# An Exploration of Multilevel Factors Contributing to Childhood Overweight and Obesity in Saudi Arabia

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# Abstract

**Background:**

Childhood obesity is widely recognised as a pressing public health concern. In Saudi Arabia, obesity affects individuals across all age groups and contributes significantly to the rising incidence of diabetes and cardiovascular diseases. However, childhood obesity warrants particular attention for several critical reasons. Children who are overweight or obese are more likely to become obese adults, and childhood obesity is associated with a range of physiological and psychosocial consequences, with health problems traditionally observed in adults now emerging in children. Furthermore, the effects of obesity are long-term, with a substantial delay between the onset of risk factors and the manifestation of adverse health outcomes. These considerations underscore the importance of implementing obesity prevention strategies early in life.

Obesity is a multifaceted and complex condition influenced by a variety of systemic and causal factors. To account for this complexity, this thesis adopts Bronfenbrenner's ecological systems theory as a guiding framework. This theory provides a lens through which to examine the multiple factors contributing to childhood obesity within the interconnected contexts of the child's home, school, and broader community.

**Aim and Objectives:**

The overall aim of this research is to identify the key factors contributing to childhood overweight and obesity in Saudi Arabia and to assess the relative influence of different ecological contexts. Specifically, the study seeks to explore how home, school, and community environments shape children's dietary behaviours, physical activity, and sedentary lifestyles within the Saudi context.

**Methodology:**

A mixed-method sequential explanatory design was employed, consisting of two quantitative studies followed by a qualitative study. The quantitative phase utilised cross-sectional survey questionnaires, while the qualitative phase involved semi-structured interviews designed to build upon and deepen understanding of the quantitative findings.

Study one involved distributing a survey to a sample of 787 participants, each of whom had at least one child aged 6–18 years and resided in Najran, Saudi Arabia. This study focused on dietary habits, physical activity, and sedentary behaviours, which represent key behavioural determinants of childhood obesity. Particular attention was given to family dynamics and parental behaviours, examining how home environmental factors contribute to unhealthy lifestyles and obesity among Saudi children.

Study two recruited school employees in the Najran region (n = 459) to complete a cross-sectional survey questionnaire. This study aimed to identify the cultural, environmental, and organisational factors within schools that influence children's eating habits and physical activity behaviours. It also explored teachers' knowledge of obesity-related issues, their understanding of the role of diet and physical activity in obesity prevention, and their perceptions of their responsibility in addressing childhood obesity within schools.

Study three employed qualitative semi-structured interviews to gain deeper insights into the findings of the previous two studies and to identify barriers and facilitators to promoting healthy diets and physical activity in Saudi Arabia. This study examined the existence and effectiveness of relevant policies and programmes, their implementation and dissemination, and the extent of collaboration between key sectors, including the Ministries of Health and Education, the Municipality Department, and the Authority of Youth and Sport. A purposive

sampling technique was used to recruit twelve stakeholders at the management level from various organisations for in-depth interviews.

**Findings:**

The findings of this thesis highlight several key factors influencing childhood obesity in Najran, including cultural, societal, and environmental influences. Gaps in parental knowledge regarding nutrition were identified, indicating a need for targeted educational programmes to promote healthier food environments within the home. Environmental barriers, such as unsafe neighbourhoods and limited access to play areas, were found to restrict opportunities for children's physical activity, highlighting the importance of urban planning improvements.

Cultural norms, particularly gender roles, were shown to limit mothers' participation in physical activity, emphasising the need for culturally sensitive interventions. Within the school environment, the lack of structured nutrition education and physical education, along with limited sports infrastructure, revealed significant gaps in health promotion efforts. Although some policies addressing childhood obesity are in place, the findings indicate that more effective collaboration, consistent enforcement, and public education are required to address childhood obesity in Najran.

**Discussion:**

Overall, the findings demonstrate that childhood obesity in Saudi Arabia is shaped by a complex interaction of factors across multiple ecological levels. The interdependence of home, school, and community environments highlights the limitations of interventions that focus solely on individual behaviour change and underscores the need for a systems-based approach to obesity prevention.

**Conclusion and recommendations:**

This thesis contributes to a comprehensive understanding of the multifactorial nature of childhood obesity in Saudi Arabia, with a particular focus on the ecological contexts of home, school, and community. Promoting healthier behaviours among children requires a multifaceted and holistic approach that enhances parental knowledge, creates supportive home and neighbourhood environments, and addresses cultural and societal constraints on physical activity.

Future interventions should move beyond individual-level strategies and instead focus on broader environmental and structural influences. Policymakers, schools, and communities must work collaboratively to develop and implement coordinated, culturally appropriate interventions that create supportive environments and enable children to lead healthier lives.

# Dedication

This thesis is dedicated to the soul of my beloved father. Though you are no longer with me, your love, wisdom, and guidance continue to shape my journey. I wish you were here to witness this accomplishment, but I know you are watching over me with pride. Your unwavering support, patience, and belief in me have been the foundation of my work, and this project is a reflection of your enduring influence. May Allah grant you eternal peace, bless your soul with Jannat al-Firdaus, and reward you for your patience. You will forever remain in my heart and prayers.

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# Chapter 1 Introduction

## 1.1 Overview:

Childhood overweight and obesity are considered a crucial public health issue that has raised concerns worldwide. Childhood obesity is linked to a higher chance of premature death and disability in adulthood (World Health Organization , 2019). Overweight and obese children and adults are more likely to develop a range of noncommunicable diseases, including type 2 diabetes, hypertension, cardiovascular disease, stroke, and cancer (Berenson et al., 1998; Butland et al., 2007; Shashaj et al., 2014). Therefore, preventing and reducing childhood obesity levels is one of the global public health priorities.

Saudi Arabia has undergone a rapid epidemiological transition, with non-communicable diseases accounting for approximately 73% of all deaths nationwide (World Health Organization, 2022). National data indicate that 59–68% of adults are overweight or obese, with adult obesity prevalence estimated at around 20–24% (Althumiri et al., 2021), while diabetes affects approximately 17.7% of the adult population (International Diabetes Federation, 2021) and hypertension around 25–26% (Ministry of Health, 2018). Among children and adolescents, national studies report overweight prevalence ranging from 14–22% and obesity prevalence between 7–19%, depending on age group and reference standards (Al-Hazzaa et al., 2022; AlEnazi et al., 2023). At the regional level, evidence suggests that Najran follows similar but slightly lower trends, with studies from southern Saudi Arabia reporting adult obesity prevalence of approximately 18–22% and childhood obesity prevalence ranging from 6–10%, reflecting early exposure to non-communicable disease risk factors (El Mouzan et al., 2012). These national and regional epidemiological patterns highlight the public health significance of childhood obesity within both Saudi Arabia and the Najran context.

In Saudi Arabia, the rate of childhood obesity and overweight has significantly increased in the last 2 decades. The rate of obesity among Saudi males aged 5-9 years is 20% and 24% of those aged 10-14 years. The World Health Organization reported that the prevalence of obesity in Saudi Arabia has increased from 14.3% in 2010 to 17.4% in 2016 among children aged 5–19 years (Aljaadi & Alharbi, 2020). The observed variation in childhood obesity prevalence across regions of Saudi Arabia is likely influenced by differences in urbanisation, socioeconomic conditions, and lifestyle patterns. More urbanised regions tend to be associated with higher consumption of energy-dense foods, reduced physical activity, and increased sedentary behaviours, while less urbanised areas may retain more traditional dietary practices and active routines. These regional disparities are further shaped by variations in built environments, cultural norms, and access to health-promoting resources, as discussed in the literature reviewed in Chapter 2.

The current epidemic of obesity at the population level arises from the complex interactions of multi-level influences. These include biological, social, environmental, and behavioural factors (Frerichs et al., 2013) and can be assessed at the individual, organisational, and local level. The seminal Foresight Report (2007) conceptualised obesity as a complex, systematic, multi-casual problem, rooted in urban lifestyle, decreased physical activity and high calories intake, affordability and availability of food, psychological stimuli such as anxiety and epigenetic triggers as well as unhealthy modern environment and behaviours (Butland et al., 2007). These complex interrelated factors and contextual forces place eating and physical activity behaviour beyond an individual's choices (Kahneman, 2003).

The rapid and significant prevalence of obesity in the Middle East Region has been related to several factors such as, increased urbanization, high income that lead to change in food habit ( increased consumption of fatty, salty and fast food), and the lack of exercise and physical activity due to the lifestyle change(ALNohair, 2014; WHO, 1998). Saudi Arabia is one of the

top five oil exporting countries worldwide (Klautzer et al., 2014). Since the discovery of oil, there has been a significant growth in incomes. Although this income growth presents great opportunities for the development of healthcare and education infrastructure, it also brings with it a shift in food habits and a great opportunity for a sedentary lifestyle, especially in young people (Badran & Laher, 2012). In Saudi Arabia and the wider Gulf region, a large portion of food is an important part of the socialization process, which consists of meals of rice (high carbohydrates) and meat (high fat) (Al Othaimeen et al., 2007). In addition, there is limited access to sport and exercise facilities due to, for instance, the high temperatures that force people to stay indoors, and the traditional and cultural barriers that prevent women from participating in sports and exercise (ALNohair, 2014; Badran & Laher, 2012).

Despite the efforts to prevent this epidemic, obesity is still recognised as one of the public health threats. Although research on obesity is growing in the Saudi context, the evidence on how to prevent it is still limited.

## 1.2 Rationale for this Thesis

The issue of childhood obesity in Saudi Arabia has emerged as a significant public health challenge, one that is linked to an increasing prevalence of chronic diseases such as diabetes and cardiovascular conditions. Despite a growing recognition of this problem, research into the multi-dimensional factors that contribute to childhood obesity in the Saudi context remains limited. Addressing this gap is crucial, as childhood obesity not only affects the immediate health and well-being of children but also sets the stage for long-term health consequences that extend into adulthood. The rationale for this study, therefore, is grounded in the need to understand the complex, interconnected factors that influence childhood obesity in Saudi Arabia, with a focus on the unique cultural, environmental, and systemic factors at play.

Obesity is a multifaceted condition, influenced by various factors that extend beyond individual behaviours. These include socio-cultural, familial, environmental, and policy-related influences that shape children's eating habits, physical activity, and overall lifestyle choices. The complexity of childhood obesity requires a comprehensive approach that considers these various layers. By applying Bronfenbrenner's ecological systems theory, this study aims to explore the multi-level factors that contribute to childhood obesity in Saudi Arabia. The ecological model provides a holistic framework for understanding how a child's immediate surroundings home, school, and community interact with broader societal and cultural factors to shape health outcomes. This theoretical framework enables an in-depth examination of how multiple layers of influence, from the family to societal structures, affect childhood obesity.

The rationale for focusing on childhood obesity, rather than obesity in the general population, stems from the early onset of risk factors that can lead to chronic health issues. Children who are obese are more likely to remain obese into adulthood, and their risk for developing serious health conditions, such as type 2 diabetes, hypertension, and psychological challenges, increases significantly. Early intervention during childhood is therefore critical, as it allows for the possibility of preventing the long-term effects of obesity. Moreover, by addressing childhood obesity, there is a greater potential to impact the health trajectory of future generations, reducing the burden of obesity-related diseases on the healthcare system.

This study adopts a mixed-methods sequential explanatory design to provide a comprehensive understanding of the contributing factors. The rationale for using a combination of quantitative and qualitative methods is to ensure a balanced and thorough exploration of the issue. The quantitative phase enables the collection of data from a large sample to identify the key behavioural, environmental, and familial factors associated with childhood obesity. This data is then enriched by the qualitative phase, which offers more profound insights into the specific

barriers and facilitators that influence the implementation of healthy behaviours and policies in Saudi Arabia.

By targeting multiple ecological levels individual, family, school, and community, the study aims to uncover the complex interplay of factors that contribute to childhood obesity. These levels are critical in Saudi Arabia, where rapid social and cultural changes, urbanisation, and shifting family structures have transformed traditional lifestyles. Factors such as parental knowledge gaps, cultural norms surrounding gender roles, school environments lacking nutrition and physical education, and urban planning that does not prioritise safe play spaces all contribute to the obesity crisis. This study seeks to identify these barriers and propose actionable solutions tailored to the Saudi context.

Ultimately, the rationale for this research is driven by the desire to address the underlying causes of childhood obesity in Saudi Arabia through a comprehensive, context-sensitive approach. By examining the various ecological contexts that contribute to childhood obesity, the study hopes to provide valuable insights that can inform future interventions and policies. The findings of this thesis aim to support the development of targeted programmes and initiatives that improve children's nutrition, increase physical activity, and foster healthier environments at home, in schools, and within the broader community. By doing so, it contributes to the global conversation on childhood obesity and provides a framework for tackling this pressing public health issue in the Kingdom of Saudi Arabia.

## 1.3 Aim and Objectives of the Thesis

### Aim:

The primary objective of this thesis is to explore the various factors that contribute to childhood overweight and obesity in Saudi Arabia. Specifically, the study focuses on how the home,

school, and community environments influence children's health. The goal is to understand how these various settings impact childhood obesity and to identify the barriers and factors that could hinder or help its reduction in Saudi Arabia.

## Objectives:

1. To identify the factors in the home environment that influence children's eating habits, physical activity, and sedentary behaviours, including understanding how parents' behaviours and the family environment contribute to childhood obesity in Saudi Arabia.
2. To explore the role of the school environment in promoting or deterring healthy eating and physical activity among children. This objective focuses on teachers' knowledge of obesity, their attitudes, and the school policies related to physical activity and diet.
3. To understand the influence of the community environment including cultural attitudes, neighbourhood resources, and public health policies on childhood obesity in Saudi Arabia.
4. To examine the challenges and support present in current policies and programmes related to childhood obesity, this involves looking at the role of different organisations (such as the Ministry of Health, the Ministry of Education, and other sectors) in tackling the problem of childhood obesity.
5. To analyse how each of the home, school, and community environments contributes to childhood obesity, and how these environments interact with each other to affect children's health behaviours.
6. To provide recommendations for improving programmes and policies aimed at reducing childhood obesity in Saudi Arabia, based on the findings from these studies.

## 1.4 Importance of the Thesis

Childhood obesity is a growing public health concern worldwide, with profound long-term health implications, including an increased risk of diabetes, cardiovascular diseases, and other chronic conditions. In Saudi Arabia, the rising prevalence of childhood obesity highlights the urgent need for evidence-based interventions that address the root causes of unhealthy weight gain in children. This study is significant for several key reasons:

- Obesity is a major health challenge in Saudi Arabia, yet limited research has examined its multifaceted causes within the local context. By focusing on childhood obesity in the Najran region, this study provides valuable insights that can inform national and regional health policies aimed at prevention and intervention.
- Previous research has mainly focused on individual behaviours without fully considering the environmental and cultural factors that impact children's dietary and physical activity habits. This study fills this gap by investigating parental knowledge, home environments, and school influences on children's health behaviours.
- The findings from this study have direct implications for legislators, teachers, and public health professionals. By identifying barriers to healthy eating and physical activity in both the home and school, the study provides evidence-based recommendations for developing educational programs, improving school infrastructure, and strengthening collaborative efforts between health and education sectors.
- Cultural norms, environmental constraints, and lifestyle habits play a crucial role in influencing children's health. This study highlights how factors such as gender roles, neighbourhood safety, and school policies impact childhood obesity.

## 1.5 Motivations

As a researcher from Najran city, my motivation for exploring the multilevel factors contributing to childhood overweight and obesity in Saudi Arabia comes from both personal and professional interests. Growing up in Najran, I witnessed personally the rapid changes in lifestyle and dietary habits that have moved across Saudi Arabia in recent years. These changes have brought with them a concerning rise in childhood obesity rates, with extensive implications for public health.

The prevalence of obesity among Saudi children is alarmingly high, with recent studies showing that the obesity prevalence rate reached 35% in 2020, compared to the global rate of 13% (El-Sahli, 2023; Leppäniemi et al., 2023; Salem et al., 2022). As a researcher and a member of the Saudi community, I feel a deep responsibility to address this growing health crisis.

My motivation is further increased by the complex nature of childhood obesity, which is influenced by several factors ranging from individual behaviours to societal and environmental influences. By applying Bronfenbrenner's ecological systems theory to this issue, I aimed to provide a comprehensive understanding of how these various factors interact within the unique cultural and social context of Saudi Arabia, and particularly in Najran.

Najran is located in the south-western region of Saudi Arabia, close to the Yemeni border. Recent population estimates indicate that Najran city has approximately 457,000 residents, with a mostly young population structure, consistent with national demographic trends in Saudi Arabia (World Population Review, 2026). Najran was selected for this study due to its distinct cultural and environmental context and the limited empirical research on childhood obesity in southern regions of the Kingdom compared with more urbanised central and eastern regions. Culturally, Najran is characterised by strong tribal traditions, cohesive family structures, and

traditional dietary practices, combined with emerging influences of dietary modernisation. Environmentally, Najran's hot climate, limited walkability, and relatively fewer recreational facilities may restrict opportunities for physical activity, while shifts in the local food environment toward increased availability of energy-dense foods may contribute to obesogenic conditions.

Furthermore, the potential long-term consequences of childhood obesity, including increased risks of diabetes and cardiovascular diseases, emphasise the urgency of this research. Therefore, by exploring key contributing factors and assessing the relative influence of various ecological contexts, this study aims to provide valuable insights that can inform practical interventions and policies to decrease childhood obesity in Saudi Arabia.

## 1.6 Contributions of the Thesis

This thesis offers several important contributions to the understanding of childhood obesity in Saudi Arabia, specifically through an ecological systems perspective that explores the interconnected influences of home, school, and community environments. This study employed a mixed-methods approach, which provides a comprehensive analysis of the factors that contribute to childhood obesity and offers evidence-based recommendations for targeted interventions.

This study is situated within the ongoing development of public health in Saudi Arabia, which has increasingly shifted from a treatment-focused model toward prevention and health promotion, particularly for non-communicable diseases. In line with national public health priorities and Saudi Vision 2030, this research contributes context-specific evidence on

childhood obesity to support school-, family-, and community-based preventive strategies and inform population-level public health interventions.

**Parental Influence and Home Environment:**

- The research highlights critical gaps in parental knowledge regarding nutrition and physical activity. While parents are aware of the importance of a healthy diet, many lack a clear understanding of specific dietary guidelines for children.
- The study identifies the impact of home food availability on children's eating habits, emphasising the role of parents in shaping dietary behaviours through food choices and meal structures.
- Cultural norms and gender roles influence parental behaviours, particularly concerning mothers' participation in physical activity and its downstream effects on children's lifestyle habits.

**School Environment**

- The research provides new insights into the limited role of schools in promoting healthy lifestyles in Najran. This finding highlights the absence of structured physical activity and nutrition education in the curriculum.
- The study identifies knowledge gaps among school staff regarding childhood obesity and its prevention, which highly indicates the need for professional development programs to equip teachers and staff with the necessary skills to promote healthy behaviours.
- The study finds the lack of school infrastructure and resources, such as sports facilities and educational programs on healthy eating, which hinders children's ability to adopt healthier habits.

**Community Environment**

- The findings demonstrate how cultural practices, including dietary customs and sedentary lifestyles driven by increased technology use, contribute to childhood obesity.
- Safety concerns and the lack of accessible play areas are shown to be key barriers to physical activity. These findings provide evidence of the need for urban planning initiatives that prioritise child-friendly environments.
- The research highlights inconsistencies in the implementation of public health policies related to childhood obesity.

## 1.7 Structure of Thesis

**Chapter One:**

This chapter provides an introduction to the topic of childhood obesity, which emphasises its significance and the rationale for conducting the study. It also outlines the motivation behind addressing this issue in the context of Saudi Arabia and defines the study's aim and objectives. Additionally, this chapter provides an overview of the thesis's structure and summarises the content and focus of each subsequent chapter.

**Chapter Two:**

This chapter presents a comprehensive review of the existing literature, providing a comprehensive background on childhood obesity. It also explores the primary determinants of obesity, discussing global and regional prevalence rates, associated health complications, and underlying causes. The chapter further examines global efforts and strategies aimed at tackling

childhood obesity. In addition, it introduces the theoretical and conceptual frameworks that underpin this research.

**Chapter Three:**

This chapter outlines the research methodology employed in conducting the study. It details the research process, underlying paradigms, and the philosophical approach. The chapter also describes the study's target population, sampling methods, and the tools used for collecting both quantitative and qualitative data. Furthermore, the chapter explains the rationale behind adopting a mixed-methods design and concludes with a discussion on the ethical considerations and the approach to data analysis.

**Chapter Four:**

This chapter explores the influence of parents and the home environment on children's dietary and physical activity habits. It presents the findings from the parent questionnaire, highlighting the characteristics of the study population, including the parents' roles and behaviours. The chapter examines how parental knowledge, attitudes, and practices related to nutrition and physical activity impact children's health behaviours. It also investigates broader home environment factors, including the availability of healthy food, the presence of physical activity opportunities, and the socio-cultural dynamics within the home. Additionally, the chapter examines how neighbourhood and environmental conditions contribute to or hinder healthy lifestyle choices for children.

**Chapter Five:**

This chapter explores the impact of the school environment on children's dietary habits and physical activity behaviours. It presents the findings from the school employees' questionnaire,

detailing the characteristics of the study population. The chapter investigates how cultural, environmental, and organisational factors within the school setting impact children's health behaviours, particularly their eating habits and levels of physical activity. It also examines the role of school policies, facilities, and educational practices related to nutrition and physical education. Furthermore, the chapter examines the perspectives and knowledge of school staff regarding childhood obesity, as well as their perceptions of their responsibility in promoting healthier lifestyle choices among students.

**Chapter Six:**

This chapter presents the methods and findings from the qualitative analysis of the interview data. It identifies the key themes that emerged from the interviews and offers a detailed discussion of these findings, providing deeper insights into the barriers and facilitators to promoting healthy eating and physical activity in Saudi Arabia.

**Chapter Seven:**

The final chapter provides an overall discussion of the research findings, drawing conclusions about the prevention of childhood obesity in Saudi Arabia. It examines the study's implications for public health, highlighting the need for targeted interventions to address the multifaceted nature of childhood obesity. This chapter also offers recommendations for culturally relevant interventions that take into account the specific social, cultural, and environmental factors unique to Saudi Arabia. In addition, the chapter discusses the study's limitations and suggests areas for future research, emphasizing the importance of continued exploration into practical strategies for promoting healthier lifestyles among children. It calls for a holistic approach, involving collaboration between policymakers, schools, families, and communities, to create supportive environments that foster healthy behaviours in children.

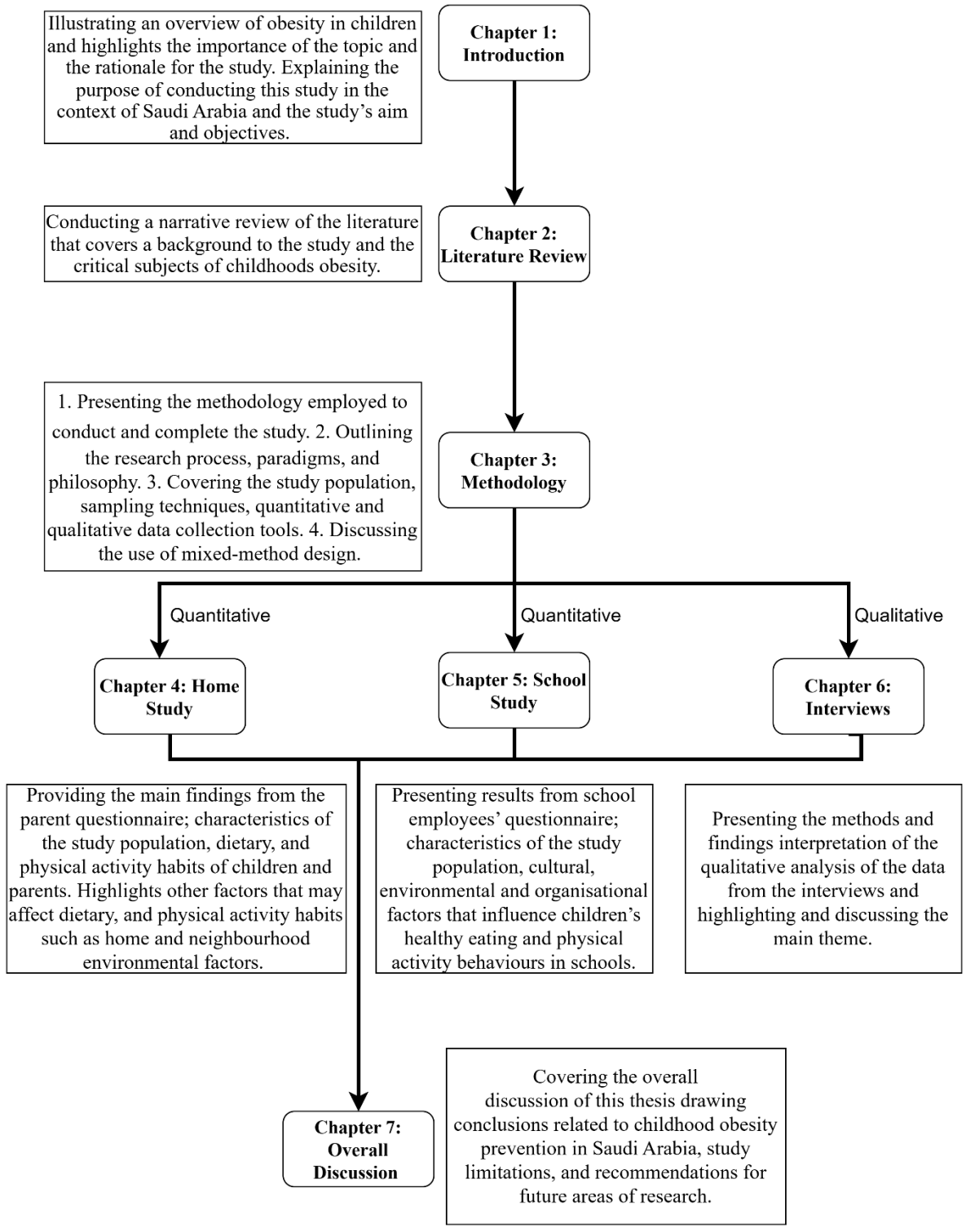


Figure 1. 1: Structure of Thesis

# Chapter 2 Literature Review

## 2.1 Aim of this chapter

The aim of this literature review was to (i) define and clarify how obesity is measured in adults and children, (ii) summarise global and Saudi trends in overweight and obesity, (iii) synthesise evidence on key determinants of childhood obesity across ecological levels (home, school, community, and wider policy environment), and (iv) identify research gaps that justify and shape the focus of this study in Najran. This review therefore provides the conceptual and empirical basis for the study's theoretical framework and the rationale for the research questions presented later in the thesis.

A narrative literature review approach was adopted because the evidence relevant to childhood obesity in Saudi Arabia spans multiple disciplines and study types (epidemiological studies, school-based research, behavioural studies, and policy/strategy documents). This approach enabled integration of evidence across these areas to support the multi-level framing used in Sections 2.4–2.9.

## 2.2 Obesity Definition and Measurement

Fat, one of the essential components of the human body, is stored in adipose tissue. It functions as a thermal insulator for the body and as a storage of body energy when energy intake is lower than energy expenditure (Deurenberg & Yap, 1999). Obesity has been defined as a condition involving an increase in the number of fat cells or an abnormal growth of adipose tissue due to an enlargement of fat cells' size (Jo et al., 2009). The World Health Organisation (WHO) defines obesity as the accumulation of adipose tissue to an extent that impairs health and well-being (WHO, 2022). Previously, obesity was not recognised as a disease, with the American

Medical Association (AMA) classifying it as a disability rather than a disease. In 2013, AMA explicitly changed its statement: "*obesity as a complex, chronic disease that requires medical attention came as the result of developments over three decades"*(Kyle et al., 2016).

There are several tools and techniques that can measure body fat, such as computed tomography (CT) or magnetic resonance imaging (MRI). However, these tools are not suitable for field studies, as they are expensive and time-consuming (Ponti et al., 2020). For population studies, the WHO establishes values for obesity based on the body mass index (BMI), which is the ratio of mass to height, and it is calculated as follows: weight/(height)$^2$ (kg/m$^2$). In adults, *overweight* is defined as a BMI greater than or equal to 25 kg/m$^2$, while *obesity* is defined as a BMI greater than or equal to 30 kg/m$^2$, as shown in Table 1 (WHO, 2014). In 2004, the WHO assessed whether these international BMI cut-off points for determining if someone is overweight or obese were appropriate for Asian populations. They concluded that these thresholds were probably not appropriate, as there is a high risk of type 2 diabetes and cardiovascular disease among Asian populations at BMI values lower than 25 kg/m$^2$; however, it was not possible to redefine thresholds for these groups, and the WHO recommended retaining the current thresholds as the international classifications.

Obesity in children differs from that in adults, as body fat composition in children varies, differing significantly according to their development, maturation, and sexual development. The WHO Child Growth classification system categorises children by weight and height, ranking them from birth to 5 years old and from 5 to 19 years old (Group & de Onis, 2006). In the UK, the British 1990 growth reference (UK90) is used to measure overweight and obesity in children. This percentile chart consists of nine percentile lines (0.4th, 2nd, 9th, 25th, 50th, 75th, 91st, 98th and 99.4th) (T. J. Cole et al., 1995), with obesity and overweight in children defined as BMI ≥ 95th and ≥ 85th percentile, respectively (X. Li et al., 2020).

## 2.3 Obesity as an Epidemic

Obesity is now considered a global epidemic that has increased significantly in the last four decades. If this figure continues, the majority of the world's adult population will be either overweight or obese by 2030 (Haththotuwa et al., 2013, 2020). Obesity is associated with increased morbidity and mortality for many diseases and has been identified as a major risk factor for cardiovascular diseases, diabetes, metabolic syndrome, and Alzheimer's disease (Alford et al., 2018; Eckel & Krauss, 1998) (Alford, Patel, Perakakis, & Mantzoros, 2018; Eckel & Krauss, 1998; Furukawa et al., 2004; Wing et al., 2011).

In 2016, the WHO estimated that there were about 650 million adults (age 18 and older) were obese and 1.9 billion were overweight worldwide; the number of children under the age of 5 who were overweight or obese were 41 million, and more than 340 million children and adolescents between 5 and 19 years old overweight or obese. Moreover, from 1975 to 2016, the obesity rate almost tripled (Ahmed & Konje, 2023). This high increase in prevalence led the WHO to describe obesity as a 'global epidemic'. The high incidence rate suggests that by 2030, half of the world's population will be obese (Dobbs et al., 2014). This high prevalence of obesity, together with its serious complications, also affects countries' economies; the economic burden of obesity is very high, specifically, it was estimated in 2014 to be $2 trillion globally (R. Dobbs et al., 2014a). Thus, obesity has been described as "the disease of the twenty-first century" (Senturk & Shikora, 2021).

The health and economic burdens of this disease draw the attention of health organisations and scientists to address obesity-related problems as well as to prevent the spread around the world. Health organisations and medical care providers have introduced programmes on physical activity and/or national habits to reduce the prevalence of obesity. One example is the

Netherlands, where 18 partners from healthcare providers and insurance companies have collaborated to form what is called The Partnership Overweight Netherlands (PON), which in turn established an integrated healthcare standard for obesity. This standard is not only concerned with the early diagnosis of obesity but also with lifestyle intervention and medical therapy for obese people (Seidell & Halberstadt, 2015).

## 2.4 Prevalence of Obesity

The prevalence of obesity is increasing at an alarming rate in many parts of the world. Recent estimates indicate that 2.5 billion adults worldwide are overweight, of whom over 890 million are living with obesity (World Health Organization, 2024). According to updated WHO data, the global prevalence of obesity has nearly tripled since 1975, with rates continuing to rise across most regions. In 2022, approximately 43% of adults worldwide were overweight, while around 16% were classified as obese (World Health Organization, 2024).

Childhood overweight and obesity have also increased substantially. Globally, an estimated 37 million children under the age of 5 and over 390 million children and adolescents aged 5–19 years were overweight or obese in 2022 (World Health Organization, 2024). Regional disparities persist, with the highest prevalence observed in the WHO Region of the Americas, while lower but rapidly increasing rates are reported in the South-East Asia and African regions (World Health Organization, 2024).

The prevalence of overweight in high-income and upper-middle-income countries was more than double that of low- and lower-middle-income countries. In 2015, a study compared obesity in 195 countries over the previous 25 years: it found that the highest obesity prevalence in adults was observed in Egypt (35.3%), while the lowest adult obesity prevalence was observed

in Vietnam (1.6%); moreover, the childhood obesity prevalence was highest in the USA, at 12.7%, while the lowest childhood obesity was in Bangladesh, at 1.2% (Kerr et al., 2025).

The global prevalence of overweight and obesity increased by 27.5% for adults and 47.1% for children between 1980 and 2013 (Sun et al., 2022). In 2015–2016, the prevalence of obesity among US youth was 18.5%; among adolescents aged 12–19 years, it was 20.6%, while among children aged 6–11 years, it was 18.4% (Hales, Carroll, Fryar, & Ogden, 2017). In Canada, the prevalence of obesity increased from 6.1% to 18.3% between 1985 and 2011 (S. El Adam et al., 2022). In the UK, the prevalence of obesity more than doubled in the last 10 years (Agha & Agha, 2017). The Health Survey for England (HSE) results for 2014 showed that 61.7% of adults (65.3% of men and 58.1% of women) were overweight or obese. Moreover, the data from the HSE 2012 showed that the proportion of obese adults increased, from 13% of men in 1993 to 24% in 2012 and from 16% of women in 1993 to 25% in 2012 (HSCIC, 2012). Taken together, these global trends confirm that obesity is a persistent and escalating public health challenge affecting both adults and children worldwide. Importantly, they highlight the need for context-specific research to understand how global patterns translate into local determinants of childhood overweight and obesity, thereby justifying focused investigation within specific national and regional settings such as Saudi Arabia.

### 2.4.1 Prevalence of Childhood Obesity in Saudi Arabia

Gulf countries, including Kuwait, Bahrain, Saudi Arabia, and the United Arab Emirates, have the highest obesity prevalence rates and are among the top ten countries worldwide for obesity (El-Sahli, 2023; Salem et al., 2022). In Saudi Arabia, the prevalence rate of obesity reached 35% in 2020, compared to a global rate of 13% (El-Sahli, 2023; Leppäniemi et al., 2023; Salem et al., 2022). Socioeconomic developments have significantly contributed to the high obesity

prevalence rate in Saudi Arabia, where the rapid increase in household income has brought associated lifestyle changes, including reduced physical activity and increased consumption of obesogenic foods and drinks.

