Qualitative Health Research. 2003 Sep;13(7):995-1004.

Babcock HM, Zack JE, Garrison T, Trovillion E, Jones M, Fraser VJ, Kollef MH. An educational intervention to reduce ventilator-associated pneumonia in an integrated health system: a comparison of effects. Chest. 2004 Jun 30;125(6):2224-31.

Bailey R. Physical education and sport in schools: A review of benefits and outcomes. Journal of school health. 2006 Oct 1;76(8):397-401.

Bandura A. Health promotion by social cognitive means. Health education & behavior. 2004 Apr;31(2):143-64.

Bandura A. Social cognitive theory: Handbook of social psychological theories, pp349-373.

Bariatric and Metabolic Institute. *Health Risks of Childhood Obesity*. UC San Diego, School of Medicine, Health Sciences. Available at: https://health.ucsd.edu/specialties/surgery/bariatric/weight-loss-surgery/adolescent-weight-loss/Pages/health-risks.aspx [Accessed: 3 August 2016].

Spear BA, Barlow SE, Ervin C, Ludwig DS, Saelens BE, Schetzina KE, Taveras EM. Recommendations for treatment of child and adolescent overweight and obesity. Pediatrics. 2007 Dec 1;120(Supplement 4):S254-88.

Barton BA, Eldridge AL, Thompson D, Affenito SG, Striegel-Moore RH, Franko DL, Albertson AM, Crockett SJ. The relationship of breakfast and cereal consumption to nutrient intake and body mass index: the National Heart, Lung, and Blood Institute Growth and Health Study. Journal of the American Dietetic Association. 2005 Sep 30;105(9):1383-9.

Bauman A, Bull F, Chey T, Craig CL, Ainsworth BE, Sallis JF, Bowles HR, Hagstromer M, Sjostrom M, Pratt M. The international prevalence study on physical activity: results from 20 countries. International Journal of Behavioral Nutrition and Physical Activity. 2009 Mar 31;6(1):21.

Bauman AE, Reis RS, Sallis JF, Wells JC, Loos RJ, Martin BW, Lancet Physical Activity Series Working Group. Correlates of physical activity: why are some people physically active and others not?. The lancet. 2012 Jul 27;380(9838):258-71.

Kirshner D, Whitson JA, editors. Situated cognition: Social, semiotic, and psychological perspectives. Psychology Press; 1997, pp 281-300.

Berkey CS, Rockett HR, Field AE, Gillman MW, Frazier AL, Camargo CA, Colditz GA. *Activity, dietary intake, and weight changes in a longitudinal study of preadolescent and adolescent boys and girls*. Pediatrics. 2000, 105(4), 56.

Biddle SJ, Gorely T, Stensel DJ. Health-enhancing physical activity and sedentary behaviour in children and adolescents. Journal of sports sciences. 2004 Aug 1;22(8):679-701.

Biddle SJ, Pearson N, Ross GM, Braithwaite R. Tracking of sedentary behaviours of young people: a systematic review. Preventive medicine. 2010 Nov 30;51(5):345-51.

Bitsch V. Qualitative research: A grounded theory example and evaluation criteria. Journal of Agribusiness. 2005 Aug;23(1):75-91.

Blanchette L, Brug J. Determinants of fruit and vegetable consumption among 6–12- year- old children and effective interventions to increase consumption. Journal of human nutrition and dietetics. 2005 Dec 1;18(6):431-43.

Bleich S, Cutler D, Murray C, Adams A. Why Is the Developed World Obese? National Bureau of Eeconimic Research Working Paper No. 12954.

Boddy LM, Knowles ZR, Davies IG, Warburton GL, Mackintosh KA, Houghton L, Fairclough SJ. Using formative research to develop the healthy eating component of the CHANGE! school-based curriculum intervention. BMC public health. 2012 Aug 29;12(1):710.

Bolton G. Writing and professional development. SAGE Publications Limited; 2010.

Boote DN, Beile P. Scholars before researchers: On the centrality of the dissertation literature review in research preparation. Educational researcher. 2005 Aug;34(6):3-15.

Bowen GA. Supporting a grounded theory with an audit trail: An illustration. International Journal of Social Research Methodology. 2009 Oct 1;12(4):305-16.

Bowling A, Ebrahim S. Handbook of health research methods: investigation, measurement and analysis. McGraw-Hill Education (UK); 2005 Jun 1.

Bowman SA, Gortmaker SL, Ebbeling CB, Pereira MA, Ludwig DS. Effects of fast-food consumption on energy intake and diet quality among children in a national household survey. Pediatrics. 2004 Jan 1;113(1):112-8.

Branscum P, Sharma M, Wang LL, Wilson B, Rojas-Guyler L. A process evaluation of a social cognitive theory–based childhood obesity prevention intervention: The comics for health program. Health promotion practice. 2013 Mar;14(2):189-98.

Braun V, Clarke V. Using thematic analysis in psychology. Qualitative research in psychology. 2006 Jan 1;3(2):77-101.

Braveman PA, Egerter SA, Mockenhaupt RE. Broadening the focus. American journal of preventive medicine. 2011 Jan 1;40(1):S4-18.

Bray GA, Nielsen SJ, Popkin BM. Consumption of high-fructose corn syrup in beverages may play a role in the epidemic of obesity. The American journal of clinical nutrition. 2004 Apr 1;79(4):537-43.

Brazier JE, Harper R, Jones NM, O'cathain A, Thomas KJ, Usherwood T, Westlake L. Validating the SF-36 health survey questionnaire: new outcome measure for primary care. Bmj. 1992 Jul 18;305(6846):160-4.

Brier E, Clavier C, Olivier F. Correlation power analysis with a leakage model. InInternational Workshop on Cryptographic Hardware and Embedded Systems 2004 Aug 11 (pp. 16-29). Springer, Berlin, Heidelberg.

Brotman LM, Dawson-McClure S, Huang KY, Theise R, Kamboukos D, Wang J, Petkova E, Ogedegbe G. Early childhood family intervention and long-term obesity prevention among high-risk minority youth. Pediatrics. 2012 Mar 1;129(3):e621-8.

Brown, AL, Ash D, Rutherford M, Nakagawa K, Gordon A, Campione, JC. "Distributed Expertise in the Classroom." In *Distributed Cognitions: Psychological and Educational Considerations*. Cambridge, UK: Cambridge University Press. 1993, pp. 190-1, 201-4.

Brown H, Hume C, Pearson N, Salmon J. A systematic review of intervention effects on potential mediators of children's physical activity. BMC public health. 2013 Feb 23;13(1):165.

Brown T, Summerbell C. Systematic review of school- based interventions that focus on changing dietary intake and physical activity levels to prevent childhood obesity: an update to the obesity guidance produced by the National Institute for Health and Clinical Excellence. Obesity reviews. 2009 Jan 1;10(1):110-41.

Brown R, Ogden J. Children's eating attitudes and behaviour: a study of the modelling and control theories of parental influence. Health education research. 2004 Jun 1;19(3):261-71.

Buchwald H, Avidor Y, Braunwald E, Jensen MD, Pories W, Fahrbach K, Schoelles K. Bariatric surgery: a systematic review and meta-analysis. Jama. 2004 Oct 13;292(14):1724-37.

Burke H, Mancuso L. Social cognitive theory, metacognition, and simulation learning in nursing education. Journal of Nursing Education. 2012 Oct 1;51(10):543-8.

Burns C. A review of the literature describing the link between poverty, food insecurity and obesity with specific reference to Australia. Melbourne: VicHealth; 2004 Apr.

Burns, N. and S. K. Grove. *The role of measurement. In D. Kay (Ed.). The practice of nursing research: conduct, critique and utilisation* (pp. 281-333). Philadelphia, W.B. Saunders Company. 1987.

Calmorin L. Statistics in education and the sciences. Rex Bookstore, Inc.; 1997.

Campbell KJ, Crawford DA, Ball K. Family food environment and dietary behaviors likely to promote fatness in 5-6 year-old children. International journal of obesity. 2006 Aug 1;30(8):1272.

Campbell KJ, Hesketh KD. Strategies which aim to positively impact on weight, physical activity, diet and sedentary behaviours in children from zero to five years. A systematic review of the literature. Obesity reviews. 2007 Jul 1;8(4):327-38.

Campbell KJ, Crawford DA, Salmon J, Carver A, Garnett SP, Baur LA. Associations between the home food environment and obesity- promoting eating behaviors in adolescence. Obesity. 2007 Mar 1;15(3):719-30.

Campbell NC, Murray E, Darbyshire J, Emery J, Farmer A, Griffiths F, Guthrie B, Lester H, Wilson P, Kinmonth AL. Designing and evaluating complex interventions to improve health care. BMJ: British Medical Journal. 2007 Mar 3;334(7591):455.

Caprio S, Daniels SR, Drewnowski A, Kaufman FR, Palinkas LA, Rosenbloom AL, Schwimmer JB, Kirkman MS. Influence of race, ethnicity, and culture on childhood obesity: implications for prevention and treatment. Obesity. 2008 Dec 1;16(12):2566-77.

Carlson SA, Fulton JE, Lee SM, Maynard LM, Brown DR, Kohl III HW, Dietz WH. Physical education and academic achievement in elementary school: data from the early childhood longitudinal study. American journal of public health. 2008 Apr;98(4):721-7.

Carr LT. The strengths and weaknesses of quantitative and qualitative research: what method for nursing?. Journal of advanced nursing. 1994 Oct 1;20(4):716-21.

Carter AO, Saadi HF, Reed RL, Dunn EV. Assessment of obesity, lifestyle, and reproductive health needs of female citizens of Al Ain, United Arab Emirates. Journal of Health, Population and Nutrition. 2004 Mar 1:75-83.

Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. Public health reports. 1985 Mar;100(2):126.

Cawley J, Cisek-Gillman L, Roberts R, Cocotas C, Smith-Cook T, Bouchard M, Oz M. Effect of HealthCorps, a high school peer mentoring program, on youth diet and physical activity. Childhood Obesity (Formerly Obesity and Weight Management). 2011 Oct;7(5):364-71.

Canters for Disease Control and Prevention. *Childhood Obesity Facts: Health Effects of Childhood Obesity.* 2000. Retrieved From http://www.cdc.gov/healthyyouth/obesity/facts.htm

Canters for Disease Control and Prevention. *Childhood Obesity Facts: Health Effects of Childhood Obesity.* 2014. Retrieved From http://www.cdc.gov/healthyyouth/obesity/facts.htm

Canters for Disease Control and Prevention. *Children's Food Environment State Indicator Report*, 2011. Available from:

https://www.cdc.gov/obesity/downloads/childrensfoodenvironment.pdf

Central Department of Statistics and Information. *Latest Statistical Releases. 2011*. Retrieved From http://www.cdsi.gov.sa/english/

Champion VL, Skinner CS. The health belief model. Health behavior and health education: Theory, research, and practice. 2008;4:45-65.

Chan, T. *Economic Costs: Paying the Price for Those Extra Pounds.* 2013. [online].Available from: https://www.hsph.harvard.edu/obesity-prevention-source/obesity-consequences/economic/

Checkley W, Ghannem H, Irazola V, Kimaiyo S, Levitt NS, Miranda JJ, Niessen L, Prabhakaran D, Rabadán-Diehl C, Ramirez-Zea M, Rubinstein A. Management of NCD in low-and middle-income countries. Global heart. 2014 Dec 31;9(4):431-43.

Christakis NA, Fowler JH. The spread of obesity in a large social network over 32 years. n engl j med. 2007 Jul 26;2007(357):370-9.

Clark VLP, Creswell JW. The mixed methods reader. Sage, 2007.

Clark VLP, Creswell JW. The mixed methods reader. Sage; 2008.

Clarke JL, Griffin TL, Lancashire ER, Adab P, Parry JM, Pallan MJ. Parent and child perceptions of school-based obesity prevention in England: a qualitative study. BMC public health. 2015 Dec 9;15(1):1224.

Cohen L, Manion L, Morrison K. Research methods in education. Routledge; 2011 Mar 7.

Cole K, Waldrop J, D'Auria J, Garner H. An Integrative Research Review: Effective School- Based Childhood Overweight Interventions. Journal for Specialists in Pediatric Nursing. 2006 Jul 1;11(3):166-77.

Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. Bmj. 2000 May 6;320(7244):1240.

Contento IR. Nutrition education: linking research, theory, and practice. Jones & Bartlett Learning; 2007.

Coon KA, Tucker KL.. *Television and children's consumption patterns*. Minerva pediatrica. 2002 54(5), 423-36.

Cormack D. *The research process in nursing*. London, Blackwell Scientific, 2000.

Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. Bmj. 2008 Sep 29;337:a1655.

University of York. Centre for Reviews and Dissemination. Systematic reviews: CRD's guidance for undertaking reviews in health care. University of York, Centre for Reviews & Dissemination; 2009.

Creswell JW, Miller DL. Determining validity in qualitative inquiry. Theory into practice. 2000 Aug 1;39(3):124-30.

Creswell JW. Research design: Qualitative, quantitative, and mixed methods approaches. (2nd ed.) Thousand Oaks, CA: Sage, 2003.

Creswell JW, Clark VL. Designing and conducting mixed methods research, 2008.

Creswell JW. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications; 2013 Mar 14.

Croezen S, Visscher TL, Ter Bogt NC, Veling ML, Haveman-Nies A. Skipping breakfast, alcohol consumption and physical inactivity as risk factors for overweight and obesity in adolescents: results of the E-MOVO project. European Journal of Clinical Nutrition. 2009 Mar 1;63(3):405.

Cunliffe AL. Reflexivity, learning and reflective practice. In The Sage Handbook of management learning, education and development. Armstrong, SJ. and Fukami, CV. eds. Sage, 2009.

Curran GM, Bauer M, Mittman B, Pyne JM, Stetler C. Effectiveness-implementation hybrid designs: combining elements of clinical effectiveness and implementation research to enhance public health impact. Medical care. 2012 Mar;50(3):217-26.

Curry LA, Nembhard IM, Bradley EH. Qualitative and mixed methods provide unique contributions to outcomes research. Circulation. 2009 Mar 17;119(10):1442-52.

D'Autume C, Musher-Eizenman D, Marinier E, Viarme F, Frelut ML, Isnard P. Eating behaviors and emotional symptoms in childhood obesity: a cross-sectional exploratory study using self-report questionnaires in 63 children and adolescents. Archives de pediatrie: organe officiel de la Societe francaise de pediatrie. 2012 Aug;19(8):803-10.

Daniels SR. Causes of childhood obesity. The Journal of Pediatrics, 2007, 150(6), A1.

DashN. Online Research Methods Resource for Teachers and Trainers: Selection of the Research Paradigm and Methodology. 2005. Available from: http://www.celt.mmu.ac.uk/researchmethods/Modules/Selection_of_methodology/

Dashti, S., Esfehani, A. J., & Joseph, H. L. (2014*). The preventive effect of physical activity on weight maintenance in overweight and obese women.* La Clinica Terapeutica, 165(3), pp 155-161.

Datar A, Nicosia N. Junk food in schools and childhood obesity. Journal of Policy Analysis and Management. 2012 Mar 1;31(2):312-37.

Datar A, Sturm R. Physical education in elementary school and body mass index: evidence from the early childhood longitudinal study. American journal of public health. 2004 Sep;94(9):1501-6.

Davidson C. Transcription: Imperatives for qualitative research. International Journal of Qualitative Methods. 2009 Jun;8(2):35-52.

Davidson J, Milligan C. Embodying emotion sensing space: introducing emotional geographies.

Dehghan M, Akhtar-Danesh N, Merchant AT. Childhood obesity, prevalence and prevention. Nutrition journal. 2005 Sep 2;4(1):24.

Davies D, Dodd J. Qualitative research and the question of rigor. Qualitative health research. 2002 Feb;12(2):279-89.

De Onis M, Blössner M, Borghi E. Global prevalence and trends of overweight and obesity among preschool children. The American journal of clinical nutrition. 2010 Nov 1;92(5):1257-64.

DeMattia L, Lemont L, Meurer L. Do interventions to limit sedentary behaviours change behaviour and reduce childhood obesity? A critical review of the literature. obesity reviews. 2007 Jan 1;8(1):69-81.

Demetriou Y, Höner O. Physical activity interventions in the school setting: A systematic review. Psychology of sport and exercise. 2012 Mar 31;13(2):186-96.

Denscombe M. The Good Research Guide for Small-Scale Social Research Projects, Buckingham: Open University Press, 1998.

Dobbins M, Husson H, DeCorby K, LaRocca RL. School- based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18. The Cochrane Library. 2013 Jan 1.

Dowrick C, Leydon GM, McBride A, Howe A, Burgess H, Clarke P, Maisey S, Kendrick T. Patients' and doctors' views on depression severity questionnaires incentivised in UK quality and outcomes framework: qualitative study. Bmj. 2009 Mar 19;338:b663.

Duffy ME. Designing nursing research: the qualitative- quantitative debate. Journal of Advanced Nursing. 1985 May 1;10(3):225-32.

Eakin EG, Lawler SP, Vandelanotte C, Owen N. Telephone interventions for physical activity and dietary behavior change: a systematic review. American journal of preventive medicine. 2007 May 31;32(5):419-34.

Ebbeling CB, Pawlak DB, Ludwig DS. Childhood obesity: public-health crisis, common sense cure. The lancet. 2002 Aug 10;360(9331):473-82.

Eisner EW. The Enlightened Eye: Qualitative Inquiry and the Enhancement of Educational Practice. Prentice Hall, 1991.

El-Hazmi MA, Warsy AS. Prevalence of obesity in the Saudi population. Annals of Saudi medicine. 1997 May 1;17:302-6.

El- Hazmi MA, Warsy AS. A comparative study of prevalence of overweight and obesity in children in different provinces of Saudi Arabia. Journal of Tropical Pediatrics. 2002 Jun 1;48(3):172-7.

El Mouzan MI, Foster P J, Al Herbish A S, Al Salloum AA, Al Omer AA, Qurachi MM, Kecojevic T. Prevalence of overweight and obesity in Saudi children and adolescents. Annals of Saudi medicine, 2010, 30(3), 203.

Eliassen EK. The impact of teachers and families on young children's eating behaviors. YC Young Children. 2011 Mar 1;66(2):84.