Obesity is considered a major public health concern that affects individuals of all ages and genders. Epidemiological studies have shown that approximately one-third of adults in Saudi Arabia are obese (Hammad & Berry, 2017), and a systematic review indicates that obesity prevalence among children is increasing (Hammad & Berry, 2017). In 2016, a study reported that the childhood obesity prevalence in Saudi Arabia was 18% (Farsi et al., 2016). According to Al-Hazzaa et al. (2022), the percentages of participants classified as overweight and obese varied according to the reference used: the IOTF reference produced rates of 18.4% and 12.7%, the WHO reference produced rates of 19.1% and 18.9%, and the KSA reference produced rates of 22.4% and 19.3%, respectively. As can be seen, values for overweight and obesity prevalence were higher when using the WHO reference. In terms of region, the obesity prevalence among 351,195 children and adolescents was highest in the Central and Eastern regions (9.89% and 9.87%, respectively) of Saudi Arabia, as shown in

Figure *2.1*.

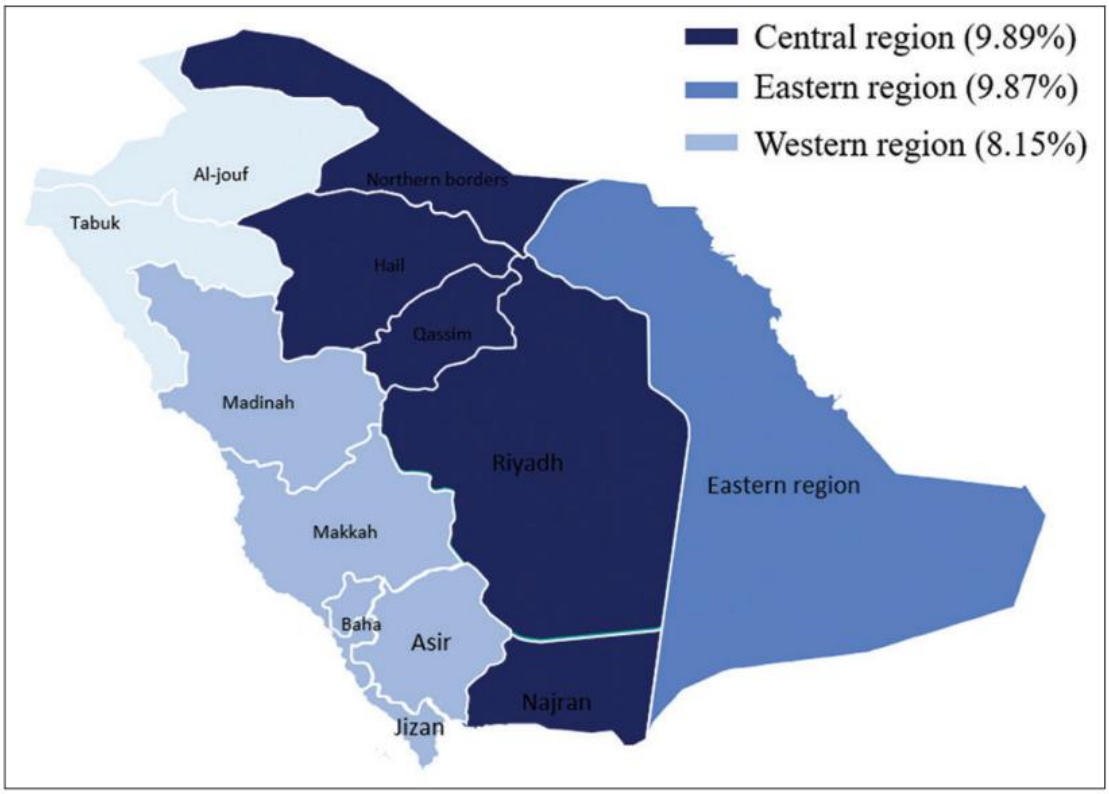


Figure 2.1: Obesity prevalence among Saudi children across regions in Saudi Arabia *(AlEnazi et al., 2023a).*

Many studies have explicitly focused on school-aged children. For example, using the 2007 WHO standards, one study revealed that 21.5% of school-aged children from the three main regions in Saudi Arabia (Central, Western, and Eastern) were overweight (14.4%) or obese (7.1%) (Al Shaikh et al., 2020). Using Saudi growth charts, another study found a slightly lower estimate among school-aged children, estimating that 11% were overweight and 7.6% were obese (Ibrahim et al., 2021a).

However, a systematic review of obesity prevalence in Saudi Arabia focused on obesity prevalence (compared to global rates) among the youngest age group, and it highlighted critical health concerns for this age group (Hammad & Berry, 2017). AlEnazi et al. (2023) found that the obesity prevalence was highest (12.2%) among the youngest age group (2–6 years), followed by those aged 14–19 years (9.5%) and 7–13 years (7.1%). By contrast, Mustafa et al.

(2021) found a lower obesity prevalence rate among preschool-aged children compared to those aged 15 years or older (34.7% vs. 51.4%); however, this study was only conducted in schools in the cities of Abha and Khamis Mushayet, using data collected from self-administered questionnaires distributed to a total of 300 children, thus lacking adequate representativeness. The reviewed Saudi evidence demonstrates a high and regionally variable prevalence of childhood overweight and obesity, influenced by differences in age group, geographic location, and measurement standards. These variations highlight the importance of conducting region-specific studies using clearly defined criteria and support the need for focused research in underrepresented regions such as Najran to better understand local drivers of childhood obesity.

Table 2.1 Prevalence of overweight and obesity in Saudi Arabian children and adolescents' studies

| Reference | Area / Region | Population / sample size | Design / method | Prevalence (%) | Conclusion |
|---|---|---|---|---|---|
| (AlEnazi et al., 2023b) | Saudi Arabia (multi-region; NGHA facilities) | 2–19 y; n = 351,195 | Population-based retrospective study | Overweight 11.2%; Obesity 9.4% (2–6 y obesity 12.3%; boys > girls) | ~1 in 5 children/adolescents overweight or obese; supports early prevention. |
| (T. R. Adam et al., 2024) | Saudi Arabia | 2–19 y; 21 studies; n = 63,512 | Systematic review (CDC criteria) | Overweight 5–29%; Obesity 3.8–49.7% | Wide variability by region/age/definition; burden remains high. |
| (Al-Hussaini et al., 2019) | Riyadh city | 6–16 y; n = 7,930 | Cross-sectional; WHO BMI-for-age SD | Overweight 13.4%; Obesity 18.2% | Obesity increased markedly vs earlier comparable estimates; adolescents higher. |
| (El Mouzan et al., 2010a) | National | 5–18 y; n = 19,317 | National cross-sectional; WHO BMI SDS (+1/+2/+3) | Overweight 23.1%; Obesity 9.3%; Severe obesity 2.0% | Baseline national prevalence; recommends prevention to curb increases. |
| (Ibrahim et al., 2021b) | Jeddah and Madina | 11–18 y; n = 522 | Multi-school cross-sectional | Overweight 13.2%; Obesity 26.1% (boys obesity 34.5% vs girls 19.0%) | High adolescent obesity; family-environment strategies recommended. |
| (Ibrahim et al., 2021b) | Saudi Arabia (all regions) | School students; n = 365,165 (174,340 elementary + 190,825 intermediate) | National school-based survey; Saudi BMI growth charts | Overweight 11.0%; Obesity 7.6%; combined 18.6% | Obesity/overweight remain major concerns; policy action recommended. |

## 2.5 Aetiological Determination of Obesity

The Alma Ata Declaration of Health for All and the Ottawa Charter (WHO, 1986) emphasise well-being not just the absence of disease as the basis of public health; moreover, health is not only impacted by individual behaviour but is also influenced by different factors, including social, economic, political, and environmental factors. According to Acheson (1988), public health is "*the science and art of preventing disease, prolonging life and promoting health through organised efforts of society.*"

Health matters to everyone; to individuals, families, and communities. Over the years, improvements in the health and well-being of populations have been achieved through a variety

of measures. Some of these are delivered in a healthcare context, such as vaccination programmes, or other contexts, such as the workplace, home, and general environment. Many of the most considerable advances in improving the health and well-being of populations have been achieved through non-medical developments; for example, clean air regulation and improved housing and sanitation substantially reduced morbidity and mortality in Western European countries in the 19th and 20th centuries. Many factors can influence the health status of individuals and communities (Figure *2.2*): these include genetic background, social and economic living standards, the built environment, and the availability and accessibility of health services, both preventive and curative. These factors create a major challenge for policymakers and health professionals, as it is difficult to identify a single factor behind a particular population health problem (Dahlgren & Whitehead, 1991). In such matters, the goal of healthcare providers or any community should be to extend the number of years of healthy life for the population they care for. In light of that goal, people, social infrastructure, government support to those in need, and exploration of disease epidemics may all play a role in the public health (Haneline & Meeker, 2009).


Figure 2.2 Main determinants of health *(Dahlgren & Whitehead, 1991)*.

Obesity is one of the main public health issues. The causes of obesity seem straightforward: it may seem at first that individuals are entirely responsible for their weight through their daily food choices, diet, energy intake, and physical activity levels. However, it is a complicated condition, and multiple factors could contribute to the increased rates. Specifically, genetic, social, environmental, and behavioural factors contribute to obesity (Lin & Li, 2021).

### 2.5.1 Genetic and biological determinants

Any factor that increases energy input or decreases energy output, even by a small amount, will contribute to obesity in the long term. Some studies have shown that genetic factors are responsible for more than 45% individual variations in adiposity (Maes et al., 1997; Sørensen et al., 1989; Stunkard et al., 1986). Genetic influence helps to explain some of the variance in weight gain across individuals. Previous research has clearly shown that kids with obese parents are also likely to be overweight. However, whether this is due to a genetic component or environmental factors remains a topic of debate (Kleinendorst et al., 2019). The influence of genetics was highlighted by Stunkard et al. (1986), who studied obesity prevalence in adopted children and found a strong association with biological parents and none with adoptive parents (Stunkard et al., 1986). However, “genes are not destiny”: the gene–environment interaction has been found to be an important factor in the development of obesity (van Vliet-Ostaptchouk, Snieder, & Lagou, 2012). Although genetic factors are important, in this thesis, more attention will be given to other factors that could increase obesity at the population level, such as environmental and behavioural factors.

### 2.5.2 Dietary Intake and Food Patterns

Despite the absence of conclusive evidence that diet is a factor in the increasing levels of obesity observed over recent years (L.-M. Atkin & Davies, 2000), various studies have nevertheless identified changes in consumption patterns as being at least partly responsible. Greater consumption of fast food (Müller et al., 1999) and soft/sweetened drinks (Harnack et al., 1999; Ludwig et al., 2001; Malik et al., 2006), as well as an increase in the average intake of fat (Who & Consultation, 2003) have all been cited. For example, a cross-sectional study conducted with a cohort of 1,468 German primary school-aged children identified all the above, as well as noting that the children they studied ate insufficient amounts of fruits and vegetables (Müller et al., 1999).

Changes in eating habits were also discussed in the Foresight Report (Aylott et al., 2008), not only in terms of the types of food consumed, but also whether they were freshly prepared at home or purchased from takeaway restaurants or stores selling ready-cooked meals, all of which are indications of changing lifestyles. Food has become increasingly affordable, and the above report suggests that supermarket offers such as “two for the price of one” can affect a population’s obesity levels (Aylott et al., 2008). Furthermore, the nature of the foods themselves has changed, along with the eating and purchasing options: foods now tend to be more energy-dense, containing fewer nutrients such as vitamins and minerals but more calories and high levels of hydrogenated fats, sugars, and salts.

Several papers have stated that soft drinks play a particular role in the rising levels of obesity. Malik et al. (2006), for example, reviewed thirty studies that used a range of methodologies to examine the relationship between consumption of soft drinks and obesity, all of which reached the aforementioned conclusion. Likewise, a sample of 548 school-aged children from a range of ethnic backgrounds in four different locations in Massachusetts was studied over two years

in the mid-1990s; their results revealed that each additional soft drink serving entailed a 1.6 times greater risk of obesity (Harnack et al., 1999).

Another study investigated the consumption of soft drinks among 103 adolescents (13–18 years old), all of whom reported drinking at least one such drink per day. Over 25 weeks, the intervention group was asked to consume non-calorific drinks, which were delivered to their homes. The researchers concluded that this reduction in sugar consumption had a positive effect on body weight; moreover, this effect was particularly notable among those adolescents who had reported greater consumption of soft drinks at baseline (Ebbeling et al., 2006).

Although the link between increased sugar intake and obesity seems clear, the picture is more complex regarding other dietary patterns. A study carried out in the UK with a cohort of 77 randomly selected pre-schoolers from eight different locations found no relationship between the amount of total energy, fat, carbohydrates, or proteins consumed and the percentage of body fat. Furthermore, a cohort of 1701 children and adolescents (4–18 years) studied as part of the National Diet and Nutrition Survey (NDNS) showed that although less energy was consumed in children's diets in 1998 than in a similar survey in 1983, the children were nevertheless both taller and heavier (Smithers et al., 2000). The authors of the report concluded that the link between dietary intake and rising levels of obesity is not as strong as previously suggested. However, they noted that methodological difficulties, such as verifying the accuracy of the foods and drinks actually consumed, may have skewed the results.

### 2.5.3 Physical Activity and Sedentary Behaviour

As with dietary intake, there is no clear answer as to whether rising levels of obesity can be positively linked to decreasing levels of physical activity; furthermore, if they are, it is unclear whether educational or other interventions are effective in persuading people to engage in a

less sedentary mode of life (Davison & Birch, 2001a). Nonetheless, most researchers suggest that activity and obesity are indeed linked. The sedentary behaviour associated with such phenomena as 'screen time' has been associated with rising BMI, and there is a consensus that children with low activity levels in particular tend to become overweight and even obese (Andersen et al., 1998; Barlow & Dietz, 1998; Müller et al., 1999; Trost et al., 2001). Müller et al. (1999), for example, looked at the link between hours spent watching television and obesity in children and found not only that was there a positive link but also that watching television for more than one hour per day was linked to eating sweets and drinking soft drinks as well, thereby creating a double effect on children's likelihood of gaining weight (Müller et al., 1999).

It has been pointed out that the increase in sedentary behaviour may be due to the decreased opportunities children have for physical activity outside the home; for example, walking and cycling have declined over the past three decades. The Foresight Report (Aylott et al., 2008) lists urban design, safety, availability of and access to resources such as playing fields and parks, and neighbourhood cultures as important factors in whether children are willing to undertake physical activities outside the home.

### 2.5.4 Environmental Factors

Several environmental factors in the home, school, and community environments have been found to be associated with childhood obesity.

In the home, parents have a direct influence on their children's weight. Their influence on their children's food selection and their effect on their obesity have been highlighted (Klesges et al., 1991). In addition, parental factors have also been linked to children's dietary intake and

physical activity (L. Mahmood et al., 2021). Walking to school is an example of a healthy lifestyle; however, more than 50% of children go to school with their parents by car (Anderson & Butcher, 2006). In addition, technological developments and a lack of parental awareness contribute to a sedentary lifestyle among children at home, where they spend a considerable amount of time watching TV and playing games.

Additionally, children spend a significant amount of time every day at school, and this can have an impact on their weight. Accordingly, extensive research has been conducted to investigate how schools influence childhood obesity. For example, it has been found that children who consume the school lunch tend to be more obese than children who bring their lunch from home (Schanzenbach, 2009). Moreover, it has been found that children who attend public schools are more likely to be overweight than those who attend private schools, and this is likely because public schools often offer low-cost lunches or breakfasts, which have been shown to have a positive correlation with children's weight (J. Li & Hooker, 2010).

The area around children's homes has an impact on their weight. Previous studies have found an increase in the weight of children who live near convenience stores (Xin et al., 2021). For example, in Arkansas, a significant association has been found between the number of fast food restaurants within one mile of a school and the obesity rate of students (Alviola IV et al., 2014). Moreover, an association was found between the number of parks near a child's home and children's healthy weight (Potwarka et al., 2008).

### 2.5.5 Socioeconomic Status

The term 'socioeconomic status' is generally used to identify a person's status in comparison to others based on various factors such as income, qualifications, type of occupation, and where they live. Inequalities in society in terms of where people are born, grow, live, work, and age

cause health inequalities i.e., the lower a person's position in society, the worse their health. According to the National Obesity Observatory (NOO), there are significant inequalities in obesity prevalence among children, for both girls and boys, and across different age groups. Since the 1960s, socioeconomic inequalities have increased in the UK, which has led to inequalities in child and adult obesity, with those from poorer backgrounds more likely to be obese than others (PHE, 2013). In recent years, the prevalence of obesity and overweight among school-aged children in England has stabilised. However, children from families with low socioeconomic status have not benefited from this stabilisation, and this may create a need to decrease socioeconomic inequalities in childhood obesity (Buoncristiano et al., 2021). Childhood obesity persists into adulthood, with overweight children more likely to be obese as adults than children of normal weight; moreover, obesity is associated with a range of diseases and thus with reduced life expectancy.

### 2.5.6 Endocrine Disorders

Minor endocrine disorders have been reported as primary and secondary causes of obesity development (Schwartz et al., 2017). Examples of endocrine disorders that could cause obesity are hypothyroidism and polycystic ovarian syndrome (Palomba et al., 2023). However, these disorders can be diagnosed and treated; thus, endocrine disorders are not considered an important cause of obesity.

### 2.5.7 Sleeping and Medication Factors

Another potential cause of obesity is related to sleep duration and quality: numerous reports have concluded that there is an association between short sleep duration and poor sleep quality and obesity (Ding et al., 2018). The mechanism of this association is not fully understood.

In addition, the use of many medications has been associated with weight gain, including glucocorticoids (Suh & Park, 2017) and antipsychotics (Dayabandara et al., 2017). Seeking medical advice and using drug alternatives might prevent drug-related obesity.

## 2.6 Consequences of Unhealthy Weight

Unhealthy weight has three types of consequences: physiological health, psychosocial health, and economic.

### 2.6.1 Physiological Health Consequences

Overweight and obesity increase the risk of a range of health diseases for both adults and children, including type 2 diabetes, hypertension, cardiovascular disease, stroke, and cancer (Berenson et al., 1998; Butland et al., 2007; Shashaj et al., 2014). Overweight is strongly associated with diabetes, and the American Diabetes Association (ADA, 2012) recommends checking for diabetes in individuals who are more than 45 years old and who present with overweight or obesity, even without the presence of any symptoms. Obesity is considered the most significant contributor to mortality related to ischemia of arterial vessels in the heart and brain. Dyslipidaemia and hyperglycaemia are the most important causes of hypertension and blockage of the arterial tree, of which obesity is the main underlying causative factor (Chakraborty et al., 2023). Recent research has shown that childhood obesity lays the foundation of coronary artery disease and stroke, even without obesity in adulthood, by increasing carotid-intimal thickness (Juonala et al., 2011). Also, obesity-related diabetes is a risk factor for cancer, as it further raises the risk of intestinal, pancreatic, breast, and kidney cancers (Scully et al., 2021). A range of meta-analyses and systematic reviews have also linked overweight and/or obesity to tumours of the gallbladder, blood (Budny et al., 2019), ovaries, epithelium (Wichmann & Cuello, 2021), and prostate gland (Discacciati et al., 2012).

In 2010, overweight and obesity were estimated to cause 3.4 million deaths, 3.9% of years of life lost, and 3.8% of disability-adjusted life-years (DALYs) worldwide (Ng et al., 2014a). In addition, many mechanical and metabolic consequences associated with childhood obesity result in a number of chronic diseases (Daniels, 2006); obstructive sleep apnoea syndrome and orthopaedic problems are the two primary mechanical complications of childhood obesity (Bitners & Arens, 2020).

### 2.6.2 Psychosocial Health Consequences

Overweight and obesity are associated with social stigmatisation for both children and adults. Obese individuals can face social disadvantages in multiple aspects of life, including employment, education, healthcare, and interpersonal relationships (Rand et al., 2017). Psychosocial discrimination against children and adolescents who are obese can lead to social isolation and, subsequently, to physiological problems (Sagar & Gupta, 2018). In addition, overweight and obese children and adolescents may experience multiple psychosocial consequences, including teasing, depression, poor self-esteem, body-image dissatisfaction, and reduced quality of life; these increase the probability of eating disorders, over-eating, and a sedentary lifestyle (Pothiraj et al., 2022).

### 2.6.3 Economic Consequences

The global emergence of obesity is not only a health issue but also an economic burden (Tremmel et al., 2017). Overweight and obesity impact the broader economy through, e.g., increased benefit payments, lost working days, and negative social consequences, including social exclusion, discrimination, and a loss of or lower earnings (Sturm, 2002). Overweight and obese adolescents are much more likely than others to become obese as adults; furthermore, obesity and overweight in childhood and adolescence are associated with increased risk of premature mortality in adulthood. Obese adults may be more likely than their normal-weight

counterparts to become disabled before retirement, thereby lowering their earnings and raising the costs (Reilly & Kelly, 2011).

The costs of obesity in the UK are estimated to be as high as £3.7 billion per year, including £49 million in obesity treatments, £1.1 billion in treating the consequences of obesity, £1.1 billion in indirect costs for premature deaths, and £1.45 billion in the cost of sickness absence. If similar costs for the overweight population are included, the estimate approaches £7.4 billion per year (WMC, 2010).

Cawley and Meyerhoefer calculated that obesity accounts for approximately one-fifth of all medical expenditures in the US, which totalled around US$200 billion in 2005 alone. Each obese individual requires approximately US$1,150 (men) or US$3,600 (women) more in medical expenditures than a non-obese individual, to address either their obesity or to manage a related disease (Cawley et al., 2014; Cawley & Meyerhoefer, 2010).

## 2.7 Obesity and Overweight Prevention Interventions

One way to counteract obesity is through the development of obesity intervention programmes. Those programmes are implemented in various contexts, including schools, homes, healthcare facilities, childcare settings, and community environments. School-based programmes incorporating recommendations for healthy eating programmes showed significantly lower rates of overweight and obesity in children (Dietz & Baur, 2022). Additionally, family-based interventions in the home have shown a reduction in children's weight (Berge & Everts, 2011). Not all such programmes positively influence children's weight; some interventions fail to show any significant reduction in children's weight. For example, one study conducted a primary care intervention, wherein four standard consultations attempted to alter nutrition, physical activity, and sedentary behaviour over 12 weeks; however, there were no significant changes in children's BMI (Wake et al., 2009). At the same time, moderate evidence suggests

that a combined community/school intervention could reduce children's weight (Bleich et al., 2018a). Most obesity intervention programmes have been conducted in Western countries, with such programmes and policies limited to Eastern countries such as Saudi Arabia. Thus, this thesis focuses on obesity in Saudi Arabia.

While international evidence suggests that family, school, and community-based interventions can be effective in reducing childhood obesity, the applicability of these approaches within the Saudi context remains limited by a lack of locally grounded research. This reinforces the need for studies that explore contextual influences and feasibility of interventions within specific Saudi regions, including Najran.

### 2.7.1 Family-Based Interventions

Childhood obesity is a worldwide public health issue, as the children of this generation are significantly heavier than prior generations (Lobstein et al., 2015). In the last four decades, obesity prevalence among children and adolescents has risen to nearly 50%. Such increases have been seen in both developed and developing nations (Ng et al., 2014a). Although recent research suggests that the obesity increase has become static in recent years, the current prevalence in developed nations is still alarmingly high. It poses long-term threats for the youth population in terms of physical, social, and economic development (Akseer et al., 2017).

Healthcare professionals have developed many new interventions to address the issue of childhood obesity (Wilfley et al., 2017). One type of intervention seeks to prevent childhood obesity through family-based methods. The focus was shifted towards such interventions following the advice of the Institute of Medicine, which suggested that parents are a critical part of the solution to childhood obesity. A literature review indicates that the family environment is essential to preventing and treating childhood obesity (Golan et al., 2006;

Hingle et al., 2010; Kitzmann & Beech, 2011; Knowlden & Sharma, 2012; Sung-Chan et al., 2013).

Concerning childhood obesity, family-based interventions, significant issues to address include whether interventions continuously focus on diet and physical activity without considering the role of other predictors, including sedentariness due to electronic media use and sleep deprivation. Other issues include the role of these factors for specific age groups and the variable of family or even national socioeconomic status (Chen et al., 2008; Gortmaker et al., 1996; Li et al., 2017). Additionally, when factors and interventions studied in a wide variety of populations are combined, it is challenging to identify best practices or guidelines that can apply to broader communities (Dumbka et al., 1997; Yancey et al., 2006).

Family members play a central role in helping children transition from obesity to an average weight. However, a systematic review that conducted a content analysis of interventions between 2007 and 2016 identified significant gaps. These knowledge gaps were included in both the intervention content and the demographic variables of the studies' populations. Study cohorts were not representative of low-income groups; neither children of very early ages nor those of older ages were included, and ethnic minorities were underrepresented (Popkin, 2001; Prentice, 2006). Furthermore, studies did not address the type of family structure, such as single-parent households (which are increasing over time) or a nuclear family (McLanahan & Percheski, 2008). These findings suggest determining outcomes by family structure and identifying the results of family-based interventions. Moreover, most interventions were studied with White populations, and many ethnic minorities (such as black/African American and Asian) were not represented. The need for such studies limits scientific insights into minority communities and thus the ability to apply or suggest relevant interventions. Finally, most studies focused on children in the age group 2–10 years, although evidence indicates that obesity prevention strategies are most critical during the early infancy period (Lanigan, 2018).

### 2.7.2 School-Based Interventions

Obesity in school-going children is a threat to upcoming generations and public health. The rate of overweight and obesity increased from 17% to 23.8% for boys and from 16% to 23% for girls in the last forty years in developed nations, while in developing and underdeveloped countries, the overweight and obesity prevalence increased from 8% to 13% for both boys and girls in the same period (Ng et al., 2014b). It is common knowledge that childhood obesity is linked with adverse health outcomes later in life, such as lung disorders, amnesia, exercise intolerance, high blood pressure, and chronic inflammatory disease, as well as negative psychological effects during childhood (Ebbeling et al., 2002).

Recent research has highlighted the importance of the school environment and the applicability of such obesity interventions to regulate this epidemic. Children spend most of their active time (usually 6–8 hours) in school. Additionally, physical facilities, games, companionship with other students, and exercise can be easily incorporated into daily school routines. School policies also influence students' health-related behaviours (Pangrazi & Beighle, 2019).

Previous systematic reviews have highlighted the importance of school-based interventions (Gonzalez-Suarez et al., 2009; Summerbell et al., 2005), which can reduce BMI by up to 3.27 (Harris et al., 2009). However, these studies were conducted in developing nations, such as China, and the effectiveness of these interventions in socio-economic environments where childhood obesity is progressing at an alarming rate is questionable. As a result, the applicability of such school-based interventions in very different environments is in doubt (Yan-Ping et al., 2010).

School-based intervention strategies include physical activity (e.g., increased intensity and duration of physical activity in school), health education (e.g., ensuring awareness of obesity), healthy eating (e.g., modifying which meals are available to kids in school), weight

management (e.g., defining weight-related indicators or guiding and recording overweight and obese children), psychological well-being, and infrastructure support for sporting amenities (Feng et al., 2017). Physical activity and diet control are the two most studied interventions in school-going children; of the two, physical activity has been found to be superior to diet control interventions in terms of controlling obesity (Katz et al., 2008; Martin et al., 2016). In terms of controlling obesity, treatment interventions were more effective than prevention studies, according to a meta-analysis (Bleich et al., 2018b). The reason is that children with a greater BMI are more likely to adhere to the intervention compared to children with a normal or overweight BMI. To enhance the impact of these interventions, other components such as parental support and supervision should be incorporated (Sobol-Goldberg et al., 2013). The application of interventions such as physical activity combined with health education can have a more substantial effect on obesity control than physical activity alone. Further research is needed in this area to investigate the long-term impact of these interventions.

Despite the appeal of schools as a setting for childhood obesity prevention interventions, their limitations should be considered. A key barrier is the pressure schools face in raising educational standards in the core subjects of literacy and numeracy, which results in resistance among school personnel to using education time for health promotion. The 'crowded curriculum', together with a lack of teacher competence and training in physical activity and nutrition, also limits the school's role. On this topic, Whitby (2010) discussed the burden on schools concerning planning, budgeting, staff training time, and the time required to deliver health promotion programmes.

### 2.7.3 Community-Based Interventions

According to the WHO, approximately 40% of the world's adult population is overweight, and that does not differ across genders (although around 15% of women are obese compared to

only 11% of men). Obesity and overweight are the leading causes of mortality and morbidity and account for approximately 5% of deaths, and even more (8.4%) in high-income countries (WHO, 2009). Furthermore, the social and economic burdens of obesity were estimated to cost about 94 million DALYs (Lim et al., 2013). Severe obesity often requires surgical intervention, which is not only costly but also leads to various complications itself. Thus, preventing obesity before it occurs, instead of treating it, is of considerable importance. One type of prevention initiative is community-based interventions, which promote physical activity in the natural and built environments. In addition, community-based interventions can educate indivisuals about the potentially damaging impact of obesity on health in later life and how this can be managed (Baker & Schaltegger, 2015).

Community-based initiatives should be low-risk, low-initiative, low-maintenance, and focused on community well-being; one example is community gardening. Community gardening may be a sustainable and maintainable intervention that connects physical activity, ensures a supply of healthy food, and educates the community on healthy living concepts (Armstrong, 2000). Such an intervention can promote health, physical activity, and food security in the community, as well as instill a culture that can be maintained for life and have a spillover effect on family members, the community, and, in turn, the whole nation (Darnton-Hill et al., 2004).

### 2.7.4 Policy Response to Obesity and Overweight in the Saudi Context

***Health system policy***

Saudi Arabia's health-sector response to obesity has evolved from general NCD prevention toward more structured obesity-focused programmes and clinical guidance. The Ministry of Health (MOH) established an Obesity Control Program (OCP) within its chronic disease structures to support prevention, early identification, and integrated care for individuals living with obesity (Ministry of Health (Saudi Arabia), (n.d.)). In parallel, national clinical guidance has been developed to standardise obesity management, including recommendations for screening, behavioural intervention, and clinical care pathways within primary care and specialist services (Alfadda et al., 2016a). Broader national policy direction has been shaped by Vision 2030 and the National Transformation Program, which explicitly emphasise prevention and increasing participation in physical activity as part of improving population health outcomes (Almubark & Alqahtani, 2023a).

***Education system policy***

Schools are a major setting for obesity prevention because they influence food access, physical activity opportunities, and health literacy. A key school-based initiative is Rashaka, launched jointly by the MOH and Ministry of Education to address childhood obesity through promoting healthy dietary behaviours, increasing physical activity, and improving awareness of obesity-related risks (Al Eid et al., 2017). Evidence on school-level implementation has continued to grow; for example, recent evaluation research has examined Rashaka's effectiveness and predictors of change in BMI among participating students, reinforcing the importance of school-based, multi-component approaches and monitoring of outcomes (Banany et al., 2024).

In addition to programmes, policy actions have targeted the school food environment. MOH communications have indicated that specific items (including soft drinks, energy drinks, chips,

chocolate and sweets) are not permitted for sale in school canteens, reflecting a move toward restricting high-sugar/high-fat products within educational settings (Al Eid et al., 2017). However, peer-reviewed work highlights that compliance and effectiveness of school food policies can be uneven in practice, supporting the need for clearer enforcement mechanisms and routine monitoring (Banany et al., 2024).

**Food environment and nutrition policy (SFDA and labelling reforms)**

Beyond schools, Saudi Arabia has increasingly used regulatory levers to shape the broader food environment. The Saudi Food and Drug Authority (SFDA) introduced mandatory menu calorie labelling (implemented nationally from 2018), requiring restaurants and food outlets to display calorie information to support healthier consumer choices. Recent peer-reviewed studies suggest the policy has increased awareness, although behavioural impact on choices can be inconsistent, indicating that labelling may be most effective when combined with complementary interventions (education, reformulation, and healthier default options) (Binobead et al., 2024). Emerging research also examines consumer responses to calorie labelling in online food ordering applications, reflecting the need for policy adaptation to digital food environments (Alkhunein et al., 2024).

Saudi Arabia has also implemented actions on harmful nutrients in the food supply. SFDA reports indicate the country moved to eliminate industrially produced trans fats (via restrictions on partially hydrogenated oils), aligning with global recommendations to reduce cardiovascular risk and improve dietary quality (Al-Jawaldeh et al., 2024).

***Fiscal measures and sugar-sweetened beverage policy***

Saudi Arabia has adopted fiscal policies to reduce consumption of sugar-sweetened beverages (SSBs) and energy drinks. In 2017, the country introduced excise taxes that increased the price of sugary beverages, including a substantial excise tax on energy drinks and soft drinks; this policy has been analysed as one of the most ambitious SSB tax implementations globally (Alsukait, Bleich, et al., 2020). Evidence from peer-reviewed evaluations indicates that taxation was associated with reductions in SSB consumption among schoolchildren in at least one major metropolitan region (Eastern Province), suggesting potential benefit in reducing intake of high-sugar beverages (Alhareky et al., 2021). A WHO Eastern Mediterranean review similarly concludes that SSB taxes can contribute to reduced sugar consumption and support obesity prevention, particularly when integrated into broader public health strategies (Al-Jawaldeh et al., 2024).

***Energy drinks policy***

Saudi Arabia introduced early restrictions on energy drinks through Cabinet-level actions in 2014, including bans on advertising and sponsorship, restrictions on sales in some public settings, and warning label requirements. Peer-reviewed commentary has highlighted these measures as a protective public health response given concern about high caffeine and sugar content and potential harms among young people (Alfadda et al., 2016b). The subsequent use of excise taxation further strengthened policy control over energy drink consumption by increasing price and limiting accessibility (Al-Jawaldeh et al., 2024).

### 2.7.5 The UK Policy Response to Obesity: Shift to a Systems Approach

Governments and authorities in many countries are prioritising obesity in developing public and health policies, and have recognised it as a critical issue. Obesity has been a longstanding concern for the UK government, having been on the public policy agenda since the early 1990s.

However, the obesity-raising trends have shown no signs of addressing this issue. Policy can play a key role in combating the obesity epidemic at the population level. Interventions and policy changes can influence multiple sectors at different levels and drive change in obesogenic environments (Musingarimi, 2008; Sacks, Swinburn, & Lawrence, 2009). However, if policies are developed to take action in one part of the system, there might be an opposing force in another, leading to their ineffectiveness and shortcomings.

The UK Government's Foresight programme in 2007 was asked to consider how society might deliver a sustainable response to obesity in the UK over the next 40 years. The objectives of this project were to 1) identify the factors that influence obesity, 2) understand the relationships between these factors, and 3) analyse how the future level can be changed and identify effective future responses. The Foresight report 'Tackling Obesities: Future Choices' has illustrated that a systems approach is required, which comprises an integrated policy response at both local and national levels. This approach requires action by multiple sectors, including government (both central and local), communities, industry, business, and families in which they live. The Foresight has developed an obesity systems map, which aims to help policymakers anticipate the likely impact of preventive policies across several segments of the systems map. The systems map consists of seven subsystems to illustrate the interrelations between various factors, including biology, individual activity, environmental activity, individual psychology, societal influences, food consumption, and food production (Kopelman, 2010).

In response to the Foresight report, various initiatives, programmes, and policy documents have been launched by the government. Some of them are to advise people on healthy diets and physical activities, such as the Change for Life programmes. Others aim to provide people with guidance on recommended levels of physical activity as outlined in the UK physical activity guidelines. Additionally, some initiatives target businesses and organisations through the Public Health Responsibility Deal which encourages businesses to sign up and take action to

help people eat healthier; for example, reducing ingredients with high salt and fat, encouraging people to eat more fruit and vegetables, putting calories on the menu, and reducing portion sizes. One of the policy documents that has been informed by the Foresight report findings is 'Healthy Lives, Healthy People: A call to action on obesity in England', published in 2011. This document provides guidance to encourage a wide range of partners to play their part in addressing obesity. It highlighted that the local authority could play a significant role and responsibility in developing and implementing programmes to tackle obesity.

## 2.8 Theoretical Framework

### 2.8.1 Ecological Systems Theory (EST)

Ecological systems theory (EST) was developed by Bronfenbrenner & Ceci (1994) to outline and identify human development as framed by the contexts of the systems of association that form an individual's environment. (Alternatively, 'bio-ecological systems theory' has been proposed as another name for the EST, to highlight that a child's biology is a structural ecosystem in establishing the development of a child.) Subsets of the environmental system correspond to concentric circles and include the microsystem, mesosystem, ecosystem, and macrosystem (Kamenopoulou, 2016).

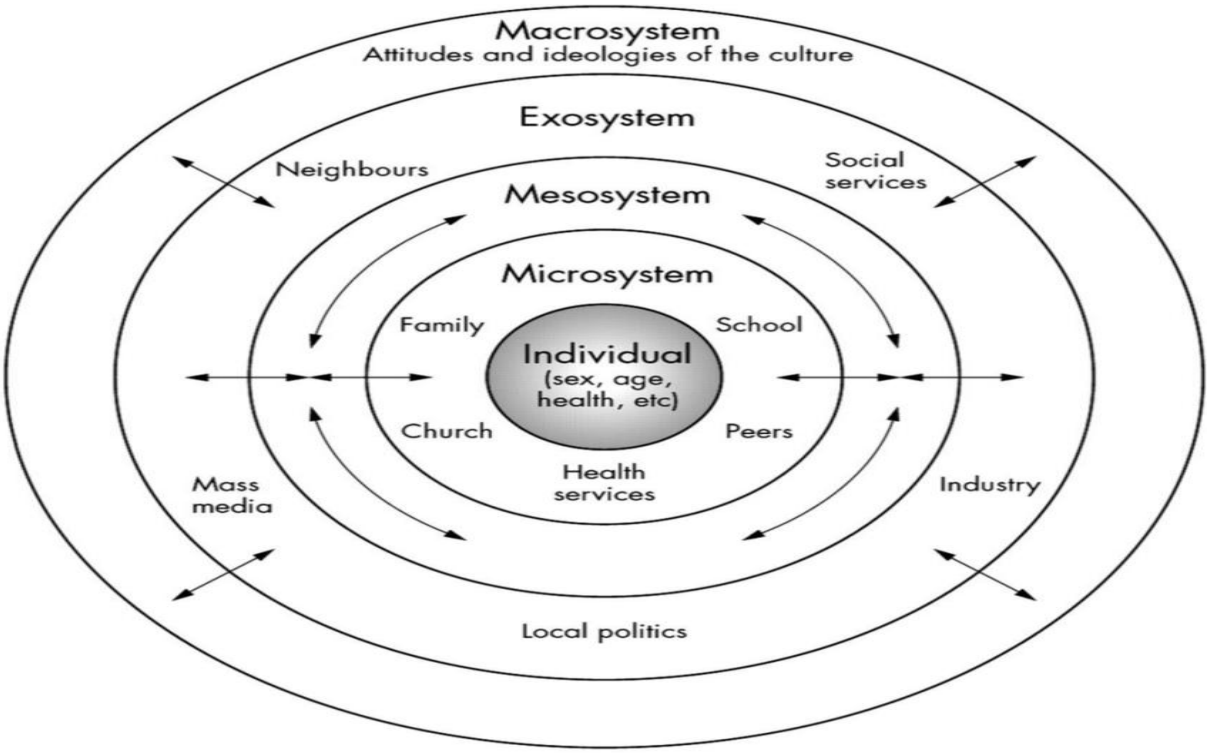


Figure 2.3 Bronfenbrenner's Ecological Systems Theory

The EST is the most prevalent framework for addressing the increasing BMI in children. Various studies have employed the EST as a theoretical perspective through which to formulate their abstract frameworks. The EST allows for complex conceptualisations, wherein multifactorial interactions occur in a child at risk of becoming overweight or obese (Boonpleng et al., 2013; Davison & Birch, 2001b; Galvez et al., 2010). Cohen et al. concluded that exploring a theoretical framework model is superior to theory, in that a pictorial illustration of a structure or process assists in constructing and examining conclusions and models by precisely depicting essential concerns, in contrast to theoretical application (D. A. Cohen et al., 2000; M. Cole, 2009).

EST can be used to investigate the components preceding a disease in combination with the applications of preventive strategy and interventions, and it is similar in addressing childhood obesity and extending to their parents (Davison & Birch, 2001b; Tudge et al., 2009). However, the limitations of EST are that it does not explain the processes through which individuals grow

in interaction with their surrounding systems (Davison & Birch, 2001b) and that it depends on models instead of being supported by claims (Tudge et al., 2009)

Table 2.2 Summary of the systems proposed by Brofenbrenner, adapted from (Kamenopoulou, 2016)

| System | Explanation |
|---|---|
| **Micro-system** | The immediate contexts in which the individual participates; the people in these contexts are in direct contact with the individual. |
| **Meso-system** | Influences between members of micro-systems, e.g., school and family relationships. |
| **Exo-system** | External influences on the individual from systems not directly related to the micro-system, e.g., policy and legislation. |
| **Macro-system** | Broader cultural and social influences, e.g., social and economic status. |

### 2.8.2 Socio-Ecological Model (SEM)

The Social Ecological Model (SEM), or the ecological model, originates from Bronfenbrenner's EST (Raingruber, 2014). The SEM investigates the associations between a person's behaviour and the environment (Raingruber, 2014). In recent years, the SEM has been utilised in health advancement and has been successfully applied in obesity research as well as extended to other diseases (Johns Hopkins University, 2016). The ecological model, an extension of the SEM, perceives health as being shaped by the interaction between the individual and their socio-ecological environment (Sallis & Glanz, 2009). Over the last twenty years, modifications of the original SEM model have led to the development of other models (Glanz et al., 2008). However, Bronfenbrenner's original model remains the most widely used model (S. L. Brown, 2011; Hickey et al., 2012). The five levels within the SEM (from micro-

to macro-) are conceptualised as concentric circles, with each sequential level encompassing all the levels below it (Woolf & Aron, 2013).

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

Obesity pathogenesis is multifactorial, and interventions to control or treat obesity require the integration of approaches that comprise the physical and social environments. The SEM enables us to identify and investigate influencing factors relating to social environments, but not to physical environments. However, due to the multifaceted aetiology of obesity, other influences such as biological, environmental, and anthropological factors which may vary with demographic, cultural, or social values can also contribute to obesity prevention (Baral et al., 2013; Max et al., 2015). The SEM has been applied in widespread health interventions for various reasons (Moore et al., 2015); specifically, the WHO (2015) recently utilised the SEM as a theoretical framework for regulating models of the increase in chronic and infectious diseases, as well as for recognising the associated threatening and shielding factors associated throughout the world. The SEM is also used to identify causative factors apart from risk and protective factors that influence the prevention of obesity in children (Amarasinghe & D′ Souza, 2012; Yin et al., 2012).

The SEM has its limitations; for one thing, it is a complex model with only two dimensions, which distorts the contribution of the factors involved (Stanger, 2011; Stokols, 1996). Additionally, the enclosed circles of models are only valuable in theory, but they are impractical when considering the intricate details of a person's life incidents (Raingruber, 2014). Stanger (2011) suggested that altering the current model may lead to an eco-centred model (Stanger, 2011). However, every component of the model requires further evaluation in an ever-changing personal scenario, where a slight change in one variable can impact the whole model (Boonstra, 2016; Fabinyi et al., 2014). The SEM has been criticised for under-consideration of persons' capabilities and ignoring their rights, mindsets, and emotional intricacy (J. E. Davis, 2011; Stanger, 2011); at the same time, it disregards genetic and intellectual dynamics in initial phases (McLaren & Hawe, 2005; Raingruber, 2014), without considering the impact of other variables which affect individuals' weight.

## 2.9 Conceptual Framework

### 2.8.1. Individual

As pointed out above, it may seem at first that individuals are entirely responsible for their weight through their daily food, diet, energy intake, and physical activity levels: when the amount of energy taken in is more than the amount of energy expended, the additional energy is stored as fat, and continuing this process over a period of time results in an increase of BMI (Butland et al., 2007). However, the current epidemic of obesity at the population level arises from complex interactions of factors at multiple levels, including biological, social, environmental, and behavioural factors (Frerichs et al., 2013). These complex, interrelated factors and contextual forces place eating and physical activity behaviour beyond an

individual's choices (Kahneman, 2003). Understanding the complex dynamics of these interrelated factors is essential to combating the obesity epidemic.

### 2.8.2. Social Transmission of Unhealthy Behaviour (Family/Carers)

Research has found evidence that the obesity epidemic might be spreading through social networks (Christakis & Fowler, 2007): the chances of becoming obese increase by 57% if a person has a friend who became obese, and the likelihood of one spouse becoming obese increases by 37% when the other spouse has become obese. In addition, individuals of the same gender have a greater influence on each other than those of a different gender. Furthermore, the social transmission of unhealthy behaviour can occur from adult to child and from child to child (Frerichs et al., 2013). Thus, parental and family engagement in child health-promotion interventions is important. Accordingly, it is essential that health educators and service providers understand what parents perceive as effective weight management strategies for their children (Wills & Lawton, 2015), as this could help in developing and sustaining patient-centred care and services. Parents can play a critical role in terms of their influence on their child's eating habits, behaviour, and level of physical activity; at the same time, the school environment has a potentially important cultural and influential role.

### 2.8.3. School Environment

Schools are a common setting for implementing interventions to promote children's health. Schools' infrastructures and physical environments, policies, curricula, and staff have the potential to positively influence children's health (T. Brown & Summerbell, 2009). During the school day, particularly physical education and school playtime, children are offered regular opportunities to engage in physical activity (Ridgers et al., 2006). The workplace may not be

important for adults' physical activity, but for children and adolescents, schools are likely to be a critical contributor to their physical activity (D. Cohen et al., 2008). Schools are also a critical environment for students' nutrition, as they consume at least breakfast there, which is considered an important daily meal (Mensink et al., 2012). In addition, the school environment can play a crucial role in improving children's diet and shaping their eating behaviours (YOUNG, 1997a). Time allocation for school meals and the way food is displayed can also affect children's eating behaviour. To this end, in the United States, for example, one of the recommended national strategies to prevent and reduce childhood obesity is creating school food environments that facilitate healthy eating among children (Huang et al., 2013). In short, schools can play a key role in promoting healthy lifestyles by creating healthy environments for their students (Naidoo & Wills, 2000).

### 2.8.4. Local Environment

The local environment can also have an impact on individuals' food choices and healthy lifestyles. For example, it has been found that children who attend schools which are near fast food restaurants are more likely to be obese than those who attend schools without fast food outlets nearby (Currie et al., 2010) difference between those two groups of children is not only in their weight status; it has also been found that the children who attend schools near fast food outlets (i.e., within half a mile) consumed lower amounts of fruits and vegetables and consumed more fizzy drinks (B. Davis & Carpenter, 2009). A study in the UK, conducted with 3,600 adolescents, suggested that those who regularly eat at fast food restaurants tend to have a greater weight and consume more unhealthy food compared to those who do not (L. K. Fraser et al., 2011).

### 2.8.5. Government Policy

Government policies are perceived to contribute to the obesity epidemic through poor diet, unhealthy foods, and low levels of physical activity. In the context of Saudi Arabia, a wide range of government departments across multiple sectors must collaborate to ensure that people get the proper support and information to lead healthier lives, helping them reach and maintain healthier weights, make healthy food choices, and adopt a healthy lifestyle. More information on this is presented in the study's Design section.

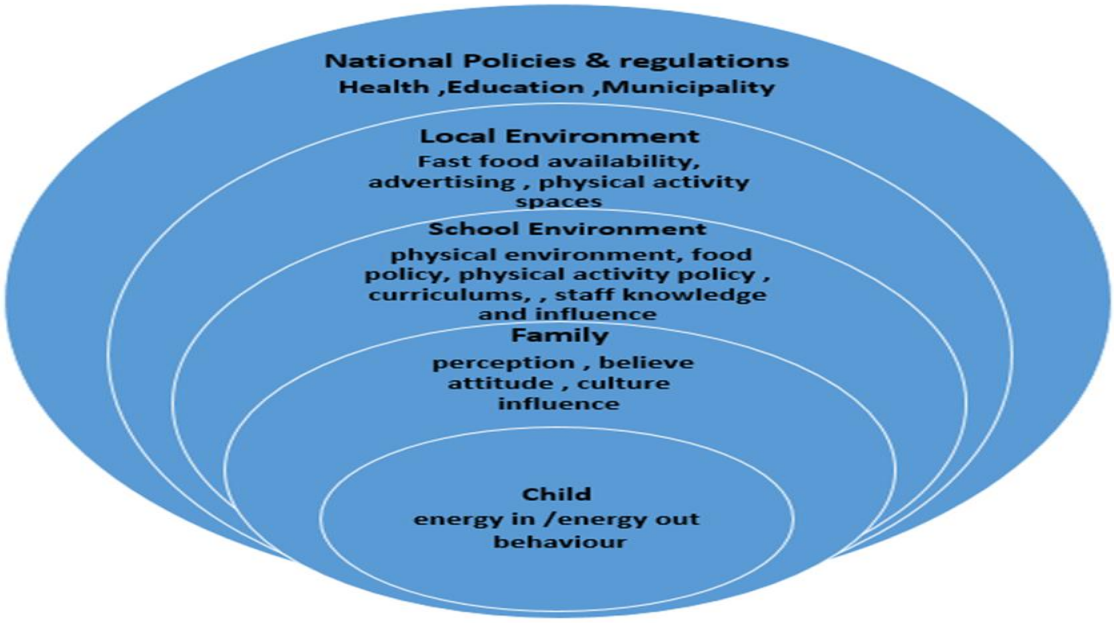


Figure 2.4: Levels of influencing factors on childhood obesity considered in this project: Conceptual framework.

## 2.10 Research Gaps and Motivations

### 2.10.1 Gaps in International Literature

The literature review indicated that many studies on childhood obesity interventions are based on Western populations, and this raises concerns regarding the development of childhood

obesity prevention interventions in non-Western nations. This led to the development of the primary goal of this thesis which is to determine the factors that contribute to childhood overweight/obesity in Saudi Arabia within the contexts of the child's home, school, and community, and to assess the relative contribution of each of the ecological contexts to childhood overweight/obesity.

### 2.10.2 Research Gaps in Saudi Arabia (Najran)

Despite growing research on childhood obesity in Saudi Arabia, there are no studies that have comprehensively explored how the home, school, and community environments together contribute to childhood overweight/obesity. Most existing research tends to focus on individual factors, such as dietary habits or physical activity levels, without considering the interconnected and multi-level influences that affect children's health behaviours. This gap is particularly manifest in Najran City, where cultural, environmental, and policy-related factors may interact in unique ways to influence obesity risk.

At the home level, previous research has explored parental feeding practices, screen time, and family dietary habits. However, few studies have considered how these factors interact with schools' policies and neighbours' environments. For example, parental awareness of obesity risks may not lead to healthier behaviours if schools do not apply better nutrition education and provide opportunities for physical activity.

At the school level, many researchers have examined physical education programmes and school canteen policies. However, they rarely consider how external factors, such as neighbourhood safety or accessibility to playgrounds, could affect children's activity levels. For example, even if a school promotes physical activity, children may still lead sedentary lifestyles due to a lack of safe outdoor spaces in their communities.

At the community level, studies have investigated the availability of parks, walkability, and urban infrastructure, yet few studies have analysed how these environmental factors interact with home and school-based interventions. In Najran, concerns in outdoor safety, extreme weather conditions, and socio-cultural norms on outdoor activities, particularly for females, further complicate efforts to promote physical activity.

Given the interconnected nature of childhood obesity factors, a significant research gap remains in understanding how much each ecological context (home, school, and community) contributes to obesity risk. Therefore, to address these research gaps, interdisciplinary studies that integrate quantitative and qualitative methods to assess the relative influence of each factor are needed. Such an approach would provide a more holistic understanding of childhood obesity in Saudi Arabia and inform more effective, evidence-based interventions adapted to local contexts, particularly in regions such as Najran.

# Chapter 3 Methodology

## 3.1 Research Process and Design

It is essential for researchers to develop a research plan and framework that can inform their process of collecting, gathering, and analysing data. The research process can provide a roadmap that helps the researcher understand and decide how the various elements of the research will be chosen and implemented. The research design plays a critical and fundamental role in connecting theories and arguments and can provide direction for collecting and analysing data (Churchill Jr, 1979; Frankfort-Nachmias & Nachmias, 2008). This thesis adopts one of the leading research process models, known as 'the research process onion', to inform the research process and design. Developed by Saunders et al. (2009), the research process onion conceptualises the research process as a series of layers, similar to those of an onion; at the core point are the data collection and analysis; however, to reach that central point, several issues must be considered, and the researcher should decide on each step of the research, progressively moving inward through each layer. Figure 3.1 depicts the components of the onion, including philosophies, approaches, strategies, choices, time horizons, and techniques and procedures.

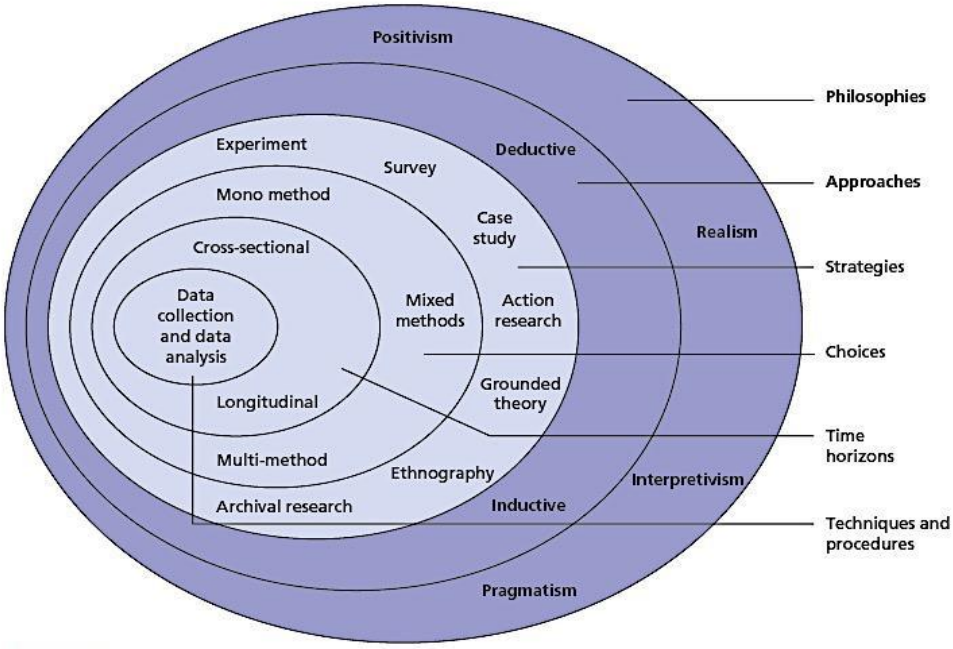


Figure 3.1 The research process onion (Saunders et al., 2009)

## 3.2 Research Philosophy and Paradigm

A research philosophy is an idea or belief about the way in which data on a phenomenon should be collected, gathered, and analysed. According to Žukauskas et al. (2018), philosophy serves as the basis of research, underpinning the selection of research strategies and the process of formulating the research problem, data collection, and analysis. In other words, the research philosophy can be defined as the development of knowledge and assumptions within a specific research field, guided by the nature of the research (Saunders et al., 2007). Hitchcock & Hughes (1995) argued that research stems from assumptions, which means that the choice of a specific research philosophy is influenced by the researcher's specific views and opinions; different researchers may have different assumptions about the nature of truth and knowledge. Four main types of research philosophy will be discussed here: the positivist research philosophy, the interpretivist research philosophy, the pragmatist research philosophy, and the realistic research philosophy.

### 3.2.1 Pragmatism

The research philosophy of pragmatism is considered a flexible approach that does not belong to any one specific system of philosophy or reality. Under pragmatism, researchers have the freedom to choose the methods and techniques that are most suitable for addressing the research questions (L. M. Kelly & Cordeiro, 2020). Pragmatism is said to be a mix of qualitative and quantitative methods that are used to conduct research (Bryant, 2017). In addition, it is concerned with optimised outcomes and incorporates the beliefs and values of the participants. The pragmatic process is employed as an emerging research paradigm to obtain practical results and the effects of concepts on vital components (Baker & Schaltegger, 2015).

Pragmatists do not view the world as an absolute unity; the truth is what is currently happening, and it does not depend on the mind, which is not subject to reality and the mind dualism (Žukauskas et al., 2018b). Pragmatism is by nature an eclectic philosophy: it is not committed to any one system of philosophy and reality, because the main concern is with the application of 'what works' and with solutions to problems. The main feature of pragmatism is that researchers are 'free' to choose the methods, techniques, and procedures of research that best meet their needs and purposes.

### 3.2.2 Positivism

The concept of positivism is closely related to the idea of objectivism, meaning that reality is constant and can be examined and observed objectively. Under such a philosophical approach, researchers rely on objectivity and facts in order to explain the causal relationship (Žukauskas et al., 2018a). Positivism is primarily associated with research relying on scientific evidence

and numerical data from experiments and observations (Easterby-Smith et al., 1991). Neuman (1997) argued that the positivist paradigm focuses on the discovery, explanation, and disclosure of facts related to specific hypotheses and theories. Researchers who employ this paradigm focus on general social data and large-scale information, rather than the details of the research (Cooper & Schindler, 2013); therefore, the personal attitudes of the researchers are not entirely relevant and do not affect scientific research.

### 3.2.3 Realism

The philosophy of realism posits that there is a reality quite independent of the mind. It is a research philosophy that relies on the assumption of a scientific approach in order to develop knowledge (T. W. Mitchell, 2016). In other words, realism views reality and beliefs as existing in a specific environment, which is divided into two groups: direct realism and critical realism. Direct realism refers to what people see, feel, and hear, while critical realism is about people's perceptions and experiences in specific situations (McMurray et al., 2004; Sekaran & Bougie, 2016).

### 3.2.4 Interpretivism

Unlike the positivist philosophy, the researcher in interpretivist research plays an active role; they not only rely on collecting objective facts but also interact with the participants' actions and behaviours and interpret these accordingly. Interpretivism is defined as "*an epistemological position that requires the social scientist to grasp the subjective meaning of social action*" (Bryman, 2008). This research philosophy is based on people's mindsets within their environment. Researchers employ this approach to understand the connections between

people, as it perceives a social existence that affects ideas and opinions (Thorne, 2016). Its acknowledgement of the relationship between culture and people facilitates its priority among researchers, since it deals with people's participation in the social and cultural aspects of their lives. However, this approach is challenging for researchers due to the limited resources for determining methodology. Yanow & Schwartz-Shea (2015) stated that a key difficulty lies in the lack of established methods for determining the appropriate level of interpretation within a study.

## 3.3 Research Reasoning

### 3.3.1 Inductive Research

According to Jebb et al. (2017), the inductive approach involves inductive reasoning, which begins with observations and theories in the research process. It provides results through observations from the methodology; specifically, it involves a systematic search through the observation process in order to develop explanations. It delivers models through a series of hypotheses. The downsides of the inductive research approach are that it cannot guarantee conclusions (Yom, 2015), it assumes the uniformity of nature throughout the universe, and it relies on observations for the collection of information.

### 3.3.2 Deductive Research

The deductive research approach is concerned with the development of hypotheses. It is based on existing theory and designs the research strategy to test a hypothesis (Woiceshyn & Daellenbach, 2018). It helps determine the possibility of causal relationships between variables

and concepts, and it enables the researcher to measure specific ideas quantitatively. Sekaran & Bougie (2016) indicated that the concept of deduction is based on consistency and coherence within a system; however, it is considered useless for providing new information, making generalisations, and giving reasons from limited experiences.

## 3.4 Research Methods

Research approaches are generally either quantitative or qualitative. In the case of obesity, some variables are measurable (e.g., Body Mass Index (BMI), prevalence). In contrast, others are psychological, cultural, or environmental, with the latter being more difficult to quantify (e.g., behaviour, living environment). Therefore, both quantitative and qualitative methods are used to address our research problem.

Table 3.1: Comparison of Qualitative and Quantitative Methods (Burns, 2000)

| Qualitative | Quantitative |
|---|---|
| **Assumptions** | |
| Reality is socially constructed | Facts and data have an objective Reality |
| Variables are complex and interwoven; difficult to measure | Variables can be measured and Identified |
| Events viewed from the informant's perspective | Events viewed from an outsider's Perspective |
| Dynamic quality of life | Static reality of life |
| **Purpose** | |
| Interpretation | Prediction |
| Contextualisation | Generalisation |
| Understanding the perspectives of Others | Casual explanation |
| **Method** | |
| Data collection using participants observation, unstructured interviews | Testing and measuring |
| Concludes with hypotheses and grounded theory | Starts from a hypothesis and Theory |
| Emergence and portrayal | Manipulation and control |
| Inductive and naturalistic | Deductive and experimental |
| Data analysis through themes from Informants' descriptions | Statistical analysis |
| Data reported in language of Informant | Statistical reporting |
| Descriptive write-up | Abstract, impersonal write-up |
| **Role of researcher** | |
| Researcher as instrument | The researcher applies formal Instruments |
| Personal involvement | Detachment |
| Empathic understanding | Objective |

### 3.4.1 Quantitative Methods

McQueen & Knussen (2002) argued that quantitative research typically employs a numerical system to measure or describe the social world, with the assumption that everything can be described or measured using such a system. Quantitative research offers significant statistical advantages, as large amounts of data can be collected and analysed in a logical and replicable manner. Quantitative research is used to understand a problem by generating diverse numerical data and to transform usage statistics. It helps quantify attitudes, opinions, behaviours, and other defined variables (Jensen, 2017).

Quantitative research methods are described in terms of the research philosophies of positivism and empiricism, which are commonly applied in physical sciences research (Locke et al., 2000). Typically, as Jupp (2006) and Szyjka (2012) observed, quantitative methods are linked to the positivist philosophy, meaning that these methods are of use when objectivity (not subjectivity) enables a researcher to gain insights into phenomena. Objectivists consider empirical evidence as vital to discovering knowledge on phenomena, and such evidence is gathered through the exploration of facts and causal events using quantifiable, observable, and objective data (John W. Creswell, 2003; Szyjka, 2012) explained that when applying quantitative methods, a researcher will typically identify and categorise specific variables; then, the researcher will create hypotheses about the relationships between these variables and will conduct investigations (e.g., correlational analysis) to confirm or reject these hypotheses.

According to Plano Clark & Creswell (2008), the key advantage of quantitative research is its ability to provide an objective viewpoint, derived from an understanding of the facts drawn from the data. In this way, as Duffy (1985) and Locke et al. (2000) pointed out, the researcher can safeguard their independent and objective outlook as they endeavour to interpret the facts. Additionally, Edmunds stated that *"quantitative research provides results that can be*

*generalised to a specific population as it is based on statistical sampling of the target population" (Edmunds, 1999)*. Quantitative research aims to discover objective truths that can be generalised across similar contexts and circumstances, and it is this generalisability that makes this research especially valuable in the areas of public health and the natural sciences (Wight & Abraham, 2000; Howden-Chapman et al., 2007; Locke et al., 2000). Nonetheless, Carr (1994) argued that quantitative approaches are less flexible, due to the quantitative parametric experiments involved, and are not suitable for natural settings.

It can be concluded that an examination of the relationships between the diverse variables impacting obesity in Saudi Arabian children, along with the elucidation of data on their occurrences and causes thereof, can benefit from the use of quantitative research methods. Moreover, Parahoo (2014) stated that quantitative data can identify additional evidence and information about the values, meanings, and beliefs linked to physical activity and healthy eating. By adopting quantitative methods in this study, the findings of this research will be more generalisable to the Kingdom of Saudi Arabia.

There are two key approaches associated with quantitative research methods: experimental and non-experimental (Thomas, 2003). First, Cormack (2000) explained that the experimental approach has a tendency towards manipulating and controlling study variables. Carr (1994) elaborated that experimental and quasi-experimental quantitative research generates objective and measurable evidence to explain relationships between variables, which involves the manipulation of an independent variable to measure the effect it has on a dependent variable. Second, as Lobiondo-Wood and Haber (2006) argued, the aim of non-experimental quantitative research is generally to examine people, situations, or events or to create an overview of observable phenomena.

**Experimental:** This method is able to manipulate variables and is used to identify cause-and-effect relationships. It requires research to be conducted in a lab or places with experimental groups (McCusker & Gunaydin, 2015). It is utilised in laboratory-based experiments in order to attain a high level of control and reliability.

**Non-Experimental:** This method allows the researcher to control, alter, and manipulate variables (Barnham, 2015); however, it relies on interpretation, observation, and interactions to obtain a conclusion.

#### *3.4.1.1 Quantitative Data Collection Types*

- **Survey Questionnaires:** Survey questionnaires are a method that is used to gather data through a questionnaire (Walter & Andersen, 2016). Researchers conduct surveys in various ways, including paper-based questionnaires, self-completion questionnaires, and Internet-based questionnaires, among others.

### 3.4.2 Qualitative Methods

Qualitative research is typically used in social and behavioural studies; it is concerned with developing explanations of social phenomena and assessing opinions, attitudes, and behaviour. In qualitative research, the design is more flexible, developing throughout the data collection process (Robson, 2002). Norman & Lincoln (1994) argued that in qualitative research, the choice of tools and practices to use depends on the research questions and the context; they are not set in advance. (Glesne, 2006) highlighted the popularity of qualitative research methods for examining complicated social phenomena and explained that this approach involves the careful investigation of the viewpoints and ideas of the study population. (Myers, 1997) added that qualitative methods provide researchers with the opportunity to conduct an in-depth

analysis of data by evaluating narratives and their meanings, and thus, in turn, the data. In other words, qualitative research is a process of inquiry conducted in a natural setting that aims to interpret human or social issues through the construction of a detailed and holistic image derived from narratives and the comprehensive viewpoints of the participants (John W. Creswell, 2003).

The research philosophies underpinning qualitative research are constructivism and interpretivism (Lincoln & Guba, 1982). Qualitative methods can be understood as interpretive because they investigate phenomena by examining a broader social context and/or people's personal experiences and interpersonal interactions (Tashakkori & Teddlie, 2008). According to Newman (2006), qualitative methods involve a naturalistic approach, the aim of which is to understand phenomena in context-specific and uncontrolled settings. The collection of data thus occurs in a natural setting, and the researcher is considered to have a personal investment in the research. Consequently, a qualitative researcher is seen as a central instrument of their study. Data analysis in qualitative research is detailed and time-consuming; accordingly, Szyjka (2012)and Saunders et al. (2009) argue that qualitative research is more suitable for studies involving smaller sample sizes. In addition, the qualitative approach is inductive, and it facilitates the detailed analysis that health studies demand.

In order to understand children's perceptions of the connections between physical activity, diet, and obesity, it is vital to apply qualitative research, as qualitative methods enable the examination of thoughts, attitudes, perceptions, and experiences. Qualitative research adopts an interpretivist approach and centers on the social factors that affect the social sciences and nature, in contexts where people can interpret their surroundings or themselves (Mackenzie & Knipe, 2006). This focus is essential in any attempt to answer 'how' and 'why' questions concerning lifestyle behaviours and obesity in children. The value of qualitative research in health studies lies in its ability to allow members of a study population to freely express their

thoughts and feelings about, as well as discuss their experiences with, elements such as physical exercise and diet.

The points outlined above reveal that it would be ineffective to apply a single research approach in this study: quantitative methods can define behaviour and lifestyle variables and their relationships with each other, while qualitative methods can examine participants' reactions and experiences concerning certain situations by gaining an understanding of underlying reasons, opinions, and motivations. Qualitative research helps provide solutions to problems and develop ideas and hypotheses for quantitative research (Alvesson & Sköldberg, 2017). Therefore, the nature of this research necessitates a mixed-methods approach to gather and analyse the necessary data and thereby adequately answer the study questions.

#### *3.4.2.1 Types of Qualitative Methodology*

- **Case Studies:** These are used to explain an organisation or an entity in research work. It is used in various areas, including education, health, and the social sciences, etc. Taylor et al. (2015) argued that it can be challenging to operate sometimes, as it involves deep dives and a thorough understanding of data collection methods and inferring from the data.
- **Interviews:** This is one of the most common qualitative research methods. They are a purely conversational method that provides openings for the respondents. The technique offers opportunities to gather data and understand people's motivations (Flick, 2018). It helps in gaining experience by asking the right question to the right person and thereby collecting meaningful data.
- **Focus Group:** According to Fletcher (2017), this is the standard method used in data collection. It does not require interaction with the group or

individuals; however, it is an expensive method that is used to explain complex processes. It is used in market research when testing new products and concepts.

- **Observation:** This process uses personal properties to gather information and data. It helps compare qualifying differences (Lew et al., 2018). Observation is a data collection method defined by watching behaviours and events or noting physical characteristics in their natural setting (Team, 2008).