Ellis PD. The essential guide to effect sizes: Statistical power, meta-analysis, and the interpretation of research results. Cambridge University Press; 2010 Jul 1.

Ello-Martin JA, Ledikwe JH, Rolls BJ. The influence of food portion size and energy density on energy intake: implications for weight management. The American journal of clinical nutrition. 2005 Jul 1;82(1):236S-41S.

Epstein LH, Goldfield GS. Physical activity in the treatment of childhood overweight and obesity: current evidence and research issues. Medicine and science in sports and exercise. 1999 Nov;31(11 Suppl):S553-9.

Epstein LH, Gordy CC, Raynor HA, Beddome M, Kilanowski CK, Paluch R. Increasing fruit and vegetable intake and decreasing fat and sugar intake in families at risk for childhood obesity. Obesity. 2001 Mar 1;9(3):171-8.

Epstein LH, Paluch RA, Gordy CC, Dorn J. Decreasing sedentary behaviors in treating pediatric obesity. Archives of pediatrics & adolescent medicine. 2000 Mar 1;154(3):220-6.

Erlandson DA. Doing naturalistic inquiry: A guide to methods. Sage; 1993 Jul 7.

Farris JW, Taylor L, Williamson M, Robinson C. A 12-week interdisciplinary intervention program for children who are obese. Cardiopulmonary physical therapy journal. 2011 Dec;22(4):12.

Fitzgibbon M L, Beech B M. The role of culture in the context of school-based BMI screening. Pediatrics. 2009, 124(1), 50-62.

Flegal K M, Carroll M D, Ogden C L, Curtin LR. Prevalence and trends in obesity among US adults, 1999-2008. Jama. 2010, 303(3), 235-241.

Flick U. An Introduction to Qualitative Research. London: Sage Publications, 2006.

Flodmark CE, Marcus C, Britton M. Interventions to prevent obesity in children and adolescents: a systematic literature review. International journal of obesity 2006,30(4), 579-89.

Floros JD, Newsome R, Fisher W, Barbosa- Cánovas GV, Chen H, Dunne CP, German JB, Hall RL, Heldman DR, Karwe MV, Knabel SJ. Feeding the world today and tomorrow: the importance of food science and technology. Comprehensive Reviews in Food Science and Food Safety. 2010 Sep 1;9(5):572-99.

Flurry LA, Burns AC. Children's influence in purchase decisions: a social power theory approach. Journal of Business Research. 2005 May 31;58(5):593-601.

Flynn MAT, McNeil DA, MaloffB, Mutasingwa D, Wu M, Ford C, Tough SC. Reducing obesity and related chronic disease risk in children and youth: a synthesis of evidence with best practice recommendations. Obesity Reviews. 2006 7(1), 7-66.

Food Research and Action Center (2015). Consequences of Childhood Obesity [Online]. Food Research and Action Center. Available at: http://frac.org/initiatives/hunger-and-obesity/what-are-the-consequences-of-childhood-overweight-and-obesity/ [Accessed: 3 August 2016].

Franks PW, Hanson RL, Knowler WC, Sievers ML, Bennett PH, Looker HC. Childhood obesity, other cardiovascular risk factors, and premature death. New England Journal of Medicine. 2010 Feb 11;362(6):485-93.

Gale NK, Heath G, Cameron E, Rashid S, Redwood S. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. BMC medical research methodology. 2013 Sep 18;13(1):117.

Gibson EL, Kreichauf S, Wildgruber A, Vögele C, Summerbell CD, Nixon C, Moore H, Douthwaite W, Manios Y. A narrative review of psychological and educational strategies applied to young children's eating behaviours aimed at reducing obesity risk. Obesity reviews. 2012 Mar 1;13(s1):85-95.

Gibson EL, Wardle J, Watts CJ. Fruit and vegetable consumption, nutritional knowledge and beliefs in mothers and children. Appetite. 1998 Oct 31;31(2):205-28.

Gill P, Stewart K, Treasure E, Chadwick B. Methods of data collection in qualitative research: interviews and focus groups. British dental journal. 2008 Mar 22;204(6):291-5.

Golafshani N. Understanding reliability and validity in qualitative research. The qualitative report. 2003;8(4):597-606.

Golan M, Crow S. Parents are key players in the prevention and treatment of weight-related problems. Nutrition reviews. 2004 Jan 1;62(1):39-50.

Goldschmidt AB, Tanofsky-Kraff M, Wilfley DE. A laboratory-based study of mood and binge eating behavior in overweight children. Eating behaviors. 2011 Jan 31;12(1):37-43.

Gonzalez-Suarez C, Worley A, Grimmer-Somers K, Dones V. School-based interventions on childhood obesity: a meta-analysis. American journal of preventive medicine. 2009 Nov 30;37(5):418-27.

Green LW, Kreuter MW, Deeds SG, Partridge KB, Bartlett E. Health education planning: a diagnostic approach.

Griffee DT. Validating a questionnaire on confidence in speaking English as a foreign language. JALT Journal. 1997 Nov;19(2):177-97.

Grimm GC, Harnack L, Story M. Factors associated with soft drink consumption in school-aged children. Journal of the American Dietetic Association. 2004 Aug 31;104(8):1244-9.

Gross R. Psychology: The science of mind and behaviour 7th edition. Hodder Education; 2015 Aug 14.

Guba EG, Lincoln YS. Competing paradigms in qualitative research. Handbook of qualitative research. 1994;2(163-194):105-177.

Guba E, Lincoln Y. Chapter 8; Paradigmatic Controversies, contradictions and emerging confluences. The Sage Handbook of Qualitative Research Third Edition, Sage Publications, Thousand Oaks, CA. 2005.

Guerra PH, da Silveira JA, Salvador EP. Physical activity and nutrition education at the school environment aimed at preventing childhood obesity: evidence from systematic reviews. Jornal de Pediatria (Versão em Português). 2016 Feb 29;92(1):15-23.

Haines L, Wan KC, Lynn R, Barrett TG, Shield JP. Rising incidence of type 2 diabetes in children in the UK. Diabetes care. 2007 May 1;30(5):1097-101.

Hall KD, Heymsfield SB, Kemnitz JW, Klein S, Schoeller DA, Speakman JR. Energy balance and its components: implications for body weight regulation. The American journal of clinical nutrition. 2012 Apr 1;95(4):989-94.

Harris JL, Bargh JA. Television viewing and unhealthy diet: implications for children and media interventions. Health communication. 2009 Nov 12;24(7):660-73.

Hart KH, Bishop JA, Truby H. An investigation into school children's knowledge and awareness of food and nutrition. Journal of Human Nutrition and Dietetics. 2002 Apr 1;15(2):129-40.

Hatchett A, Hallam JS, Ford MA. Evaluation of a social cognitive theory- based email intervention designed to influence the physical activity of survivors of breast cancer. Psycho- Oncology. 2013 Apr 1;22(4):829-36.

Hawkes C. Uneven dietary development: linking the policies and processes of globalization with the nutrition transition, obesity and diet-related chronic diseases. Globalization and health. 2006 Mar 28;2(1):4.

AAP (American Academy of Paediatric) (2015). *The Emotional Toll of Obesity* [Online]. American Academy of Paediatrics. Available at: https://www.healthychildren.org/English/health-issues/conditions/obesity/Pages/The-Emotional-Toll-of-Obesity.aspx

Hearth Math Institute (2009). *Childhood Obesity and Emotional Eating* [Online]. Available at: https://www.heartmath.org/articles-of-the-heart/the-world-of-kids/childhood-obesity-and-emotional-eating/

Health and Social Care Information Centre. Statistics on Obesity, Physical Activity and Diet England 2014. Available online at http://content.digital.nhs.uk/catalogue/PUB13648/Obes-phys-acti-diet-eng-2014-rep.pdf.

Hendrie GA, Brindal E, Corsini N, Gardner C, Baird D, Golley RK. Combined home and school obesity prevention interventions for children: what behavior change strategies and intervention characteristics are associated with effectiveness?. Health Education & Behavior. 2012 Apr;39(2):159-71.

Hernández B, Gortmaker SL, Colditz GA, Peterson KE, Laird NM, Parra-Cabrera S. Association of obesity with physical activity, television programs and other forms of video viewing among children in Mexico city. International Journal of Obesity & Related Metabolic Disorders. 1999 Aug 1;23(8).

Hesketh K, Waters E, Green J, Salmon L, Williams J. Healthy eating, activity and obesity prevention: a qualitative study of parent and child perceptions in Australia. Health promotion international. 2005 Mar 1;20(1):19-26.

Hesketh K, Waters E, Green J, Salmon L, Williams J. Healthy eating, activity and obesity prevention: a qualitative study of parent and child perceptions in Australia. Health promotion international. 2005 Mar 1;20(1):19-26.

Deeks JJ, Higgins J, Altman DG. Analysing data and undertaking meta- analyses. Cochrane handbook for systematic reviews of interventions: Cochrane book series. 2008 Sep 22:243-96.

Higgins JP, Green S (Eds.). Cochrane handbook for systematic reviews of interventions (Vol. 5). Chichester: Wiley-Blackwell, 2008.

Hill JO, Wyatt HR, Reed GW, Peters JC. Obesity and the environment: where do we go from here?. Science. 2003 Feb 7;299(5608):853-5.

Hills AP, Andersen LB, Byrne NM.. Physical activity and obesity in children. British Journal of Sports Medicine, 2011, 45(11), 866-870.

Holloway I, Wheeler S Qualitative Research in Nursing (2 ed.). Malden, MA: Blackwell, 2002.

Holt EM, Steffen LM, Moran A, Basu S, Steinberger J, Ross JA, Hong CP, Sinaiko AR. Fruit and vegetable consumption and its relation to markers of inflammation and oxidative stress in adolescents. Journal of the American Dietetic Association. 2009 Mar 31;109(3):414-21.

Howard-Drake EJ, Halliday V. Exploring primary school headteachers' perspectives on the barriers and facilitators of preventing childhood obesity. Journal of Public Health. 2015 Mar 5;38(1):44-52.

Howden-Chapman P, Matheson A, Crane J, Viggers H, Cunningham M, Blakely T, Cunningham C, Woodward A, Saville-Smith K, O'Dea D, Kennedy M. Effect of insulating existing houses on health inequality: cluster randomised study in the community. Bmj. 2007 Mar 1;334(7591):460.

Hughner RS, Maher JK. Factors that influence parental food purchases for children: Implications for dietary health. Journal of Marketing Management. 2006 Nov 1;22(9-10):929-54.

Ivankova NV, Creswell JW, Stick SL. Using mixed-methods sequential explanatory design: From theory to practice. Field methods. 2006 Feb;18(1):3-20.

Jain A, Langwith C. Collaborative school- based obesity interventions: Lessons learned from 6 southern districts. Journal of School Health. 2013 Mar 1;83(3):213-22.

James J, Thomas P, Cavan D, Kerr D. Preventing childhood obesity by reducing consumption of carbonated drinks: cluster randomised controlled trial. Bmj. 2004 May 20;328(7450):1237.

James PT. Obesity: the worldwide epidemic. Clinics in dermatology. 2004 Aug 31;22(4):276-80.

Jaminet P, Jaminet SC. Perfect Health Diet: regain health and lose weight by eating the way you were meant to eat. Simon and Schuster; 2012 Dec 11.

Jones RA, Lubans DR, Morgan PJ, Okely AD, Parletta N, Wolfenden L, de Silva-Sanigorski A, Gibbs L, Waters E. School-based obesity prevention interventions: practicalities and considerations. Obesity research & clinical practice. 2014 Oct 31;8(5):e497-510.

Jones WJ, Williams LS, Meschia JF. Validating the Questionnaire for Verifying Stroke-Free Status (QVSFS) by neurological history and examination. Stroke. 2001 Oct 1;32(10):2232-6.

Jones-Smith JC, Popkin BM. Understanding community context and adult health changes in China: development of an urbanicity scale. Social science & medicine. 2010 Oct 31;71(8):1436-46.

Kaisari P, Yannakoulia M, Panagiotakos DB. Eating frequency and overweight and obesity in children and adolescents: a meta-analysis. Pediatrics. 2013 May 1;131(5):958-67.

Karnik S, Kanekar A. Childhood obesity: a global public health crisis. International journal of preventive medicine. 2012 Jan;3(1):1.

Katz DL, O'connell M, Njike VY, Yeh MC, Nawaz H. Strategies for the prevention and control of obesity in the school setting: systematic review and meta-analysis. International journal of obesity. 2008 Dec 1;32(12):1780.

Katzmarzyk PT, Gledhill N, Shephard RJ. The economic burden of physical inactivity in Canada. Canadian Medical Association Journal. 2000 Nov 28;163(11):1435-40.

Kelishadi R, Ardalan G, Gheiratmand R, Gouya MM, Razaghi EM, Delavari A, Majdzadeh R, Heshmat R, Motaghian M, Barekati H, Mahmoud-Arabi MS. Association of physical activity and dietary behaviours in relation to the body mass index in a national sample of Iranian children and adolescents: CASPIAN Study. Bulletin of the World Health Organization. 2007 Jan;85(1):19-26.

Khalid ME. Is high-altitude environment a risk factor for childhood overweight and obesity in Saudi Arabia?. Wilderness & environmental medicine. 2008 Sep;19(3):157-63.

Khambalia AZ, Dickinson S, Hardy LL, Gill TA, Baur LA. A synthesis of existing systematic reviews and meta- analyses of school- based behavioural interventions for controlling and preventing obesity. Obesity Reviews. 2012 Mar 1;13(3):214-33.

Kipping RR, Jago R, Lawlor DA. Developing parent involvement in a school-based child obesity prevention intervention: a qualitative study and process evaluation. Journal of Public Health. 2011 Sep 21;34(2):236-44.

Koch T. Establishing rigour in qualitative research: the decision trail. Journal of advanced nursing. 2006 Jan 1;53(1):91-100.

Krebs NF, Himes JH, Jacobson D, Nicklas TA, Guilday P, Styne D. Assessment of Child and Adolescent Overweight and Obesity. Pediatrics, 120. S193-S228. http://dx. doi. org/10.1542/peds. 2007.

Krebs NF, Himes JH, Jacobson D, Nicklas TA, Guilday P, Styne D. Assessment of Child and Adolescent Overweight and Obesity. Pediatrics, 120. S193-S228. http://dx. doi. org/10.1542/peds. 2007.

Kriemler S, Meyer U, Martin E, van Sluijs EM, Andersen LB, Martin BW. Effect of school-based interventions on physical activity and fitness in children and adolescents: a review of reviews and systematic update. British journal of sports medicine. 2011 Sep 1;45(11):923-30.

Krishnaswamy KN, Sivakumar AI, Mathirajan M. Management research methodology: integration of principles, methods and techniques. Pearson Education India; 2009.

Kropski JA, Keckley PH, Jensen GL. School- based obesity prevention programs: an evidence- based review. Obesity. 2008 May 1;16(5):1009-18.

Ku PJ, Lee K. A survey on dietary habit and nutritional knowledge for elementary school children's nutritional education. Journal of the Korean Society of Food Culture. 2000;15(3):201-13.

Kvale S. InterViews: An introduction to qualitative research interviewing. Thousand Oaks. Sage Publication, 1997.

Lamb GS, Huttlinger K.. Reflexivity in nursing research. Western Journal of Nursing Research. 198911(6),765-72.

Lazarou C, Soteriades ES. (). *Children's physical activity, TV watching and obesity in Cyprus: the CYKIDS study.* The European Journal of Public Health. 2010, 20(1), 70-77.

Leger L. . What‘s the place of schools in promoting health? Are we too optimistic? Health Promotion International, 2004, 19, 405–8.

Levy TS, Ruán CM, Castellanos CA, Coronel AS, Aguilar AJ, Humarán IM. Effectiveness of a diet and physical activity promotion strategy on the prevention of obesity in Mexican school children. BMC public health. 2012 Mar 1;12(1):152.

Li XH, Lin S, Guo H, Huang Y, Wu L, Zhang Z, Ma J, Wang HJ. Effectiveness of a school-based physical activity intervention on obesity in school children: a nonrandomized controlled trial. BMC public health. 2014 Dec 16;14(1):1282.

Lincoln YS, Guba EG. Naturalistic inguig. Beverly Hills: Sage. 1985.

Lindsay AC, Sussner KM, Kim J, Gortmaker S. The role of parents in preventing childhood obesity. The Future of children. 2006 Apr 1:169-86.

Linnan L, Steckler A. Process evaluation for public health interventions and research. San Francisco: Jossey-Bass; 2002.

Littlewood J, Yousuf S. Primary health care in Saudi Arabia: applying global aspects of health for all, locally. Journal of Advanced Nursing. 2000 Sep 1;32(3):675-81.

Livingstone MB. Childhood obesity in Europe: a growing concern. Public health nutrition. 2001 Feb;4(1a):109-16.

Lloyd JJ, Logan S, Greaves CJ, Wyatt KM. Evidence, theory and context-using intervention mapping to develop a school-based intervention to prevent obesity in children. International Journal of Behavioral Nutrition and Physical Activity. 2011 Jul 13;8(1):73.

Lloyd JJ, Logan S, Greaves CJ, Wyatt KM. Evidence, theory and context-using intervention mapping to develop a school-based intervention to prevent obesity in children. International Journal of Behavioral Nutrition and Physical Activity. 2011 Jul 13;8(1):73.

LoBiondo-Wood G, Haber J. Nursing research: Methods and critical appraisal for evidence-based practice.

Lobstein T, Baur L, Uauy R. Obesity in children and young people: a crisis in public health. Obesity reviews. 2004 May 1;5(s1):4-85.

Locke LF, Spirduso WW, Silverman SJ.. Proposals that work: planning dissertations and proposal (4th ed.). Thousand Oaks, CA: Sage, 2000.

Long AF, Godfrey M, Randall T, Brettle A, Grant MJ. Developing evidence based social care policy and practice. Part 3: feasibility of undertaking systematic reviews in social care.

Lucas B, Cox C, Perry L, Bridges J. Changing clinical team practices in preparation of patients for Total Knee Replacement: Using Social Cognitive Theory to examine outcomes of an action research study. International journal of orthopaedic and trauma nursing. 2013 Aug 31;17(3):140-50.