## 3.5 Mixed-Methods Approach

Mixed-methods research involves the collection, analysis, and integration of both quantitative and qualitative data, which helps provide an understanding of the research problem. The most advantageous characteristic of this approach is that it offers possibilities in terms of triangulation; it utilises different data resources, methods, and researchers to examine the same phenomenon (Brannen, 2017). The disadvantages arise when the research design is complex; in such cases, considerable time is needed to plan and implement this type of research. In studies on health and social sciences, this approach can be used to analyse the quantitative data from different qualitative interviews, while health visitors conduct observations in primary health settings. In this way, the mixed-methods approach offers the potential to harness the strengths while balancing the weaknesses of both qualitative and quantitative designs to address complex health issues and other living chronic diseases (E. Smith et al., 2017). It is essential for the researchers to present mixed methods as an appropriate design for answering the research question.

The core idea of mixed-methods research (Greene, Caracelli, & Graham, 1989) is that the combination of quantitative and qualitative research provides a greater understanding of the study's problems than either methodology alone (Creswell, 2005). This type of research design is used by researchers to combine the different elements of qualitative and quantitative research approaches; it enables the use of qualitative and quantitative viewpoints, data collection, and analysis in order to gain breadth and depth in understanding and validation (Palinkas, Horwitz, Green, & Wisdom, 2015). It is helpful for generalising the data and aids researchers in designing and validating their instruments.

The four major types of mixed-methods designs are triangulation design, embedded design, explanatory design, and exploratory design (Clark et al., 2008; Ivankova & Creswell, 2009).

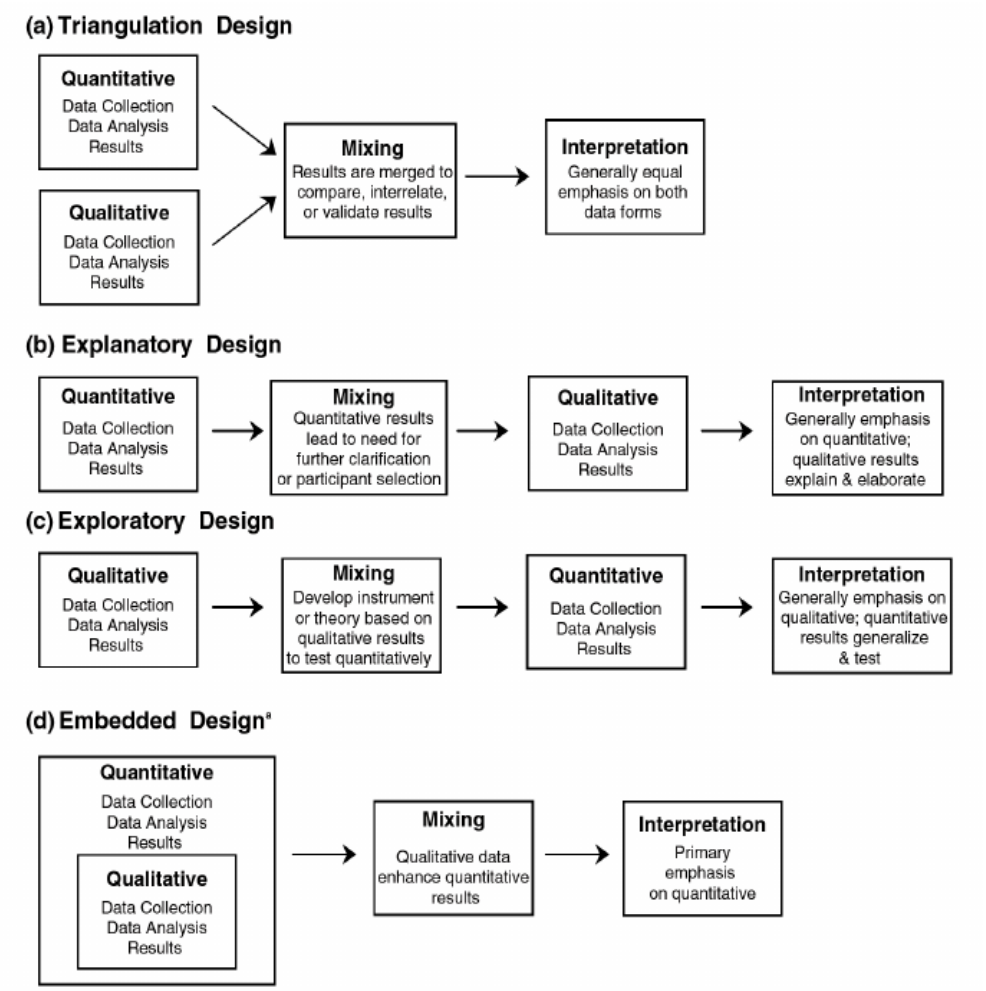


Figure 3.2 The Four Major Mixed-Methods Designs. This figure is based on Creswell and Plano Clark (2007), adapted by Clark et al. (2008)

## 3.6 Sampling

In designing research, sampling is used to take measurements of larger populations, groups, people, objects, and items. The sample is representative of the population, in order to ensure the findings can be generalised from the research sample to the population. The researcher depends on the reliability of the findings in selecting the sample, which includes individuals from various sections and domains of the population to ensure it is genuinely representative of the whole population (Robertson & Sibley, 2018). The researchers study

sample populations, rather than the whole population; this helps make the research activities manageable and convenient for the researcher. Researchers use sampling to collect data from every individual in a smaller group that represents the larger group; if the sample is truly representative of the population in question, the researchers can take the results and generalise them to the wider population.

In the context of health sciences, sampling is used to restrict the age, sex, group, and socioeconomic background concerning the disease. It is applicable to a particular group of people. Researchers' decisions on sample selection are important. To choose the appropriate setting, it helps to consider the inclusion and exclusion criteria. The probability sampling technique is used to obtain unbiased results (Gentles et al., 2015) to ensure the reliability and validity of the sample's inferences. There are three primary probability sampling methods used in medical research: random sampling, stratified sampling, and cluster sampling. It is essential for the researcher to provide an optimal sample size for the research; this must be carefully considered during the planning and design phase of clinical research to provide a power analysis.

### 3.6.1 Probability Sampling Types

Probability sampling is a type of sampling in which every individual in the population has an equal chance of being selected (Guetterman, 2015), ensuring that a diverse subset is represented in the sample. A few different types of probability sampling are used in research.

#### *3.6.1.1 Simple Random Sampling*

This sampling is used to randomly select individuals for the sample from among the entire population (Rubin & Babbie, 2016). It often uses the aid of a computer program or a random-number generator.

#### *3.6.1.2 Stratified Random Sampling*

This sampling method divides the population into subgroups and selects a simple random sample from each subgroup (Yom, 2015). This is used to provide greater statistical accuracy than simple random sampling, and it helps ensure that certain groups are represented in the sample.

#### *3.6.1.3 Cluster Sampling*

Cluster sampling involves dividing the population into small clusters, typically based on geographic location and boundaries (Flick, 2018); the researcher collects data from five different groups, which then make up the sample.

### 3.6.2 Non-Probability Sampling

Barnham (2015) explained that non-probability sampling involves selecting participants based on the chosen method for research. One disadvantage of this method is that volunteers are different from non-volunteers in certain variables. There are different types of non-probability sampling.

#### *3.6.2.1 Convenience Sampling*

Convenience sampling is considered a non-probability sampling method and is often utilised in clinical and qualitative research. With this sampling technique, clinical cases or participants

available within a specific location, such as hospitals, medical records databases, internet sites, or customer membership lists, are selected (Stratton, 2021).

One disadvantage of using convenience sampling is that the identified associations and effects cannot be generalised to the target population. However, this technique is simple, not costly, and less time-consuming than other sampling strategies (Golzar et al., 2022; Stratton, 2021).

#### *3.6.2.2 Purposive Sampling*

The main aim of purposive sampling is to select participants who are most likely to provide appropriate and useful information. This sampling method helps identify and select cases in a way as to effectively utilise limited research resources (Amankwaa, 2016; S. Campbell et al., 2020).

This sampling method deviates from random sampling techniques and aims to ensure that specific types of cases—namely those which are most relevant—are included in the final research sample. The reason for adopting a purposive strategy is that, given the aims and objectives of the study, specific groups of people may hold different and important perspectives on the ideas and issues under consideration, and therefore need to be included in the sample (S. Campbell et al., 2020; Robinson, 2014).

#### *3.6.2.3 Quota Sampling*

The use of quota sampling offers greater flexibility compared to requiring fixed numbers of cases with specific criteria. The quota sampling method identifies categories and specifies the minimum number needed for each; as the study proceeds, the numbers in each category are monitored to ensure the quotas are met. The minimum quota ensures that key respondents are

part of the final sample, which may result in greater flexibility in shaping the sample (Yang & Banamah, 2014).

## 3.7 Questionnaire Validity and Reliability

In quantitative research, reliability and validity are key aspects, with validity being the primary consideration. Validity confirms the quality of the tool or instrument (such as a questionnaire) and is crucial (Masuwai et al., 2024). In other words, validity refers to the accuracy with which the items of a tool or instrument evaluate the concept being measured in the research study (Oluwatayo, 2012).

The different methods for examining validity recommended by Zhang & Garcia (2023) include face validity, content validity, construct validity, and criterion-related validity. Face and content validity represent subjective assessments by researchers. Face validity involves researchers' subjective assessments of the instrument's appearance and relevance, considering whether its items seem relevant, reasonable, and clear; face validity is generally regarded as the weakest form of validity (Connell et al., 2018). Content validity evaluates whether the questions or items in an instrument (e.g., a questionnaire) accurately and comprehensively represent the subject being measured. However, there is a concern associated with content validity, which is determining whether the questionnaire includes appropriate questions that define the construct under evaluation (Masuwai et al., 2024). Consequently, researchers typically seek alternative methods to validate their instruments (Deniz & Alsaffar, 2013). For questionnaire design, two other validity concepts that are frequently employed are criterion validity and concurrent validity. Criterion-related validity refers to the extent to which the survey's measurements correspond to other external criteria (Taherdoost, 2016). Concurrent

validity is assessed simultaneously with the survey, either through questions within the survey or through measures acquired from other sources (Deniz & Alsaffar, 2013).

## 3.8 Justification for the Selection of Pragmatic Philosophy and Mixed Methods Approach

In this thesis, I explore the issue of childhood obesity in Saudi Arabia, a significant public health challenge with multifaceted causes and consequences. To address this complex issue, I have chosen to adopt a pragmatic philosophical approach combined with a mixed-methods research design.

I believe that adopting a pragmatic philosophy and a mixed-methods approach is crucial to obtaining a comprehensive and practical understanding of the problem. Pragmatism, as a philosophical approach, emphasises finding practical solutions to real-world problems. This makes it particularly suitable for my research on childhood obesity, as the goal is not only to understand the causes and consequences of the issue but also to find effective ways to address it in the Saudi context.

The pragmatic philosophy emphasises the need for research to be directly related to real-world problems, rather than being confined to theoretical constructs. Given that childhood obesity in Saudi Arabia is influenced by various factors, including cultural norms, socioeconomic conditions, and healthcare systems, a pragmatic approach enables a more flexible, solution-oriented investigation. This philosophy encourages a combination of both qualitative and quantitative research methods to address the complexity of the issue. This is particularly important when dealing with an issue like childhood obesity, where both numerical data and

contextual factors (such as cultural perceptions and lifestyle habits) are essential for understanding the phenomenon in depth.

The selection of a mixed methods approach enables me to integrate the strengths of both qualitative and quantitative research. The quantitative component allows the identification of demographic patterns and the exploration of risk factors in a larger population. On the other hand, the qualitative component provides a deeper understanding of the experiences, attitudes, and beliefs of children, parents, and healthcare professionals regarding obesity. This combination of data types provides a more complete picture of the issue. Moreover, the use of mixed methods allows me to triangulate the findings, enhancing the validity and robustness of my research. The flexibility inherent in the mixed methods approach also allows me to adapt my research to the unique cultural and social context of Saudi Arabia, ensuring that the results are both relevant and meaningful.

Sequential explanatory design is a type of mixed-methods research; it involves an initial phase of quantitative data collection, followed by a qualitative phase. It is used to analyse the phase of quantitative data collection and analysis. The purpose of this type of research is to explore the phenomenon, specifically developing and testing new instruments (Patten & Newhart, 2017). With respect to health outcomes, a valuable use of the sequential explanatory design is determining the causes of a condition and integrating quantitative measurements with qualitative exploration. It contributes to the behaviour of the context and allows the researchers to address considerations for instrument development, preparation, and testing of the health condition.

## 3.9 Selection of Data Collection Tools

The selection of appropriate data collection tools for this thesis was a key step in ensuring the validity and reliability of the research findings. To make an informed decision, I first conducted a comprehensive review of the existing literature and relevant documents related to my research topic, which allowed me to examine various tools employed in similar studies and understand their strengths and limitations in addressing the research objectives.

In addition to the literature review, I participated in six workshops that were part of the Healthy Weight Care Pathway for children in Lambeth, London. These workshops focused on children's healthy eating and physical activity, providing me with practical insights into effective strategies for promoting healthy lifestyles in children. Throughout these workshops, I had the opportunity to engage in informal discussions with facilitators, teachers, and other participants, which enriched my understanding of the real-world application of data collection in this field.

By integrating the knowledge gained through the workshops and informal discussions with my document review, I was able to carefully select tools that would be both effective and culturally appropriate for my research, ensuring that the data collected would provide a comprehensive understanding of the topic.

Parents and school survey questionnaires have been generated from an established and validated survey that was used in previous studies. This instrument was developed by Annabelle Wilson, Anthea Magarey, and Nadia Mastersson (2013) (Wilson et al., 2013). The questionnaire was developed by members of the Eat Well Be Active Community Programme of Australia, which included academics with expertise in childhood obesity, nutrition, physical activity, and community development. More details about these instrument domains and

questions are available in the methods section of Chapters 4 and 5 (the questionnaires are attached in Appendices A and B, respectively).

The interview guide used in this study was developed based on the initial findings from the quantitative studies, as well as a document containing sample key informant interview questions related to healthy eating and active living policies. The sample questions were created and adapted by Washington University, Transtria, and Active Living by Design, drawing on established frameworks. Many of these items were sourced from the WK Kellogg Food and Fitness Planning and Assessment Guide, which provides a comprehensive approach to assessing food and fitness policies. The guide aimed to explore key issues surrounding the implementation of policies promoting healthy eating and physical activity, with a focus on identifying barriers, facilitators, and the effectiveness of current practices within the context of Saudi Arabia (see Appendix C).

## 3.10 Data Collection Tools Validation process

**Parents' Questionnaire Pilot Testing**

Initially, the parents' questionnaire underwent a pilot testing phase with 30 participants from the target population. The purpose of this pilot was to assess the clarity, relevance, and comprehensibility of the questionnaire items and to identify any potential difficulties participants might encounter when responding to the questions. Participants were asked to complete the questionnaire and provide feedback regarding their experience while answering it.

During this process, participants were encouraged to highlight any questions they found confusing or difficult to interpret. They were also asked to comment on the clarity of the wording, the appropriateness of the response options, and the overall structure of the questionnaire. This feedback helped identify several areas that required revision.

Based on the participants' feedback, modifications were made to improve the wording of certain questions, clarify instructions, and reduce potential ambiguity. In addition, some response options were revised to better capture the range of possible answers. For example, several participants reported difficulty understanding what constitutes a portion of fruit for a child. To improve clarity, an explanatory note was added to the questionnaire stating that "one portion is approximately the amount that can fit in the palm of a child's hand." These revisions helped ensure that the questions were more easily understood by participants.

**School Questionnaire Pilot Testing**

The school questionnaire was also piloted prior to the main survey distribution. Five schools in Najran were selected to review the questionnaire before it was administered more widely. The purpose of this step was to ensure that the questionnaire was appropriate for the school context, clearly understood by teachers, and relevant to the educational environment. Piloting the questionnaire with schools allowed potential issues to be identified and addressed before the large-scale distribution of the survey.

Each participating school formed a small panel of teachers who reviewed the questionnaire and provided feedback. The teachers were asked to assess the clarity, relevance, and cultural appropriateness of the questions, as well as the extent to which the items reflected factors influencing childhood obesity within the school environment. They were also invited to suggest improvements to the wording of questions, recommend additional items that might be relevant, and identify any questions that might be unclear or unnecessary.

The feedback from the teachers resulted in several improvements to the questionnaire. Some questions were reworded to make them clearer and easier for school staff to interpret, while others were simplified to reduce ambiguity. In addition, minor adjustments were made to ensure that the terminology used in the questionnaire was appropriate for the school context and aligned with common practices within Saudi schools. These revisions helped ensure that the final questionnaire was both culturally appropriate and relevant to the educational setting.

**Piloting the Interviews**

Prior to the main phase of data collection, the semi-structured interview guide was piloted with two individuals who held comparable roles to those of the intended participants but were not included in the final sample. The purpose of the pilot was to assess the clarity, relevance, and flow of the interview questions, as well as to ensure that the questions aligned with the study's conceptual framework based on Bronfenbrenner's ecological systems theory.

Feedback from the pilot interviews informed several refinements to the interview guide. This included rewording questions to enhance clarity, adjusting the sequence to facilitate a more natural conversational flow, and adding follow-up prompts to encourage deeper reflection on policy-related barriers and facilitators. The piloting phase also allowed the researcher to assess the suitability of the interview duration, confirm the effectiveness of the audio recording process, and develop confidence in probing techniques and managing the interview environment.

## 3.11 Statistical Analysis Method

To analyse the relationships and correlations between the main variables in this study; namely population characteristics, perceptions, knowledge, and school environment-related factors. MATLAB software (version R2023a) was utilised to determine Spearman's rank correlation coefficients. This nonparametric measure was selected for its ability to measure monotonic relationships without assuming normality or linear associations between variables. Using MATLAB's 'corr' function with the 'Type' parameter set to 'Spearman', we calculated correlations between all specified variables. This was applied using the following MATLAB function: [rho, p] = corr(x, y, 'Type', 'Spearman'), where x and y refer to the paired observations for each variable combination (See Appendix D). This method was used to determine the strengths and directions of the correlations between variables. The results have a value between -1 (significant negative correlation) and 1 (significant positive correlation). Statistical significance was also calculated using a threshold of $p < 0.05$, with a p-value less than 0.05 considered a significant correlation. The results were then visualised using a heatmap, generated using MATLAB's 'heatmap' function. Although the primary statistical analysis was conducted using SPSS, a member of staff with expertise in statistical visualisation at the University of Hertfordshire provided guidance and support in using MATLAB to generate the heatmap and enhance the visual presentation of the correlation results.

## 3.12 Translation and Back-Translation of Data Collection Tools

To ensure the linguistic and cultural appropriateness of the data collection tools, I employed a systematic translation and back-translation process. The original instruments, consisting of a questionnaire survey and interview guide, were first translated from English into Arabic. To achieve this, I invited two bilingual English teachers from Saudi Arabia, who are fluent in both

languages and knowledgeable in the research context, to assist with the translation. Their expertise in terminology ensured that the translated versions accurately conveyed the intended meaning while remaining culturally appropriate. After completing the initial translation, I conducted a back-translation procedure. A third bilingual English teacher, also fluent in both Arabic and English, independently translated the Arabic versions of the instruments back into English. This back-translator was unaware of the original English versions to minimise any bias and ensure the translation was accurate. The translated and back-translated versions of the questionnaires and interview guide were then compared for consistency. Any discrepancies between the two versions were discussed with the translators, and necessary adjustments were made to ensure that the original intent and meaning were preserved. This rigorous translation and back-translation process helped ensure that the data collection tools were linguistically accurate and culturally sensitive, thus enhancing the validity and reliability of the research findings. Furthermore, participants' responses, which were provided in Arabic, were translated into English for the purposes of analysis and reporting while preserving their original meaning and context. Ethical considerations were strictly observed throughout the research process. Participants' privacy and confidentiality were protected by removing all identifying information and assigning anonymised codes (e.g., P1, P2) when presenting the findings. All data were securely stored and used solely for academic research purposes in accordance with institutional ethical guidelines.

## 3.13 Ethical Considerations

The Ethics Committee at the University of Hertfordshire, Health and Human Sciences ECDA in the United Kingdom has reviewed and approved this study, protocol number: LMS/PGT/UH/02038. The Ministry of Health in Saudi Arabia-General Directorate of Health

Affairs in Najran-Public Health Department has also issued similar letters of permission to collect data and conduct this study (Appendices E & F).

# Chapter 4 Parental Influences on Children's Physical Activity and Healthy Eating in Najran, Saudi Arabia

## 4.1 Background

According to the World Health Organisation (WHO), the Gulf countries have some of the highest rates of obesity, with Kuwait, Bahrain, Saudi Arabia, and the United Arab Emirates being among the top ten countries worldwide for obesity (ALNohair, 2014a).

In Saudi Arabia, a study conducted in 1991 with 4800 children (6–18 years old) found that the prevalences of overweight and obesity among Saudi boys were 17.6% and 11.3%, respectively (Al-Sekait et al., 1992). Another study in 1996 found that the overall prevalence of overweight was 11.7%, and that of obesity was 15.8%, among male schoolchildren (6–18 years old) (Al-Nuaim, Bamgboye, & Al-Herbish, 1996). Furthermore, a study conducted with primary school boys in the central area of Saudi Arabia in 2005 found a prevalence of obesity of 24.5% (Al-Hazzaa, 2007). A more recent study conducted in Tabuk city in the northern area concluded that the prevalences of overweight and obesity among male primary school students were 7.3% and 17.4%, respectively. In comparison, the prevalences of overweight and obesity among female students were 12.4% and 20.9%, respectively (Al Dahi et al., 2014).

The high and accelerating prevalence of obesity in the Middle East has been related to several factors, including increased urbanisation, higher incomes leading to changes in food habits (e.g., increased consumption of fatty, salty, and fast food), and the lack of exercise and physical activity due to lifestyle changes (ALNohair, 2014b; WHO Consultation on Obesity (1997: Geneva et al., 1998). Saudi Arabia is one of the five top oil-exporting countries across the world (Klautzer et al., 2014); since the discovery of oil, incomes have grown significantly. Although this income growth provides increased opportunities for developing healthcare and

education infrastructure, it brings with it a shift in food habits and more opportunities for sedentary lifestyles, especially among youth (Badran & Laher, 2012). In Saudi Arabia and the wider Gulf region, an important part of socialisation is large portions of food, which almost consist of meals with rice (high in carbohydrates) and meat (high in fat) (Al Othaimeen et al., 2007). In addition, access to sport and exercise facilities is limited, due to (among other things) high temperatures and weather, which force people to stay indoors, along with traditional cultural barriers to sports and exercise, especially for women. More than half of boys aged 7–12 years old in Riyadh do not participate in even moderate levels of physical activity, and 81% of adult men in Riyadh city are inactive. Almost all (99.5%) adult women in Asir province engage in no exercise of any type (ALNohair, 2014a).

Research has found evidence that the obesity epidemic could be spreading through social networks (Christakis & Fowler, 2007): the chance of becoming obese increases by 57% if a person has a friend who became obese, and the likelihood of one spouse becoming obese increases by 37% when the other spouse is obese. In addition, people of the same gender have a greater influence on each other than those of a different gender. Furthermore, the social transmission of unhealthy behaviour could occur as adult-to-child and as child-to-child (Frerichs et al., 2013). Accordingly, parental and family engagement in child health-promotion interventions is important, as parents can play a critical role through their influence on their children's eating habits, behaviour, and level of physical activity. Consequently, it is essential that health educators and service providers understand what parents perceive as weight management strategies for their children (Wills & Lawton, 2015); such understanding could help in developing and sustaining patient-centred care and services.

Parents and family members are an important part of addressing overweight and obesity, particularly in children. Parents' behaviours and habits influence their children in terms of an active or inactive lifestyle (sedentary lifestyle, TV watching) and the diet and nutrition

environment (healthy food choices). Parents' perceptions of their children's weight are essential in addressing obesity. It is important in obesity intervention that parents are able to recognise children's (over)weight condition, level of physical activity, and healthy food choices. Therefore, it is important to explore various aspects, including: knowledge about the role of parents and other family members in preventing obesity; the level of engagement of schools and other sectors in addressing obesity (i.e., the activities or programmes in place); and the social, cultural, and environmental barriers which may influence diet and nutrition choices and engagement in indoor or outdoor physical activity.

## 4.2 Methods

### 4.2.1 Aim and Objectives

#### Aim:

To investigate how factors within the home environment, including parental behaviours, socioeconomic characteristics, and family dynamics, influence children's eating habits, physical activity, and sedentary behaviours associated with childhood obesity in Saudi Arabia, within the interpersonal level of the Ecological Model.

#### Objectives:

• To examine the association between socioeconomic and demographic characteristics (such as household socioeconomic status, parental education level, family size, and child gender) and children's eating behaviours, physical activity, and sedentary behaviours.

• To explore parents' perceptions and awareness regarding their children's eating habits, physical activity levels, and risk of obesity.

• To assess the role of parental support behaviours (such as encouragement, role modelling, monitoring, and facilitation) in shaping children's healthy eating, physical activity, and screen time behaviours.

• To identify key home environmental factors that may contribute to unhealthy lifestyles and increased risk of childhood obesity among children in Saudi Arabia.

### 4.2.2 Study Setting

To recruit participants for this study, we selected the research site of Najran City in Saudi Arabia. According to the General Authority for Statistics in Saudi Arabia, in 2016 the city's population was 569,332. As an average Saudi city, Najran was selected instead of a large city with special characteristics, as the latter might result in biased estimates of some main variables (such as cultural and social factors). For example, in Riyadh the capital city and the main trading destination and location of goods exchange, hundreds of thousands of foreign workers labour in the city, while Jeddah has received millions of pilgrims of different ethnicities and backgrounds over the years, many of whom have stayed and become residents of the city. Moreover, Najran is an under-researched context with respect to obesity and healthy lifestyles: to the best of the researcher's knowledge, no study has been conducted on this topic in this city to date, which makes it an attractive choice. Finally, the researcher's background, including social contacts and previous work experiences, can be considered another main factor for choosing this setting.

### 4.2.3 Sampling

To obtain the sample population for this study, a combination of non-random sampling methods, including self-selection and snowball sampling, was used. The sample of this study included parents and caregivers of children under the age of 18 years. In order to ensure

appropriate participant recruitment, sampling began with a self-selection approach involving adults who have or take care of children: such adults were approached in places where the available adults were most probably parents, such as school areas, family sections in shopping malls, the researcher's social network, and social events. This was followed by a snowball approach, in which participants were asked to provide contacts to recruit more participants from their social, personal, or work networks.

### 4.2.4 Data Collection

The data collection period occurred in October and November 2016. An online survey was developed using surveymonkey.com. For participants who were willing to complete the survey in the presence of the researcher, the latter provided participants a tablet device (iPad) with online access. However, the majority of participants preferred to complete the survey in their free time. For these participants, the researcher provided a survey link, which was sent via the WhatsApp application along with a short invitation. All participants were asked to circulate the survey link to their contacts.

The online method was particularly useful in the context of Saudi Arabia, as it enabled the researcher, as a male investigator, to reach a larger number of mothers who play a primary role in childcare and nutrition. Online distribution allowed mothers to participate conveniently and privately without the need for direct face-to-face interaction, which may otherwise limit participation due to cultural or social considerations.

However, despite these efforts, certain limitations remain. Online surveys may underrepresent parents with limited internet access or lower digital literacy. Additionally, the use of social and professional networks may introduce convenience sampling bias. Future studies may consider combining online surveys with additional methods such as paper-based questionnaires

distributed in schools or primary healthcare centres to improve representation across different socioeconomic groups.

### 4.2.5 Survey Question Design

The questionnaire contained closed multiple-choice questions, with some questions including the option to check all that apply. A free-text box was provided for participants to offer any other comments. The questionnaire was divided into four sections. In section one, the following demographic information was collected: gender, age group, level of education, family size, employment status, and average monthly income.

Section two collected data on food availability at home. The main question in this section was "*How frequently do you buy (bring to your home/family)…?*" Under this question were a range of sub-questions about beverages, snacks, and fruits and vegetables. The multiple-choice answer categories were 'daily', 'more than once a week', 'once a week', 'monthly', and 'never'.

Section three addressed healthy eating, which was divided into three subgroups: healthy eating attitudes, healthy eating rules, and children's healthy eating behaviours. Each subgroup had a specific range of possible responses. For healthy eating attitudes, responses were ranked from 'strongly agree' to 'strongly disagree', and the answers to the healthy eating rules questions included 'always', 'often', 'sometimes', 'rarely', and 'never'. For children's healthy eating behaviours, responses were ranked from 'Do not eat it daily' to '5 or more', with intermediate ranks of '1', '2', '3', and '4'.

Section four collected data on physical activity and comprised two main subgroups: physical activity attitudes and physical activity rules.

Section five examined the participants' level of knowledge on healthy eating and physical activity for children, such as recommended maximum daily screen time, the recommended

daily servings of fruits and vegetables, and the amount of daily physical activity that children need.

In Section Six, participants were asked about the barriers they perceive that make it harder for their family to live a healthier lifestyle. Answers to these questions had an option to check all that apply, and a free text box was provided for any other comments.

### 4.2.6 Response Rate Calculation

The response rate is a mathematical calculation that aids in understanding the state of and bias in an investigation; it can be calculated by dividing the number of valid responses by the sample's number. In this study, since we used an online survey, we calculated the response rate by dividing the number of participants who accessed the survey by the number of participants who completed the survey. The total number of participants who accessed the survey link was 1154, while the number of completed responses was 787. Thus:

$$response\ rate = \frac{number\ of\ visits\ to\ survey\ link}{number\ of\ completed\ responses} = \frac{1154}{787} = 0.68 = 68\%$$

## 4.3 Results

### 4.3.1 Characteristics of Participants

The total sample of this study consists of 787 parents. The characteristics of the participants are presented in Table *4.1*. Before the study began, we predicted that male participants would outnumber female participants, due to cultural barriers and the traditional norms of Saudi society; in line with this, 67.3% of the sample were men. In terms of age, 37.2% of the participants were under the age of 35 years, 42.6% were aged 35–44 years, and the remaining were 45 years and older.

The participants were categorised into six age groups. The majority of participants were in the two middle age groups—which together comprise the ages 25–44 years—with 72.2% of the sample: most of the males participants were in the 35–44 years age group, while most of the female participants were in the 25–34 years age group. The rest of the sample was distributed as follows: 7.6% in the <25 years age group, 17.9% in the 45–55 years age group, and only 2.3% in the >55 years age group, with one female participant over 65 years.

In terms of educational level, the sample consists of relatively educated participants: almost half of the participants hold at least an undergraduate degree, and 7.8% have a postgraduate qualification. The rest of the sample had a secondary school diploma (21.9%) or had an intermediate or primary school qualification (5.9%).

With respect to family size, more than half of the participants (63.6%) reported that they live with fewer than 6 family members: 41.6% fell within the size category of 4–6 family members, and 21.7% belonged to the size category of 1–3 family members. Beyond that, 28.5% of participants stated that their family size is 7–9 members, and 8.3% of the sample reported living in a family with more than 10 members.

The majority of participants (58.3%) were employed in the public sector, while 10.8% worked in the private sector and 2.4% were self-employed. The remainder were either students (5.10%), not working (16.8%), or retired (3.2%).

In terms of monthly income, 43% of the participants reported that they earn more than 9,000 Saudi Riyals (SR) per month. Below that, 13.1% reported earning 7,000–9,000 SR per month, 10.8% reported earning 4,000–6,000 SR per month, 12.8% reported earning 1,000–3,000 SR per month, and 8% reported earning less than 1,000 SR per month. The remaining 11.9% of participants preferred not to disclose their monthly income.

Table 4.1 Characteristics of parent participants

| Characteristics | Category | Percentage (%) | Frequency (N) | Total |
|---|---|---|---|---|
| **Gender** | Male | 67.30% | 530 | 787 |
| | Female | 32.70% | 257 | |
| **Age** | 15-24 | 7.6% | 60 | 787 |
| | 25-34 | 29.6% | 233 | |
| | 35-44 | 42.6% | 335 | |
| | 45-54 | 17.9% | 141 | |
| | 55-64 | 2% | 16 | |
| | 65+ | 0.30% | 2 | |
| **Education** | primary school | 1.70% | 13 | 787 |
| | Intermediate school | 4.20% | 33 | |
| | Secondary school | 15.10% | 119 | |
| | Diploma (after secondary school) | 21.90% | 172 | |
| | Bachelor's -university degree | 48.20% | 379 | |
| | Postgraduate degree | 7.80% | 61 | |
| | Others | 1.30% | 10 | |
| **Family size** | 1-3 | 21.70% | 171 | 787 |
| | 4-6 | 41.60% | 327 | |
| | 7-9 | 28.50% | 224 | |
| | 10 and more | 8.30% | 65 | |
| **Employment** | Government-public sector | 58.30% | 459 | 787 |
| | private sector | 10.80% | 85 | |
| | Student | 5.10% | 40 | |
| | self-employed | 2.40% | 19 | |
| | Retired | 3.20% | 25 | |
| | Not working | 16.80% | 132 | |
| | Others | 3.40% | 27 | |
| **monthly income** | Less than 1000 SR | 8.00% | 63 | 787 |
| | 1000-3000 | 12.80% | 101 | |
| | 4000-6000 | 10.80% | 85 | |
| | 7000-9000 | 13.10% | 103 | |
| | more than 9000 | 43.30% | 341 | |
| | Prefer not to say | 11.90% | 94 | |

### 4.3.2 Food and Beverage Availability

Participants were asked to report their purchasing frequencies of different food and beverage items; their responses to these questions are depicted in Figure *4.1* and Figure *4-2*.

***Beverages***

More than half (52%) of the participants reported that they brought fizzy drinks into their homes at least once a week: 11.6% purchased fizzy drinks on a daily basis, 16.5% purchased them more than once a week, while 23.9% purchased fizzy drinks once a week. Of the remaining participants, 26.2% reported they purchased fizzy drinks once a month, followed by

21.8% who never purchased or brought fizzy drinks home. Similarly, 11.5% of participants reported that they purchased fruit juice every day, while 37.4% said they purchased it more than once a week, and 24.6% reported that they purchased it once a week. Slightly less than one-quarter (21.4%) of participants purchased fruit juice once a month, and only 5% reported that they never bought it. With respect to purchasing energy drinks, the vast majority (93.5%) of participants reported that they never purchased this kind of drink, and a very few (4.2%) said they purchased it only once a month.