Ludwig D. Ending the food fight: Guide your child to a healthy weight in a fast food/fake food world. Houghton Mifflin Harcourt; 2008 Mar 18.

Maatoug J, Msakni Z, Zammit N, Bhiri S, Harrabi I, Boughammoura L, Slama S, Larbi C, Ghannem H. Peer Reviewed: School-Based Intervention as a Component of a Comprehensive Community Program for Overweight and Obesity Prevention, Sousse, Tunisia, 2009–2014. Preventing chronic disease. 2015;12.

Macht M, Simons G. Emotions and eating in everyday life. Appetite. 2000 Aug 1;35(1):65-71.

Mackenzie N, Knipe S. Research dilemmas: Paradigms, methods and methodology. Issues in educational research. 2006 Oct;16(2):193-205.

Macnee CL, McCabe S. Understanding nursing research: Using research in evidence-based practice. Lippincott Williams & Wilkins; 2008.

Madani KA. *Obesity in Saudi Arabia*. Bahrain Medical Bulletin, 2000,22(3), 1-9.

Maddison R, Foley L, Mhurchu CN, Jiang Y, Jull A, Prapavessis H, Hohepa M, Rodgers A. Effects of active video games on body composition: a randomized controlled trial. The American journal of clinical nutrition. 2011 Jul 1;94(1):156-63.

Malterud K, Tonstad S. Preventing obesity: Challenges and pitfalls for health promotion. Patient education and counseling. 2009 Aug 31;76(2):254-9.

Mayo Clinic . *Diseases and Conditions: Childhood obesity.* 2014, Retrieved From: http://www.mayoclinic.org/diseases-conditions/childhood-obesity/basics/complications/con-20027428

Mays N, Pope C. Qualitative research: Observational methods in health care settings. BMJ: British Medical Journal. 1995 Jul 15;311(6998):182.

Mazzocchi M, Traill WB, Shogren JF. Fat economics: nutrition, health, and economic policy. Oxford University Press; 2009 Mar 26.

McEachan RR, Lawton RJ, Jackson C, Conner M, Lunt J. Evidence, theory and context: using intervention mapping to develop a worksite physical activity intervention. BMC public health. 2008 Sep 22;8(1):326.

Medical Research Council. *A framework for the development and evaluation of RCTs for complex interventions to improve health.* London: Medical Research Council, 2000.

Merriam SB. Qualitative Research and Case Study Applications in Education. Revised and Expanded from" Case Study Research in Education.". Jossey-Bass Publishers, 350 Sansome St, San Francisco, CA 94104; 1998.

Michels N, Sioen I, Braet C, Eiben G, Hebestreit A, Huybrechts I, Vanaelst B, Vyncke K, De Henauw S. Stress, emotional eating behaviour and dietary patterns in children. Appetite. 2012 Dec 31;59(3):762-9.

Michie S, Abraham C, Whittington C, McAteer J, Gupta S. Effective techniques in healthy eating and physical activity interventions: a meta-regression. Health Psychology. 2009 Nov;28(6):690.

Middleton G, Evans AB, Keegan R, Bishop D, Evans D. The importance of parents and teachers as stakeholders in school-based healthy eating programs.

Midhet FM, Al-Mohaimeed AA, Sharaf F K. Lifestyle related risk factors of type 2 diabetes mellitus in Saudi Arabia. Saudi medical journal. 2010, 31(7), 768-774.

Miles MB; Huberman AM. Qualitative data analysis: an expanded sourcebook, 2nd ed. California, Sage, 1994.

Mingers J. The paucity of multimethod research: a review of the information systems literature. Information Systems Journal. 2003 Jul 1;13(3):233-49.

Ministry of Health. Saudi Ministry of Health Strategical Plan. Saudi Ministry of Health, 2012. Available from: http://www.moh.gov.sa/Portal/WhatsNew/Documents/OKIstragi260p.pdf/

Ministry of Health's Media and the Health Awareness General Department. National Campaign against Overweight and Obesity. 2012, From : http://www.moh.gov.sa/en/HealthAwareness/Campaigns/badana/Pages/default.aspx/

Misra S, Maikhuri RK, Kala CP, Rao KS, Saxena KG. Wild leafy vegetables: A study of their subsistence dietetic support to the inhabitants of Nanda Devi Biosphere Reserve, India. Journal of Ethnobiology and Ethnomedicine. 2008 May 30;4(1):15.

Monasta L, Batty GD, Cattaneo A, Lutje V, Ronfani L, Van Lenthe FJ, Brug J. Early- life determinants of overweight and obesity: a review of systematic reviews. Obesity reviews. 2010 Oct 1;11(10):695-708.

Montano DE, Kasprzyk D. Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. Health behavior: Theory, research and practice (. 2015 Jul 1.

Moore LL, Singer MR, Bradlee ML, Djoussé L, Proctor MH, Cupples LA, Ellison RC. Intake of fruits, vegetables, and dairy products in early childhood and subsequent blood pressure change. Epidemiology. 2005 Jan 1;16(1):4-11.

Moreno LA, Pigeot I, Ahrens W. Epidemiology of obesity in children and adolescents. Prevalence and etiology, Nueva York: Springer. 2011.

Morse JM. Principles of mixed methods and multimethod research design. Handbook of mixed methods in social and behavioral research. 2003;1:189-208.

Morse J, Richards L. Read me first for a user's guide to qualitative research. CA, US: Sage Publications Thousand Oaks. 2002.

Murphy C. . Saudi Arabia struggles with the burden of obesity. 2010, The National, Available at: <http://www.thenational.ae/news/world/middle-east/saudi-arabia-struggles-with-the-burden-of-obesity>.Murphy EA, Dingwall R. Qualitative methods and health policy research. Transaction Publishers; 2003 Aug 1.

Musaiger AO, Al-Mannai MA. Weight, height, body mass index and prevalence of obesity among the adult population in Bahrain. Annals of human biology. 2001 Jan 1;28(3):346-50.

Nader PR, O'Brien M, Houts R, Bradley R, Belsky J, Crosnoe R, Friedman S, Mei Z, Susman EJ. Identifying risk for obesity in early childhood. Pediatrics. 2006 Sep 1;118(3):e594-601.

Natale RA, Messiah SE, Asfour L, Uhlhorn SB, Delamater A, Arheart KL. Role modeling as an early childhood obesity prevention strategy: effect of parents and teachers on preschool children's healthy lifestyle habits. Journal of Developmental & Behavioral Pediatrics. 2014 Jul 1;35(6):378-87.

NatCen Learning. The Framework approach to qualitative data analysis. 2012, Retrieved from https://www.surrey.ac.uk/sociology/research/researchcentres/caqdas/files/Session%201%20Introduction%20to%20Framework.pdf/

National Health Service (NHS). Child obesity rates are 'stabilising'. 2015, Available at: http://www.nhs.uk/news/2015/01January/Pages/Child-obesity-rates-are-stabilising.aspx/

National Health Services UK (NHS) . Obesity. Defining Obesity. 2012, Available from: < http://www.nhs.uk/Conditions/Obesity/Pages/Introduction.aspx>, 20 February 2015

National Institute of Health. Social and Behavioral Theories. 2014, [Online]. Available at: http://www.esourceresearch.org/Default.aspx?TabId=741/

Neergaard H, Ulhøi JP, editors. Handbook of qualitative research methods in entrepreneurship. Edward Elgar Publishing; 2007.

Nemet D, Barkan S, Epstein Y, Friedland O, Kowen G, Eliakim A. Short-and long-term beneficial effects of a combined dietary–behavioral–physical activity intervention for the treatment of childhood obesity. Pediatrics. 2005 Apr 1;115(4):e443-9.

Nestle M, Jacobson MF. Halting the obesity epidemic: a public health policy approach. Public health reports. 2000 Jan;115(1):12.

Bernard HR, Bernard HR. Social research methods: Qualitative and quantitative approaches. Sage; 20006.

Nguyen-Rodriguez ST, Unger JB, Spruijt-Metz D. Psychological determinants of emotional eating in adolescence. Eating Disorders. 2009 Apr 28;17(3):211-24.

Nixon CA, Moore HJ, Douthwaite W, Gibson EL, Vogele C, Kreichauf S, Wildgruber A, Manios Y, Summerbell CD. Identifying effective behavioural models and behaviour change

strategies underpinning preschool- and school- based obesity prevention interventions aimed at 4–6- year- olds: a systematic review. Obesity Reviews. 2012 Mar 1;13(s1):106-17.

Nooteboom B. A cognitive theory of the firm: Learning, governance and dynamic capabilities. Edward Elgar Publishing; 2009.

Nutracheck. Calories Check. 2014, Online. http://www.nutracheck.co.uk/

Obesity Action Coalition, what is Obesity? Understanding Obesity. 2014, Available from: < http://www.obesityaction.org/understanding-obesity/obesity>. [20 February 2015]

PAL Technologies. ActivPAL Quantify. 2016. Retrieved From: www.paltechnologies.com/

Parahoo K. Nursing research: principles, process and issues. Palgrave Macmillan; 2014 May 30.

Parsian N, AM TD. Developing and validating a questionnaire to measure spirituality: a psychometric process. Global journal of health science. 2009 Mar 3;1(1):2.

Pate RR, O'neill JR, Lobelo F. The evolving definition of" sedentary". Exercise and sport sciences reviews. 2008 Oct 1;36(4):173-8.

Patton, M.Q. Qualitative Research and Evaluation Methods (2nd ed). Thousand oaks, CA: Sage Publications, 2001

Pearson M, Chilton R, Woods HB, Wyatt K, Ford T, Abraham C, Anderson R. Implementing health promotion in schools: protocol for a realist systematic review of research and experience in the United Kingdom (UK). Systematic reviews. 2012 Oct 20;1(1):48.

Pocock M, Trivedi D, Wills W, Bunn F, Magnusson J. Parental perceptions regarding healthy behaviours for preventing overweight and obesity in young children: a systematic review of qualitative studies. Obesity reviews. 2010 May 1;11(5):338-53.

Pescovitz OH, Eugster EA, editors. Pediatric endocrinology: mechanisms, manifestations, and management. Lippincott Williams & Wilkins; 2004.

Plano, CV, Creswell J. (Eds) The Mixed Methods Reader. Thousand Oaks CA: Sage, 2007.

Pocock M, Trivedi D, Wills W, Bunn F, Magnusson J. Parental perceptions regarding healthy behaviours for preventing overweight and obesity in young children: a systematic review of qualitative studies. Obesity reviews. 2010 May 1;11(5):338-53.

Polit DF. Statistics and Data Analysis for Nursing Research: Pearson New International Edition: Do I Really Need This Stuff? Pearson Higher Ed; 2013 Oct 3.

Pope C, Mays N, Popay J. Synthesising qualitative and quantitative health evidence: A guide to methods: A guide to methods. McGraw-Hill Education (UK); 2007 Jul 1.

Popkin BM. The nutrition transition and obesity in the developing world. The Journal of nutrition. 2001 Mar 1;131(3):871S-3S.

Popkin BM. The nutrition transition and obesity in the developing world. The Journal of nutrition. 2001 Mar 1;131(3):871S-3S.

Popkin BM, Gordon-Larsen P. The nutrition transition: worldwide obesity dynamics and their determinants. International journal of obesity. 2004 Nov 1;28(S3):S2.

Popkin BM, Mendez M. The rapid shifts in stages of the nutrition transition: The global obesity epidemic. Globalization and health. 2007:68-80.

Popkin BM, Adair LS, Ng SW. Global nutrition transition and the pandemic of obesity in developing countries. Nutrition reviews. 2012 Jan 1;70(1):3-21.

Popoveniuc B. Self Reflexivity. The Ultimate End of Knowledge. Procedia-Social and Behavioral Sciences. 2014 Dec 19;163:204-13.

Powell LM, Slater S, Chaloupka FJ, Harper D. Availability of physical activity–related facilities and neighborhood demographic and socioeconomic characteristics: a national study. American journal of public health. 2006 Sep;96(9):1676-80.

Prentice AM, Jebb SA. Fast foods, energy density and obesity: a possible mechanistic link. Obesity reviews. 2003 Nov 1;4(4):187-94.

Prince SA, Adamo KB, Hamel ME, Hardt J, Gorber SC, Tremblay M. A comparison of direct versus self-report measures for assessing physical activity in adults: a systematic review. International Journal of Behavioral Nutrition and Physical Activity. 2008 Nov 6;5(1):56.

Procter L. Exploring the role of emotional reflexivity in research with children. Emotion, Space and Society. 2013 Nov 30; 9:80-8.

Puder JJ, Munsch S. Psychological correlates of childhood obesity. International journal of obesity. 2010 Dec 1;34(S2):S37.

Quercia S, Candela M, Giuliani C, Turroni S, Luiselli D, Rampelli S, Brigidi P, Franceschi C, Bacalini MG, Garagnani P, Pirazzini C. From lifetime to evolution: timescales of human gut microbiota adaptation. Frontiers in microbiology. 2014;5.

Raczynski JM, DiClemente RJ, editors. Handbook of health promotion and disease prevention. Springer Science & Business Media; 2013 Nov 11.

Jenkins DJ. Foods that Harm, Foods that Heal: An AZ Guide to Safe and Healthy Eating. CMAJ: Canadian Medical Association Journal. 1997 Dec 1;157(11):1597.

Reilly JJ. Physical activity, sedentary behaviour and energy balance in the preschool child: opportunities for early obesity prevention. Proceedings of the Nutrition Society. 2008 Aug;67(3):317-25.

Reis HT, Judd CM, editors. Handbook of research methods in social and personality psychology. Cambridge University Press; 2000 Mar 13.

Rendo T, Moleres A, Del Moral AM. Effects of the FTO gene on lifestyle intervention studies in children. Obesity facts. 2009;2(6):393-9.

Rey-López JP, Vicente-Rodríguez G, Biosca M, Moreno LA. Sedentary behaviour and obesity development in children and adolescents. Nutrition, Metabolism and Cardiovascular Diseases. 2008 Mar 31;18(3):242-51.

Rihoux B, Grimm H, editors. Innovative comparative methods for policy analysis: Beyond the quantitative-qualitative divide. Springer Science & Business Media; 2006 Mar 20.

Ritchie J, Lewis J. Qualitative research practice: A guide for social science students and researchers. Sage; 2003.

Rovniak LS, Anderson ES, Winett RA, Stephens RS. Social cognitive determinants of physical activity in young adults: a prospective structural equation analysis. Annals of Behavioral Medicine. 2002 May 1;24(2):149-56.

Rubin A, Babbie E. Essential research methods for social work. Belmont, CA: Thomson Brooks/Cole. ISBN 978-0-495-81171-8; 2010.

Rubin A, Babbie ER. Research methods for social work. Belmont, CA: Brooks/Cole, Cengage Learning. (562 Required Text) Chapter 12. OR Engel, RJ & Schutt, RK (2009). Fundamentals of social work research. 2011.

Rudolf MC, Sahota P, Barth JH, Walker J. Increasing prevalence of obesity in primary school children: cohort study. Bmj. 2001 May 5;322(7294):1094-5.

Sahoo K, Sahoo B, Choudhury AK, Sofi NY, Kumar R, Bhadoria AS. Childhood obesity: causes and consequences. Journal of family medicine and primary care. 2015 Apr;4(2):187.

Saibul N, Shariff ZM, Lin KG, Kandiah M, Ghani NA, Rahman HA. Food variety score is associated with dual burden of malnutrition in Orang Asli (Malaysian indigenous peoples) households: implications for health promotion. Asia Pacific journal of clinical nutrition. 2009 Sep 1;18(3):412-22.

Salas-Salvadó J, Bulló M, Babio N, Martínez-González MÁ, Ibarrola-Jurado N, Basora J, Estruch R, Covas MI, Corella D, Arós F, Ruiz-Gutiérrez V. Reduction in the incidence of type 2 diabetes with the Mediterranean diet. Diabetes care. 2011 Jan 1;34(1):14-9.

Salehi K, Golafshani N. Using mixed methods in research studies: An opportunity with its challenges. International Journal of Multiple Research Approaches. 2010 Dec 1;4(3):186.

Sallis JF, Glanz K. The role of built environments in physical activity, eating, and obesity in childhood. The future of children. 2006 Apr 1:89-108.

Sallis JF, McKenzie TL, Alcaraz JE, Kolody B, Faucette N, Hovell MF. The effects of a 2-year physical education program (SPARK) on physical activity and fitness in elementary school students. Sports, Play and Active Recreation for Kids. American journal of public health. 1997 Aug;87(8):1328-34.

Sandelowski M. Combining qualitative and quantitative sampling, data collection, and analysis techniques in mixed- method studies. Research in nursing & health. 2000 Jun 1;23(3):246-55.

Sanigorski AM, Bell AC, Swinburn BA. Association of key foods and beverages with obesity in Australian schoolchildren. Public health nutrition. 2007 Feb;10(2):152-7.

Saudi Embassy. About Saudi Arabia, Government of SA. 2013. Available from: < http://www.saudiembassy.net/about/. [20 February 2015].

Saudi Gazette. Fast food & unhealthy diet. Health. 2012. Available from: < http://www.saudigazette.com.sa/index.cfm?method=home.regcon&contentid=20130826178168>. [20 February 2015]

Schalkwijk AA, Bot SD, de Vries L, Westerman MJ, Nijpels G, Elders PJ. Perspectives of obese children and their parents on lifestyle behavior change: a qualitative study. International Journal of Behavioral Nutrition and Physical Activity. 2015 Aug 19;12(1):102.

Schostak J. Interviewing and representation in qualitative fieldwork, 2006.

Scollan-Koliopoulos, M. . OECD. Health at a Glance. OECD Indicators, 2011.

Scott G. *Design and evaluation of a school-based intervention programme to improve children's eating habits as a contribution to preventing childhood obesity* (Doctoral dissertation, King's College London (University of London)).

Seale C. Quality in Qualitative Research. Qualitative Inquiry. 1999,5(4), 465-78

Seidman I. Interviewing as qualitative research: A guide for researchers in education and the social sciences. New York: Teachers College Press. 2013.

Sharma M. School- based interventions for childhood and adolescent obesity. Obesity reviews. 2006, 7(3) 261-69.