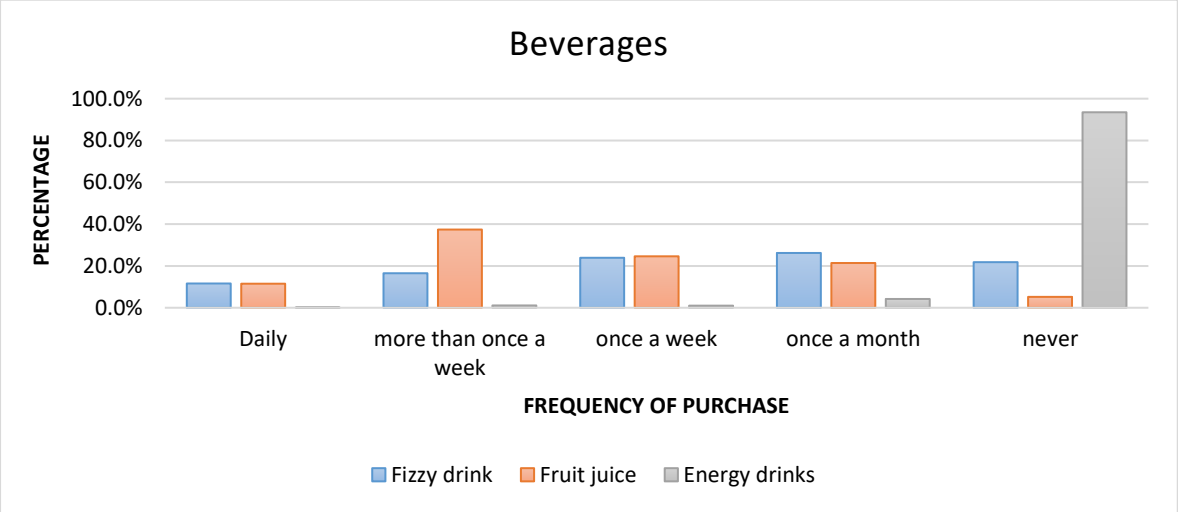


Figure 4.1 Purchasing frequency of different beverages

***Food***

Participants generally reported that they purchased healthy foods (fruits and vegetables) more than non-core foods (crisps, biscuits, chocolates, cakes, and muffins). Participants reported their daily, more than once a week, and once a week purchases of fruits (72%), vegetables (88.4%), chocolate (62.3%), biscuits (76.8%), and cakes, muffins, and donuts (32%), and crisps (64.5%). The percentages of participants reporting that they purchased biscuits every day and

those reporting that they purchased fruits every day were nearly equal. Furthermore, almost three times as many participants stated that they purchased vegetables every day as reported purchasing crisps and chocolate on a daily basis. However, in terms of long-term i.e., monthly purchasing behaviour, almost one-third of participants (31.2%) purchased chocolate, nearly half (46.2%) purchased cakes, muffins, and donuts, and over one-quarter (27.2%) purchased crisps.


Figure 4-2: Purchasing frequency of different food items

### 4.3.3 Healthy Eating Rules

Figure *4.3* shows the frequencies of various rules participants have at home regarding their children's eating behaviours. Almost equal percentages of participants reported that their children always (14.2%), rarely (14.4%), or never (14.4%) watched TV at meal times. A quarter of participants (25.4%) reported that their children often watch TV while eating, and 31.6% reported that their children sometimes watch TV at meal times.

With respect to whether their children were encouraged to eat fruits and vegetables, more than half of the participants (56.2%) reported than they always encouraged their children to eat fruits

and vegetables, followed by 23.6% who often and 17.4% who sometimes encouraged their children to do so.

Participants were asked if they set limits on how regularly their children can have certain drinks or food. The percentage of participants who reported always setting limits was 35.5% for drinks and 25.7% for food; nearly the same number of participants often set limits on their children's drinks and food (25.9% and 25.7%, respectively). For children's drinks, 21.6% reported they sometimes set limits, and 7% reported that they rarely set limits. A quarter (26.5%) of participants said that sometimes they set limits on their children's food, while 10.2% rarely control their children's food and snack intake. Finally, 10% reported never setting limits on drinks, and 12.5% reported never setting limits on food.

With respect to whether they reminded their children to drink water, slightly less than half of the participants (42.4%) reported that they always reminded their children to drink water, followed by 23.3% who often reminded them and 21.1% who sometimes reminded their children to drink water. Of the remaining participants, 7.3% and 5.9% reported that they rarely or never reminded their children to drink water, respectively.

Nearly half of the participants (45.5%) always sat with their children when they had meals, while 36.1% often did and 16.6% sometimes had meals with their children.

One question asked participants if they would make something else if the children did not like what was being served. In response, 16.7% always, 22.7% often, 33.4% sometimes, 13.4% rarely, and 13.8% never reported offering any alternative food.

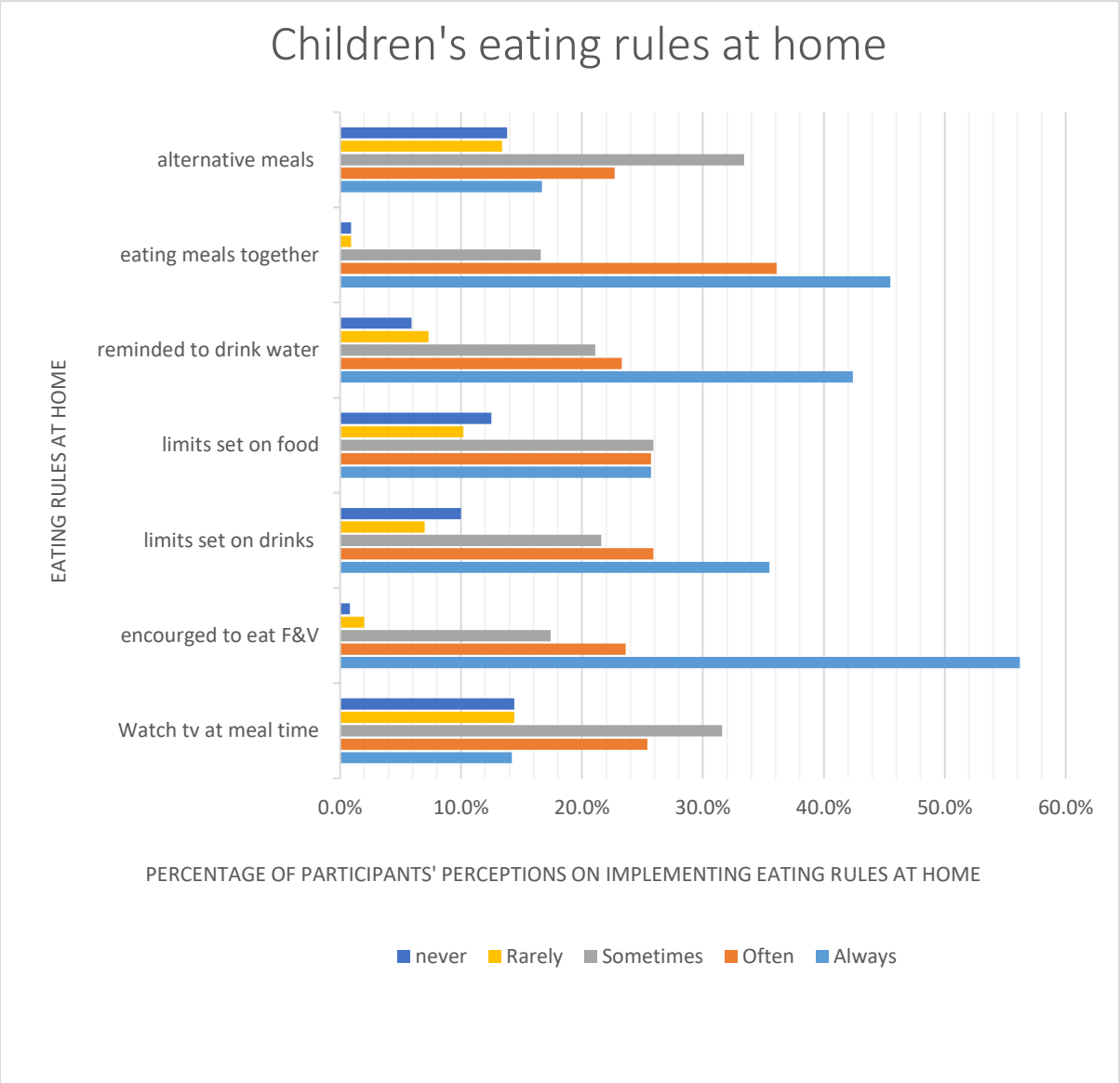


Figure 4.3: Participants' self-reports of applying healthy eating rules with their children at home

### 4.3.4 Children's Daily Consumption of Fruits and Vegetables

Children's daily consumption of fruits and vegetables, as reported by participants, is illustrated in Figure *4.4*. The vast majority of participants reported that their children do not eat fruits (82.4%) or vegetables (83%) every day, or eat only one serving per day. Slightly more than half of the participants (51.1%) said that their children do not have fruits every day, and 44.8% said that their children do not eat vegetables every day. This was followed by 31.1% reporting

that their children have at least one serving of fruit per day and 38.2% reporting that their children have at least one serving of vegetables every day. Only 1.3% of participants reported that their children eat five or more servings of fruits per day, and 1.4% reported that their children eat five or more servings of vegetables per day.

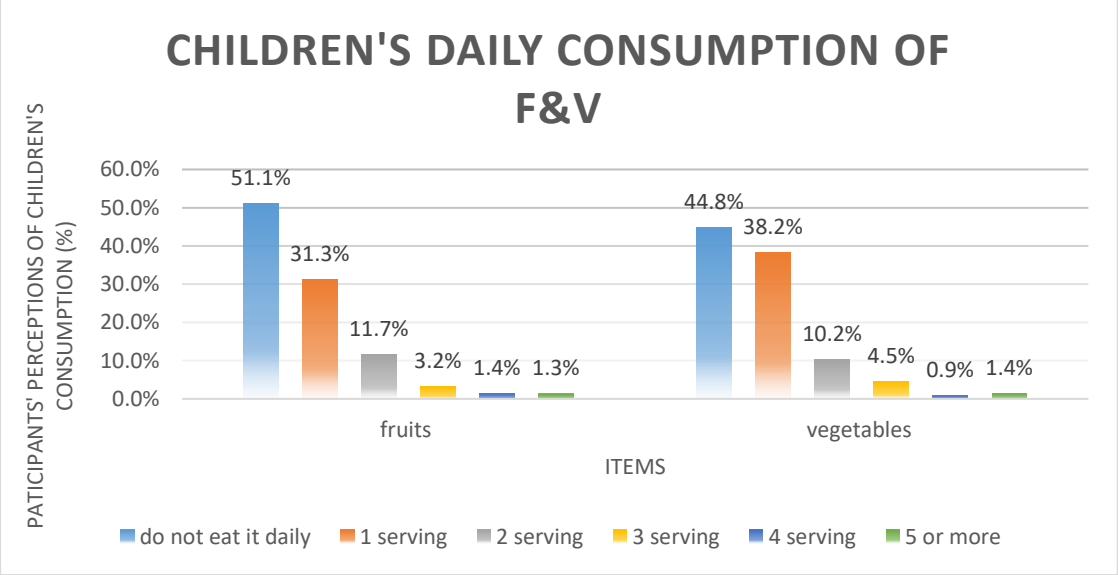


Figure 4.4 Children's daily consumption of fruits and vegetables, as reported by participants

### 4.3.5 Children's Healthy Eating Attitudes

Participants were asked a range of questions in relation to their children's healthy eating attitudes, which are shown in

Table *4.2*.

The majority of participants strongly agreed (50.4%) or agreed (41.6%) that it is highly important that their children eat fruits and vegetables every day. However, 18.4% of

participants strongly agreed and 43.5% agreed that it is difficult to get children to eat fruits and vegetables every day; in contrast, some participants disagreed (18.4%) and strongly disagreed (6.4%) with this statement, meaning they may find it easy to get their children to eat fruits and vegetables every day.

Table 4.2 Children's health eating attitudes

| Statement | Response | Count N | Percentage % |
|---|---|---|---|
| **My child eating fruit and vegetables every day is a high priority for me** | strongly agree | 397 | 50.4% |
| | Agree | 327 | 41.6% |
| | not sure | 62 | 7.9% |
| | not agree | 1 | 0.1% |
| | strongly not agree | 0 | 0.0% |
| **I find it difficult to get my child to eat fruit and vegetables every day** | strongly agree | 145 | 18.4% |
| | Agree | 342 | 43.5% |
| | not sure | 105 | 13.3% |
| | not agree | 145 | 18.4% |
| | strongly not agree | 50 | 6.4% |
| **There are no stores selling fresh fruit and vegetables within easy walking (i.e. 10 minutes walking) distance of our Home** | strongly agree | 142 | 18.1% |
| | Agree | 237 | 30.2% |
| | not sure | 102 | 13.0% |
| | not agree | 203 | 25.8% |
| | strongly not agree | 102 | 13.0% |
| **Fresh fruit and vegetables are too expensive** | strongly agree | 76 | 9.7% |
| | Agree | 235 | 29.9% |
| | not sure | 165 | 21.0% |
| | not agree | 245 | 31.2% |
| | strongly not agree | 65 | 8.3% |
| **There is not enough information about healthy eating for children in our neighbourhood or school.** | strongly agree | 414 | 52.7% |
| | Agree | 235 | 29.9% |
| | not sure | 77 | 9.8% |
| | not agree | 43 | 5.5% |
| | strongly not agree | 16 | 2.0% |

In terms of fruit and vegetable availability at grocery stores near home, nearly half of the participants strongly agreed or agreed that there are no such groceries available near their

homes. However, more than one-third disagreed or strongly disagreed with this statement, while 13.0% were not sure/neither agreed nor disagreed.

With regard to the pricing and cost of fresh fruits and vegetables, the number of participants who agreed that fruits and vegetables are expensive was almost the same as the number of participants who disagreed with that statement: specifically, 9.7% strongly agreed and 29.9% agreed. In comparison, 8.3% strongly disagreed and 31.2% disagreed. The remaining 21% reported that they were not sure whether fruits and vegetables are too expensive or not.

A significant majority of participants (82.6%) believed that information on children's healthy eating in their neighbourhood or schools is insufficient. Specifically, slightly more than half of the participants (52.7%) strongly agreed and agreed with this statement. Of the remaining, 9.8% were not sure, and only 5.5% disagreed and 2.0% strongly disagreed that information on children's healthy eating in their neighbourhood or schools is insufficient.

### 4.3.6 Parental Knowledge of Healthy Eating and Physical aActivity

The questions in Table *4.3* ask about participants' basic knowledge and awareness regarding healthy eating and physical activity for children. Nearly 20% of participants were not sure how to answer any of these questions.

In terms of children's daily physical activity needs, 6.8% believed that children need less than half an hour, and 25.2% thought that children need at least half an hour of physical activity to stay healthy. Moreover, 33.8% believed that children need at least one hour, and 14.2% believed that children need at least one and a half hours, of physical activity per day to stay healthy. In terms of the maximum daily screen time recommended for children, 32% thought one hour a day, while 26.6% thought two hours a day. Surprisingly, some participants (14.1%)

believed that the recommended daily screen time is three hours per day, while others (5.4%) even thought this was four hours a day.

Participants were also asked about the recommended daily servings of fruits and vegetables for children. The responses were as follows: 13.6% believed that less than one serving per day is enough, 45.3% thought that children need 1–2 servings a day, and 18.9% believed children need 3–5 servings a day. Only 3% of participants believed that children need at least 5 servings of fruits and vegetables every day.

Table 4.3: Parental knowledge on healthy eating and physical activity for children

| Statement | Responses | Percentage % | N |
|---|---|---|---|
| **How much physical activity do you think your child needs every day to stay healthy? At least** | less than half an hour | 6.8% | 53 |
| | half an hour | 25.2% | 195 |
| | one hour | 33.8% | 262 |
| | one hour and a half | 14.2% | 110 |
| | not sure | 20.0% | 155 |
| **The maximum daily screen time (e.g., TV, Video games) recommended for children is:** | one hour | 32.0% | 247 |
| | two hours | 26.6% | 206 |
| | three hours | 14.1% | 109 |
| | four hours | 5.4% | 42 |
| | not sure | 21.9% | 169 |
| **The recommended daily serving of fruits and vegetables for children is:** | less than one | 13.6% | 105 |
| | 1-2 serves | 45.3% | 351 |
| | 3-5 serves | 18.9% | 146 |
| | 5 serves at least | 3.0% | 23 |
| | not sure | 19.3% | 149 |

### 4.3.7 Opportunities for Physical Activity at Home and Neighbourhood

The survey asked participants to report on home and community resources that promote children's physical activity; these items are shown in Table *4.4*. More than half of the participants (58.6%) strongly disagreed or disagreed with the statement that their children's daily physical activity is not a priority for them. Similarly, when asked about physical activity information, more than half (58.5%) strongly disagreed or disagreed with the statement that

there is enough information about physical activity opportunities for children in their neighbourhood; an additional 23.2% of participants reported that they do not know if there is enough information about physical activity opportunities for children in their neighbourhood or school. Relatedly, 64% of participants reported that there are not enough recreation/sports facilities in their neighbourhood, which discouraged school-aged children from being physically active. In terms of neighbourhood safety, a sizeable majority of participants (80.6%) strongly agreed and agreed that their neighbourhood is not a safe place for their young children (primary school-aged) to walk or cycle alone, even during the day. However, 41.1% of participants reported that the parks and playgrounds near their home are considered a safe place for young children.

Table 4.4: Participants' perception of home and neighbourhood physical activity environment

| Statement | Strongly agree (%) | Agree (%) | Not sure (%) | Disagree (%) | Strongly disagree (%) |
|---|---|---|---|---|---|
| **My child being physically active on most days of the week is not a high priority for me.** | 12.4 | 18.9 | 10.2 | 34.5 | 24.1 |
| **It is not safe for primary school-aged children to walk or cycle alone in our neighbourhood during the day.** | 54.1 | 26.5 | 7.5 | 8.4 | 3.6 |
| **The closest park/playground to home is safe for primary school-aged children to play in.** | 14.8 | 26.3 | 21.9 | 19.4 | 17.5 |
| **There are enough recreation/sports facilities (e.g., football courts, parks, and playgrounds) in our neighbourhood to encourage children to be physically active.** | 8.0 | 12.5 | 15.4 | 21.3 | 42.8 |
| **There are playgrounds and parks within easy walking distance of our home.** | 7.6 | 16.4 | 11.9 | 20.5 | 43.7 |
| **There is enough information about physical activity opportunities for children in our neighbourhood /schools.** | 6.5 | 11.8 | 23.2 | 23 | 35.5 |
| **There is enough variety of equipment at home for children to use to be physically active.** | 7.8 | 34.8 | 18.5 | 23.8 | 15 |

### 4.3.8 Parental Knowledge and Attitudes Towards Children's Physical Activity

As presented in Table *4.5*, 29.6% of participants reported that they always or often encouraged their children to play outdoors, while 32.5% reported they sometimes encouraged their children to play outside. However, 38% reported that they rarely or never encouraged their children to play outdoors.

According to the Healthy People 2020 guidelines, the recommended amount of daily physical activity for children is at least one hour per day. On this front, participants' knowledge of their children's daily physical activity needs was low: 20% were not sure, and 32% reported that their children only need half an hour or less per day to be healthy. Still, 33.8% reported that they believe children need at least one hour of physical activity, and 14.2% believed that children need at least one and a half hours of physical activity per day to stay healthy.

With regard to limits on screen time at home, nearly half of the participants (46.2%) reported that they always or often set limits on the amount of time children can watch TV, play computer games, or use tablets, while 30.1% sometimes set limits on screen time. However, 23.6% reported they rarely or never have such rules for their children at home.

In terms of the recommended maximum daily screen time that is recommended for children, 21.9% of participants were not sure how many hours their children should spend in front of screens per day, and 19.5% reported that children can watch television or use other electronic devices for more than two hours a day. Slightly more than half of the participants (58.6%) reported that the maximum daily screen time for children is one or two hours.

Table 4.5: Participants' knowledge and rules concerning children's physical activity

| Question | Responses | Percentage % | Count |
|---|---|---|---|
| **Were the children encouraged to play outdoors** | Always | 13.8% | 107 |
| | Often | 15.8% | 123 |
| | Sometimes | 32.5% | 253 |
| | Rarely | 14.3% | 111 |
| | Never | 23.7% | 184 |
| **How much physical activity do you think your child needs every day to stay healthy? At least** | Less than half an hour | 6.8% | 53 |
| | Half an hour | 25.2% | 195 |
| | One hour | 33.8% | 262 |
| | One hour and half | 14.2% | 110 |
| | Not sure | 20.0% | 155 |
| **Were limits set on the amount of time the children can (watch TV, use other electronic devices, and play video games?** | Always | 19.7% | 152 |
| | Often | 26.5% | 205 |
| | Sometimes | 30.1% | 233 |
| | Rarely | 10.7% | 83 |
| | Never | 12.9% | 100 |
| **The maximum daily screen time (e.g., TV, Video games) recommended for children is** | One hour | 32.0% | 247 |
| | Two hours | 26.6% | 206 |
| | Three hours | 14.1% | 109 |
| | Four hours | 5.4% | 42 |
| | Not sure | 21.9% | 169 |

## 4.3.9 Statistical analysis results

### *Correlation Analysis*

Spearman's rho correlation coefficients (Figure *4.5*) were used to evaluate correlations between the socioeconomic factors (gender, age, nationality, education level, and family size) of respondents and purchasing frequency for items including soft drinks, fruit juice, energy drinks, crisps, cakes, savoury and sweet biscuits, chocolate, vegetables, and fruit. These purchasing frequencies reflect the eating behaviours of children, and the demographic and socioeconomic variables were thought to be potential influencing factors.

The findings reveal a strong correlation between the purchasing frequency of several food categories and age, providing evidence that children's food choices may be partially dependent on the age of the participant. For example, age correlates positively with the frequency of buying soft drinks and chocolates (r = 0.096** and r = 0.116**, respectively), indicating that older participants may be more interested in these items. Family size also has a strong relationship with certain purchasing behaviours, apparent in its positive correlation with chocolate purchases (r = 0.102**) and with bakery products (r = 0.075*), indicating that larger families are more likely to buy these products.

Socioeconomic status indicators, such as education level, have few significant associations with purchasing behaviours (see Table 6), showing only minor correlations with family size and no strong direct associations with food purchasing frequencies.

Correlations between purchasing frequencies of different snack foods such as crisps, biscuits, and chocolates reveal that these items are often purchased together, indicating clustering in children's eating preferences.

Overall, the table reveals that age and family size (r = 0.275**) are more influential than parental gender (r=0.008), nationality, or education level in predicting children's snack food purchasing behaviour. However, each of these factors may contribute to variations in children's eating habits and preferences.

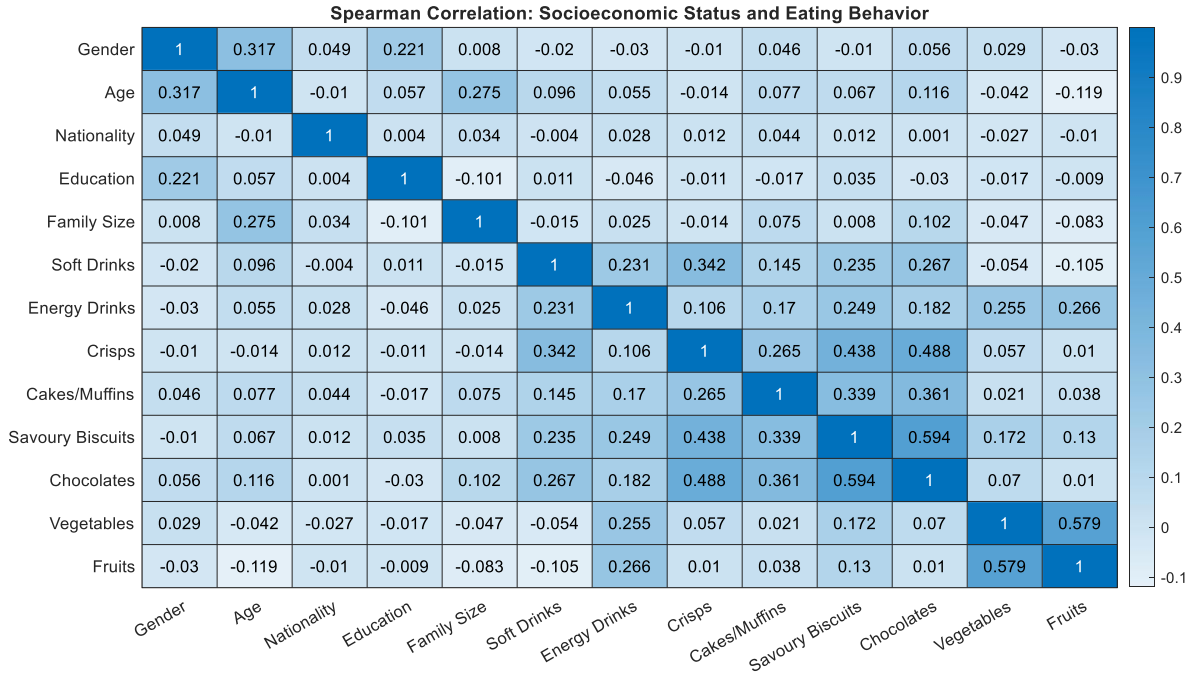


Figure 4.5 Spearman's correlations of socioeconomic status, gender, number of family members, parental education, and level with children's eating behaviour: ** Significant at $p < 0.01$, * Significant at $p < 0.05$.

The associations between the socioeconomic characteristics of children (sex, age, nationality, educational attainment, and household size), rules about screen time, and encouragement to play outdoors or to walk/cycle with a family member were assessed using Spearman's correlation coefficients (Table 7). Determinants of physical activity in children are expressed as the components of socioeconomic status, sex, and family characteristics.

Some strong correlations hint at some fairly clear trends. For example, gender showed positive correlations with restrictions on food (r =. 107) and drinks (r =. 120) and with children eating meals with family members (r =. 209). Our results imply that there is a relevant influence of gender (female) on parental socialisation around eating behaviours. Moreover, specific behaviours show tighter connections with age of the participant: for instance, the older the participant, the higher the probability that they will make an alternative meal if a child rejects what is offered (r =. 10.183), suggesting that older participants might be more accommodating

to children, 193(9. Likewise, reminders for children to drink water are positively related to household size (r =. 145**), indicating that children may need more encouragement or reminders to drink more in larger households.

Parental educational attainment has an association with certain physical activity behaviours, although its effect seems to be negligible: educational level had a small negative relationship with encouragement to play outside (r = -.04) 064) and with active transportation behaviours (i.e., walking or cycling) (r = -. 075*). These results could suggest differences in lifestyle planning/approach, with families in higher educational attainment tending to prioritise other opportunities or formalised, structured involvement over outdoor play and family active transportation.

Table 4.6 Spearman's correlations of socioeconomic status, gender, number of family members, and parental educational level, and physical activity behaviour: ** Significant at p <0.01, * Significant at p < 0.05.

| Spearman's correlation | Gender | age | nationality | education level | family size |
|---|---|---|---|---|---|
| gender | 1 | | | | |
| age | .315** | 1 | | | |
| nationality | 0.049 | 0.000 | 1 | | |
| education level | .211** | 0.029 | -0.016 | 1 | |
| family size | 0.005 | .229** | 0.039 | -.116** | 1 |
| My child eating fruit and vegetables every day is a high priority for me | .094** | 0.036 | -0.041 | -0.042 | -0.019 |
| I find it difficult to get my child to eat fruit and vegetables every day | -0.024 | -0.021 | -0.037 | 0.045 | -0.027 |
| There are no stores selling fresh fruit and vegetables within easy walking (i.e., 10 minutes walking) distance of our home | .095** | 0.017 | 0.048 | 0.057 | -0.038 |
| Fresh fruits and vegetables are too expensive | -.153** | -0.019 | -0.009 | 0.036 | -0.049 |
| There is not enough information about healthy eating for children in our neighbourhood or school. | -0.064 | -.078* | -0.033 | -0.005 | -0.018 |
| Did the child(ren) watch TV at meal times? | -0.024 | -0.005 | -0.010 | -0.028 | 0.065 |
| Were the child(ren) encouraged to eat fruit and vegetables? | 0.039 | 0.059 | -0.001 | 0.016 | 0.067 |
| Were limits set on the types of drinks the children can drink regularly? | .102** | -0.003 | -0.016 | -0.003 | .074* |
| Were limits set on the types of food (snacks) the children can eat regularly? | .107** | -0.040 | 0.034 | -0.003 | 0.069 |
| Were the children reminded to drink water? | 0.042 | 0.061 | 0.030 | 0.035 | .145** |
| Did an adult sit down with the children when they ate meals? | .209** | .077* | 0.047 | 0.027 | 0.064 |
| Did you make something else if the children did not like what was being served? | .148** | .183** | 0.023 | 0.065 | .129** |
| Were the children encouraged to play outdoors? | 0.009 | -0.006 | 0.021 | -0.064 | -.072* |
| Were limits set on the amount of time the children can (watch TV, use other electronic devices, and play video games)? | .102** | 0.048 | -0.042 | 0.010 | -0.055 |
| Did adult family members walk or cycle to get to or from places (e.g., work, shops)? | -0.060 | 0.039 | -.107** | -.075* | -.095** |
| The recommended daily serving of fruits and vegetables for children is: | 0.012 | -0.002 | -0.054 | -0.055 | 0.036 |
| How much physical activity do you think your child needs every day to stay healthy? At least | 0.057 | 0.030 | -.083* | 0.023 | -.110** |
| The maximum daily screen time (e.g., TV, Video games) recommended for children is: | -0.004 | .071* | 0.009 | -0.057 | 0.067 |

***Regression Analysis***

Table *4.7* presents the regression results of socioeconomic influence on children's daily fruit consumption, with β, t, and significance levels per predictor. The model constant or intercept (β=1.168) indicates that when all other variables are 0, the fruit consumption indicates a low level of consumption of fruits ($p < 0.01$, t-value =2.804).

The following predictor is statistically significantly positively associated with children's fruit consumption: employment status (Beta = 0.038, t = 2.008, $p < 0.05$), in that children in employed families are more likely to eat more than one piece of fruit daily compared to children in unemployed families. The effects of other variables, including age (Beta = 0.066, t = 1.566, $p = 0.118$), nationality (Beta = 0.222, t = 0.653, $p = 0.514$), education level (Beta = -012, t= -0339, $p$ = 07035), and family size (Beta=064, t-1-189, $p$ = .0690) was not significant, since their corresponding signs were higher than 0.05. This indicates that these elements do not directly affect how often children receive fruit servings. The analysis tests of significance for the dependent and independent variables show that employment status is the only statistically significant predictor of all of those examined; this signifies that while several factors have an effect on a child's behaviour as to whether or not they eat fruit at home, employment status has an exact one-off unique effect.

Table 4.7 Spearman's correlations of socioeconomic status, gender, number of family members, and parental educational level, and servings of fruit consumed each day by children: * Significant at p < 0.05.

| | **Beta** | **T** | **Sig.** |
|---|---|---|---|
| **Constant** | 1.168 | 2.804 | 0.005 |
| **Age** | 0.066 | 1.566 | 0.118 |
| **Nationality** | 0.222 | 0.653 | 0.514 |
| **Education level** | -0.012 | -0.339 | 0.735 |
| **Family size** | 0.064 | 1.506 | 0.132 |
| **Employment status** | 0.038 | 2.008 | 0.045* |

## 4.4 Summary of Key Findings

This section summarises the key findings of this study and compares findings with the international literature.

### 4.4.1 Healthy Eating and Home Environment

Multiple factors play a role in childhood obesity and poor diet, one of which is the home food environment (Patrick & Nicklas, 2005; Rosenkranz & Dzewaltowski, 2008). The home environment includes food and beverage availability as well as parenting style, rules, and practices. In this study, participants reported high purchasing frequencies of a variety of food and beverage items, with fizzy drinks (52%), chocolates (62.3%), biscuits (76.8%), crisps (64.5%), fruits (72%), and vegetables (88.4%) reported as being purchased at least once a week. This means that children are heavily exposed simultaneously to both non-core foods as well as fruits and vegetables. Previous studies have shown an association between the availability of unhealthy foods in the home and a low intake of fruits and vegetables in children (K. J. Campbell et al., 2007; Pearson et al., 2009). Our findings were in line with existing research: children's daily intake of fruits and vegetables was reported to be very low, with 80% of participants reporting that their children did not eat either fruits or vegetables on a daily basis.

Although most participants (92%) considered that children eating fruits and vegetables every day was a high priority for them, only 1.3% of participants reported that their children met the recommended daily consumption of fruits and vegetables (5 servings per day). A study conducted in 2013 found that 2.6% of Saudis aged 15 years or older met the guidelines for daily consumption of fruits and vegetables (El Bcheraoui et al., 2015). In the Najran region specifically, 1.26% of residents meet the guidelines for daily consumption of fruits and vegetables. Accordingly, the low consumption of fruits and vegetables among children found in our study could be related to adults' low consumption, as previous work as posited:

children's eating habits have been found to be related to parents' eating habits, food preferences, and role modelling (Dave et al., 2012; El Bcheraoui et al., 2015).

Controlling children's food and setting limits on their snack consumption could be a challenge for parents. In our data, nearly two-thirds of participants stated that they find it difficult to get their children to eat fruits and vegetables. At the same time, 51.2% reported that they always or often set limits on their children's food and snack consumption. However, this type of home/parent rule may work counterproductively, especially when a range of healthy and unhealthy foods is available: one study found that restricting specific foods increases children's desire to consume those foods (Fisher & Birch, 1999). Nevertheless, our study indicates that children of parents who apply food rules and restrictions at home are more likely to consume fruits than children who live in a home with no restrictions on their food choices.

### 4.4.2 Physical Activity

Increasing children's physical activity has been found to be associated with several parent behaviours (Cleland et al., 2011; Prochaska et al., 2002). Along these lines, our study found that 64% of participants never walk or cycle to get to places such as the shops or work. This kind of parental behaviour may negatively influence their children's physical activity levels. Previous studies have confirmed that parental level of physical activity observed by their children i.e., parental role modelling can positively influence children's physical activity levels (Cleland et al., 2011; Yao & Rhodes, 2015).