Sharma M. Dietary education in school-based childhood obesity prevention programs. Advances in Nutrition: An International Review Journal, 2011 2(2), 207-16.

Shaya FT, Chirikov VV, Breunig IM, Seal B, Hanna NN, Mullins CD. PCN146 Specialty Care and Treatment in Medicare HCC Patients. Value in Health. 2012 Jun 30;15(4):A234.

Shenton AK. Strategies for Ensuring Trustworthiness in Qualitative Research Projects. Education for Information. 2004, 22(2), 63-75.

Sherry JL, Lucas K, Greenberg BS, Lachlan K. Video game uses and gratifications as predictors of use and game preference. Playing video games: Motives, responses, and consequences. 2006 Mar 28;24(1):213-24.

Showell NN, Fawole O, Segal J, Wilson RF, Cheskin LJ, Bleich SN, Wu Y, Lau B, Wang Y. A systematic review of home-based childhood obesity prevention studies. Pediatrics. 2013 Jul 1;132(1):e193-200.

Silverman, D. Interpreting Qualitative Data: Methods for Analysing Talk, Text and Interaction, 2nd ed. London. Sage. 2001

Singh AS, Mulder C, Twisk JW, Van Mechelen W, Chinapaw MJ. Tracking of childhood overweight into adulthood: a systematic review of the literature. Obesity reviews. 2008 Sep 1;9(5):474-88.

Singh M.. Mood, food, and obesity. Frontiers in psychology, 2014, 5.

Smith J, Firth J. Qualitative data analysis: the framework approach. Nurse researcher, 2011, 18(2), pp 52-62.

Stake RE Case Studies, in: Handbook of Qualitative Research, Denzin, N.K; Lincoln, Y.S., Eds, Thousand Oaks: Sage, 1994, 236–247

Stenbacka C. Qualitative Research Requires Quality Concepts of Its Own. Management Decision. 2001 39(7), 551-5

Steinbeck KS. The importance of physical activity in the prevention of overweight and obesity in childhood: a review and an opinion. Obesity reviews. 2001, 2(2), 117-30.

Stephens TV, Woo H, Innis SM, Elango R. Healthy pregnant women in Canada are consuming more dietary protein at 16-and 36-week gestation than currently recommended by the Dietary Reference Intakes, primarily from dairy food sources. Nutrition Research. 2014, 34(7), 569-76.

St-Onge MP, Keller KL, Heymsfield SB. Changes in childhood food consumption patterns: a cause for concern in light of increasing body weights. The American journal of clinical nutrition. 2003 Dec 1;78(6):1068-73.

Story M, Kaphingst KM, French S. The role of schools in obesity prevention. The future of children. 2006 Apr 1:109-42.

Story M, Nanney MS, Schwartz MB. Schools and obesity prevention: creating school environments and policies to promote healthy eating and physical activity. The Milbank Quarterly. 2009 Mar 1;87(1):71-100.

Strong WB, Malina RM, Blimkie CJ, Daniels SR, Dishman RK, Gutin B, Hergenroeder AC, Must A, Nixon PA, Pivarnik JM, Rowland T. Evidence based physical activity for school-age youth. The Journal of pediatrics. 2005 Jun 30;146(6):732-7.

Brown T, Summerbell C. Systematic review of school- based interventions that focus on changing dietary intake and physical activity levels to prevent childhood obesity: an update to the obesity guidance produced by the National Institute for Health and Clinical Excellence. Obesity reviews. 2009 Jan 1;10(1):110-41.

Swinburn BA, Caterson I, Seidell JC, James WP. Diet, nutrition and the prevention of excess weight gain and obesity. Public health nutrition. 2004 Feb;7(1a):123-46.

Tarro L, Llauradó E, Albaladejo R, Moriña D, Arija V, Solà R, Giralt M. A primary-school-based study to reduce the prevalence of childhood obesity–the EdAl (Educació en Alimentació) study: a randomized controlled trial. Trials. 2014 Feb 14;15(1):58.

Tashakkori A, Teddlie C, editors. Sage handbook of mixed methods in social & behavioral research. Sage; 2010 Jun 21.

Tashakkori A, Teddlie C. Foundations of mixed methods research: Integrating quantitative and qualitative techniques in the social and behavioral sciences. London: SAGE. 2008

Taylor RW, McAuley KA, Williams SM, Barbezat W, Nielsen G, Mann JI. Reducing weight gain in children through enhancing physical activity and nutrition: the APPLE project. Pediatric Obesity. 2006 Sep 1;1(3):146-52.

Van Teijlingen E, Hundley V. The importance of pilot studies. Nursing standard. 2002 Jun 19;16(40):33-6.

Thomas RM. Blending qualitative and quantitative research methods in theses and dissertations. Corwin Press; 2003 Mar 14.

Thomas J, Harden A. Methods for the thematic synthesis of qualitative research in systematic reviews. BMC medical research methodology. 2008 Jul 10;8(1):45.

Thompson B. Foundations of behavioral statistics: An insight-based approach. Guilford Press; 2006 Mar 21.

Simmons BW, Naylor PJ, Pfeiffer KA. Physical activity for preschool children—how much and how? Applied Physiology, Nutrition, and Metabolism. 2007 Nov 14;32(S2E):S122-34

Tishelman C, Degner LF, Mueller B. Measuring symptom distress in patients with lung cancer: a pilot study of experienced intensity and importance of symptoms. Cancer Nursing. 2000 Apr 1;23(2):82-90.

Tobin S, Grondin S. Video games and the perception of very long durations by adolescents. Computers in Human Behavior. 2009 Mar 31;25(2):554-9.

Toschke AM, Küchenhoff H, Koletzko B, Kries R. Meal frequency and childhood obesity. Obesity research. 2005, 13(11), 1932-38.

Tremblay MS, Willms JD. Is the Canadian childhood obesity epidemic related to physical inactivity?. International journal of obesity. 2003 Sep 1;27(9):1100.

Tremblay MS, LeBlanc AG, Kho ME, Saunders TJ, Larouche R, Colley RC, Gorber SC. Systematic review of sedentary behaviour and health indicators in school-aged children and youth. International Journal of Behavioral Nutrition and Physical Activity. 2011, 8(1), 1.

Trost SG, Kerr LM, Ward DS, Pate RR. Physical activity and determinants of physical activity in obese and non-obese children. International journal of obesity. 2001 Jun 1;25(6):822.

University of Birmingham. Obesity in the UK. 2016. [online]. Available from: http://www.birmingham.ac.uk/research/activity/mds/centres/obesity/obesity-uk/index.aspx/

University of Twente. Search strategies. 2012. Available from: https://www.itc.nl/Pub/Home/library/Library-Guides/LiteracyCourse/Module_3/Module3-Search_strategies.html/

Van Cauwenberghe E, Maes L, Spittaels H, van Lenthe FJ, Brug J, Oppert JM, De Bourdeaudhuij I. Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and 'grey'literature. British journal of nutrition. 2010 Mar;103(6):781-97.

Vanselow MS, Pereira MA, Neumark-Sztainer D, Raatz SK. Adolescent beverage habits and changes in weight over time: findings from Project EAT. The American journal of clinical nutrition. 2009 Dec 1;90(6):1489-95.

Verstraeten R, Roberfroid D, Lachat C, Leroy JL, Holdsworth M, Maes L, Kolsteren PW. Effectiveness of preventive school-based obesity interventions in low-and middle-income countries: a systematic review. The American Journal of Clinical Nutrition. 2012 Aug 1:ajcn-035378.

Viitasalo A, Eloranta AM, Lintu N, Väistö J, Venäläinen T, Kiiskinen S, Karjalainen P, Peltola J, Lampinen EK, Haapala EA, Paananen J. The effects of a 2-year individualized and

family-based lifestyle intervention on physical activity, sedentary behavior and diet in children. Preventive medicine. 2016 Jun 30;87:81-8.

Wainer H; Braun HI. Test validity. Routledge. 2013

Wang Y, Beydoun MA, Liang L, Caballero B, Kumanyika SK. Will all Americans become overweight or obese? Estimating the progression and cost of the US obesity epidemic. Obesity. 2008 Oct 1;16(10):2323-30.

Wang Y, Cai L, Wu Y, Wilson RF, Weston C, Fawole O, Bleich SN, Cheskin LJ, Showell NN, Lau BD, Chiu DT. What childhood obesity prevention programmes work? A systematic review and meta- analysis. Obesity reviews. 2015 Jul 1;16(7):547-65.

Wang Y, Wu Y, Wilson RF, Bleich S, Cheskin L, Weston C, Showell N, Fawole O, Lau B, Segal J. Childhood obesity prevention programs: comparative effectiveness review and meta-analysis.

Warner J. Video Games, TV Double Childhood Obesity Risk. 2004 [online]. Available from:http://www.webmd.com/parenting/news/20040702/video-games-tv-double-childhood-obesity-risk

Warren JM, Henry CJ, Lightowler HJ, Bradshaw SM, Perwaiz S. Evaluation of a pilot school programme aimed at the prevention of obesity in children. Health promotion international. 2003 Dec 1;18(4):287-96.

Summerbell CD, Waters E, Edmunds LD, Kelly S, Brown T, Campbell KJ. Interventions for preventing obesity in children. Cochrane Database Syst Rev. 2005 Jul;3(3).

Weaver K, Olson JK. Understanding paradigms used for nursing research. Journal of advanced nursing. 2006 Feb 1;53(4):459-69.

Wechsler H, Devereaux RS, Davis M, Collins J. Using the school environment to promote physical activity and healthy eating. Preventive medicine. 2000 Aug 1;31(2):S121-37.

Weil A. Eating Well for Optimum Health: The Essential Guide to Food, Diet and Nutrition. Sphere Publishing Imprint. 2008.

Weiner B. Human motivation. Psychology Press. 2013.

Werthmann J, Field M, Roefs A, Nederkoorn C, Jansen A. Attention bias for chocolate increases chocolate consumption–an attention bias modification study. Journal of Behavior Therapy and Experimental Psychiatry. 2014 Mar 31;45(1):136-43.

Wight D, Abraham C. From psycho-social theory to sustainable classroom practice: developing a research-based teacher-delivered sex education programme. Health education research. 2000 Feb 1;15(1):25-38.

Wijga AH, Scholtens S, Bemelmans WJ, de Jongste JC, Kerkhof M, Schipper M, Sanders EA, Gerritsen J, Brunekreef B, Smit HA. Comorbidities of obesity in school children: a cross-sectional study in the PIAMA birth cohort. BMC Public Health. 2010 Apr 9;10(1):184.

Wilkie HJ, Standage M, Gillison FB, Cumming SP, Katzmarzyk PT. Multiple lifestyle behaviours and overweight and obesity among children aged 9–11 years: results from the UK

site of the International Study of Childhood Obesity, Lifestyle and the Environment. BMJ open. 2016 Feb 1;6(2):e010677.

Williams CL, Hayman LL, Daniels SR, Robinson TN, Steinberger J, Paridon S, Bazzarre T. Cardiovascular health in childhood. Circulation. 2002 Jul 2;106(1):143-60.

Williams M, Vogt WP. The SAGE handbook of innovation in social research methods. Sage Publications; 2011 Apr 19.

Wing RR, Goldstein MG, Acton KJ, Birch LL, Jakicic JM, Sallis JF, Smith-West D, Jeffery RW, Surwit RS. Behavioral science research in diabetes. Diabetes care. 2001 Jan 1;24(1):117-23.

Wolin KY, Petrelli J M. Obesity. Santa Barbara, Calif: Greenwood Press. 2009.

Leatherdale ST, Wong S. Peer reviewed: association between sedentary behavior, physical activity, and obesity: inactivity among active kids. Preventing chronic disease. 2009 Jan;6(1).

Woolford SJ, Clark SJ, Strecher VJ, Gebremariam A, Davis MM. Physicians' perspectives on increasing the use of BMI charts for young children. Clinical pediatrics. 2008 Jul;47(6):573-7.

Word Population Review. Major Cities in Saudi Arabia Population. 2011. Retrieved From: http://worldpopulationreview.com/countries/saudi-arabia-population/major-cities-in-saudi-arabia/

World Factbook. The world factbook 2012 - 13. Washington, D.C: Central Intelligence Agency. 2013

World Health Organisation. Health education for adolescents; Guidelines for parents, teachers, health workers and the media. WHO, Geneva. 2001

World Health Organization. Commission on Ending Childhood Obesity. WHO, Geneva. 2015

World Health Organization. Health Systems Strengthening Glossary. WHO, Geneva 2006. Retrieved from: http://www.who.int/healthsystems/Glossary_January2011.pdf/ [10 December, 2014]

World Health Organization. The challenge of obesity in the WHO European Region and the strategies for response. WHO, Geneva. 2007. Retrieved from: http://www.euro.who.int/__data/assets/pdf_file/0010/74746/E90711.pdf

World Health Organization. Nutrition. World Health Organization. WHO, Geneva. 2010. Retrieved from: http://www.who.int/nutrition/challenges/en/

World Health Organization. Health Systems Strengthening Glossary. WHO, Geneva Retrieved 2011. from http://www.who.int/healthsystems/Glossary_January2011.pdf/

World Health Organization WHO: Childhood overweight and obesity. World Health Organization. WHO, Geneva. 2014. Retrieved from: http://www.who.int/dietphysicalactivity/childhood/en/

Wright J, Dean R. A balancing act: Problematising prescriptions about food and weight in school health texts. Journal of Didactics and Educational Policy, 16(2), 2007, 75-94

Yager Z, O'; Dea JA. The role of teachers and other educators in the prevention of eating disorders and child obesity: what are the issues?. Eating disorders. 2005 May 1;13(3):261-78.

Young B. Does food advertising make children obese?. Young consumers. 2003 Jun 1;4(3):19-26.

Zimmerman BJ, Boekarts M, Pintrich P, Zeidner M. A social cognitive perspective. Handbook of self-regulation. 2000;13(1):695-716.

Appendix 1: Self-Reported Questionnaire (Children)

Finding Out About Children, Diet and Activities

Information Sheet

Hello my name is Duaa and I am trying to find out about children, their diet and the activities they carry out in Saudi Arabia. Please would you be able to help me by answering the following questions. If you have any questions or would like further explanations, please contact me at the address below.

THANK YOU for agreeing to take part in this study!

Address:	**Al-Faisalia Area** **Al-Madina Al Munawarah** **Saudi Arabia**
Name:	**Duaa Hefni**
Telephone Number:	**SA + 0559805337**
Email:	**[duaa-hefni@hotmail.co.uk]**

Appendix 2: Self-Reported Questionnaire (Parents)

Finding Out About Children, Diet and Activities Questionnaire
SECTION A: Personal Details

This section of the survey will be asking you questions about you.

1. What is your name?

2. How old are you?

3. What is your date of birth?

4. Who do you live with?

Both parents	☐	Uncle/Aunt	☐
Mother alone	☐	Grandparents	☐
Father alone	☐	Other	☐

SECTION B: Activities and Lifestyle
This section of the survey will be asking you questions about how you spend your time throughout the day doing daily activities.

5. How many hours of TV do you think you watch every day?

Less than 1 hour ☐ 1–3 hours ☐ More than 3 hours ☐

6. Do you have a laptop or computer?

Yes ☐ No ☐

7. If yes, how many hours per day do you spend working on your laptop or computer or on the internet (excluding games)?

Less than 1 hour ☐ 1–3 hours ☐ More than 3 hours ☐

8. Do you use smartphones or 'tablet' (e.g. Android, iPad or Kindle Fire) computers?

Yes ☐ No ☐

9. If yes, how many hours per day do you spend in total using smartphones or tablet computers (do not include time spent using a laptop or computer)?

Less than 1 hour ☐ 1–3 hours ☐ More than 3 hours ☐

10. Do you play video games?

Yes ☐ No ☐

11. If yes, how many hours per day do you spend playing video games either on a video games console or the computer?

Less than 1 hour ☐ 1–3 hours ☐ More than 3 hours ☐

12. How do you travel to school?

Walking ☐ By bus ☐ By car ☐ By train ☐

13. If by bus, car, or train, how many hours per day do you spend travelling by transport to school?

Less than 1 hour ☐ 1–3 hours ☐ More than 3 hours ☐

14. If by walking, how many hours per day do you spend walking to school?

Less than 1 hour ☐ 1–3 hours ☐ More than 3 hours ☐

15. How many hours of sleep do you get on average each night?

Less than 6 hours ☐ 6–8 hours ☐ More than 8 hours ☐

16. Do you do any of the following activities (please tick all that apply)?

Bicycling	☐	Martial arts	☐
Gymnastics	☐	Soccer	☐
Horse riding	☐	Sports	☐
Household work	☐	Swimming	☐

Jogging ☐ Walking ☐

Other (please state) .....

17. If yes, how many minutes per week on average for each activity?

Bicycling	.....	Martial arts	.....
Gymnastics	.....	Soccer	.....
Horse riding	.....	Sports	.....
Household work	.....	Swimming	.....
Jogging	.....	Walking	.....

Other (please state) .....

18. Do you take part in physical education at school?

Yes ☐ No ☐

19. If yes, how many hours per week?

Less than 1 hour ☐ 1–3 hours ☐ More than 3 hours ☐

SECTION C: Diet and Nutrition

This section of the survey will be asking you questions about meal times, the types of food you eat, the places where you eat, how often you eat, and food allergies.

20. Do you eat breakfast before you go to school?

Yes ☐ No ☐

21. If yes, what do you typically have (please tick all that apply)?

Beans	☐	Fried bread	☐
Bread	☐	Fruit	☐
Bread and jam	☐	Helwa	☐

Cereal	☐	Honey	☐
Cheese	☐	Meats	☐
Chocolate	☐	Oat or bran bar	☐
Chocolate bar	☐	Olives	☐
Chocolate Cereal	☐	Orange juice	☐
Coffee	☐	Porridge	☐
Crisps	☐	Sausages	☐
Croissant	☐	Shakshouka	☐
Croissant and chocolate	☐	Sweet bread	☐
Croissant and jam	☐	Sweets	☐
Dates	☐	Tea	☐
Donuts	☐	Unleavened bread	☐
Eggs	☐	Yoghurt	☐

Other (please state) .....

22. Do you eat breakfast at school?

Yes ☐ No ☐

23. If yes, what food do you typically eat for breakfast at school (please tick all that apply)?

Beans	☐	Fried bread	☐
Bread	☐	Fruit	☐
Bread and jam	☐	Helwa	☐
Cereal	☐	Honey	☐

Cheese	☐	Meat	☐
Chocolate	☐	Oat or bran bar	☐
Chocolate bar	☐	Olives	☐
Chocolate Cereal	☐	Orange juice	☐
Coffee	☐	Porridge	☐
Crisps	☐	Sausages	☐
Croissant	☐	Shakshouka	☐
Croissant and chocolate	☐	Sweet bread	☐
Croissant and jam	☐	Sweets	☐
Dates	☐	Tea	☐
Donuts	☐	Unleavened bread	☐
Eggs	☐	Yoghurt	☐

Other (please state) .....

24. Do you eat at fast food restaurants (e.g. McDonalds, Herfy, Kudu, Al Baik, Al Tazaj, or Abu Nawas)?

Yes ☐ No ☐

25. On average how many times a DAY do you eat in fast food restaurants?

Once	☐	4–6 times	☐
1–3 times	☐	More than 6 times	☐

26. On average how many times a WEEK do you eat in fast food restaurants?

Once	☐	4–6 times	☐
1–3 times	☐	More than 6 times	☐

27. If yes, what do you normally eat there?

Beef burger	☐	Milk shakes	☐
Chicken burger	☐	Onion rings	☐
Corndogs	☐	Paninis	☐
Desserts	☐	Paninos sandwiches	☐
Frappucino	☐	Pasta	☐
French fries	☐	Pizza	☐
Fried chicken	☐	Salad (chicken)	☐
Fruit juices	☐	Salad (cheese)	☐
Halloumi cheese	☐	Salad (green)	☐
Hommos	☐	Steaks	☐
Kabab	☐	Submarine sandwich	☐
Koklata rolls	☐	Wings	☐
Labneh	☐	Wraps	☐

Other (please state) .....

28. Do you drink 'soft drinks' (these are drinks which are carbonated or fizzy and have sweeteners or flavours added, e.g. 'Coca Cola', 'Pepsi', 'Fanta', 'Sprite', etc.)?

Yes	☐	No	☐

29. If yes, on average how many (350 ml) cans of <u>non-diet</u> soft drinks do you consume in a week?

One	☐	4–6 cans	☐
1–3 cans	☐	More than 6 cans	☐

30. If yes, on average how many (350 ml) cans of <u>diet</u> soft drinks do you consume in a week?

One	☐	4–6 cans	☐
1–3 cans	☐	More than 6 cans	☐

31. Do you drink 'energy drinks' (these are drinks which contain stimulants such as caffeine, e.g. 'Red Bull', 'Boom Boom', 'Bison', or 'Spitz')?

Yes	☐	No	☐

32. If yes, on average how many (350 ml) cans of energy drinks do you consume in a week?

One	☐	4–6 cans	☐
1–3 cans	☐	More than 6 cans	☐

33. Do you eat vegetables (excluding <u>fried</u> vegetables such as potato wedges or french fries)?

Yes	☐	No	☐

34. If yes, on average how many times a day do you eat vegetables?

Once	☐	5-a-day	☐
1–3 times	☐	6 times	☐
4 times	☐	More than 6 times	☐

35. Do you eat fruit?

Yes	☐	No	☐

36. If yes, on average how many times a day do you eat fruit?

Once	☐	4–6 times	☐
1–3 times	☐	More than 6 times	☐

37. Do you eat dairy products (such as cheese, milk, yoghurts)?

Yes ☐ No ☐

38. If yes, on average how many times a week do you eat dairy products (such as cheese, milk, yoghurts)?

Once ☐ 4–6 times ☐

1–3 times ☐ More than 6 times ☐

39. Do you eat meat (such as beef, camel, chicken, goat, fish, lamb)?

Yes ☐ No ☐

40. If yes, on average how many times a week do you eat meat?

Once ☐ 4–6 times ☐

1–3 times ☐ More than 6 times ☐

41. Do you eat beans, pulses or nuts (such as fava beans, lentils, nuts)?

Yes ☐ No ☐

42. If yes, on average how many times a week do you eat beans or nuts (such as fava beans, lentils, nuts)?

Once ☐ 4–6 times ☐

1–3 times ☐ More than 6 times ☐

43. Do you eat breads or cereals (such as corn, oats, rice, wheat)?

Yes ☐ No ☐

44. If yes, on average how many times a week do you eat bread or cereals (such as corn, oats, rice, wheat)?

Once ☐ 4–6 times ☐

1–3 times ☐ More than 6 times ☐

45. Do you eat snacks (such as biscuits, crisps, potato chips, cake, chocolate, ice cream)?

Yes ☐ No ☐

46. If yes, on average how many times a week do you eat snacks (such as biscuits, crisps, potato chips, cake, chocolate, ice cream)? *Please count each snack as one time, for example if you eat 3 packets of crisps, 2 chocolate bars, and 2 ice creams a week this would be 7 times a week, so you would tick the '7-9 times' a week box.*

Once ☐ 7–9 times ☐

1–3 times ☐ 9–11 times ☐

4–6 times ☐ More than 11 times ☐

47. If yes, please write down how many of these you eat on average every week.

Biscuits **.....** Crisps or potato chips **.....**

Buns **.....** Donuts **.....**

Cake **.....** Frozen yoghurt **.....**

Chocolate **.....** Ice cream **.....**

Chocolate type bars **.....** Sweet pastries **.....**

Other (please state) .....

48. Do you have any allergies or food intolerances?

Yes ☐ No ☐

49. If yes, please write down which ones you have or which food you do not eat.

.....

.....

.....

50. Do you have any 'genetic gland disorders' such as inactive or enlarged thyroid (*please ask me if you would like this question explained further)*?

Yes ☐ No ☐

51. **If yes, please write down which one(s) you have.**

.....

.....

.....

52. Do you have any type of diabetes?

Yes ☐ No ☐

53. If yes, please write down which one(s) you have (e.g. Type 1 Diabetes or Type 2 Diabetes).

.....

.....

.....

Do you have any other comments or views that you would like to share with me regarding diet and nutrition?

.....

.....

.....

Appendix 3: Anthropometric measures

Weight (W): Measured using dial or electronic scales.

Height (H): Measured using a tape measure or CMR.

Body Mass Index (BMI): Calculated ($W\ (kg)/H\ (m)^2$).

IOTF BMI Cut-Offs:

Table 4 | International cut-off points for BMI for thinness grades 1, 2, and 3 by sex for exact ages between 2 and 18 years, defined to pass through BMI of 16, 17, and 18.5 at age 18, obtained by averaging data from Brazil, Great Britain, Hong Kong, Netherlands, Singapore, and US

	Boys			Girls		
Age (years)	16	17	18.5	16	17	18.5
2.0	13.37	14.12	15.14	13.24	13.90	14.83
2.5	13.22	13.94	14.92	13.10	13.74	14.63
3.0	13.09	13.79	14.74	12.98	13.60	14.47
3.5	12.97	13.64	14.57	12.86	13.47	14.32
4.0	12.86	13.52	14.43	12.73	13.34	14.19
4.5	12.76	13.41	14.31	12.61	13.21	14.06
5.0	12.66	13.31	14.21	12.50	13.09	13.94
5.5	12.58	13.22	14.13	12.40	12.99	13.86
6.0	12.50	13.15	14.07	12.32	12.93	13.82
6.5	12.45	13.10	14.04	12.28	12.90	13.82
7.0	12.42	13.08	14.04	12.26	12.91	13.86
7.5	12.41	13.09	14.08	12.27	12.95	13.93
8.0	12.42	13.11	14.15	12.31	13.00	14.02
8.5	12.45	13.17	14.24	12.37	13.08	14.14
9.0	12.50	13.24	14.35	12.44	13.18	14.28
9.5	12.57	13.34	14.49	12.53	13.29	14.43
10.0	12.66	13.45	14.64	12.64	13.43	14.61
10.5	12.77	13.58	14.80	12.78	13.59	14.81
11.0	12.89	13.72	14.97	12.95	13.79	15.05
11.5	13.03	13.87	15.16	13.15	14.01	15.32
12.0	13.18	14.05	15.35	13.39	14.28	15.62
12.5	13.37	14.25	15.58	13.65	14.56	15.93
13.0	13.59	14.48	15.84	13.92	14.85	16.26
13.5	13.83	14.74	16.12	14.20	15.14	16.57
14.0	14.09	15.01	16.41	14.48	15.43	16.88
14.5	14.35	15.28	16.69	14.75	15.72	17.18
15.0	14.60	15.55	16.98	15.01	15.98	17.45
15.5	14.86	15.82	17.26	15.25	16.22	17.69
16.0	15.12	16.08	17.54	15.46	16.44	17.91
16.5	15.36	16.34	17.80	15.63	16.62	18.09
17.0	15.60	16.58	18.05	15.78	16.77	18.25
17.5	15.81	16.80	18.28	15.90	16.89	18.38
18.0	16.00	17.00	18.50	16.00	17.00	18.50

(Cole *et al.*, 2007)

Anthropometric Measurements Sheet

Name :	
Age:	
Height (cm):	

Weight (kg):			
Body Mass Index:			
BMI Categorisation:	**Underweight (<18.5)**	**Overweight (>25)**	**Obese (>30)**
	Yes ☐	**Yes** ☐	**Yes** ☐
BMI Cut-Off:	**BMI Grade 1 (Below 18.5):** ☐ **BMI Grade 2 (Below 17):** ☐ **BMI Grade 3 (Below 16):** ☐		

Appendix 4: Information sheet (parents).

Investigation into the Lifestyle and Dietary Habits of Saudi School Children

INFORMATION SHEET

Dear Parents,

We would like to invite you to participate in this original research project. You should only participate if you are happy for you and your child to participate in this study. Before you decide whether to take part in this project, it is important for you to understand why the research is being carried out and what your participation will involve. If after reading this information sheet you do not wish to participate, or you do not wish your child to participate (e.g., because they have diabetes or severe allergies), please feel free to decline the offer.

Who has been asked to participate?

Female children that are currently studying in *Al Abrar School* in Al Madinah have been asked to participate. All the children in the classes have been asked to participate.

What is the aim of the research?

The research study aims to investigate the relationships between children's lifestyle factors (such as diet and physical activity) and weight gain. Elementary school children and adolescents are in need of constructive participation to help them solve the growing problem of overweight and obesity in Saudi Arabia. Your participation in this study is important because the results will help to provide information to inform effective solutions to the growing problem of developing obesity in Saudi schools.

What will my child be asked to do if they take part in the research?

If your child takes part in the research she will be required to fill in a written questionnaire about her lifestyle and diet. Also, a small group of students from the class will also be selected to take part in a short group interview session.

What will the parents be asked to do if they agree to take part in the research?

If the parents take part in the research they will be asked to fill out a short questionnaire regarding household surroundings, dietary habits and lifestyle of their children.

Who will conduct the research?

The research will be conducted by Duaa Hefni who is a PhD student from Saudi Arabia currently studying at the University of Salford in Greater Manchester, United Kingdom.

How long will the research last?

The data collection will be conducted over a period of [3] months.

Will the outcomes of the research be published?

The research project will form part of a written PhD thesis to be submitted for assessment at The University of Salford, Greater Manchester, United Kingdom. However, no personal or identifying information about the children or their parents will be disclosed to the public in any form.

How is confidentiality maintained?

The research will be undertaken on a confidential basis. This means that ALL personal information provided to me will not be disclosed to the public (e.g., names of participating children will be removed from publications).

Further information

If you have any questions, or would like any further information about this study please contact: Duaa Hefni, Telephone: 07702085261; Email: [duaa-hefni@hotmail.co.uk].

Appendix 5: Research withdrawal form

Investigation into the Lifestyle and

Dietary Habits of Saudi School Children

WITHDRAWAL FORM

PERSONAL DETAILS

Child's details		**Parent/Guardian's details**
Name:		Mother's name:
…….....		……..
Date of Birth:		Father's name:
…….		……
School Year:		Mother's phone:
…….....		……
		Father's phone:
		……

RESEARCH WITHDRAWAL

I have read the Information Sheet provided regarding the research which is to be undertaken at *Al-Abrar School* and I would like to withdraw my child from participating in the research.

Print Name (Parent/Guardian):

.....

Signature (Parent/Guardian):

.....

Dated:

.....

Appendix 6: Ethics approval

University of Salford MANCHESTER

Research, Innovation and Academic Engagement Ethical Approval Panel

College of Health & Social Care
AD 101 Allerton Building
University of Salford
M6 6PU

T +44(0)161 295 7016
r.shuttleworth@salford.ac.uk

www.salford.ac.uk/

15 January 2014

Dear Duaa,

RE: ETHICS APPLICATION HSCR13/82 – Investigating the effectivensss of an obesity prevention program to improve healthy eating habits among Saudi children aged 9 to 15 years old based in schools in Madinah (Saudi Arabia) – **PANEL'S COMMENTS**

The College Research, Innovation and Academic Engagement Ethical Approval Panel have reviewed your application, but have asked that the following comments be addressed before ethical approval can be granted:

1. Focus – Please consider swapping the focus with the title.

2. Objectives – Please expand on what the motivational drivers are and give examples.

3. Research Strategy – Please expand and rationalise the study design (i.e. observational, interventional, is there a control group?). Greater detail is required regarding how the questionnaires will be administered. Please add more information about why the children are being interviewed in groups. Are there dedicated time periods to be interviewed or are they focus groups? It is not clear.

4. Rationale – Please proof read this section as sentences do not make sense and as a result the reviewers were not able to fully understand your rationale. What empirical evidence is available regarding this problem? Less anecdotal and more facts and figures are required. How do you know that it is just the children that need educating? How about the parents? If they do not provide healthier options then telling children may not influence what they eat if it is not available.

5. Approaching Individuals – Please expand on how children will be approached in the School. Are all children being asked and those that agree taking part? What if you get less than or more than 30? How will adults be approached? Are you just sending a letter or having a meeting with them all? Please provide more details in this section.

6. Informed Consent – Please demonstrate that you have considered how to word and approach adults as opposed to children. Will 9 year olds understand the terminology in your information sheet and in the semi structured questionnaires?

7. Data Protection – Please provide more information on how the data will be transferred from the researchers home to the University.

8. Other Ethical Issues – The whole notion of diet and exercise means that children will have to confront their body image. What has been put into place if these children are affected by seeing their body measurements, being told they are overweight and not eating well? Please add in the support systems you have in place eg. Is there any psychological counselling available?

9. No. of Subjects – Please expand on the rationale for your sample sizes for the class and interviews. It is suggested that the class 1 includes students 8 to 9 years old which is potentially younger (≤9 yrs) than the suggested population target. Does this mean that the age range is 8 – 15yrs?

10. Code of Ethics used – Please use the code of ethics to fully inform the completion of this application.

11. Participant Information Sheet – Greater information is needed in the participant information sheet for the parents. It has to include the exact details of what will be done to the child. A separate information sheet needs to be provided for the child and made easy to read and understand. How will consent be gained if required from all parties?

12. Consent Form – Please provide a separate form for the child. If the parent agrees to the child taking part then consent should be completed with the child too.

13. Recruitment Material – Provide more detail as to how your will recruit the children to be in the 'class'.

14. Research Instrument – The information you are using in the education and training session is heavily Western and depicts both girls in short clothing and boys. Please comment on how suitable this is and if it is appropriate. What literature is already available in Saudi that could be used regarding diet and exercise? Are the health food sources and snacks you mention available in Saudi? Has the cost of purchasing a healthy diet been considered?

15. Interview Guide – This is mainly made out of closed questions and could be made more open to explore children's views rather than getting answers to pre- determined questionnaire. Can 27 questions be answered in 15 minutes?

16. Other Comments – This application gives an outline of a study that could provide some useful information about eating and exercise. However, there are many details that have been omitted. Greater consideration needs to be made to the delivery of the teaching session such as asking if anyone has allergies for the food tasting sessions, providing the literature to be handed out after the training and clarifying how the Kid's Award and Class Award are actually going to be done. Are you suggesting that the 'class' do the activities or all of the children at the School. It is not clear if the

Educational session is to everyone or just those in the study?

I would be grateful if you could forward your responses to me at your earliest convenience, r.shuttleworth@salford.ac.uk. Please note, all amendments/ additions should be clearly highlighted in the original documentation before re-submitting.

Yours sincerely,

Rachel Shuttleworth

Rachel Shuttleworth
College Support Officer (R&I)

Appendix 7: Semi-Structured Interview Questions (Children)

INTRODUCTION

Hello. My name is Duaa and I would like to spend about 25 minutes talking to you about diet and lifestyle. I am going to ask you a number of questions regarding your diet and food that you eat, and also any activities that you may do. If you want to talk about other things that you think are relevant when I ask a question, please feel free to do so. Also if you do not understand any question I ask then please let me know and I can explain it better for you.

QUESTIONS

1. How would you describe a healthy diet? (*in terms of food*)

2. How would you describe an unhealthy diet? (*in terms of food*)

3. Do you believe you eat healthily or unhealthily?

4. What kinds of food do you regularly eat?

5. How would you describe an active lifestyle? (*in terms of activities*)

6. How would you describe an inactive lifestyle? (*in terms of lack of activities*)

7. Do you regularly watch television?

8. How much time would you say that you spend watching television every day?

9. Do you regularly play video games?

10. How much time would you say that you spend playing video games every day?

11. Do you regularly spend time on the computer or the internet?

12. How much time would you say that you spend on the computer or the internet every day?

13. Do you regularly spend time on physical activities at school?

14. How much time would you say that you spend on physical activities at school?

15. Do you regularly spend time on physical activities outside of school?

16. How much time would you say that you spend on physical activities outside of school?

17. Do you believe diets work?

18. Do you believe doing a lot of physical exercise will help you lose weight or stop you getting fat?

19. Do you think you are overweight or obese?

20. Are you happy with your weight?

21. Are you currently trying to lose weight?

22. If yes, how are you trying to lose weight?

23. Do you weigh yourself regularly?

24. Do you enjoy eating?

25. Do you sometimes eat to make yourself feel better if you are upset?

26. Do you eat what you want to eat, what is available, or what your parents make you eat?

27. In your opinion, what is the best way to stop getting fat

Appendix 8: An interview consent form

Research Participant Consent Form

Title : Assessing the effectiveness of an educational programme designed to change the eating and exercise habits of female girls in a school in Madinah.