A study conducted by Pugliese & Tinsley (2007) found that children's and adolescents' physical activity levels are significantly related to parents' positive encouragement and increasing levels of competency. Another study confirmed that children who spend more time outdoors have a lower prevalence of overweight and are more active than children who spend

less time outdoors (Cleland et al., 2008). Our data showed that children were not sufficiently encouraged to be more physically active: almost 40% of participants stated that they rarely or never encouraged their children to play outdoors, and 32.5% said they only sometimes encouraged them. This may be due to two main reasons. First, parents are not fully aware of how much their children need to be physically active: 30% believed that children only need half an hour or less of physical activity per day. Second, safety issues may play a role, as 80% of participants considered their neighbourhoods to be unsafe for unsupervised walking or cycling for children, especially young ones (primary school-aged) even though 41.1% of participants reported that the parks and playgrounds near their homes are considered a safe place for young children. Children playing outdoors could expose them to various accidents: in Saudi Arabia, a study conducted on childhood motor vehicle injuries admitted to hospital found that 71% of children in their sample were injured as pedestrians, 27% as auto passengers, and 1.5% as bicyclists (Crankson, 2006). This may explain why parents consider their neighbourhood unsafe and consequently do not encourage their children to play outdoors. Our data confirm this, as we found a significant association between participants' perceptions of the safety of their neighbourhood and their encouragement of their children to play outdoors. In short, parents who consider their neighbourhood to be a safe place are more likely to encourage their children to play outdoors.

There are many parental supportive behaviours which can increase children's physical activity, such as providing sports equipment, providing transportation, and enrolling their children in physical activity opportunities (J. Mitchell et al., 2012). However, our findings show that participants reported a lack of recreational and sports facilities near their home (64%), along with a lack of physical activity opportunities and equipment at home (38.8%).

Given our results, it is clear that a range of factors related to parental behaviours and the home environment make it difficult for children to be physically active.

### 4.4.3 TV Viewing and Screen Time

TV watching and other types of screen time are considered sedentary behaviours and are linked to less movement and lower energy expenditure (A. J. Atkin et al., 2012; Tremblay et al., 2011). The American Association of Paediatrics, Obesity Canada (Adamo et al., 2010), and the Saudi Arabian Society of Metabolic and Bariatric Surgery (Al-Shehri et al., 2016) recommend that families limit screen time for school-age children to less than two hours per day. Previous studies have found that increased screen time is associated with low levels of physical activity in children (Jackson et al., 2009). Screen time has also been found to be positively linked to childhood overweight (Laurson et al., 2008; Must et al., 2007).

Our study results reveal that 21.9% of participants were not sure how many hours their children should spend in front of screens per day. Moreover, 19.5% reported that their children can watch television or use other electronic devices for more than two hours a day. This figure indicates that more than 40% of our study sample either were not aware of screen time limits or did not mind that their children spent lots of time in front of screens, because parents are not aware of the negative health implications for children of this kind of behaviour.

Another reason for these results could be the parents' own screen time behaviours themselves. Our data shows that slightly more than 80% of participants reported always or often sitting with their children when they have their meals. In comparison, nearly 40% of participants admitted that their children always or often watch TV while eating. This means that not only children but also parents are watching TV while they eat. A study conducted in 2016 found that parents' behaviours and attitudes including co-viewing, screen time limits, and other media-access controls are associated with child TV viewing (Pyper et al., 2016). A recent systematic review and meta-analysis has suggested that children and adolescents who eat while watching TV are at greater risk of being overweight or obese (Ghobadi et al., 2018).

# Chapter 5 School Staff Perceptions of Factors Contributing to Childhood Obesity in Najran

## 5.1 Introduction

Schools are a common setting for the implementation of interventions to promote children's health. During the school day, physical education classes and school playtime (e.g., recess), children are offered regular opportunities to engage in physical activity. The workplace may not be important for adults' physical activity, but for children and adolescents, schools are likely to be a critical contributor to promoting physical activity (D. Cohen et al., 2008). In addition, school environments can play a crucial role in improving children's diet and shaping their eating behaviours (Dudley et al., 2015): schools are a critical setting for student nutrition, because that is where they consume at least breakfast, which is considered an important daily meal (Mensink et al., 2012). The time allocated for school meals and the way food is displayed can also affect children's eating behaviours. In the United States, for example, one of the nationally recommended strategies to prevent and reduce childhood obesity is creating school food environments that facilitate healthy eating among children (Yamane, 1973). Schools can play a key role in promoting healthy lifestyles by creating healthy environments for their students (Naidoo & Wills, 2000), as schools' infrastructures and physical environments, policies, curricula, and staff have the potential to positively influence children's health (Lim et al., 2013).

The education system in Saudi Arabia is centrally administered and government-funded, with the Ministry of Education (MoE) responsible for planning, policy, curriculum, teacher standards, and facilities across the entire country. The system spans pre-primary (optional), primary, intermediate, and secondary education, typically covering ages 4–18, with compulsory education from age 6 to at least age 14. The Ministry oversees a network of public

schools and private schools that follow national standards, ensuring access to schooling throughout Saudi regions.

In the past decade, several studies have argued that obesity in Saudi school-aged children is influenced by multiple factors, such as poor dietary patterns, sedentary lifestyles, unhealthy school meals, lack of organised sports, and eating habits (Al-Rukban, 2003; Fisher & Birch, 1999; Pearson et al., 2009; Rosenkranz & Dzewaltowski, 2008). In 2006, in response to the World Health Organization's (WHO) recommendations vis-à-vis the National Diet and Physical Activity Strategy, the Saudi Ministry of Health established the Diet and Physical Activity Programme. This programme is enacted by the regional directorates of health across all the country's regions. In addition, in 2013, the Health Programs and Chronic Diseases Control General Department launched the Obesity Control Programme. This programme has nominated 20 coordinators across the country, with each general directorate having a coordinator. These two programmes aim to promote diet and physical activity as well as combat obesity in Saudi Arabia, both in schools and in the community (H, 2016). Assessing the existing policy and interventions is useful for understanding the current issues in schools' environments that could influence children's healthy eating and physical activity behaviours. Therefore, the main aim of this study was to assess and describe school staff's perceptions of the role of schools in obesity prevention efforts, along with the current factors affecting schools' food and physical activity environments in Saudi Arabia.

**Aim of the Study**

The aim of this study is to examine school staff's perceptions of the role of schools in preventing childhood obesity and to explore the factors within the school environment that influence students' dietary behaviours and physical activity in Saudi Arabia, using an

ecological perspective to understand how individual, interpersonal, organisational, and policy-level factors interact within the school setting.

**Objectives**

- To explore school staff's perceptions of the role of schools in promoting healthy eating and physical activity among students.
- To identify organisational and environmental factors within schools that influence children's dietary behaviours and opportunities for physical activity.
- To examine school policies, infrastructure, and practices related to nutrition and physical activity that may support or hinder obesity prevention efforts.
- To investigate interpersonal influences within the school setting, including the role of teachers and staff in shaping students' health behaviours.
- To analyse these factors within an ecological framework in order to understand the multi-level influences affecting obesity prevention in the school environment.

## 5.2 Methods

A cross-sectional survey was conducted in the city of Najran, Saudi Arabia, between January and February 2017. The target population of this study was school staff in the city of Najran. According to data from the General Authority for Statistics, in 2016, the total number of workers in all schools in Najran was 6032, with 52% working in primary schools, 23% in intermediate schools, and 25% in secondary schools. To obtain a sample that was most probably representative of the study population, a list of all schools was used as the sampling

frame. Schools were stratified proportionately according to their level (i.e., primary/intermediate/secondary). From here, the education directorate office in Najran randomly selected 40 primary schools, 20 intermediate schools, and 20 secondary schools.

**Inclusion and Exclusion Criteria**

All staff members working in the selected public schools in Najran were considered eligible to participate in the study, including teachers, administrative staff, and other school employees present during the data collection period. The study included staff from primary, intermediate, and secondary public schools that were selected through the stratified random sampling process. Schools eligible for inclusion were those officially registered under the Najran Education Directorate and operating during the study period.

Private schools, international schools, and nursery or kindergarten institutions were excluded from the study to ensure uniformity in the educational system and administrative structure of the sampled institutions. In addition, staff members who were absent during the data collection period or who declined to participate were not included in the final sample

The sample size for school staff was calculated based on Yamane's formula (Yamane, 1973):

$$n = \frac{N}{1+N(e)2}$$

where n= sample size

N= population size

E= error of 5%

In calculations of this formula with an error of 5% and with 95% confidence intervals, the minimum sample size of this study should be 375. However, to avoid low response rates, we

decided to increase our target population to 800 participants. To this end, we invited at least 10 staff members from each of the 80 schools that had been selected for the sampling frame.

An online survey was developed using SurveyMonkey software. The survey link, along with an invitation to participate and a consent form, was distributed to the selected schools by the General Directorate of Education.

### 5.2.1 Survey Question Design

The questionnaire contained closed multiple-choice questions, with some questions including the option to check all that apply. A free text box was offered for participants to provide any other comments. The survey was divided into five sections. In Section one, the following demographic information was collected: gender, level of education at which they work, and their role/job title.

Section two collected data on children's exposure to healthy messages at school, including in classroom lessons, school curricula, homework, and general school activities. Under this question were a range of sub-questions about healthy eating, physical activity, and fruits and vegetables. The multiple-choice answers were ranges of frequencies (none, once a term, once a week, daily) and level of agreement (from strongly agree to disagree strongly).

Section three was about teachers' skills, attitudes, and perceptions of healthy eating and physical activity for children at school, divided into three subtopics: healthy eating, physical activity, and fruits and vegetables. These include, e.g., teachers' training and experiences, or resources used in the teaching process. Each sub-topic had specific possible responses laid out in multiple-choice options, such as yes-no answers, frequency, and level of agreement.

Section four examined teachers' level of knowledge of children's healthy eating and physical activity. Example topics include the recommended maximum daily screen time, recommended daily servings of fruits and vegetables, and the amount of physical activity that children need every day.

In Section Five, participants were asked about the school environment concerning physical activity and whether they think it encourages people to use the school's sports facilities. Finally, a free-text box was provided to enable teachers to give any other comments.

### 5.2.2 Response Rate Calculation

The response rate is a mathematical calculation that aids in understanding the state of and bias in an investigation; it can be calculated by dividing the number of valid responses by the number of samples. In this study, although schools were targeted as the sampling frame, individual school staff members were the actual unit of analysis, not the schools. The researcher distributed 800 questionnaires and received 459 final, valid, completed responses. Therefore, the response rate was: $response\ rate = \frac{number\ of\ valid\ responses}{sample\ number} = \frac{459}{800} = 0.57$, or 57%.

## 5.3 Results

### 5.3.1 Participants' Characteristics

The total sample of the survey consisted of 459 school workers. The characteristics of the participants are presented in Table *5.1*. The gender breakdown was 55% female and 45% male. More than half of the participants worked at primary schools (54%), with 19% working at intermediate schools and 34% at secondary schools. Of all participants, a sizable majority acted

as a classroom teacher (68%), while 21% were in administration roles and 10% were in supervision roles.

Table 5.1 Characteristics of participants

| Characteristic | Category | Count N | Percentage (%) |
|---|---|---|---|
| **Gender** | Male | 208 | 45 |
| | Female | 251 | 55 |
| **Education Institution** | Primary | 246 | 54 |
| | Intermediate | 86 | 19 |
| | Secondary | 155 | 34 |
| **Role** | Administrative | 98 | 21 |
| | Supervision | 47 | 10 |
| | Teaching | 314 | 68 |

### 5.3.2 School Staff Training and Expertise in Healthy Eating and Physical Activity

Participants were asked if they believe that childhood obesity is considered an issue in our society: 65% (n=299) answered 'yes', while 27.8% did not believe that childhood obesity is an issue. Additionally, participants' training and expertise in the field of healthy eating and physical activity were identified, as can be seen in Figure *5.1*. It was surprising how little training/experience the school staff we surveyed seemed to have on this topic: 81% of participants reported that they did not have any training or expertise in healthy eating and 83% reported the same for physical activity; only 19% had training in healthy eating and 17% in physical activity.

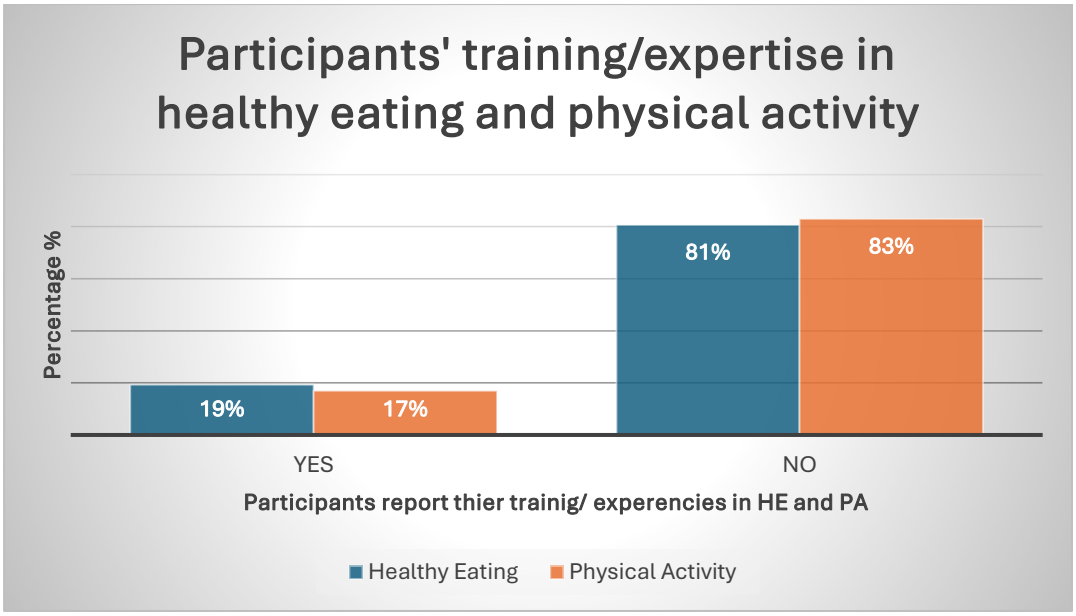


Figure 5.1 Participants' training and experiences in healthy eating and physical activity (n=455)

### *Teaching and Learning Activities*

School-based obesity prevention interventions that entail multi-component approaches, such as increasing children's physical activity levels, can have an impact on students' weight status and improve their dietary habits. Teaching and learning activities that focus on promoting healthy lifestyles are among the key strategies for preventing obesity in schools.

The teaching and learning activities are divided into three sections: fruits and vegetables, physical activity, and healthy eating activities.

### *Fruits and Vegetables*

The results clearly revealed a lack of activities promoting positive attitudes towards fruits and vegetables among students. Most participants reported that there are no such activities in their schools: as shown in Table *5.2*, 93% of participants reported that there were no visits to fruit-

and vegetable-growers, 84% stated that there were no fruit and vegetable tasting or growing activities, and 78% reported that there are no cooking sessions in their schools. However, some participants reported that their students engaged in such activities at least once a term: 19.3% reported conducting cooking sessions, 15% reported engaging in fruit and vegetable growing activities, and 13% reported participating in tasting activities.

Table 5.2 Fruit and vegetable activities

| Activity | none | Once a term, at least | Weekly | Daily |
|---|---|---|---|---|
| **cooking sessions (n=457)** | 77.9% | 19.3% | 2.4% | 0.4% |
| **growing fruit/vegetable (n=458)** | 83.8% | 15.1% | 0.9% | 0.2% |
| **fruit and vegetable tastings activities(n=457)** | 84.0% | 12.9% | 2.6% | 0.4% |
| **visits to fruit/vegetable growers (n=457)** | 96.3% | 3.5% | 0.0% | 0.2% |

***Physical Activity (PA)***

The study identified schools' teaching and learning activities to promote PA among students. Participants were asked to respond to a range of statements related to PA and how often they believed students in their schools were engaged in such activities. As listed in Table *5.3*, PA in this study included teaching fundamental movement skills, classroom lessons on PA, homework based on PA, and PA resources used in teaching. Almost 90% reported that they do not assign students homework based on PA, and 72% said that no PA resources were used in their teaching. Moreover, 61% stated no classroom lessons about PA were conducted, and 63.5% said they never teach students fundamental movement skills. However, 29% reported receiving weekly or daily classroom lessons on PA, and 10% said they conducted lessons about PA at least once per term; in addition, 20% reported that they taught movement skills to students at least once a week.

Table 5.3 Physical activity in school teaching (n=457)

| Activity | None | Once a term | Weekly | Daily |
|---|---|---|---|---|
| **Teaching fundamental movement skills** | 63.5% | 17.1% | 12.5% | 7.0% |
| **Classroom lessons about PA** | 61.0% | 10.1% | 24.1% | 4.8% |
| **Homework based on PA** | 89.5% | 6.6% | 2.6% | 1.3% |
| **PA resources used in teaching** | 72.0% | 16.1% | 8.1% | 3.7% |

### *Healthy Eating (HE)*

As shown in Table *5.4*, among all the participants, 58.7% reported that there are no classroom lessons about HE, 68.8% stated that they do not assign students homework on HE, and 62% said they do not use HE resources in their teaching. However, approximately one-third of participants said there are lessons about HE at least once a term; additionally, 23.9% reported that they assign students homework on HE, and 23.9% said they used HE resources in teaching at least once per school term. A very few participants reported that these HE activities were used on a weekly or daily basis: only 11% used HE resources in teaching every week, while 7% conducted weekly classroom lessons about HE, and 7.6% gave students homework on HE once a week.

Table 5.4 Healthy eating in school teaching and learning activities

| Activity | None | Once a term | Weekly | Daily |
|---|---|---|---|---|
| **Classroom lessons about HE** | 58.7% | 33.6% | 7.2% | 0.4% |
| **Homework about HE** | 68.8% | 22.3% | 7.6% | 1.3% |
| **HE resources used in teaching** | 62.1% | 23.9% | 11.2% | 2.9% |

### 5.3.3 School Curricula

Health education topics can be assigned under the formal school curriculum to help students develop the knowledge, attitudes, and skills needed for a healthy lifestyle. Participants were asked to share their perceptions regarding the availability of healthy messages about HE and PA in school curricula. The findings revealed that HE messages were more available than PA messages. Almost 50% of participants reported that PA is not included in school curricula, as shown in Figure *5.2*, while 26% reported that HE is not included. Moreover, 46.3% said that there are a few HE materials in school curricula, and 23.8% reported some HE materials in school curricula. By contrast, approximately one-third of participants believed that there are a few PA messages in school curricula, and 14.0% reported some PA materials in school curricula.

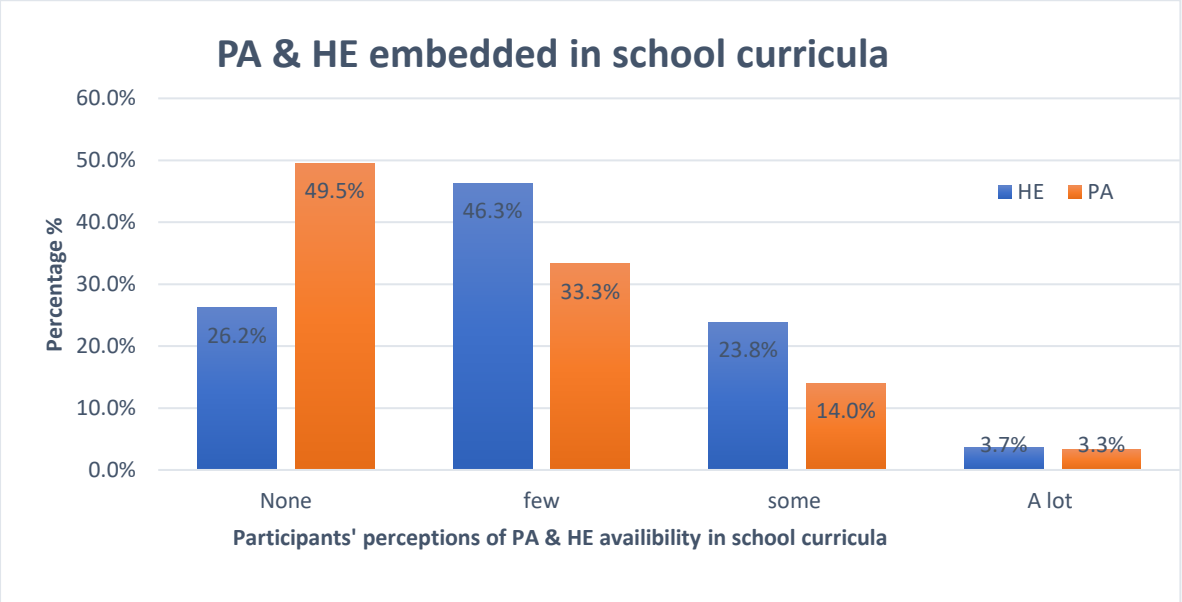


Figure 5.2 participants' perception of PA & HE availability in school curricula.

### 5.3.4 Physical Activity Opportunities in Schools

Participants' perceptions regarding the role of the school in promoting PA were assessed through three statements: "There are enough facilities to encourage students to be active at break times"; "The school offers a wide variety of physical activities"; and "The school encourages the wider community to use its PA facilities" as shown in Table *5.5*. Response categories for each item ranged from 1 = strongly agree to 5 = strongly disagree. Approximately half of the participants agreed that there are enough sports facilities to encourage students to be active, and slightly less than half believed that the school offers a wide variety of physical activities for students. However, 44.8% disagreed with the statement that the school offers its PA facilities to be used by the wider community.

Table 5.5 Physical activity opportunities in schools

| | **Strongly Agree/Agree** | | **Strongly Disagree/Disagree** | |
|---|---|---|---|---|
| | **N** | **%** | **N** | **%** |
| **There are enough facilities to encourage students to be active during break times** | 224 | 49 | 139 | 30.4 |
| **The school offers a wide variety of physical activities** | 214 | 46.9 | 155 | 34 |
| **The school encourages its PA facilities to be used by the wider community.** | 155 | 34.2 | 203 | 44.8 |

### 5.3.5 School Staff Attitudes Towards Physical Activity

Participants' beliefs and attitudes towards PA for students in schools are shown in Table *5.6*. Participants tended to perceive that PA during lunchtime in schools is crucial, with 89% agreeing with the statement "Active lunchtime play is important". Participants also expressed the attitude that teachers' PA is important in influencing their students, with more than half

(57%) disagreeing with the statement "It is not important for teachers to model being physically active". Most participants believed that the external support (i.e., from outside schools) to promote PA in schools is insufficient, with 89.6% agreeing with the statement "There is little support from external professionals/organisations for promoting PA in schools". Furthermore, a relatively high proportion of participants (57.8%) believed that it is better for students to walk or cycle to and from school. Finally, slightly more than half of the participants (57.1%) expressed confidence that they would be able to include PA sessions for their students in the classroom if they had the chance to do so.

Table 5.6 School staff attitude towards physical activity

| | **Strongly Agree/Agree** | | **Strongly Disagree/Disagree** | |
|---|---|---|---|---|
| | **N** | **%** | **N** | **%** |
| **Active lunchtime play is important** | 404 | 89.2% | 19 | 4.2% |
| **It is not important for teachers to role model being physically active** | 148 | 32.7% | 258 | 57.1% |
| **It is better for students to walk or cycle to school** | 262 | 57.8% | 116 | 25.6% |
| **There is little support from external professionals/organisations to promote PA in schools** | 407 | 89.6% | 16 | 3.5% |
| **Confident in the ability to include PA opportunities for students in the classroom** | 259 | 57.1% | 120 | 26.4% |

### 5.3.6 School Staff's Knowledge of Physical Activity and Healthy Eating

The participants' knowledge of guidelines for physical activity, sedentary behaviour, and fruit and vegetable consumption for school-aged children was assessed through multiple statements, as shown in Table *5.7*. School-aged children should be physically active at least 60 minutes per day; on this, participants' knowledge was relatively good, with 40% reporting that children need one hour or 1.5 hours of physical activity per day. Currently, with lives surrounded by technology and digital media, it is difficult to define "screen time"; however, in this study, we

considered screen time as when children are watching TV or playing video games. Children aged 2 years and above should not spend more than two hours a day in front of screens; on this topic, more than two-thirds of participants recognised that the maximum daily screen time for children should be two hours or less. Finally, the WHO and many health organisations continue to recommend that children should eat at least five servings of fruits and vegetables every day; however, only 9% of participants were conscious of these recommendations, and more than 40% believed that 2 or fewer servings of fruits and vegetables per day would be enough for children.

Table 5.7 Beliefs and attitudes towards prompting fruits and vegetables eating.

| Question | Responses | % | N |
|---|---|---|---|
| **How much PA do school-aged child needs daily? (n= 453)** | less than half an hour | 19.9% | 90 |
| | half an hour | 26.5% | 120 |
| | one hour | 26.9% | 122 |
| | one hour and a half | 15.0% | 68 |
| | not sure | 11.7% | 53 |
| **The maximum daily screen time (e.g. TV, Video games) recommended for children is: (n=453)** | one hour | 27.2% | 123 |
| | two hours | 42.2% | 191 |
| | three hours | 15.2% | 69 |
| | four hours | 4.0% | 18 |
| | not sure | 11.5% | 52 |
| **The recommended daily serving of fruits and vegetables for school children is:** | less than one | 8.4% | 38 |
| | 1-2 servings | 35.7% | 162 |
| | 3-5 servings | 31.7% | 144 |
| | At least 5 servings | 9.0% | 41 |
| | not sure | 15.2% | 69 |

### 5.3.7 School Staff's Attitudes Regarding Fruits and Vegetables

Participants' attitudes and beliefs regarding the importance of eating fruits and vegetables and their role in the promotion thereof were assessed through a range of statements, as shown in Table *5.8*. More than half of the participants (55.7%) were motivated to teach students about the importance of eating fruits and vegetables every day. However, 59% of participants were not sure whether they would be able to teach students the importance of eating fruits and

vegetables. This is explained by earlier results, where 81% of participants reported that they do not have any training or experience regarding healthy eating.

Most participants believed that teachers should be good role models for eating fruits and vegetables, as this may inspire students to follow their example. At the same time, more than half of the participants felt that encouraging kids to eat fruits and vegetables is the responsibility of the family, not the school. Most participants believed that external support (i.e., from outside schools) in promoting fruit and vegetable consumption among children in schools is insufficient, with 87.4% agreeing with the statement "There is little support from external professionals/organisations for promoting fruit and vegetable eating in schools". Finally, participants expressed the attitude that eating more fruits and vegetables leads to better behaviour, with 72.3% agreeing with the statement "Kids who eat more fruit and vegetables behave better."

Table 5.8 School staff attitude regarding fruits and vegetables

| | **Strongly Agree/Agree** | | **Strongly Disagree/Disagree** | |
|---|---|---|---|---|
| | **N** | **%** | **N** | **%** |
| I am motivated to teach students the importance of eating fruit and vegetables every day | 254 | 55.7 | 130 | 28.5 |
| Unsure of my ability to teach students the importance of eating fruit and vegetables | 269 | 59 | 111 | 24.4 |
| It is important for teachers to role model eating fruit and vegetables | 418 | 92.3 | 15 | 3.3 |
| Encouraging kids to eat fruit and vegetables is the responsibility of the family, not the school | 243 | 53.6 | 182 | 40.1 |
| There is little support from external professionals/organisations to promote fruit and vegetable eating in schools | 397 | 87.4 | 24 | 5.3 |
| Kids who eat more fruit and vegetables behave better | 327 | 72.3 | 9 | 1.9 |

## 5.3.8 Statistical Analysis Results

### Correlations Analysis

The relationship between teaching levels and physical activity (PA) integration was examined using Spearman's rank correlation analysis; results are presented in Figure *5.3*. A statistically significant weak negative correlation was found between primary-level schools and physical activity lessons in classrooms (r = -0.095, p = 0.042), which shows that there are potential limitations in physical activity lessons integrated at the primary educational stage. On the contrary, secondary level teaching demonstrated a statistically significant weak positive correlation with r = 0.147, p = 0.002, which indicates that a slightly more marked integration of physical activity at this educational level.

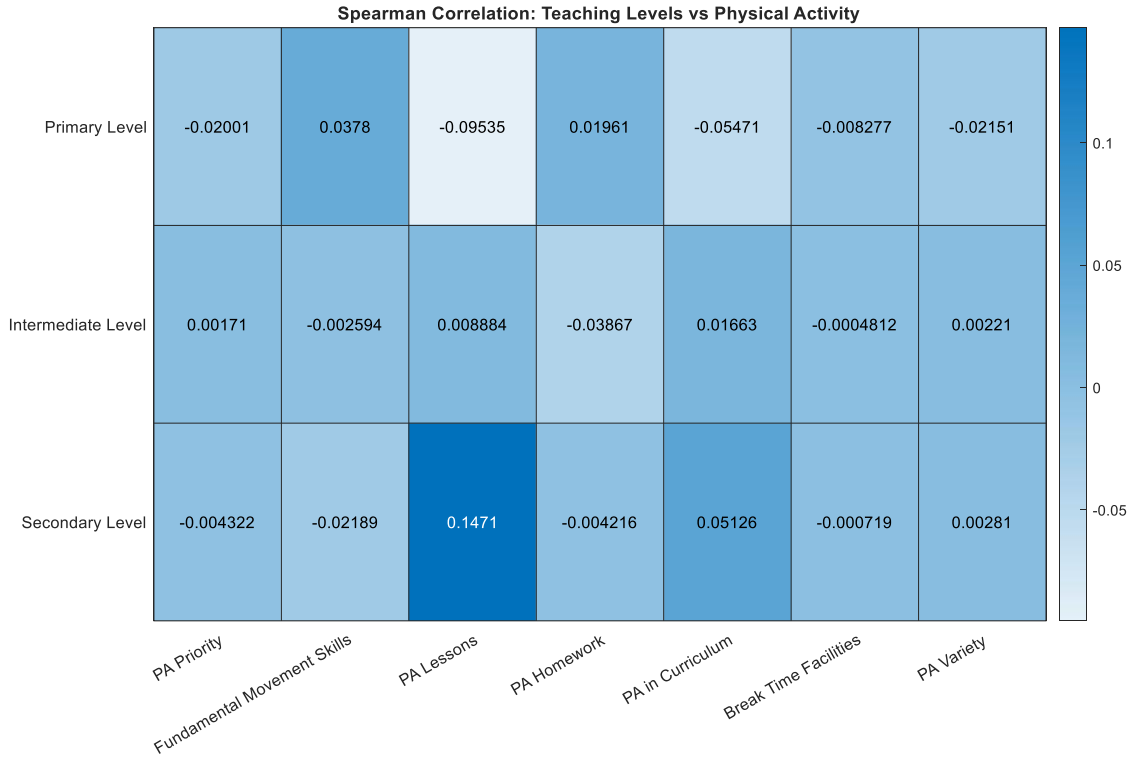


Figure 5.3 Spearman's Correlation Heatmap: Physical Activity Integration among Teaching Levels, including Primary, Intermediate, and Secondary.

In terms of healthy eating, the correlations between the school level and healthy eating are shown in Figure *5.4*. Significant correlations were mainly observed at the primary level. Primary level teaching demonstrated notable positive correlations with several healthy eating aspects, such as a positive correlation with healthy eating embedded in curriculum (r = 0.201, p = 1.465e-05), encouraging water bottle usage (ρ = 0.202, p = 1.332e-05), classroom healthy eating lessons (r = 0.147, p = 0.0016), healthy eating homework (ρ = 0.133, p = 0.0043), and fruit/vegetable cooking sessions (r = 0.152, p = 0.0011). In contrast, secondary-level teaching showed weak negative correlations across most healthy eating aspects, including classroom lessons (r = -0.149, p = 0.0013), healthy eating embedded in the curriculum (r = -0.178, p = 0.0001), and water bottle encouragement (r = -0.159, p = 0.0006). Intermediate-level teaching showed largely non-significant correlations, with the lowest associations observed in aspects related to healthy eating.

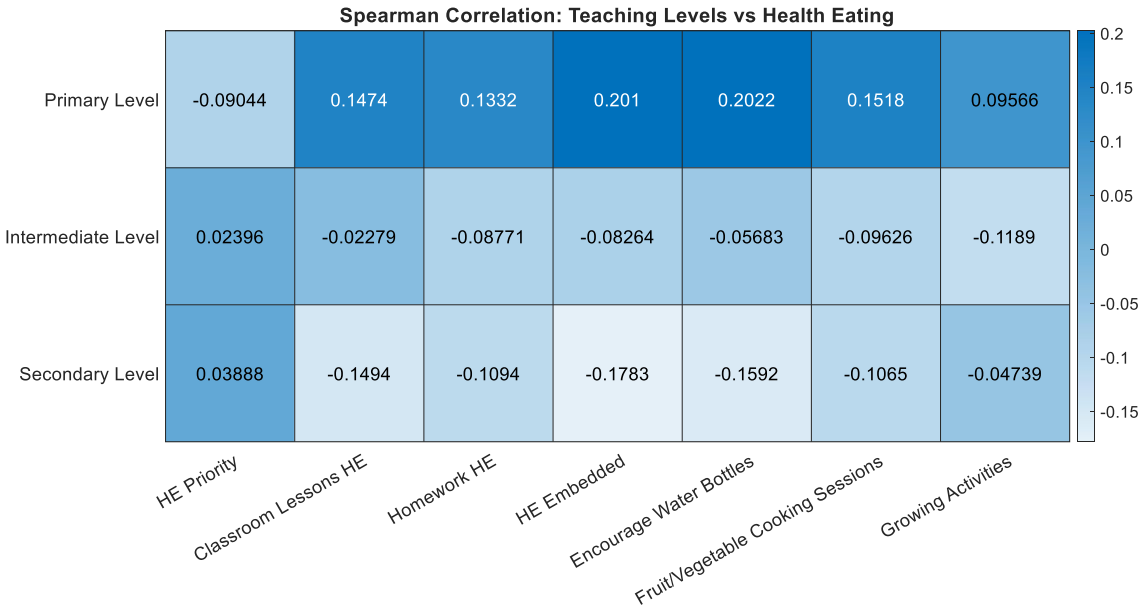


Figure 5.4 Spearman's Correlation Heatmap: Healthy Eating Integration among Teaching Levels, including Primary, Intermediate, and Secondary.

The relationships between the teacher's gender, their perceptions of childhood obesity, and their knowledge and experiences were also examined using the Spearman method and are presented in Figure *5.5*. The most statistically significant correlations are observed for the teacher's gender. Teachers' gender shows a strong negative correlation with daily physical activity recommendations at their schools (r = -0.365, p = 1.0023e-15), indicating that female teachers tend to recommend much lower daily physical activity durations compared to male teachers. In addition, teachers' gender has a slight negative correlation with physical activity training (r = -0.211, p = 6.2363e-06), which indicates that female teachers may have less training or expertise in physical activity compared to their male counterparts.