Name: Duaa Hefni

 I confirm that I have read and understood the information sheet for the above study (version x- date) and what my contribution will be.

Yes

No

 I have been given the opportunity to ask questions (face to face, via telephone and e-mail)

Yes

No

 I agree to take part in the interview

Yes

No

NA

 I agree to the interview being tape recorded

Yes

No

NA

 I agree to digital images being taken during the research exercises

Yes

No

NA

 I understand that my participation is voluntary and that I can withdraw from the research at any time without giving any reason

Yes

No

 I understand how the researcher will use my responses, who will see them and how the data will be stored.

Yes

No

□ I agree to take part in the above study

Yes

No

Name of participant

……

Signature

……

Date ……

Name of researcher taking consent

……

Researcher's e-mail address ……

I certify that the above information is, to the best of my knowledge, accurate and correct. I understand the need to ensure I undertake my research in a manner that reflects good principles of ethical research practice.

Signed by Student _____

Print Name _____

Date _____

In signing this form I confirm that I have read this form and associated documentation.

I have discussed and agreed the contents with the student on _____

(Please insert date of meeting with student).

Signed by Supervisor _____

Print Name _____

Date _____

Appendix 9: An example of participant short form semi structured interview transcript

D: Hello. My name is Duaa and I would like to spend about 20 minutes talking to you about diet and lifestyle. I am going to ask you a number of questions regarding your diet and foods that you eat, and also any activities that you may do. If you want to talk about other things that you think are relevant when I ask a question, please feel free to do so. Also if you do not understand any question I ask then please let me know and I can explain it better for you.

QUESTIONS

Example 1

1. **DH1** How would you describe a healthy diet? (In terms of foods)

2. **RKA** I think a healthy diet would consist mainly of the intake of healthy food. A healthy diet would also require eating the main meals at specific times. So eating the right kind of food at the right time of day.

3. **DH2** How would you describe an unhealthy diet? (In terms of foods)

4. **RKA** An unhealthy diet I think would be when you are eating lots and lots of fast food, like pizzas and burgers and this type of fast foods. Also, if you eat lots of crisps and sweets, cakes and pastries and those kinds of unhealthy things.

5. **DH3** Do you believe you eat healthily or unhealthily?

6. **RKA** Um…well, I think that maybe I'm kind of both sometimes. Sometimes I eat healthy and sometimes I don't –sometimes I eat unhealthy things as well, so I eat both ways.

7. **DH4** What kinds of foods do you regularly eat?

8. **RKA** Basically, I eat a lot of things like crisps and sweets, all the unhealthy stuff like that, but in terms of food I usually eat rice and curry. Plain rice with some kind of curry, this is what I eat usually.

9. **DH5** How would you describe an active lifestyle? (In terms of activities)

10. **RKA** I believe that an active lifestyle needs to be doing exercises, lots of exercises, and also walking too. It needs to be a lot of movement and not too much lying around.

11. **DH6** How would you describe an inactive lifestyle? (In terms of activities)

12. **RKA** This would be when the person isn't doing exercise, no exercise at all during the day, and is doing a lot of eating all through the day and sitting down all the time as well. So basically doing nothing all the time and eating lots of unhealthy things.

13. **DH7** Do you regularly watch television?

14. **RKA** Yes, I watch television. I like to watch a lot of television. I think I watch television too much.

15. **DH8** How much time would you say that you spend watching television every day?

16. **RKA** I watch television all the day. I watch it all the time and I think there are only one or two hours every day that don't spend watching television. I spend a lot of time watching it.

17. **DH9** Do you regularly play video games?

18. **RKA** Also, I play video games, yes, I regularly play them. I also spend too much time playing I think.

19. **DH10** How much time would you say that you spend playing video games every day?

20. **RKA** Yes, every day all the day. I play all the time, I play them on my mobile phone in my hand.

21. **DH11** Do you regularly spend time on the computer or the internet?

22. **RKA** Yes I spend time on the internet and computer but this is rarely, so not regular.

23. **DH12** How much time would you say that you spend on the computer or the internet every day?

24. **RKA** I would say not much, not a lot of time at all I think, it's rarely that I use internet and computers. I think I spend my time mostly on television and playing video games.

25. **DH13** Do you regularly spend time on physical activities at school?

26. **RKA** Well, not really, not that much. I don't like it. I don't like to do it because of the hot weather, I think it's too hot to do these activities.

27. **DH14** How much time would you say that you spend on physical activities at school?

28. **RKA** Not any time at all really. I don't spend any time on this because it's too hot to do this at school.

29. **DH15** Do you regularly spend time on physical activities outside of school?

30. **RKA** Sometimes, but really not that much. As I said I think it's very hot for activities like this.

31. **DH16** How much time would you say that you spend on physical activities outside of school?

32. **RKA** Sometimes I do cycling. I spend time on my cycle maybe for about one hour. Only sometimes of course.

33. **DH17** Do you believe **diets work**?

34. **RKA** Yes, of course. I believe that doing a diet will work for people, I think it can help them.

35. **DH18** Do you believe doing a lot of **physical exercise will help you lose weight** or stop you getting fat?

36. **RKA** Yes, sure. I think that doing lots of exercise will help you lose all the fat and help you with the fatness, and also stop you getting a lot fatter.

37. **DH19** Do you think you are overweight or obese?

38. **RKA** Yes. I think I am overweight right now, I'm currently fat and I think I need to lose the weight.

39. **DH20** Are you happy with your weight?

40. **RKA** No, I'm not happy with it. Not at all, and in fact I think I'm overweight and I need to diet, to try and lose the fat as soon as I can.

41. **DH21** Are you currently **trying to lose weight**?

42. **RKA** Yes. I'm trying to lose weight right now. I think **I need to lose a lot of weight and to lose the fat.**

43. **DH22** If yes, how are you trying to lose weight?

44. **RKA** I'm trying to lose my weight by **following a diet**. I'm trying right now to lose the fat by **reducing the intake of crisps and sweets**, and stop eating all the sweet things that make me fatter. Also **I'm doing some exercises every morning**. I'm trying to do this every morning so that I can lose my weight quickly before I get too much fat.

45. **DH23** Do you weigh yourself regularly?

46. **RKA** No. No, **I don't weigh myself regularly**. Maybe I should be doing this but I don't do it.

47. **DH24** Do you enjoy eating?

48. **RKA** Yes. I enjoy eating. I enjoy it too much I think. I enjoy eating lots of things like crisps and sweets, sugary things like donuts and cakes or biscuits, any kind of desserts really. I really enjoy eating them. But I also eat other things like chicken and rice, and curry too.

49. **DH25** Do you sometimes eat to make yourself feel better if you are upset?

50. **RKA** No. I don't really do that. Not at all, I just enjoy eating, and I don't eat only if I'm feeling upset.

51. **DH26** Do you eat what you want to eat, what is available, or what your parents make you eat?

52. **RKA** Sometimes I think about what I want to eat and then decide to eat it, and sometimes I go to the kitchen to see what is available, or what I can get to eat before I eat it.

53. **DH27** In your opinion, what is the best way to **stop getting fat**?

54. **RKA** The best way is to have an intake of healthy food. Lots of good things like salad, chicken, porridge, yoghurt and that kind of healthy foods. Also, the best way is to avoid eating crisps and sweets and unhealthy foods like cake and chocolates and donuts. You also need to be doing exercises to stop getting fat, this is the best way.

Example 2:

55. **DH1** How would you describe a healthy diet? (In terms of foods)

56. **HAA** I think a healthy diet would mean that the person is noticing the amount of food that they are eating – they are keeping an eye on how much food they are eating. I think it would also be eating healthy things - this would be eating things like tomatoes, oranges, apples, bananas, carrots and cucumbers. Eating these types of things would be a healthy diet I think.

57. **DH2** How would you describe an unhealthy diet? (In terms of foods)

58. **HAA** An unhealthy diet would be eating things like crisps and sweets. Not noticing the amount of what you are eating and having lots of cakes and things like this. Also eating things like lots of chocolate, donuts and sweet sugary foods.

59. **DH3** Do you believe you eat healthily or unhealthily?

60. **HAA** I don't know. I think I am some healthy. I would like to think that I'm healthy anyway. I don't think I am unhealthy or eat lots of unhealthy types of foods and things.

61. **DH4** What kinds of foods do you regularly eat?

62. **HAA** I drink milk every day, and at lunch I eat things like rice – I think that I don't eat unhealthy things too much.

63. **DH5** How would you describe an active lifestyle? (In terms of activities)

64. **HAA** An active lifestyle is when you go to sleep early every day and you are doing exercise.

65. **DH6** How would you describe an inactive lifestyle? (In terms of activities)

66. **HAA** I think an inactive lifestyle would be when the person doesn't do much exercise – the person isn't doing exercise and is alone watching television for a very long time every day.

67. **DH7** Do you regularly watch television?

68. **HAA** Yes, I watch television regularly. I watch television every day I think...sometimes every day anyway. Anyway it also depends on what other things I have to do.

69. **DH8** How much time would you say that you spend watching television every day?

70. **HAA** I think this depends, but I think I would say that I watch television sometimes for more than two hours every day. Sometimes it may be different but I think this is average.

71. **DH9** Do you regularly play video games?

72. **HAA** Yes, I play video games, usually every day but this also depends, but I do play regularly.

73. **DH10** How much time would you say that you spend playing video games every day?

74. **HAA** I think that usually I spend about two or three hours playing the video games, but it can be different though I can guess this is the average. Maybe more or less.

75. **DH11** Do you regularly spend time on the computer or the internet?

76. **HAA** No. I don't spend time on computers or on the internet and I spend my time on television or on video games.

77. **DH12** How much time would you say that you spend on the computer or the internet every day?

78. **HAA** I don't spend any time on the internet or computers – I use my time on video games or television.

79. **DH13** Do you regularly spend time on physical activities at school?

80. **HAA** Sometimes, yes I do, but it can be different every day and on different things.

81. **DH14** How much time would you say that you spend on physical activities at school?

82. **HAA** Um…maybe around ten minutes every day, I'm not sure. But I think it is roughly about ten minutes.

83. **DH15** Do you regularly spend time on physical activities outside of school?

84. **HAA** Yes, I do things outside of school…different things, usually after school has finished.

85. **DH16** How much time would you say that you spend on physical activities outside of school?

86. **HAA** I'm not sure…um, well I play at home, and I also do a lot of walking for things like shopping.

87. **DH17** Do you believe diets work?

88. **HAA** Yes, I think that a diet can work.

89. **DH18** Do you believe doing a lot of physical exercise will help you lose weight or stop you getting fat?

90. **HAA** Maybe yes and also maybe no. I'm between the two views. I think that sometimes doing a lot of exercise can help you lose some weight but maybe also sometimes this will not help you as well, and you can still get fat.

91. **DH19** Do you think you are overweight or obese?

92. **HAA** No. I don't think that I'm overweight or too fat, no…I don't think this way at all.

93. **DH20** Are you happy with your weight?

94. **HAA** Yes. I'm happy with my weight and I don't think that I'm getting fatter.

95. **DH21** Are you currently trying to lose weight?

96. **HAA** No. I'm not trying to lose weight. I don't think I need to lose any weight right now.

97. **DH22** If yes, how are you **trying to lose weight**?

98. **HAA** I'm not trying to lose any weight.

99. **DH23** Do you weigh yourself regularly?

100. **HAA** Sometimes. Um, yes sometimes I do weigh myself but only sometimes. It's not something I do all my life all the time, but I do weigh myself only sometimes.

101. **DH24** Do you enjoy eating?

102. **HAA** Yes, sometimes. I enjoy eating different things…sometimes I enjoy eating very much.

103. **DH25** Do you sometimes eat to make yourself feel better if you are upset?

104. **HAA** No. I don't eat to make myself feel better or eat something if I feel I'm upset.

105. **DH26** Do you eat what you want to eat, what is available, or what your parents make you eat?

106. **HAA** Well, usually my dad prepares the food, and I eat it. He prepares different things and I enjoy eating the food.

107. **DH27** In your opinion, what is the **best way to stop getting fat**?

108. **HAA** I think that the best way to stop getting fat, is to make sure that you are **eating at specific times**, that means at set times of the day. And also to **avoid drinking things like soft drinks** and eating too many things like bread or sweetbreads, or something like that.

Appendix 10: An Obesity Information Booklet

◆ إزالة الجلد من الدجاج و الشحم من اللحوم لاحتوائه على نسب عالية من الدهون والكولسترول.
◆ استبدال الحليب ومنتجاته بالحليب الخالي أو القليل الدسم عند تناوله أو عند إعداد الوجبات الغذائية.
◆ اختيار الأغذية الغنية بالألياف والنخالة لأنها تعطي أحساس بالشبع والامتلاء كالخبز الأسمر والحبوب الكاملة.
◆ إضافة الأعشاب والبهارات بدلا من الزبد والمار جرين والملح.
◆ استخدام الزيوت النباتية غير المشبعة بكمية محددة مثل زيت الذرة وعباد الشمس والكانولا أو زيت الزيتون بدلا من السمنة أو الزبدة في الطهو.

العلاج بالأدوية

يجب أن تستخدم الأدوية تحت الأشراف الطبي فقط لأنها تسبب بعض المضاعفات و الآثار الجانبية و عدم الاعتماد عليها وحدها لإنقاص الوزن بل هي جزء متمم من برنامج علاجي متكامل يتضمن نوعية وكمية الطعام إضافة إلى ممارسة الرياضة.

الجراحة

هي أخر وسائل العلاج للسمنة و تستخدم في حالات السمنة المفرطة جدا أو وجود مضاعفات وتكون الجراحة لأغراض علاجية بحتة وليس لأغراض تجميلية .

تذكر أن:

◆ تبتعد عن البدع والاعتقادات الخاطئة المتعلقة بالسمنة وخصوصا قوائم الحمية الموجودة في الكتب والمجلات التجارية ومراكز الرشاقة وحاول أن تستشير الطبيب في مدى صحة هذه الاعتقادات .
◆ تتناول الفواكه والخضروات المتنوعة بمعدل 5 – 9 مرات في اليوم حيث يعمل على تحسين الوضع الصحي للشخص ويمنح الجسم الكثير من الفيتامينات والأملاح المعدنية والألياف وغيرها من المواد الغذائية الضرورية لصحة الجسم.
◆ إن المكسرات والبذور غنية بالدهون فلا تفرط في تناولها.

الـــريـــاضـــة

تلعب الرياضة دور أساسي في إنجاح الحمية الغذائية فيفضل ممارستها بانتظام بمعدل 2- 3 مرات في الأسبوع بنشاط متوسط الجهد مثل المشي السريع أو الهرولة ولمدة 20 – 30 دقيقة على أن تزيد عدد المرات والفترة التي يمارس فيها النشاط البدني بشكل تدريجي إلى أن تصل إلى 5 أيام في الأسبوع أو أكثر.

تعديل السلوك

العلاج السلوكي أحد المفاتيح الرئيسية لبرامج المحافظة على الوزن التي تمكن الشخص من تحقيق التغيرات المطلوبة ودعم استمرارها من أجل إنقاص الوزن للمستوى المطلوب وذلك عن طريق:

1- مراقبة الشخص لنفسه لما يتناوله من طعام وما يمارسه من رياضة بشكل دوري وتدوين ذلك لتساعده على رصد وتحسين انجازاته.
2- التعرف على المثيرات التي تصاحب تناول الكثير من الطعام لإدخال التغيير المناسب عليها.
3- الدعم الأسري وتشجيع الأصدقاء والمعارف.
4- المكافأة والتشجيع .
5- تغيير طريقة التفكير ورفع الروح المعنوية للشخص .

تغير العادات الغذائية الخاطئة بعادات غذائية صحيحة مثل:

◆ المحافظة على تناول الوجبات الرئيسية والالتزام بوقت ثابت ومحدد مع تقليل حجم الحصة الغذائية المتناولة تدريجياً .
◆ مضغ الطعام جيدا أثناء تناول الوجبة الغذائية وشرب كميات كافية من الماء.
◆ الامتناع عن تناول الطعام أثناء مشاهدة التلفزيون أو عند الجلوس أمام الكمبيوتر.

◆ الامتناع عن تناول الطعام عند عدم الشعور بالجوع لمجرد توفر الغذاء أو عند تقديمه.
◆ الإقلال من تناول أو إعداد الوجبات السريعة.
◆ عدم تخزين أغذية ذات سعرات حرارية مرتفعة كالحلويات والشكولاته ورقائق البطاطس في المنزل واستبدالها بالأغذية الغنية بالألياف والفيتامينات والأملاح المعدنية كالفواكه والخضروات.
◆ طهو الطعام بالبخار أو الضغط وتحضير اللحوم والأطعمة عن طريق السلق أو الشي بدلا من قليها في الدهن.

تعريف السمنة

هي زيادة غير طبيعية في وزن الجسم بسبب تراكم الدهون المخزنة فيه وقد تكون الزيادة في جميع أجزاء الجسم أو في مواضع محددة فيه.

أسباب السمنة

تتداخل مجموعة من العوامل البيئية والوراثية في الإصابة بالسمنة ونستخلص منها ما يلي:

- **أسباب تغذوية:** كاستهلاك أطعمة ذات سعرات حرارية مرتفعة أو بكميات كبيرة أو ممارسة عادات غذائية خاطئة مثل تناول الأطعمة أثناء مشاهدة التلفزيون وغيرها قد تؤدي إلى زيادة الوزن .

- قلة النشاط الحركي وعدم ممارسة الرياضة.
- الوراثة.
- عوامل نفسية واجتماعية.
- بعض الأمراض والأدوية .

مضاعفات السمنة

تؤدي السمنة أو زيادة الوزن إلى كثير من المضاعفات مثل :

- الإصابة بمرض ضغط الدم و داء السكري وارتفاع نسبة الكولسترول في الدم وأمراض القلب و تصلب الشرايين كما تسبب الإصابة ببعض أنواع السرطانات مثل سرطان القولون والبروستاتة والثدي والإصابة بالتهابات وحصى المرارة وآلام المفاصل وخاصة الركبة وتزيد من خطر الموت المبكر .
- الإصابة بعسر الهضم والشعور بالحرقان وكذلك بصعوبة التنفس أثناء النوم وأثناء القيام بأقل مجهود حركي.
- الإصابة ببعض المشاكل النفسية مثل العزلة والاكتئاب.
- تؤدي إلى اضطرابات هرمونية متعددة مثل عدم انتظام الدورة الشهرية كما قد تؤثر على معدل الخصوبة عند المرأة.

قياس السمنة

تقاس السمنة عادة بأكثر المقاييس استخداما وهو **قياس مؤشر كتلة الجسم (BMI)** وهو حاصل قسمة وزن الجسم (بالكيلوجرام) على مربع الطول (بالأمتار) = الوزن(كجم) / (الطول) م^2

وبناء على هذا المقياس تم تقسيم أوزان الأشخاص إلى فئات كالتالي:

حالة الشخص	مؤشر كتلة الجسم (BMI)
طبيعي	24.9 – 18.5
زيادة الوزن	29.9 – 25
سمين	39.9 – 30
سمنة مفرطة	40 فأكثر

كيفية التخلص من السمنة

يوجد عدة طرق ووسائل لعلاج السمنة ويفضل أولا مراجعة طبيب العائلة للقيام بالفحوصات اللازمة للتأكد من عدم وجود مضاعفات للسمنة ولمناقشة أفضل الطرق والوسائل لإنقاص الوزن و تعتبر أفضل الطرق وأحسنها هو أتباع حمية غذائية متوازنة تحتوي على جميع العناصر الغذائية التي يحتاج إليها الجسم مع ممارسة الرياضة بصورة منتظمة وتبني نمط حياة صحي على المدى البعيد.

الحمية الغذائية

تعتبر الحمية الغذائية المنخفضة السعرات الحرارية الركيزة الأساسية لأي برنامج غذائي يهدف لإنقاص الوزن و يمكن تحقيق الفوائد الصحية المرجوة للحمية الغذائية والوصول إلى الوزن المناسب للفرد عن طريق تقليل حجم و عدد الحصص المتناولة و اختيار الأطعمة ذات السعرات الحرارية المنخفضة عن طريق الاستعانة بالهرم الغذائي وعدد الحصص الغذائية.

الهرم الغذائي

الهرم الغذائي هو دليل للتعرف على الاحتياجات الغذائية من المجموعات الغذائية بتحديد حجم و عدد الحصص اليومية التي يحتاج إليها الشخص في تكوين الوجبات الأساسية بحيث يضمن الحصول على جميع العناصر الغذائية التي يحتاج إليها الجسم من خلال التنوع والتوازن في الأطعمة.

المجموعات الغذائية	حجم الحصة
الخبز والحبوب من 6-11 حصة	- ½ خبز تستاني أو تورتيلي أو شريحة خبز عادي أو قطعة متوسطة خبز رول — ¾ كوب أرز مطبوخ أو مكرونة مطبوخة
الخضروات من 3-5 حصة	- ½ كوب خضار مطبوخة أو طازجة أو كوب خضروات ورقية خضراء
الفواكه من 2-4 حصة	- فاكهة واحدة متوسطة الحجم - ¾ كوب عصير فواكه - ½ كوب سلطة فواكه مقطعة أو مطبوخة أو معلبة
الحليب ومشتقاته من 2-3 حصة	- كوب حليب أو لبن أو روب - شريحتين جبن
اللحوم وبدائلها من 2-3 حصة	- لحم حجم راحة اليد أو سمكة متوسطة أو مستر أو فخذ دجاج صغير - ¾ كوب بقول مطبوخة أو 1-2 بيضة

Appendix 11: Designed Dietary Plan
Children's Approved Diet Plan

	Breakfast	**kcanS**	**Lunch**	**kcanS**	**Dinner**
Saturday	Cornflakes Cup milk	Cheese sandwich	5 tablespoons rice And grilled chicken breast Grilled vegetables	2 apples	Tuna salad
Sunday	Egg Sandwich Cup milk	Fruit salad	Grilled chicken or beef burger and vegetable salad	Banana	Cornflakes
Monday	Cheese pastry	Crisps and half a sandwich	6 tablespoons pasta with chicken and vegetables	Fruit salad	Cornflakes
Tuesday	Turkey sandwich with vegetables	2 carrots or cucumbers	Chicken or meat faheeta sandwic	2 carrots or cucumbers	Tuna salad
Wednesda	Cornflakes Cup of milk	Chocolate 200 kcal = half Sandwich	Chicken or beef burger or Grilled fish fillet and salad	2 carrots or cucumbers	Chicken sandwich
Thursday	Croissant	Cheese pastry	Pizza and vegetable salad	200 kcal Chocolate	Caesar Salad
Friday	Turkey sandwich with vegetables	2 carrot or cucumber	Chicken or meat fajita sandwich	2 carrots or cucumbers	Tuna salad

Sandwich:

Toast o 2 or 1/4 arabic bread or wheat or 1 Samoli central or 1 tortilla.

o 1 Mtjn eggs with a teaspoon of olive oil and vegetables as well as possible

o or

o 1 tablespoon fat cheese

o or

o brick large spoon with a little thyme.

o or

o grilled chicken breast with a lick of olive oil or tea steak without fat

• Power:

o any type of vegetables with the addition of a can of tuna (tuna salad)

o any type of vegetables with the addition of grilled chicken breast and 1 cloud Toast in the oven and clip cubes

o sauce: a tablespoon of olive oil with 1/4 spoon-refundable

• hamburger:

o slice tomatoes, lettuce and mayonnaise and ketchup

o grilled chicken breast or minced meat without fat mixed with onions, garlic, Tnchoa

• Chips:

o 1 small size 250 calories

• Pizza:

o dough pizza size equal to the size of a small tortilla bread

o Add tomato sauce and vegetables and minced chicken pieces with text Ooulihm cup cheese Motzarella

To calculate body mass:
http://www.moh.gov.sa/HealthAwareness/MedicalTools/Pages/BodyMassIndex.aspx in Arabic.

Appendix 12: Pearson Product-Moment

Pearson Product-Moment Correlation Coefficient the (r) correlation is a linear correlation necessary to find the degree of the association of two sets of variables, x and y, to obtain the value of r from ungrouped data. Strength and direction of line relationships between BMI and eating habits, as well as magnitude of physical activity was investigated and also between physical inactivity, dietary habits, and BMI in Saudi children

The formula is as follows (Calmorin 1997).

Pearson Product-Moment Correlation Coefficient (r)

$$r = (N\sum XY-(\sum X)(\sum Y))/(\sqrt{([N\sum X^2-(\sum X)^2])}\ \sqrt{([N\sum 〖YX〗^2-(\sum Y)^2])}\ )$$

Where,

X and Y, is the sample Pearson correlation coefficient,

N, are a number of samples

Appendix 13: Analysis of Variance (ANOVA)

ANOVA is a statistical method used to analyses and test differences more than two means. It may seem unusual that the technique is known by "Analysis of Variance" rather than "Analysis of Means". ANOVA has the facility of: one factor ANOVA and two factors ANOVA, with and without replications (Apet 2009).

ANOVA uses to test general rather than specific differences among means based on the IBM-SPSS statistic software computer program.

In this study one-way ANOVA was with the hypotheses are set:

H0: $\mu 1 = \mu 2 = \mu 3 \ldots\ldots\ldots\ldots\ldots = \mu n$, Which is the null hypothesis

H0: not all μ are equals at least one is different,

Which is the alternative hypothesis

In this study, ANOVA is used analysis the significant differences among BMI and number of variables at 95% confidence level.

Appendix 14: Consent Form (Parents)

Investigation into the Lifestyle and
Dietary Habits of Saudi School Children
CONSENT FORM

PERSONAL DETAILS

RESEARCH CONSENT

1.	I have read and understood the information about the research project as provided in the Information Sheet.	☐
2.	I have been given the opportunity to ask questions about the project and about myself and my child's participation.	☐
3.	I voluntarily agree to participate in the project.	☐
4.	I understand I can withdraw at any time without giving reasons and that I will not be penalised for withdrawing or questioned on why I have withdrawn.	☐
5.	The procedures regarding confidentiality of information have been clearly explained to me.	☐
6.	The use of the data in the research has been clearly explained to me.	☐

I have been asked to give consent for my daughter to participate in this research study, which will involve her completing one interview (if selected) and completing two questionnaires. I have read the information above and I have had the opportunity to ask questions about it, and any questions that I have asked have been answered to my satisfaction. I give my voluntary consent for my child to participate in this study.

Print Name (Parent/Guardian):

.....

Signature (Parent/Guardian):

.....

Dated:

.....

Appendix 15: Dietary intervention plan for children.

THE CHILDREN'S DIETARY INTERVENTION PLAN

The "**Healthy Kids**" Children's Dietary Intervention Plan will consist of three components:

Introductory Diet and Nutrition Education Workshop;

The Intervention Plan will be scheduled to take place over a period of 3 months. The Introductory Diet and Nutrition Education Workshop will take place at the children's school in Al-Madinah. This will then be followed by the taking of anthropometric measurements of the participants and the initial semi-structured interviews. This stage will form the Baseline Date. Following on from this the children's school will roll out the Kid's Award Programme together with the Class Award Programme for 3 months (APPENDIX 10). The start of this stage will form the Start Date. The repeat of the taking of anthropometric measurements and second semi-structured interviews will take place at the end of the 3-month period. This stage will form the End Date.

Introductory Diet and Nutrition Education Workshop

Taking into account that the attention span of children and adolescents is short compared to adults, the Diet and Nutrition Education Workshop will consist of a short **one-hour** session. This will be made up of the following elements:

1. **Introduction (*10 minutes*);**
2. **Children's Presentation (*20 minutes*);**
3. **Children's Interactive Session (*20 minutes*);**
4. **Plenary (*10 minutes*).**

1. Introduction

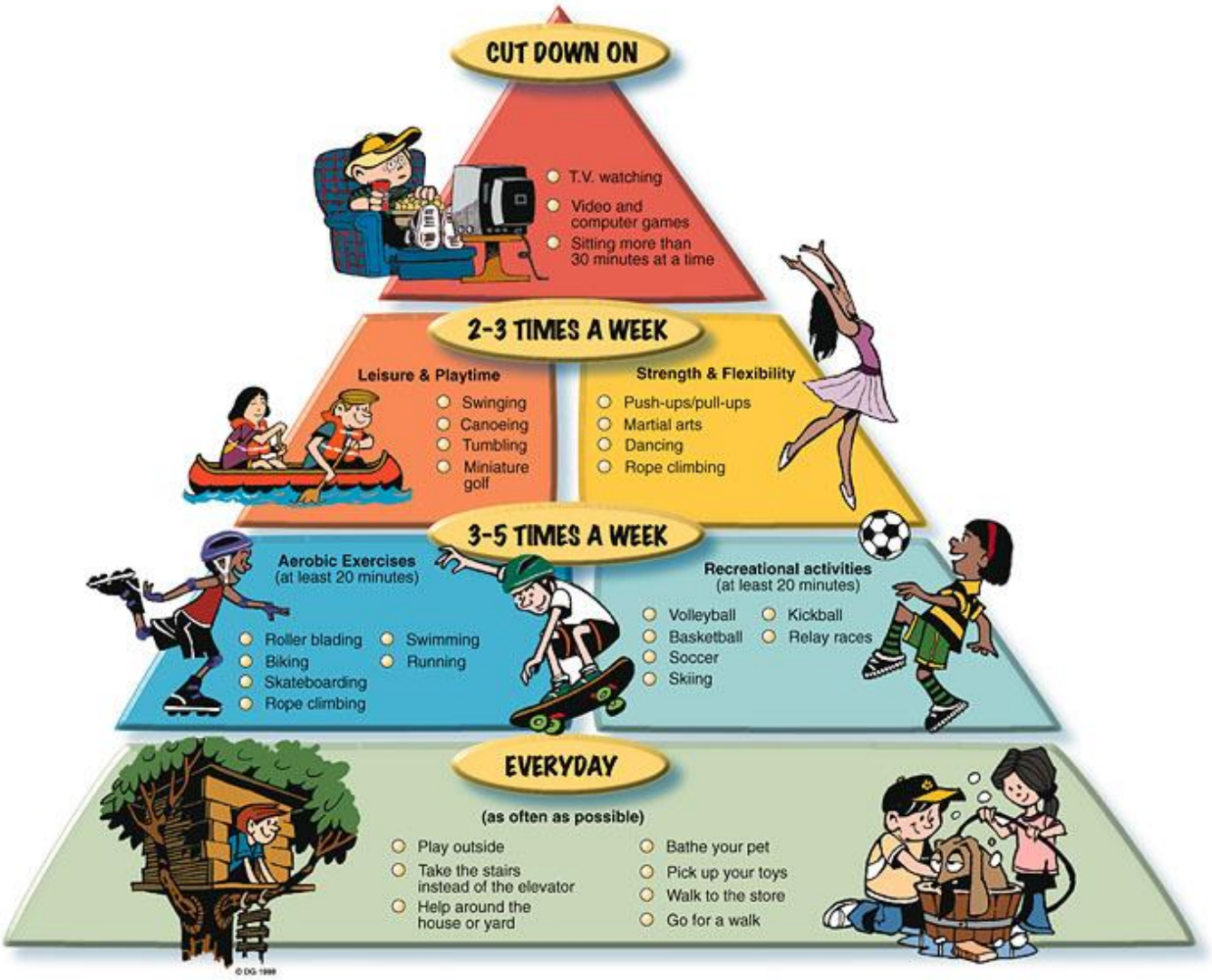
The Introduction will consist of introducing myself to the teacher and to the children and to clarify the purpose of my visit, as well as briefly explaining the nature of the **Healthy Kids** Intervention Plan. I will also use the Introduction session to outline all the elements of the Introductory Diet and Nutrition Education Workshop, as well as the Kid's Award Programme and the Class Award Programme.

2. Children's Presentation

The Children's Presentation was undertaken by me and consisted of the delivery of a 15-minute oral presentation to the children, accompanied by visual aids and a PowerPoint presentation. The content of the presentation covered issues relating to the food pyramid; the benefits of 5-a-day (fruit and vegetables); children's daily calorie intake; recommended food portions; the dangers of fast food; and the effects of healthy dietary and activity habits and lifestyle. The presentation included as many specifically designed visual aids to visually

reinforce messages about the benefits of healthy eating to the children. The presentation ended with a quick 5-minute question and answer session with the children, which provided answers to any queries that the children might have in relation to healthy eating. Examples of the types of graphics and images that were used in the presentation are set out below.

Appendix 16: An example of picture



Appendix 17: Children's Interactive Session

The Children's Interactive Session will consist of the children choosing to participate in a number of different interactive lessons. At present it is envisaged that these strategies may consist of any combination of the following:

- ***Healthy eating tasting:*** the children are provided with a variety of different trays with different plates upon which different healthy kinds of food are made available to them. Each plate will have a graphic plaque which will highlight the positive healthy attributes of the food. For example, one tray may have a selection of different types of fruit made available with each graphic plaque describing the qualities of the fruit, the calorie content, a breakdown of what the fruit is made up of, and its benefits. An example might include berries (*blueberries, raspberries and blackberries are rich in proanthocyanidins, antioxidants that can help prevent cancer and heart disease*). Other trays may include small samples of pre-cooked dishes which contain specific vegetables which are healthy with plaques explaining why they are healthy. An example might include a broccoli recipe such as a broccoli salad (*broccoli is high in minerals, vitamins, vitamin C, and phytonutrients which may help to lower the risk of cancer*). However these samples will all be specially designed to reflect cultural preferences in Saudi Arabia. Alternatively, healthy 'nibbles' might be prepared such as healthy dips along with peeled and sliced carrot sticks or celery sticks. The food plaques might then inform children of the differences in calorie content of these types of nibbles as compared to high calorie dips with crisps or nachos.
- ***Healthy activity colouring*****:** the children might like to have colouring pens and pencils made available in order to allow them to colour a number of different printed pictures or posters (i.e., which they can fill in), which highlight healthy eating or healthy activities which they can then take home.
- ***Healthy eating quizzes and games:*** the children might like to have the opportunity to take part in different healthy eating quizzes and games involving flash cards which are designed around their knowledge of the impact of healthy eating and physical activities. Alternatively, children might be shown a series of different photographs showing different foods or meals, to see if they know which the healthiest options are. The backs of the photographs might show a breakdown of the actual calorie content so that the children learn while playing.

- ***Healthy eating video:*** the children might like to sit down to view a (pre-chosen) video of healthy eating which would provide them with further details and information regarding healthy eating habits.

Plenary

The Plenary session will consist of providing a summary of what the children have completed and what will be coming up next and to thank them for their time and participation. I may also hold a final question and answer session with the children. Finally, the plenary session may involve handing out healthy eating booklets or cards for the children to take home.

Appendix 18: Children's dietary intervention poster:

University of Salford MANCHESTER

Duaa Hefni

PhD Student, d.h.hefni@edu.salford.ac.uk

Assessing the effectiveness of an obesity prevention programme to improve healthy eating habits among Saudi schoolchildren aged 9 to 15

Study aims:

To investigate the effectiveness of interventions in promoting healthy eating in Saudi children.

To explore the relationships between lifestyle factors (dietary habits, physical and sedentary activity) and the development of obesity among the participants.