Physical activity training at the schools shows positive correlations with several other variables. For example, physical activity training for teachers is positively correlated with daily physical activity recommendations (r = 0.320, p = 3.3437e-12), knowledge of fruit and vegetable serving (r = 0.230, p = 7.7221e-07), and healthy eating training (r = 0.198, p = 2.1448e-05). This indicates that teachers with physical activity training tend to have more comprehensive knowledge about nutrition and health recommendations and are more likely to recommend appropriate daily physical activity levels. The motivation to teach about fruits and vegetables is also positively associated with daily physical activity recommendations (r = 0.159, p = 0.00071), which shows a potential general approach to health education among teachers.

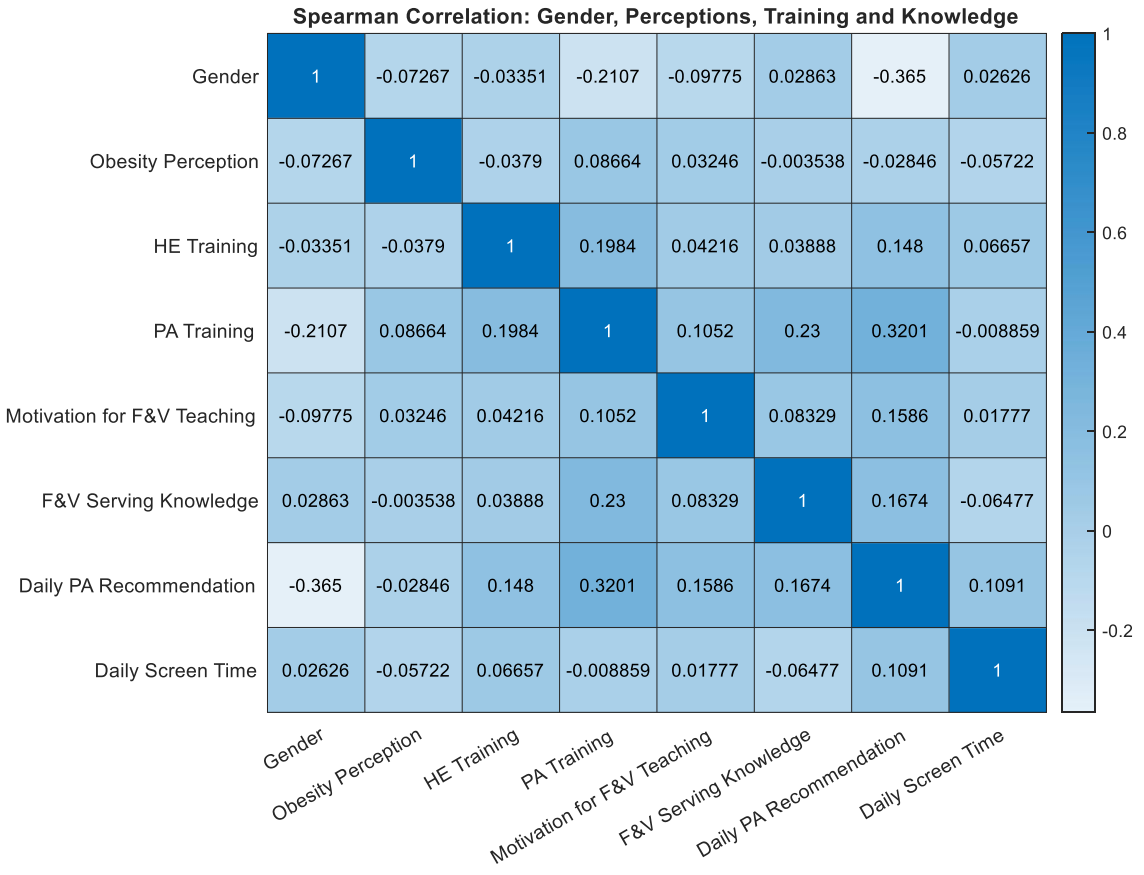


Figure 5.5 Spearman's Correlation Heatmap: Teacher Gender, Obesity Perception, and Physical Activity Insights.

## Regression Analysis

The primary aim of this regression analysis was to investigate the factors influencing teachers' recommendations for daily physical activity among students. By applying multiple linear regression, it was necessary to understand how demographic characteristics, professional training, and teachers' perceptions might predict variations in their physical activity recommendations for students. The analysis included predictors such as teachers' gender, their childhood obesity perception, healthy eating training, and physical activity training.

Table *5.9* presents the regression results for the influence of various predictors on daily physical activity recommendations. The model constant (β = 4.2784) indicates that when all other variables are held at zero, the baseline recommendation for daily physical activity is relatively

high. Teachers' gender appeared again as a significant negative predictor ($\beta = -0.77901$, $p < 0.01$, $t = -7.0464$), suggesting that female teachers are likely to recommend lower levels of daily physical activity compared to male teachers. Physical activity training also showed a strong positive association ($\beta = 0.31346$, $p < 0.01$, $t = 5.0343$), indicating that teachers with physical activity training are more likely to recommend higher daily activity levels.

Table 5.9 Regression Results for Daily Physical Activity Recommendations

| Variable | Coefficient | t-Statistic | p-Value |
|---|---|---|---|
| **Constant** | 4.2784 | 5.105 | 4.9121e-07 |
| **Gender** | -0.77901 | -7.0464 | 7.0277e-12 |
| **Obesity Perception** | -1.2824 | -1.6197 | 0.10601 |
| **Healthy Eating Training** | 0.078218 | 1.919 | 0.055626 |
| **Physical Activity Training** | 0.31346 | 5.0343 | 6.9787e-07 |

## 5.4 Summary of Key Findings

The main aim of this study was to assess school staff's beliefs about the factors contributing to obesity and their perceptions of school environments, policies, and practices regarding healthy lifestyles. Since teachers and school staff have daily contact with many children and adolescents and often have trusting relationships with them, such adults are in a position to help promote a healthy lifestyle as well as address youth obesity. However, the results of this study showed that most school staff lack training and/or expertise in the field of healthy eating and physical activity. One of the key findings revealed that 81% of participants reported they did not have any training or expertise in healthy eating, while 83% reported the same for physical activity. In contrast, only 19% had training in healthy eating, and 17% in physical activity. Additionally, our study found that a lack of knowledge among school staff regarding basic information on fruit and vegetable intake, as well as the amount of physical activity for children.

Nutrition and physical activity education in school curricula are essential components in promoting healthy lifestyles among students. Eating behaviours are more likely to improve when changes in the school environment are combined with classroom nutrition education (Lytle et al., 2004). Additionally, physical education, physical activity, and sports in schools are all associated with better student physical fitness (Story et al., 2009a). However, our study found that nearly 50% of participants reported that physical activity (PA) is not included in their school curricula, while 26% stated that healthy eating (HE) is not included in theirs. Moreover, 46.3% indicated that HE materials are limited in school curricula, while 23.8% reported that only some HE materials are included in the curricula. These findings highlight a significant deficiency in physical activity education within school curricula, whereas healthy

eating messages are more frequently incorporated. Furthermore, the results indicate that schools make minimal efforts in teaching activities related to healthy eating and physical activity, such as classroom lessons and homework. These findings align with a previous study in Saudi Arabia (Al-Khaldi et al., 2014), emphasising the need for school curricula to incorporate more comprehensive subjects on the importance of a healthy diet and regular physical activity in preventing and controlling obesity.

Obesity is often linked to factors beyond an individual's control, such as living in an environment that makes it difficult to exercise or maintain a healthy diet. Children, in particular, have a limited ability to make independent choices and are highly susceptible to external influences, such as reduced physical activity and unhealthy food options in school environments. In this study, our findings revealed that the vast majority of school staff believed physical activity is important for students during the school day and lunchtime. However, 44.8% of participants indicated that there are still insufficient sports facilities and equipment to encourage students to be active in schools.

Teaching children about healthy living can positively influence their behaviour outside of school, as what they learn in school often shapes their eating and drinking choices beyond the classroom. School gardens, cooking sessions, and fruit- and vegetable-growing activities when integrated with effective teaching strategies have been shown to increase children's vegetable consumption (Dudley et al., 2015). However, our findings demonstrated a lack of activities that promote positive attitudes toward fruit and vegetable consumption among students in Najran schools. While some participants reported that their students engaged in such activities at least once a term, only 19.3% reported conducting cooking sessions, 15% reported implementing fruit- and vegetable-growing activities, and 13% reported organising tasting activities.

# Chapter 6 Stakeholder Insights on Childhood Obesity, Nutrition, and Active Living Policies in Najran

This qualitative study seeks to explore the perspectives of key stakeholders in Najran regarding the policies and initiatives aimed at promoting healthy eating and active living among children. Through in-depth semi-structured interviews with representatives from the Najran Ministry of Health, the Ministry of Education, the Municipal Department, and the Authority of Youth and Sport, the research aims to uncover the barriers and facilitators to implementing effective childhood obesity prevention strategies in the city. By focusing on key informants with expertise and experience in relevant sectors, this study provides valuable insights into the current state of childhood obesity prevention efforts, identifies gaps in existing policies, and highlights the role of intersectoral collaboration in promoting healthier environments for children. The findings will inform future public health policies and interventions aimed at reducing childhood obesity in Najran and beyond.

## 6.1 Methodology

### Study Design

This study utilised a qualitative research design involving in-depth semi-structured interviews to explore the perspectives of key stakeholders from various sectors in the city of Najran. The semi-structured format allowed for flexibility in responses while ensuring that all relevant topics were covered. Qualitative research methods are particularly effective for exploring the

factors that influence cultural contexts (Clarke & Braun, 2013). With their open-ended questions, qualitative approaches facilitate the discovery of new factors and the generation of novel insights that may not arise through other methods (Bryman, 2008). This approach is also advantageous because it allows for sensitive and flexible questioning adapted to the context of data collection (Mason, 2002). Given that the aim of this research was to gain a deeper understanding of the patterns identified in Chapter Two, a qualitative approach was well-suited to this study, as it enabled participants to share their feelings and perspectives on specific topics openly.

**Study Sample**

Extensively used in qualitative research, purposive sampling is a non-probability sampling technique that involves intentionally selecting participants based on specific characteristics or experiences relevant to the research question. This method is particularly efficient in gaining a deep understanding of studied phenomena from a specific perspective or within a particular context. Purposive sampling is "used to select respondents that are most likely to yield appropriate and useful information" (S. E. Kelly et al., 2010) and "is a way of identifying and selecting cases that will use limited research resources effectively" (Palinkas, Horwitz, Green, Wisdom, et al., 2015).

The main goal of purposive sampling is to identify and recruit participants who can provide substantial and diverse data that enhance the research findings. This method is often used when the aim is to gain a more detailed or better understanding of a phenomenon rather than generalising findings to a larger population. Purposive sampling is particularly useful in exploratory studies where a detailed understanding is the primary objective, as it enables researchers to focus on specific characteristics, conditions, or phenomena that are central to the research question.

The key strength of purposive sampling lies in its ability to select information-rich cases that can provide valuable insight into the research topic. This method is widely preferred in qualitative research because it allows researchers to carefully target specific instances or groups that are relevant to the issue being studied.

**Participant Recruitment**

The study involved 12 participants who were selected based on their roles and expertise in key sectors in Najran. Participants were selected to ensure representation from multiple sectors involved in shaping childhood obesity-related policies and practices. These included the Ministry of Health, Ministry of Education, the Municipal Department, and the Authority of Youth and Sport. Inclusion criteria required that individuals held senior-level or decision-making roles within their respective organisations and had at least one year of experience in their current position as shown in Table *6.1*.

This strategy ensured the collection of in-depth, policy-relevant perspectives from individuals best positioned to comment on the barriers and opportunities for implementing effective interventions to address childhood obesity in the region. Potential participants were contacted either by phone or via in-person visit to see if they were interested in taking part of the study; fifteen individuals were contacted in this way, with a total of twelve participants recruited. Each participant was interviewed face-to-face at their place of work, and all interviews were recorded with the participant's permission. The interviews were transcribed verbatim and entered into QSR NVivo, a data management and analysis programme. The first two interview transcripts were initially coded into categories, themes, and dimensions relevant to the study's aims. These categories were expanded, developed, and refined with further data collection and analysis.

Table 6.1 Participants' Roles and Positions in Four Distinct Organizations: The Najran Ministry of Health, the Najran Ministry of Education, the Najran Municipal Department, and the Najran Authority of Youth and Sport.

| **Sector/Department** | **Number of Participants** | **General Roles/Responsibilities** |
|---|---|---|
| Health | 3 | Senior-level positions in public health, planning, and chronic disease management. |
| Municipality | 3 | Leadership roles in urban development, municipal services, and council advisory. |
| Education | 5 | Directors and supervisors overseeing school health and student wellbeing programmes |
| Youth and Sport | 1 | Administrative leadership in youth and sport affairs |

**Data Analysis**

Thematic analysis is a widely used qualitative research method that involves identifying patterns or themes in qualitative data. This approach is particularly useful for exploring complex research issues, and it can be applied to various epistemological and theoretical perspectives. The method is flexible and can be used in both deductive and inductive ways, enabling researchers to analyse data in relation to pre-existing themes or to allow themes to emerge organically from the data itself.

The process of thematic analysis typically involves several steps, as shown in Figure *6.1*. The first step is familiarisation with the data, where the researcher becomes acquainted with the data to identify potential themes. This is followed by coding, in which the data is categorised into themes. The themes are then analysed and interpreted to identify patterns and relationships

within the data. The analysis process is often iterative and reflective, involving constant movement between phases to ensure accuracy.

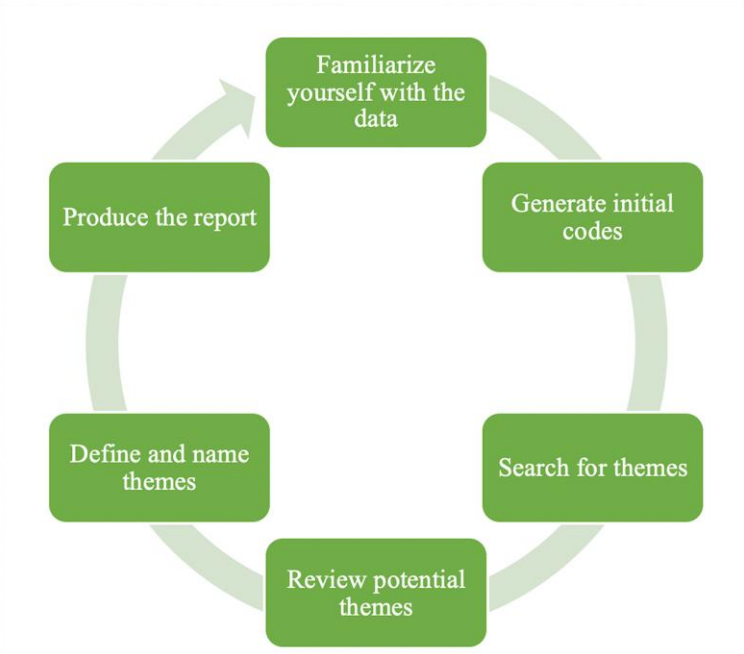


Figure 6.1 Thematic analysis steps in Qualitative Research.

One of the primary advantages of thematic analysis is its flexibility, which allows it to be applied to a wide range of data types and research questions. Additionally, it provides a more detailed and better understanding of the data by contextualising themes within the research question and the theoretical framework. Furthermore, thematic analysis can be applied with various theoretical frameworks, making it adaptable. Nevertheless, thematic analysis also has several drawbacks. For one, the analysis is subjective and can be affected by the researcher's biases, making it essential to ensure analysis reliability. The process can also be time-consuming and labour-intensive, and the findings may not be generalisable to other populations or contexts.

Recent studies have highlighted the importance of qualitative research methods, including thematic analysis, and their applications. For example, Holloway & Todres (2003) discussed the role of qualitative research and thematic analysis in nursing, along with their relevance to psychology. Boyatzis (1998) offered a detailed guide to thematic analysis and its application in various fields, such as psychology. B. Smith & McGannon (2018) emphasised the importance of rigour in qualitative research including in thematic analysis in the context of sport and exercise psychology. (Flick, 2018) provided a comprehensive overview of qualitative research methods, which covered thematic analysis, as well as their applications in various fields.

Other studies have explored the application of thematic analysis in various contexts. For example, G. Fraser et al. (2021) examined the experiences of transgender young adults in Aotearoa New Zealand, while Frohard-Dourlent et al. (2020) investigated the experiences of surgery readiness assessments in British Columbia. These studies demonstrate the adaptability of thematic analysis when exploring complex phenomena.

In addition, other researchers have contributed to the development of thematic analysis. Braun & Clarke (2006) provided a comprehensive overview of thematic analysis, including its definition, stages, advantages, and disadvantages. Braun & Clarke (2022) also provided a practical guide to thematic analysis, which emphasises the need for careful consideration of the research question, data collection, and analysis. B. Smith & McGannon (2018) discussed the challenges of ensuring reliability in qualitative research, and Varpio et al. (2017) problematised the concepts of thematic emergence, saturation, and member checking.

**Trustworthiness**

(Lincoln & Guba, 1982) argue that the trustworthiness of a research study is essential to determining its value. Trustworthiness refers to the evaluation of the quality and worth of the entire study, indicating how well the findings align with the study's aims based on the

participant data. These researchers proposed four criteria for establishing the trustworthiness of a qualitative study: Credibility, Dependability, Confirmability, and Transferability. These criteria correspond to the positivist concepts of internal validity, reliability, objectivity, and external validity (Alexander, 2019).

To increase trustworthiness, the transcripts in this study were repeatedly reviewed to identify similarities across the data. Themes were supported with direct quotations, which are presented in the Results section. Two research supervisors verified the codes and transcripts. To improve the applicability and transferability of findings, as well as avoid overgeneralisation, demographic data were collected from the participants. Consistency was maintained by ensuring that the analysis followed the objectives and aims of the study, ensuring that the participants met the inclusion criteria, and providing a clear explanation of the methodology. Finally, neutrality was enhanced by checking the coding and interpretation with two additional researchers (supervisors) and an independent researcher (i.e., not involved in the study's design and data collection), who read a final version.

## Rigour

Other techniques proposed by Seale and Silverman (1997) were implemented to improve the accuracy of the qualitative study, including using an audio-recording device to record data, quantifying events to address any concerns about the reported data, and using purposive sampling to obtain a representative sample, thereby enhancing the potential for generalisation. After data collection, transcripts were created and verified, and themes were reviewed with a second rater. Finally, detailed descriptions were provided of the study settings, participant characteristics, data collection procedures, and analysis process. The presentation of the findings contains relevant quotations (Cypress, 2017).

## 6.2 Results

### Participants' Perceptions of Childhood Obesity

All participants believed that childhood obesity has become an issue in the community. However, some described it as a significant and emerging issue, while others were aware of its existence, spread, and complications, but believed it was not a concern. Perceptions of obesity as a concern varied and were influenced by participants' professional backgrounds: in general, participants from medical/health fields perceived obesity as a concerning issue, whereas participants from other backgrounds were uncertain about it. Some participants expressed their perception of obesity based on evidence such as screening and studies, while others based their perceptions on their own judgements and daily life experiences. All participants whose perceptions were based on evidence believed that childhood obesity is a growing and serious issue.

***Childhood obesity is a big issue****…It's not just an observation…I did a study for Najran schools…the rate was between 17% and 33% among students.* ***This high rate is a big problem.*** *[P2–Manager of school health unit]*

***The incidence of obesity in Saudi Arabia is high,*** *especially obesity in children. We screened at King Khalid Hospital and markets, in many shops and in schools;* ***we found that many students and members of society were obese.*** *[P1–Public health/medical manager]*

*Yes, there is obesity in children,* ***but I think it is not a big issue****…I have no statistics or numbers, but I mean by looking—****you can't see lots of fat children****…I think it is not that [big of a] problem…in the reception year in schools only 5% may be obese… [P7–Director assistance for students' activity and guidance]*

**Influencing Factors: Unhealthy Weight Determinants/Unhealthy Lifestyle Drivers**

**Sociocultural Influences**

Sociocultural environments influencing food, eating patterns, and physical activity were identified. Participants discussed a range of such influences, including gender disparity, modernisation, and cultural influence.

**Gender Disparity**

Some participants discussed gender as one of the factors that influences physical activity levels and sedentary lifestyles, specifically for women. However, greater factors were the unavailability of recreational facilities and the environment's inappropriateness for women and school girls to be physically active. Some thought that recreational facilities are available and that women need to be encouraged more to use them. Others believed that there are some substantial cultural barriers to women being physically active.

*I have noticed that obesity in society is more among women. Women represent a large part of the society,* ***even though the sports classes in primary, middle, and secondary schools are just for boys, not girls****…It is the culture…[it]* ***encourages exercise for men only, so we see obesity spread in women*** *more…A small part of society does not accept women exercising, but the society as a whole will certainly accept it. [P1]*

*There is a huge lack of physical activity, especially for children, students in intermediate and secondary school….* ***There are no sports sessions in girls' schools, nothing****…there are efforts to do this, but we do not know if society will accept it or not. [P6]*

*Most neighbourhoods have a park where the entire family can go and walk, not just men but also women can access it…to focus on obesity and to raise awareness about the importance of physical activity…for girls and women…****We are a religious society, but exercise is not against religion for either men or women. I call on girls and women to take up this duty.*** *[P2]*

***No places for women to be physically active****… it must be safe and separated…it is* ***culture: some people do not want to take their wives to public walking spaces****. [P8]*

## Modernisation/Social Transformation

Saudi Arabia has experienced rapid growth since the discovery of oil over the recent decades. This has had an enormous influence and caused changes in various environmental and social aspects. Many participants believed that modern life has had negative influences on the population's lifestyle, food choices, and physical activity levels.

### *A- Influences on Physical Activity*

It was clear from participants' comments that the lifestyle change has led to a decrease in overall activity (walking, manual labour, housework, and sports) and promoted sedentary habits (using cars, office jobs, sitting, and excessive use of technology/mobile phones). Some participants also indicated that modern life and wealth patterns have changed people's values about manual work, which is now viewed as a 'dishonourable' or shameful job. This has had a significant impact on physical activity levels. Participants also discussed the negative effects of technology and smartphones on children's physical activity levels.

*Our grandparents and parents told us that* ***they were working with their hands****…they were very active...doing everything;* ***construction, farming, painting*** *and so on…nowadays people are restful and lazy… they do nothing …it is a cultural matter...in the past, people worked in everything and they were healthy****...it was not dishonourable or shameful****…. Also, in homes now* ***people have houseworkers, they do not work in the home****… even those who do not have enough money still have houseworkers to work for them, just to be like others… [P5]*

*I encourage my children to exercise. I explain to them the importance of exercise. I explain to them that I understand that sports are essential for their health.* ***In fact, technology has affected exercise negatively****. [P12]*

*What I noticed recently is that* ***people are not moving, not playing; that is because of smart phones****…I can see that at home,* ***my brothers are not playing anymore.*** *[P6]*

*Sedentary life is a big problem here…this is I think because of the economic revolution and quick development that we experience these days…**even small and simple jobs at home, we bring in workers to do for us…we use our cars at every movement.** [P4]*

*You know our culture has changed, our society used to be healthy in the past…**they used to move and walk a lot before cars,** but now **with modern life and technology, our thinking has changed**. I **believe that technology doesn't help our health; it only supports our rest, but negatively influences our health**. People seek the easy way of life without effort—instead of walking from one place to another, **we don't walk we use cars**. I think there is no balance between a modern life and a healthy life. [P10]*

*The ways of life have changed. In the past**, people were walking, working on farms, in houses, and everyone was moving**. Now, the story has changed; all of **us use the car** for school, and **sit inside air-conditioned houses**. Movement is all by cars. I hope society encourages individuals to exercise. Everyone should exercise, not just chubby individuals. [P1]*

*…**use of cars for all moving, even for short distances;** people do not walk, they use cars, you can see **people order from bakeries while they are sitting in their cars**…they do not walk even a few steps. In addition, there is a **social problem, which is being arrogant. This leads us to do nothing with our own hands.** [P2]*

### *B-Influences on Diet Pattern*

The rapid lifestyle change in Saudi Arabia has not only influenced physical activity but also food preferences and diet patterns. The trend of consuming junk and fast food has increased, and people are moving towards a Western diet. Most participants indicated that the Western diet and fast food outlets have become very popular; they also recognised that while these types of food are not healthy, they have been consumed in enormous amounts by adults and children. Some participants believed that this was because of the high diffusion of attractive fast food outlets, such as McDonald's, while others believed that people are not fully aware of the negative health consequences of fast food and do not know what healthy choices are. Participants also discussed how young people prefer to eat with friends outside the home, which

leads them to consume fast food. Although participants had various opinions on why people choose to eat junk and fast food, almost all agreed that these foods have become very popular and highly consumed among their community. They also believed that fast food is one of the leading causes of unhealthy weight in the Saudi population.

*It is a big problem,* ***fast food meals are full of fat and they are very popular today****. In the past,* ***people used to eat only in their home,*** *eat what they cooked, but remember that now* ***we have lots of fast food outlets*** *here and big brands like* ***McDonald's*** *and Herfy, which is a big problem. [P7]*

*The main cause of obesity is the fast food, I mean the food that replaced the main meals like chips, burgers, and restaurant food…Unhealthy food is really spreading here, it is a disease; I feel that it is something that people are forced to eat—you have to eat it, you can find it everywhere and in every house. I do not know why; I think because it is so easy to get it, or because nowadays there are no more choices, no alternatives, only fast food. [P10]*

*The fact that unhealthy food has recently spread strongly, in my home I fight and try to make my children aware, because they concentrate on unhealthy foods and leave healthy foods. [P12]*

*Unhealthy food is a big problem for us. We see young people spend most of their time in their* dewaniyas *[forums], gathering with friends or out of the house, eating unhealthy food. [P11]*

*This is the result of changes in society, such as eating fast food, French fries, chocolate, and chips. These foods were not known in the past…People eat large amounts of food that is mainly not from our environment and our habits, such as hamburgers, pastries, pastries, hotdogs, and they are changing their lifestyles. In the past, we used to eat simple, good foods and a few calories in our homes…I mean society moved to a type of commercial food, fast and high in calories… [P1]*

### Cultural Norms: Traditions and Customs

It is very popular for Saudi community members to invite each other to meals in their houses, to talk and enjoy each other's company. In addition, there are important traditions that involve people inviting their relatives and friends to have a meal together, for many reasons (returning

after travelling, having a baby, healing after illness, and more). Moreover, showing good hospitality and generosity are the main values. Participants believed that these social events and gatherings can lead to unhealthy food choices for both adults and children, as well as lead to overconsumption of high-calorie, fatty food and sweets. (In such social events, it is an offence for a guest to refuse to eat the provided food.) Other participants noted that social traditions can also have an impact on the type of food served. Most families eat together at one time, at one table, and sometimes from one plate, so that food choices can be limited. Some participants discussed the local food diversity and its possible impact on nutrition and health: the common local diet lacks fruits and vegetables and consists of high calories and fat—especially at lunchtime, as people eat Kabsa (rice and meat or chicken cooked with spices, salt, and oil) for lunch almost every day.

*It is about people's customs: at social events, they provide lots of food, and it is full of fat lamb and rice, and when you have guests in your house, you have to offer rice and meat and people have to sit down and eat…that is the culture. [P4]*

*We eat food together from a very big plate, and this is true from the religious point of view, and each person must know the amount of food he needs and not eat more than he needs. Our Arab society eats until the huge plate is finished…the way to eat in society/at social events, all these occasions require a person to eat large amounts of foods, fats and others…Society needs to pay more attention to eating healthy food and to avoiding fatty fast foods. Society here eats fatty foods such as* kabsa*. [P1]*

*We do not have a variety of foods; for example, we eat* kabsa kabsa kabsa *every day at lunch, no diversity. Food types should be different every day—eat something [different], for example today rice and tomorrow mixed vegetables and so on. [P9]*

*We know that our food is meat, oil, and rice, cooked in a pressure cooker. We eat this food and then sleep, this is dangerous to health. I want to ask: where are the vegetables and fruits? These elements are required to build the bodies of young people. These dishes should be a part of any meal, at home or out of the house. Yes, I say that meat is an important part of [diet], but not just meat. We unfortunately eat only red meat and ignore fish and white meat. In fact, we need food awareness. [P11]*

**Parental/Family Influence**

Parents and family members are an important part of addressing overweight and obesity, particularly in children. Parents' behaviours and habits can influence their children, in terms of active or inactive lifestyle (sedentary lifestyle, TV watching) and diet and nutrition environment (healthy food choices). Most participants perceived that while schools and other government sectors play a role in promoting healthy lifestyles and preventing obesity, parents hold the principal responsibility. The primary aspects of this topic discussed by participants were the availability/accessibility of unhealthy food at home, a lack of parental awareness, and parents' unhealthy dietary habits. Although participants discussed the parents' role and the influence of the home on children's physical activity, they were more focused on the effects of these influences on dietary habits. Some participants indicated that parents can be a negative role model for their children through their sedentary lifestyle and unhealthy dietary habits. They believed that parents themselves are not fully aware, as they eat junk food with their children and are physically inactive; at the same time, children always want to eat wherever their parents eat. Other participants shared that parents play an essential role in their children's weight gain and unhealthy eating, by always bringing junk food and fizzy drinks into their homes. Some participants felt that parents should set house rules regarding screen time and food, such as limiting candy and fast food.

*When we talk about children, we are very emotional: the child always loves dessert. We meet children's demands, we do not want them to cry, and that is very wrong. With these actions, we help obesity to spread by allowing children to eat all kinds of sweets. We do not know what the risks and toxins are of these foods. Another thing is the spread of fizzy drinks. The child asks for juice, asks for candy, and asks for fizzy drinks. When we meet these demands, we help spread obesity among children. Parents who wish to raise an educated generation should not meet some of their children's demands. The mother must be aware of her child at home. [P11]*

*I think parents' awareness and responsibility is very important, we can't blame kids they don't know, if you give them anything to eat or drink they will take it…if we ask kids 'do you want Pepsi?', for example, they will definitely say yes every day. [P7]*

*Parents must know two main things: the danger of some meals for their children's health, and instilling walking and exercising in their minds; they should be a good example for [their] kids…some of us now are aged 40 years or more and do not walk or work out…we just complain, and the truth is our children are our products, our children become obese and we are the reason. Honestly, I'm a father and I bring chips and fast food to my home because my kids like them; we must convince them these are bad foods, and we shouldn't bring it home. [P9]*

*Healthy food, I will say that* ***home has a big role*** *along with schools; there is no benefit if schools banned some kinds of food but it is* ***still available at home, like junk food.*** *[P6]*

*Parents do not take care…****they leave electronic devices in their kids' hands all the time****, so kids are very busy with that, they do not have time to play physically…Some parents think that* ***it is wasting time if they let their kids play outdoors****, some others do not feel safe and they worry* ***their kids may be involved in trouble or fighting when playing outside****…some parents* ***are bad models for their kids,*** *they eat everything and they go to sleep very late and* ***they bring food and Coca Cola from outside****…there must be limitations and rules in the home. [P4]*

## Response to Unhealthy Lifestyles: Policy Responses

### Current Policies/Interventions

Participants identified a range of current policies, initiatives, and interventions to combat obesity and promote healthy lifestyles. Most of these interventions were school-based, although some were community- and/or clinical-based interventions. All school-based initiatives are managed and delivered by the Ministry of Health and the Ministry of Education. One school intervention is an 'anti-obesity initiative', which is focused on measuring students' body mass index (BMI) (i.e., taking students' heights and weights and calculating their BMIs)

and reporting the results to parents. It also offers. Participants also discussed another school-based intervention called 'a health-promoting school', which aims to improve students' health and promote healthy lifestyles among students. The main activities of this programme involve improving health education and raising awareness regarding healthy food and physical activities. In addition, the Ministry of Education has established school cafeteria regulations banning fizzy drinks and fast food in schools.

Participants described another initiative established by the Ministry of Education, called 'neighbourhood club'. This initiative aims to create a physical-activity environment for local people by opening schools, sports, and recreational facilities to the public after school hours. These clubs are staffed with trained coaches and organisers to manage activities and to provide guidance and help when needed. Moreover, the Ministry of Health has held many workshops and training courses for healthcare professionals on healthy diets and physical activity. These courses aim to equip healthcare staff with the knowledge and skills necessary to deal with patients and prescribe healthy diets and physical activity. In addition, the Ministry of Health has conducted community awareness campaigns for a healthy diet in public venues, such as shopping malls, wherein they provide brochures and posters containing information on a healthy lifestyle. Municipalities have also undertaken many initiatives to create environments and offer opportunities that promote physical activity among their population, including building more parks and green spaces, creating walking tracks, and establishing community recreational spaces. They have also provided sports and recreational facilities in walking tracks and areas to encourage people to be more physically active.

*The **Ministry of Health** this year implemented an initiative programme called the [Anti-Obesity Initiative], and its application starts in schools. The ministry has chosen a group of schools in Najran as a start. In this initiative, the ministry trains their doctors, school doctors, and health center nurses. These medical teams then visit schools, measure weight and height, and calculate the rate of the body mass. The medical staff then*

*categorises students according to weight (normal weight, overweight, first-class obesity, second-class obesity, over-obesity)…The medical staff then deals with these cases; for example, overweight people can be asked to change their lifestyle, and those who suffer from obesity can be taken to the [obesity] clinic at King Khalid Hospital. [P1]*

*The Ministry of Education has established **neighbourhood clubs**, which are very important clubs. In Ibn Khaldun School, for example, the club has the highest level, at which there is a gymnasium which includes walking and movement equipment, playgrounds, and a complete gymnasium. In schools' cafeterias, they do not allow sweets, sugars, or candy to be sold, as the cafeteria health rules prohibit those. However, those rules are not followed, as we can see when we visit schools. [P2]*

*There is a new programme called **health-promoting school**; we focus on many health aspects like chronic diseases and obesity as well…we focus on healthy food in schools, we try to keep school cafeterias healthy…there are also awareness lectures for students about healthy weight and obesity. [P6]*

*There is a programme targeting students' health…[in] this collaboration between health and education, [called] **health-promoting schools**, they deliver workshops and lectures about obesity and healthy food, awareness about unhealthy food, and they also notice the obese students to send them to the hospital…and speak to parents when students need to be transferred to a healthcare center or hospital. [P9]*

*The Department of Health awareness and noncommunicable diseases, they do campaigns in public and shopping malls to raising awareness about obesity…we have a consultation clinic so people can go and find information about healthy food and obesity. [P10]*

### Barriers to Interventions' Effectiveness and Efficiency

The findings revealed that multiple initiatives, policies, and interventions have been aimed at promoting physical activity and healthy eating, as well as addressing obesity, in Saudi Arabia. However, many participants perceived these initiatives as ineffective or as somewhat effective but needing more effort. These perceptions were influenced by multiple different reasons, and various barriers were discussed.

### Vested Interests

One of the main barriers to promoting healthy eating, as cited by participants, is vested interests, especially in schools. Although Saudi Arabia bans the sale of fast food and soft drinks in school cafeterias and has banned students from bringing such items to school, participants shared that these regulations are not practically effective or implemented. They believed this was because the cafeteria operators are focused only on profit. Some participants stated that part of a cafeteria's profits is given to the school management to spend on other aspects of the schools, leading to poor monitoring and tolerance of the regulations.

*It is not effective…in schools' cafeterias, they do not allow sweets, sugars, candy to be sold, as the cafeteria health rules prohibited these. However, those rules are not followed, as we can see when we visit schools…The procedures are not effective because the school cafeteria is supposed to be responsible for students' health, not focused on profits. The schools focus on cafeteria profits to help them to spend money on schools, which is not right—taking care of the students' health is much more important…At the school, for example, the cafeteria money is spent on other things at the school. These overlapping aspects are difficult to control all at one time. [P2]*

*For school cafeterias, it is not effective, because the regulations are not implemented…honestly, if you go to school, you will see Pepsi, chips, and everything chocolate and many biscuits…They are looking for money and they bring items that they will sell more and make profit. [P7]*

*Schools' management are negligent with school cafeteria regulations; monitoring is very poor, because school management gets money from cafeterias, and they need to spend this money on other things like programmes or maintenance, so they seek profit. [P6]*

### Lack of Coordination

Obesity is a complex and multifaceted issue: tackling it requires a multi-sectoral response from governments, the private sector, and the public. Initiatives and policies to promote healthy lifestyles and prevent obesity require central coordination and synchronisation of multiple sectors and government agencies. However, most participants shared that one of the main

barriers is a lack of coordination between relevant sectors, such as the Ministries of Health and Education, the municipality, and the private sector. Participants believed that each sector is in some way participating in these initiatives, but they are working separately. Others believed that there is a conflict of interest between government agencies, as one participant explained: "If the Ministry of Health needs land to build a sport club, the municipality would not allow it, as they need it for something else; or if the municipality wants to create a walking track near school, the Ministry of Education will not accept it." This finding clearly shows that the responsibilities of different government sectors are unclear, and leadership seems to be lacking; there is no central coordination body responsible for combining efforts and managing these initiatives and policies.

*We need the governmental agencies and also the private sectors and charities such as the 'friends of the sick' charity and the business people and the big supermarkets as well to work together to obtain better results. This teamwork is what we really need. [P2]*

*The cooperation process is weak in most parts of the kingdom. This is what we see in coordination between government agencies…We do not see this coordination and cooperation in projects. There is no coordination between government agencies. The real coordination has not yet come to us… [P3]*

*In fact, there is no cooperation as far as I know. I see that it is not to the extent of organised cooperation at the professional level…when we say that we have a problem that threatens the whole society, from here, all parts of society and [all] agencies must cooperate to face this problem. In fact, I see that this cooperation is not at the required level. [P4]*

**Suggestions and Recommendations for Policy**

Study participants were asked to share their ideas and suggestions for policies promoting healthy lifestyles for the population. A range of policy and initiative recommendations was

provided to promote healthy diets and physical activity. These recommendations were varied and addressed multiple sectors and multiple levels.

**Physical Activity**

**Building the Local Environment**

Most participants suggested that the built environment is crucial to promoting physical activity and encouraging people to be more active. Participants believed that available and accessible recreational facilities (parks, walking trails, and community recreational spaces) could encourage exercise. Participants discussed the need to increase the provision of accessible and well-equipped recreational facilities, as these would offer opportunities to expose the public to active environments. Most participants believed that the local government needs to increase the number of green spaces and to improve existing ones in terms of sports facilities and infrastructure. Others suggested that the government should implement pedestrian zones or car-free streets, especially in traditional market venues and at least on weekends. They believed that such a policy would encourage walking and improve the aesthetic attractiveness of the local environment, thereby discouraging the sedentary behaviour of car use.

In addition, some participants believed that the principles of Islamic morality and local culture must be respected when promoting physical activity, especially for women. Participants discussed the need for gymnasiums, walking tracks, and recreational facilities that offer privacy for women, in order to encourage them to exercise more.

Finally, some suggested that reducing or eliminating gymnasium costs would motivate and encourage people to be more active and engage in more exercise.

**School-Based Policies Promoting Physical Activity**

The participants believed that promoting physical activity should start early in life, and in this regard, schools play a significant role for children and families. Some participants commented that promoting physical activity through the curriculum is an important school responsibility. They suggested that students must be taught the importance of physical activity for health. They also stated that physical education should include theoretical material embedded in the school curriculum. They also argued that physical education must be as important as other subjects, such as math and science, and that students must be assessed in physical education as a requirement for graduation. Some participants felt that the current rate of sport and physical activity sessions in school—namely one session per week—is not enough and must be increased to at least three sessions per week. They also remarked that there are no sports sessions in girls' schools.

Additionally, extracurricular activities such as morning queue activities, opening school facilities to families after school hours, school sports champions, and competitions were seen by many participants as important to enhancing the school's role in promoting physical activity. Some participants suggested that school sports facilities should be improved and open to the public after school hours. Finally, they suggested that it is best to start talking with school-age children about the importance of physical activity for health.

**Promoting Healthy Diets**

**Raising Awareness**

Almost all participants perceived that intensifying awareness campaigns is crucial to promoting healthy diets. They believed that these awareness campaigns should target the whole population through all possible channels. Some suggested that these campaigns are the responsibility of the Ministry of Health and should be conducted under their supervision in public places and on

health premises in the form of lectures, seminars, and leaflets. Others suggested that these campaigns must keep up with the new era of technology and that the use of social media and advertising would be more effective and powerful in delivering the campaigns' messages. They also suggested that these campaigns should provide positive messages on the importance and advantages of healthy food, food variety, meal times, and portion size for one's health and welfare, rather than conveying messages that contain negative information, such as the risks associated with unhealthy food.

*...This awareness should be delivered as advertisements on TV, social media, or on the street; I think this would be much better than a two-hour lecture. [P6]*

*All the public needs is awareness; raising awareness is very important, especially through social media, as it is very popular today—everybody uses it. [P5]*

*Raise awareness of the importance of exercise and the need of food awareness. We need Ministry of Health officials to do their part to educate the whole society…I think we need the Ministry of Health to hold seminars, provide seminars and lectures. All this activity about nutrition education. People need to know the importance of food diversity and eating meals on time. [P11]*

**Nutrition Education**

Some participants believed that while prompting healthy food habits is important for the entire population, nutrition education should start at an early stage of life and must occur in schools. They urged that nutrition should be taught to students in school as a subject. They believed that this approach would be effective in educating children and their families, making them aware of what constitutes a healthy diet and of ways to improve their diets and lifestyles.

*Obesity and health nutrition should be one of the topics of school materials. Students should be taught that obesity is very dangerous…The food topic is correlated to human behaviours. We cannot force them not to eat junk food. It is similar to smoking, which is also linked to human behaviours. But everyone should learn how to eat healthy food or how to handle food. Awareness must be emphasised here. [P2]*

**Food Labelling**

Some participants believed that a nutritional labelling policy is needed to reveal the nutritional ingredients of food being sold in stores and restaurants. They believed that such a policy would increase consumers' awareness of the ingredients in the food they eat and would help them avoid unhealthy choices.

***The number of calories and food component should be labelled**. So that a person can know the number of calories in food. People can then determine what calories they need and what to eat. [P1]*

**Changing the Food Market Environment: Fiscal Measures**

Many participants argued that strict new controls must be introduced to stop companies and food outlets from marketing and selling unhealthy food. Some of the participants referenced similar policies that were useful in changing people's habits, such as seatbelt laws and overspending penalties.

## 6.3 Summary Themes and Key Findings

The thematic analysis reveals that childhood obesity in Najran is influenced by a complex combination of cultural, societal, and environmental factors. Key themes include the role of parents in promoting healthy habits, the influence of technology on sedentary behaviours, inconsistent enforcement of school policies, and the widespread availability of unhealthy foods. Despite various governmental and educational interventions, more effective collaboration and enforcement are needed to address the root causes of obesity. Public awareness campaigns,

school-based nutrition education, and clear food labelling are seen as essential tools to promote healthier eating and more active lifestyles:

**1. Perceptions of Childhood Obesity**

- Varied Perspectives on Obesity: Some participants highlighted that childhood obesity is a major concern, citing high obesity rates in schools. Others, however, felt it was not a significant issue, stating that they do not see many obese children or that the problem is overstated without concrete evidence. This variation in perception suggests a gap in awareness and understanding of the extent of childhood obesity.

**2. Cultural and Societal Influences on Physical Activity**

- Gender-Specific Barriers: The lack of opportunities for women to engage in physical activities was a significant barrier to combating obesity. This was compounded by cultural norms that limit women's participation in exercise, particularly in public spaces. Gendered expectations play a role in the spread of obesity, especially in women.
- Cultural Shifts and Technology: Participants frequently mentioned how cultural practices and modern conveniences, such as cars, electronic devices, and household workers, have led to a more sedentary lifestyle. In the past, people worked with their hands, staying physically active; however, technology and the reliance on labour for household tasks have decreased physical movement today.

**3. Dietary Habits and the Influence of Fast Food**

- Fast Food Consumption: Unhealthy food, particularly fast food and sugary drinks, was frequently mentioned as a major contributor to childhood obesity. Items such as chips, burgers, and soft drinks are now widely available and popular among children, contributing to unhealthy eating habits.

- Parental Influence and Food Choices: A recurring theme was the role of parents in shaping children's eating habits. Several participants pointed out that parents, driven by the desire to avoid their children crying or feeling upset, often fulfill their children's demands for sweets and junk food, thereby enabling unhealthy eating patterns.
- Lack of Awareness of Health Risks: Many participants mentioned that parents may not fully understand the risks associated with unhealthy foods, such as sugary snacks and fizzy drinks, which further perpetuate obesity. Raising awareness of these health risks is seen as a critical need.
- Cultural Eating Habits: Cultural habits, such as large portions of fatty foods at social gatherings, were also identified as contributing to unhealthy diets. There was an emphasis on the societal practice of consuming large amounts of rice, meat, and fats, especially during social events, which leads to overeating.
- Home and School Roles in Dietary Habits: There was a clear acknowledgment of the important role the home environment plays in shaping dietary habits, alongside schools. If unhealthy foods are still allowed at home, school efforts to limit junk food may not be as effective.

**4. Sedentary Lifestyles and Lack of Physical Activity**

- Increased Sedentarism Due to Technology: The growing use of electronic devices, especially smartphones, has been highlighted as a major reason for the decline in physical activity among children. Parents and society often allow children to spend too much time on screens, hindering their ability to engage in physical play or outdoor activities.
- Barriers to Outdoor Play: Concerns about safety, as well as some parents' beliefs that outdoor play is a waste of time or exposes children to danger, were noted as barriers to

physical activity. Parents' reluctance to allow outdoor play or lack of awareness of the importance of exercise for children contributes to sedentary behaviours.

**5. Parental Responsibility and Awareness**

- Parental Accountability: Several participants emphasized that parents must take responsibility for their children's health by educating them about the dangers of unhealthy foods and the importance of exercise. Parents should serve as role models by adopting healthy habits themselves, such as avoiding junk food and participating in physical activities.
- Balancing Demands and Responsibility: Many parents fulfil their children's demands for unhealthy foods, such as fast food and sugary drinks, as a means to avoid conflict. However, participants pointed out that this is a contributing factor to the spread of obesity and that parents should resist catering to unhealthy cravings.

**6. Educational and Governmental Interventions**

- School and Ministry of Health Initiatives: Several participants mentioned the initiatives by the Ministry of Health and the Ministry of Education to combat obesity. Programs such as the Anti-Obesity Initiative, health-promoting schools, and neighbourhood clubs were highlighted as important efforts to raise awareness and promote healthy lifestyles among students.
- Inconsistent Enforcement of School Policies: Despite school rules that prohibit unhealthy foods, such as sweets and fizzy drinks, in cafeterias, many participants noted that these rules are not consistently enforced. This inconsistency undermines the effectiveness of school-based interventions and raises concerns about the prioritization of profits over student health in school cafeterias.

- The Need for Better Coordination: There were concerns about the lack of cooperation between government agencies, which undermines the effectiveness of obesity prevention efforts. Participants noted that coordination between various sectors, including government, private sectors, and charities, is crucial for addressing the childhood obesity issue effectively.

**7. Need for Increased Awareness and Education**

- Public Awareness Campaigns: Several participants emphasised the need for widespread awareness campaigns, particularly through popular platforms such as social media and TV. They argued that campaigns and educational materials should be designed to reach a broad audience, effectively communicating the dangers of obesity and promoting healthy living.
- School Curricula and Nutrition Education: There were calls for incorporating obesity prevention and nutrition education into school curricula. Teaching children about the importance of a balanced diet, the risks of unhealthy foods, and the benefits of regular physical activity was seen as essential for creating long-term changes in their eating and lifestyle habits.
- Food Labelling and Regulation: Some participants suggested that more transparent food labeling, particularly in terms of calories and nutritional content, could help individuals make more informed choices about their diets.

**8. Collaboration for Effective Solutions**

- Intersectoral Collaboration: There was a consensus that addressing childhood obesity requires cooperation between various sectors, including governmental agencies, schools, healthcare providers, the private sector, and community organizations.

Participants highlighted that without effective collaboration, efforts to combat obesity will be fragmented and less effective.

# Chapter 7 Overall Discussion

This thesis explores the various factors contributing to childhood overweight and obesity in Saudi Arabia, a complex issue influenced by multiple systemic and causal factors. The aim of this study was to identify the key contributors to childhood obesity in Saudi Arabia. In acknowledgement of this complexity, the research uses Bronfenbrenner's ecological systems theory as a framework, as it allows for an examination of these factors within the contexts of a child's home, school, and broader community.

The research followed a mixed-methods approach. The first phase involved distributing a cross-sectional survey to 787 parents, each with at least one child aged 6–18 years, living in Najran. This phase focused on the impact of dietary habits, physical activity, and sedentary behaviours key factors influencing childhood obesity and also examined how family dynamics and parental behaviours contribute to unhealthy lifestyles in children. The second phase recruited 459 school employees to participate in a cross-sectional survey, with the aim of understanding the cultural, environmental, and organisational factors shaping children's eating habits and physical activity in schools. The survey also explored teachers' knowledge about obesity, their understanding of the role of diet and physical activity in its prevention, and their views on their responsibilities in addressing childhood obesity in schools. The third phase involved semi-structured interviews, conducted to gain deeper insights into the findings from the earlier phases and to identify barriers and facilitators to promoting healthy diets and physical activity in Saudi Arabia. This phase also examined the effectiveness of policies and programmes, their implementation, and the collaboration between key sectors, including the Ministries of Health and Education, the Municipality Department, and the Authority of Youth and Sport.

Despite the growing concern about childhood obesity in Saudi Arabia (Almubark & Alqahtani, 2023b; Althumiri et al., 2021; Hammad & Berry, 2017; Malkin et al., 2022), several gaps exist in the literature that this study seeks to address. First, while many studies have focused on the prevalence of obesity (Albaker et al., 2022; Alhamed et al., 2023; Al-Hazzaa et al., 2022b; El Mouzan et al., 2010b, 2012; El-Hazmi & Warsy, 2002), limited research explores the specific factors at multiple levels such as family dynamics, school environment, and community culture which contribute to this issue in Saudi children. Second, much of the existing literature is quantitative, with few qualitative studies exploring the deeper, contextual factors that may shape childhood obesity. Third, there is a dearth of comprehensive research that examines the collaboration between different sectors, such as health and education, to address the issue. Finally, although efforts have been made to develop policies (Alsukait, Wilde, et al., 2020), little evaluation has been conducted as to their effectiveness and how they are implemented in practice.

The following section will discuss the main findings of these studies, revealing the key factors contributing to childhood obesity in Saudi Arabia and their implications for interventions and policy development.

## 7.1 Discussion of Key Findings from Study One

The main aim of this study was to investigate parental behaviours and home environmental factors that may contribute to the development of unhealthy lifestyles and obesity in children in Saudi Arabia.

The research’s results highlight several key insights into the factors affecting children's nutrition and physical activity habits. While most parents understand the health benefits of fruits and vegetables, many are unaware of the recommended daily intake for children. This knowledge gap likely leads to the lower consumption of these foods observed among children.

Indeed, parents admitted that their children did not consistently eat fruits and vegetables, with some reporting that their children did not consume them every day. This reveals a significant disconnect between awareness and action, pointing to the need for more education on specific dietary guidelines and practical ways to include fruits and vegetables in children's daily diets.

Furthermore, parental behaviours regarding food choices at home may worsen the problem. The high availability of unhealthy snacks, such as crisps and chocolate, was identified as a contributing factor. This finding is consistent with previous research indicating that children's food preferences and eating habits are heavily influenced by the availability of food in their home environment (Van der Horst et al., 2014). It is crucial to recognise that such parental practices might unintentionally promote unhealthy eating habits in children, even if parents do not mean to do so. Encouraging healthier home environments with more fruits, vegetables, and other nutritious options could help address this issue (Ek et al., 2016; Liu et al., 2023; Zarnowiecki et al., 2012).

Additionally, environmental factors both at home and in the neighbourhood emerged as significant barriers to children's physical activity (Cleland et al., 2011). Many parents reported concerns about the safety of their neighbourhoods, particularly with regard to unsupervised walking or cycling. This mirrors broader concerns seen in urban planning and public health literature, which often cite unsafe streets and lack of relevant infrastructure (e.g., sidewalks, parks, or bike lanes) as barriers to physical activity for children (Carver et al., 2014). Moreover, parents noted an absence of nearby playgrounds, which further restricts opportunities for children to engage in physical activity (Pugliese & Tinsley, 2007). These environmental constraints indicate that efforts to increase children's physical activity should not only focus on behavioural interventions but also consider how to improve the physical environment, such as advocating for safer and more accessible play areas.

Another notable finding from the study was the role of cultural factors influencing physical activity levels, particularly for women. Cultural norms and expectations can create significant barriers to physical activity, especially for mothers, who may face greater societal pressure to prioritise family responsibilities over personal exercise (ALNohair, 2014a). This finding highlights the need for targeted interventions that consider the unique cultural contexts in which parents, and particularly mothers, operate. Such interventions could include community-based programmes which encourage physical activity and offer opportunities for women to engage in exercise while managing family obligations.

Taken together, these findings highlight the complexity of promoting healthier behaviours among children. Accordingly, improving children's nutrition and increasing their physical activity requires a multifaceted approach that involves enhancing parental knowledge, creating supportive home and neighbourhood environments, and addressing cultural factors that may limit opportunities for physical activity. Future interventions should take a holistic approach, focusing not only on individual behaviours but also on broader environmental and societal influences that shape those behaviours.

## 7.2 Discussion of Key Findings from Study Two

This study aimed to explore the role of the school environment in promoting or hindering healthy eating and physical activity among children. In this study, we focused on teachers' knowledge of obesity, their attitudes, and the school policies related to physical activity and diet.

The findings of this research provide detailed insight into the gaps and challenges present in the school environment in Saudi Arabia regarding the promotion of healthy behaviours, including physical activity and healthy eating. Several key issues emerged, highlighting

systemic weaknesses in both current school curricula and infrastructure, and when combined, may contribute to the overall lack of attention to children's health and well-being.

One of the most significant findings was the lack of physical activity and healthy eating education subjects in the school curriculum. Despite the growing awareness of childhood obesity and the importance of healthy lifestyles, schools appear to be underperforming in providing comprehensive educational programmes on these topics. The lack of a consistent, structured approach to promoting physical activity and nutrition education in schools may contribute to students' limited understanding of healthy behaviours (Story et al., 2009b). This finding is consistent with global studies showing that incorporating structured physical education (PE) and nutrition programmes in schools has a positive effect on children's health behaviours (Lytle, 2009) (Friedrich et al., 2015; GUNASEKARAN et al., 2018; Xu et al., 2021).. Thus, it is crucial for Saudi educational policymakers to consider integrating comprehensive health education into the school curriculum to equip students with the necessary knowledge to make informed lifestyle choices.

Another identified key barrier was the lack of awareness and knowledge among school staff regarding healthy behaviours and obesity prevention (Al-Khaldi et al., 2014). This deficiency underscores the need for improved professional development opportunities for educators and staff. Without adequate training, school personnel may not feel confident in promoting or teaching healthy behaviours, which in turn could perpetuate unhealthy habits among students. Schools must prioritise staff training programmes which focus on the importance of physical activity and balanced nutrition, as well as the role of educators in fostering positive health behaviours in children (S. M. Davis et al., 2013; Erzse et al., 2023).

The research also revealed a significant shortage of sports facilities and equipment in schools, which further limits opportunities for students to engage in physical activity (Dudley et al.,

2015). Thus, even when staff are knowledgeable about the importance of physical exercise, inadequate resources make it difficult for schools to implement effective physical activity programmes. The dearth of sports infrastructure aligns with findings from other studies emphasising the importance of adequate facilities in facilitating students' participation in physical activity (Sallis et al., 2001). Accordingly, schools should prioritise investment in sport facilities and equipment in order to create environments which encourage active participation and promote long-term health benefits (Fernandes & Sturm, 2010; Hasson, Beemer, et al., 2023; Hasson, Eisman, et al., 2023).

Moreover, the findings indicate a lack of activities meant to promote positive attitudes towards healthy eating, especially regarding fruits and vegetables. In many cases, students may not have access to the information or activities that can help them develop a preference for nutritious foods. This gap is concerning, as schools are key environments wherein children can be exposed to and learn about the importance of a balanced diet (YOUNG, 1997b). By incorporating initiatives such as school gardens, cooking classes, or educational campaigns around healthy eating, schools could play a key role in shaping students' dietary habits. Furthermore, involving students in the process such as through taste tests or cooking competitions could increase their interest in healthy foods and reinforce the importance of incorporating fruits and vegetables into their daily diets (Clement et al., 2020).

Taken together, these findings highlight the critical need for a multifaceted approach to improving school-based interventions that promote healthy lifestyles in Saudi Arabia. It is evident that improving the quality of education on healthy eating and physical activity, enhancing staff training and resources, and addressing infrastructural barriers in schools are essential to creating an environment that supports healthy behaviours. Furthermore, these efforts should be complemented by community- and policy-level initiatives to ensure that health promotion in schools is aligned with broader societal goals for improving public health

outcomes. Implementing such reforms may not only reduce the prevalence of obesity among children but also encourage lifelong habits that contribute to overall well-being.

## 7.3 Discussion of Key Findings from Study Three

This study aimed to utilise a qualitative research design involving in-depth semi-structured interviews to explore the perspectives of key stakeholders from various sectors in the city of Najran.

The growing concern of childhood obesity in Najran is influenced by a combination of cultural, societal, and environmental factors. To start, this issue is shaped by variance in perceptions, where some see it as a major problem while others downplay its severity. This lack of awareness highlights the need for better education on the health risks of childhood obesity. In addition, cultural and societal factors (particularly gender roles) play a significant role in limiting physical activity (especially for women). Technology including the increased use of cars and electronic devices has also contributed to more sedentary lifestyles, reducing physical movement in both children and adults.

Dietary habits, in particular the consumption of fast food, sugary drinks, and large portions of unhealthy food, are major contributors to obesity. Parents often capitulate to their children's demands for junk food, which perpetuates unhealthy eating habits. Such habits are also exacerbated by cultural practices, such as large portions of fatty foods at social gatherings. Education for parents on the health risks of unhealthy eating and on strategies for promoting better food choices is necessary.

Sedentary behaviour is linked to the growing use of electronic devices (Barnett et al., 2018), with children spending more time on screens than engaging in physical activity. At the same time, some parents worry about outdoor safety or feel that outdoor play is unnecessary,

highlighting the need for programmes which encourage less screen time and more physical play in safe environments.

Parental responsibility is critical, as parents must model healthy behaviours and educate their children on the importance of exercise and proper nutrition. Many parents struggle to balance this responsibility with the temptation to avoid conflict, often giving in to requests for unhealthy food. Offering practical tips to parents on how to make healthier choices at home would be beneficial (Smriti et al., 2022).

At an institutional level, governmental and educational interventions have been introduced, but schools' inconsistent enforcement of policies (e.g., rules against unhealthy food in cafeterias) undermines their effectiveness. Stronger enforcement and better coordination between the government, schools, and other sectors are essential to make these initiatives work.

There is also a need for increased public awareness, particularly through media campaigns educating people about the dangers of obesity and the importance of leading a healthier life. To this end, incorporating nutrition and healthy habits into school curricula and offering more transparent food labelling can further support healthier decision-making (Kliziene et al., 2021; Pfister & Pozas, 2023; Teo et al., 2021).

Finally, tackling childhood obesity requires collaboration across different sectors, including government, schools, healthcare providers, and businesses. By working together, these sectors can create a healthier environment for children, one that provides them with the tools and knowledge to lead healthier lives (L. et al., 2010).

In conclusion, childhood obesity in Najran is influenced by cultural, societal, and environmental factors. While some programmes and policies are in place, more effective collaboration, consistent enforcement, and public education are necessary to address this issue. Raising awareness, improving school education, and encouraging physical activity are all

essential steps to reducing childhood obesity in the region. The following Figures 7.1 and 7.2 are visualisations of the possible interrelated links at different levels, including home, school, and the wider community, regarding physical activity, diet, and nutrition in the context of Najran, Saudi Arabia.

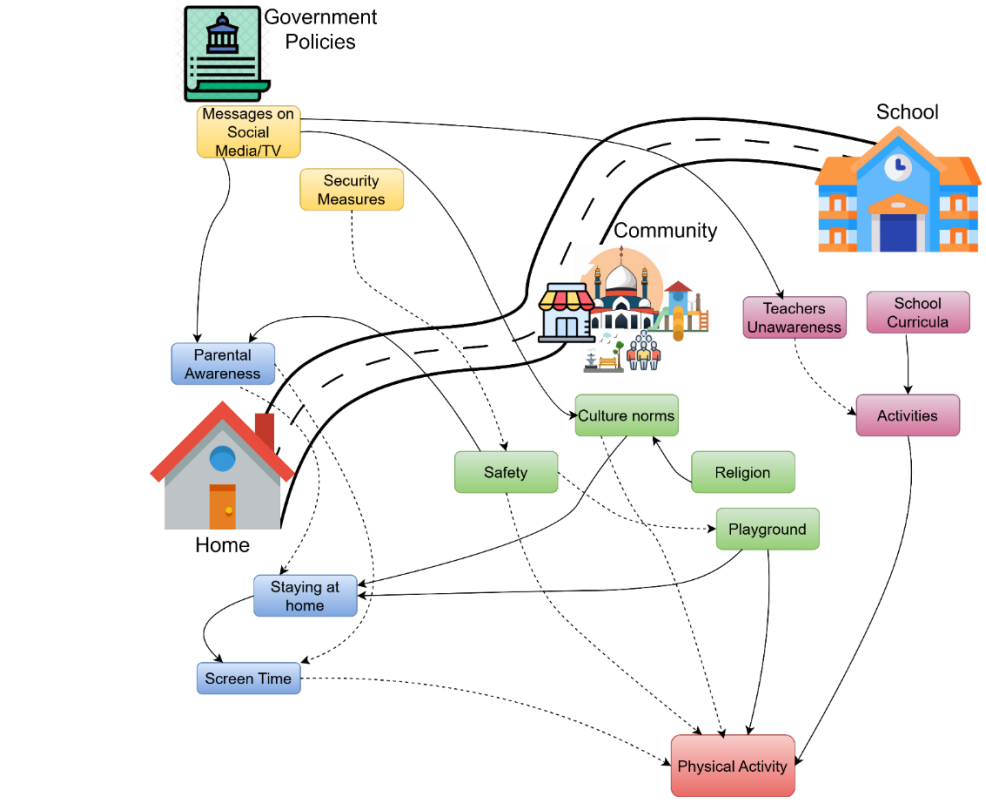


Figure 7.1 Visualisation of multilevel factors influencing the promotion of children's physical activity

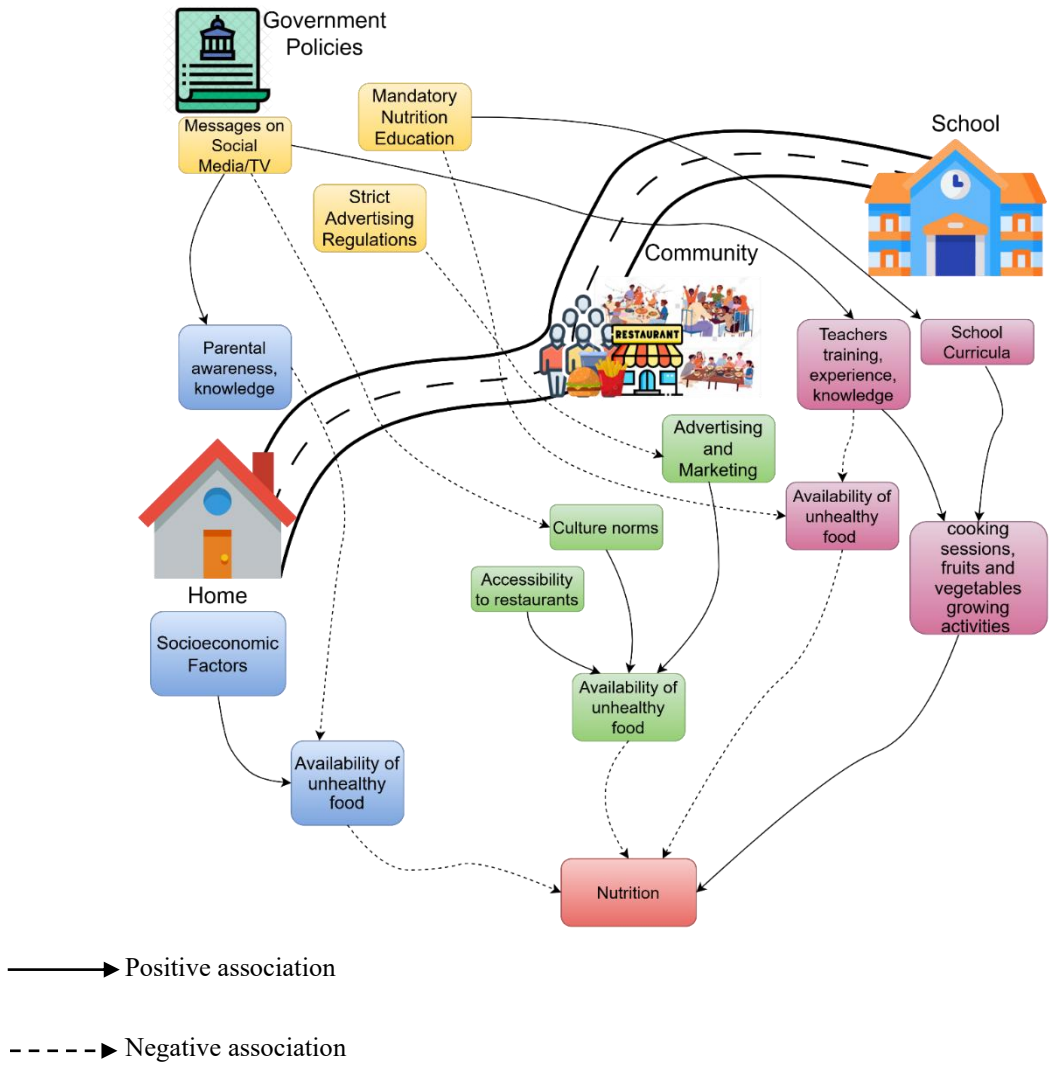


Figure 7.2 Visualisation of multilevel factors influencing the promotion of children healthy eating

## 7.4 Similarities, Convergence, and Divergence Across the Three Studies

### Similarities Across the Three Studies

One of the main similarities across the three studies is the significant influence of environmental factors on children's dietary habits and physical activity behaviours. In Study One, the home environment was identified as an important factor shaping children's eating habits. Parents reported that unhealthy snacks such as crisps and chocolate were commonly

available at home, which may encourage children to develop unhealthy eating patterns. At the same time, although many parents recognised the importance of fruits and vegetables, they lacked knowledge about the recommended daily intake for children. This lack of knowledge may contribute to the relatively low consumption of these foods among children.

Study Two highlighted the role of the school environment in shaping children's health behaviours. The findings revealed several limitations within schools, including the absence of structured education related to healthy eating and physical activity, insufficient training among teachers, and limited sports facilities. These factors may reduce schools' ability to effectively promote healthy lifestyles among students.

Study Three further extended these findings by identifying broader community and societal influences on childhood obesity. Stakeholders highlighted issues such as sedentary lifestyles, increased use of technology, reliance on cars, and cultural practices that may encourage the consumption of high-calorie foods. Together, these findings indicate that children's health behaviours are influenced by a combination of factors within the home, school, and community environments.

Another similarity across the three studies relates to the lack of awareness and knowledge about healthy lifestyles. Parents in Study One showed limited understanding of specific nutritional guidelines. In Study Two, teachers reported insufficient knowledge and training related to obesity prevention and health promotion. Likewise, stakeholders in Study Three noted that public awareness regarding childhood obesity and its health consequences remains limited. These findings suggest that improving health education and awareness among parents, teachers, and the wider community is essential for promoting healthier behaviours among children.

A further shared finding concerns the presence of environmental barriers to physical activity. Parents in Study One expressed concerns about neighbourhood safety and the lack of nearby playgrounds, which limited children's opportunities for outdoor play. In Study Two, schools were reported to lack adequate sports facilities and equipment, which restricts students' opportunities to participate in physical activity during the school day. Study Three reinforced these findings by highlighting broader environmental issues, including limited recreational spaces and the increasing use of electronic devices that contribute to sedentary behaviour.

**Convergence of Findings**

The findings of the three studies converge in demonstrating that childhood obesity cannot be effectively addressed through interventions targeting a single setting. Instead, prevention efforts require a comprehensive approach that involves families, schools, communities, and policymakers. Study