Eat healthy and say no to fast food

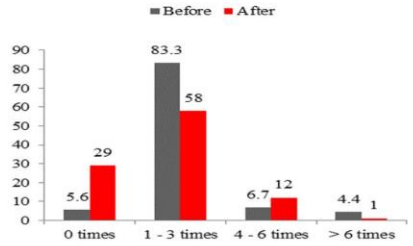
Methods:

- Mixed methods
- 90 children (9-15) and parents
- Pre-test & 3-months post-test

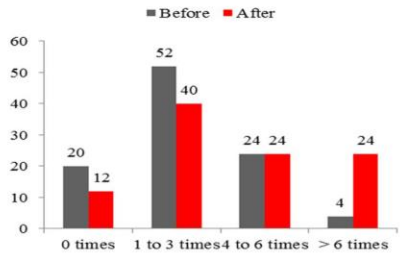
1. anthropometric measures
2. questionnaire surveys
3. interviews

- 3 month intervention strategy: diet & nutrition education, physical activity & lifestyle workshop. Interactive session & special dietary plan for children

Findings:



Frequency of fast food intake before and after the intervention



Frequency of vegetables intake before and after the intervention

Conclusion:

The programme had a positive effect on the types of food eaten. The intake of unhealthy food and drinks decreased, whilst at the same time the intake of healthy food, such as vegetables, and fruit increased after the intervention.

www.salford.ac.uk/nmsw/research/children,-young-people-and-families

Appendix 19: Calorie counter
Calories in Soft Drinks (Nutracheck, 2014)

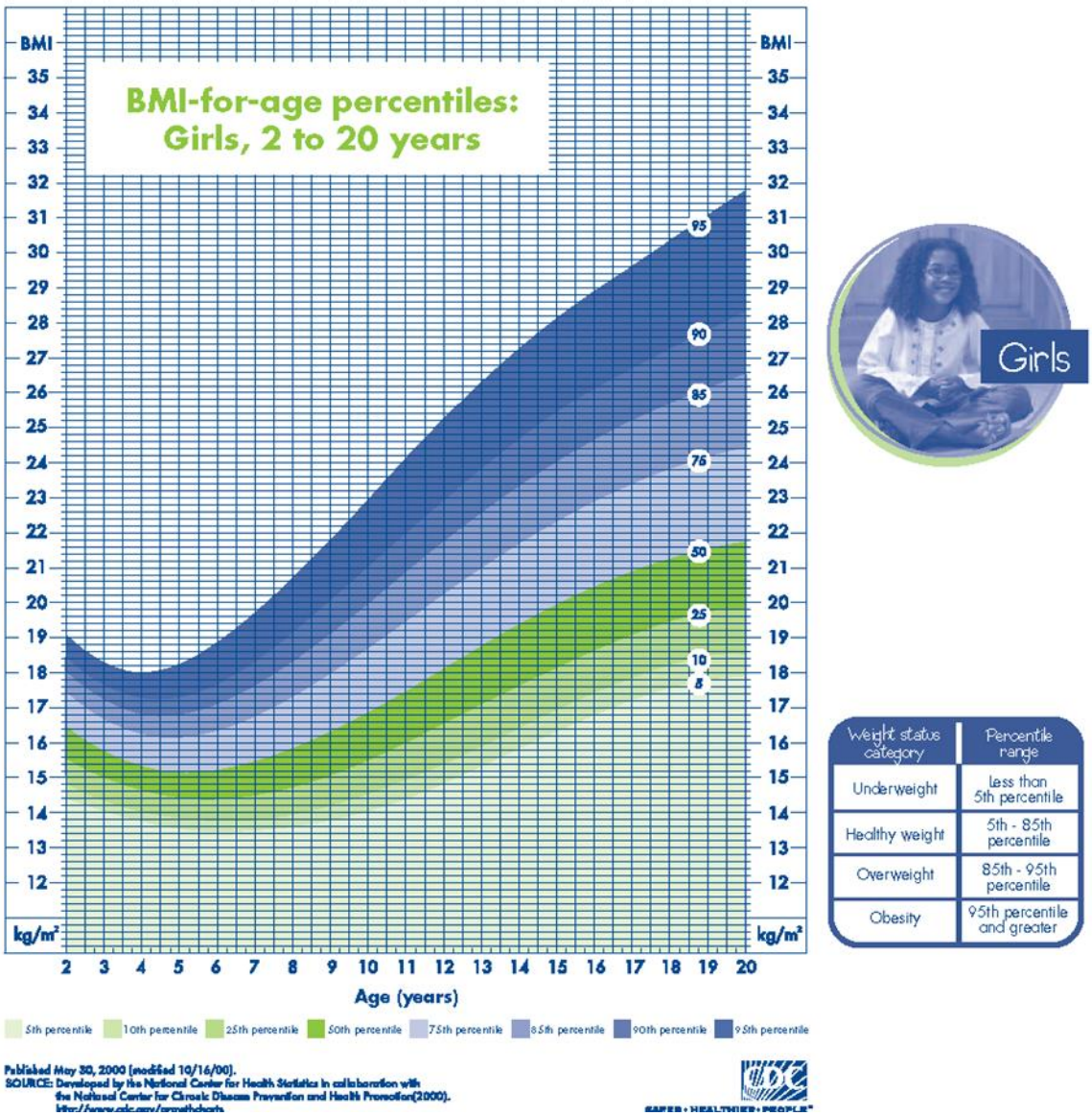
Description	Serving Sizes	kCal	Fat(g)
Calories in Drinks, Appletiser	250ml	123	0
Calories in Drinks, Capri Sun Orange (200ml)	200ml	89	0
Calories in Drinks, Coca-Cola (330ml)	can	142	0
Calories in Drinks, Coca-Cola Diet (330ml)	can	1	0
Calories in Drinks, Coca-Cola With Cherry Diet (500ml)	pack	1	0
Calories in Drinks, Diet Coke With Cherry (330ml)	can	1	0
Calories in Drinks, Coca-Cola Zero (330ml)	can	1	0
Calories in Drinks, Coca-Cola Zero (500ml)	Bottle	2	0
Calories in Drinks, Dg Old Jamaica Ginger Beer (330ml)	can	211	0.3
Calories in Drinks, Fanta Orange Zero	100ml	3	0
Calories in Drinks, Innocent Blackberries, Strawberries & Boysenberries smoothie (250ml)	bottle	131	0.3
Calories in Drinks, Innocent Kiwis, Apples & Limes smoothie (250ml)	bottle	122	0.3
Calories in Drinks, Innocent oranges mangoes & pineapples smoothie for kids (180ml)	bottle	108	0.4
Calories in Drinks, Innocent Pomegranates, Blueberries & Acai Smoothie	250ml	176	0.3
Calories in Drinks, Irn Bru	can	142	0
Calories in Drinks, Irn Bru Diet	330ml	2	0
Calories in Drinks, J2O Orange & Passion Fruit (330ml)	bottle	145	0.3
Calories in Drinks, Lemonade	200ml	30	0
Calories in Drinks, Lemondade Diet	250ml	3	0.1
Calories in Drinks, Lemonade Cloudy Diet	250ml	8	0
Calories in Drinks, Oasis Extra Light Summer Fruits (500ml)	bottle	16	0
Calories in Drinks, Pepsi (330ml)	330ml Can	139	0
Calories in Drinks, Pepsi Diet (330ml)	can	1	0
Calories in Drinks, Pepsi Max (330ml)	can	0	0
Calories in Drinks, Pepsi Max (500ml)	bottle	2	0
Calories in Drinks, Really Light Ribena (500ml)	bottle	15	0
Calories in Drinks, Redbull Energy Drink (355ml)	can	160	0
Calories in Drinks, Robinsons Summer Fruit and Barley Pink Grapefruit	250ml	38	0
Calories in Drinks, Sprite Lite 6 Cans (330ml)	can	5	0
Calories in Drinks, Sprite Zero (500ml)	bottle	5	0
Calories in Drinks, Tango Apple	100	18	0.1

Calories in Snacks and Confectionary (Nutracheck, 2014)

Description	Serving Sizes	kCal	Fat(g)
Calories in Chocolate, Cadburys Buttons	pack	170	9.7
Calories in Chocolate, Cadburys Crunchie	bar	190	7.4
Calories in Chocolate, Cadburys Dairy Milk (49g)	bar	260	14.6
Calories in Chocolate, Cadburys Flake	bar	180	10.5
Calories in Chocolate, Galaxy Minstrels (42g)	pack	212	9.2
Calories in Chocolate, Milky Bar	bar	68	3.9
Calories in Chocolate, Twix (58g)	bar	284	13.8
Calories in Crisps, Kettle Chips Lightly Salted (40g)	bag	192	10.6
Calories in Crisps, KP Hula Hoops Original (35g)	bag	175	9.7
Calories in Crisps, Mccoys Salt & Vinegar 50g	bag	179	10.6
Calories in Crisps, Mini Cheddars Original (25g)	pack	129	7.5
Calories in Crisps, Walkers Baked Ready Salted (25g)	bag	98	2
Calories in Crisps, Walkers Baked Salt & Vinegar (25g)	bag	98	2
Calories in Crisps, Walkers Crisps Ready Salted	bag	183	11.7
Calories in Crisps, Walkers Doritos Cool Original (40g)	bag	177	9.4
Calories in Crisps, Walkers Doritos Tangy Cheese	bag	177	9.4
Calories in Crisps, Walkers Salt & Vinegar Crisps (34.5g)	bag	181	11.4
Calories in Crisps, Wotsits	bag	95	5.8
Calories in Popcorn, Chocolate Popcorn (80g)	bag	413	22
Calories in Popcorn, Salted Popcorn	80g	317	9.4
Calories in Popcorn, Toffee Popcorn (100g)	50g	185	4.3
Calories in Sweets, Bassetts Jelly Babies (600g)	sweet	20	0.1
Calories in Sweets, Bassetts Murray Mints (200g)	sweet	25	0.4
Calories in Sweets, Haribo Starmix	50g	177	0.1
Calories in Sweets, Jelly Beans (100g)	pack	352	0.4
Calories in Sweets, M&S Percy Pig (100g)	sweet	25	0
Calories in Sweets, Maynards Wine Gums (52g)	pack	165	0.1
Calories in Sweets, Nestle After Eight Mints (300g)	sweet	36	1.1
Calories in Sweets, Rowntrees Fruit Pastilles	1/4 pack	180	0
Calories in Sweets, Starburst Chewy Fruit (45g)	pack	182	3.3
How many calories in a Mars Bar (54g)	bar	242	9.4
Kit Kat Calories (2 fingers)	2 fingers	106	5.5
Maltesers Calories (37g)	pack	187	9.1
Snickers Calories (62.5g)	bar	319	17.8

Calories in Bakery (Nutracheck, 2014)

Appendix 20: BMI chart



Weight status category	Percentile range
Underweight	Less than 5th percentile
Healthy weight	5th - 85th percentile
Overweight	85th - 95th percentile
Obesity	95th percentile and greater

Appendix 21: Summary of Themes and Categories Developed Based on the Interview Data Gathered

Theme 1	Categories	Key phrases
Psychological factors that impact on obesity	Healthy food choice	"*A healthy diet would be eating things like fruits and vegetables and boiled things. Fruits such as banana, oranges, mangos and kiwi; then there are vegetables such as broccoli, potatoes and carrots*" (PR14) *"A healthy diet would be eating a healthy sandwich for the breakfast with a cup of milk and for the lunch salad, curry with rice and I can have a snack like fruit and vegetables and for dinner I'd like to say something light it could be yoghurt or healthy biscuits "* (PR8)
	Access to unhealthy food and perception	*"An unhealthy diet would be eating things like crisps and sweets. Not paying attention to the amount of what you're eating and having lots of cakes and things like that. Also eating things like lots of chocolate, donuts and sugary foods".* (PR2) "*When I eat fast food from restaurants like burgers, chips, fried chicken and pizza, what else, yea when I drink lots of fizzy drinks and lots of unhealthy snacks*". (PR8)
		"Basically, I eat a lot of things like crisps and sweets, all the unhealthy stuff, but in terms of food I usually eat rice and curry. Plain rice with some kind of curry, this is what I eat usually". (PR3) *"Healthy things like salad and fruit and yoghurts. But also some unhealthy things like chocolate and cakes*". (PR11)

Theme 2	Categories	Key phrases
Environmental factors, place and culture		"*An active lifestyle would be going to the gym to do exercises and running or walking many times a week. When you try to be active and like to move around instead of staying for long hours in front of the TV*". (PR8) *"By exercising at least twice or three times a week, for example walking, running, playing football and*

		swimming." (PR15)
	School environmental factors	"*Hmm not really or not regularly to be honest."* *"They do different activity lessons each week. These are about 45 minutes. I do rest at times but most of the students don't like to do it".* (PR8) *"I don't know, maybe because of the hot weather we get tired and sweat a lot, it reaches 45C° sometimes so, just imagine what it would be like in the play area".* (PR8) *"No. I don't like playing sports at school. I don't like it when other people look at me."* How much time would you say that you spend on physical activities at school? *"I don't play sports in school. I don't do any activities in school. I don't like them*."(PR14)
	Physical activities outside school.	"*I'm not really sure because some weeks I do and some weeks I don't. Also, it depends on if I have free time or not. Sometimes I don't because of homework and work in the house. Other times I run and play at home. So I don't think I can say a specific time".* (PR11) *"Yes, I do"* How much time would you say that you spend on physical activities outside of school? *"I like playing basketball. We have a garden around our house, so, I play with my brothers and sisters when we have free time or when the weather is nice."*(PR13)

Theme 3	**Categories**	**Key phrases**
Influence of Knowledge and believe of existing obesity prevention	Perception on exercise and obesity reduction	*"I think diets work. This can be done by making a record of what you have eaten throughout the week and sticking to a daily plan.*" (PR6) *"Yes. I think diets can work. You can do it by being aware of what you eat like trying to reduce the amount of food intake, fast food and fizzy drinks". (*PR8)

strategies		*"Yes. I think all diets work for different people, but each person has something that can work for him or her , for example a specific diet can help a girl to lose weight but it might not suit another person*."(PR13)
	Awareness of strategies to tackle obesity.	*"Some people would say yes, others would say no, so maybe yes or maybe no, I'm somewhere in the middle. It could be the exercises are working best with the person and reduce his weight or it could be that it doesn't make any difference".* (PR2) *"Yes, it will help a little bit. Um, maybe it will help you to lose weight if you're very fat, and if you do it a lot I'm sure it will stop you getting fat. I think everyone knows that".* (PR10) *"Yes I think so. But I think it should be with a diet as well or it might not stop you getting fat all the time."* (PR11)
	Knowledge on the diet to manage weight/obesity	"*The best way is to have healthy food. Lots of good things like salad, chicken, porridge, yoghurt and that kind of healthy foods. Also, the best way is not to eat or avoid eating crisps and sweets and unhealthy foods like cake and chocolates and donuts. You also need to be doing exercises to stop getting fat, this is the best way*". (PR3) *"Well, the person should follow a good diet, eating fruit, vegetables and nuts, things like that. They should eat healthily as well, so not too much fatty food or takeaway all the time, or chocolates and sweets. And ice cream too. The person should try to not spend a long time on video games or the laptop, because this is inactive and makes the person lazy".* (PR11) *"Well people can do lots of things. Like if they stop eating in restaurants because it's always fatty food and is high in calories. People can do exercise with a diet. You know, one of those diets that people follow a nutritional diet."*(PR12)

Appendix 22: Research Training and PhD Study Plan
Completed Research Training

- During Research Week I attended University lectures that covered key topics in quantitative and qualitative research studies, as well as the basics of investigative research designs.
- During the Research Methods Module, I attended a research module which covered many different research methods over a period of 12 weeks. The substantive content of the Module included areas such as:
- Accessing and searching online databases for research articles;
- Data collection methods;
- Identifying participants and study populations;
- Literature search methods;
- Research ethics;
- Sampling and sampling strategies such as stratified sampling;
- The development of hypotheses;
- The development of research objectives;
- The development of research questions;
- Understanding how to critically review research articles;
- Undertaking Boolean searches; and
- Writing and publishing research

In addition to this training I have also undertaken additional training in the following research techniques:

- Attendance at the PGR (Postgraduate Research) Research Day which explored previous research studies undertaken by the College of Health;
- Attendance at the SPARC (Salford Postgraduate Annual Research Conference) (5-6th June 2013);
- EndNote Programming covering how to use EndNote in Microsoft Word, how to save EndNote databases, and how to import and export EndNote databases;
- How to complete a learning agreement (including providing a clear definition of the learning agreement);
- Qualitative Research Tools using NVivo (2 days); and
- Undertaking a Word scope (Salford University Student Skills Project) course consisting of attendance at ten workshops in academic writing skills.
- Guide to getting published on the 14th May 2014.
- Qualitative Research 21st May 2014.
- LEAP 2 Higher education 22nd Sep 2014.
- LEAP 3 Higher education 5th.
- Research Data Management.

- Qualitative Designs- methodology of data collection and measurement lecture.
- Analysis, presentation and interpretation in qualitative research lecture.

- Approaches to weight management: Mindful eating and behaviour change, and event in Leeds university
- Surviving your Internal Evaluation assessment lecture.

- Living with Diabetes Day in Manchester Workshop (2016).

- Approaches to weight management: Mindful eating and behaviour change Conference Attendance in Leeds University, (19/3/2016).

- Poster presentation in SPARC 2015 Conference in Salford University.

- Childhood obesity prevention presentation for Masters Students in Salford University (2014).

- Poster presentation in the UK Association of Chief Children's Nurses (ACCN) (4th – 5th September 2014).

- **Scheduled PhD Supervisory Meeting Dates**

1. Tuesday 16th October 2012.
2. Thursday 20th December 2012.
3. Tuesday 14th May 2013.
4. Friday 7th June 2013.
5. Wednesday 26th June 2013.
6. Thursday 18th July 2013.
7. Thursday 3rd October 2013.
8. 6th November 2013.
9. 28th November 2013.
10. 17th December 2013.
11. 17th January 2014.
12. 20th February 2014.
13. 18th March 2014.
14. 18th April 2014.
15. 22nd April 2014.
16. 7th May 2014.
17. 2nd July 2014.
18. 10th September 2014.
19. 21th October 2014
20. 23rd November 2014
21. 26th Dec 2014
22. 20th January 2015
23. 18th February 2015
24. 10th March 2015
25. 23rd April 2015
26. 11th May 2015
27. 24th June2015
28. 15th July 2015

29. 11th Aug 2015
30. 21st Sep 2015
31. 22ed Oct 2015
32. 18th Nov 2015
33. 16th Dec 2015
34. 15th Jan 2016
35. 20th Feb 2016
36. 12th Mar 2016
37. 22ed April2016
38. 25th May 2016
39. 13th June 2016
40. 17th July2016
41. 25th Aug 2016
42. 19th Sep 2016
43. 23ed Oct 2016
44. 18th Nov 2016
45. 12thDec 2016
46. 4th Jan 2016
47. 14th Jan 2016

PhD Study Plan: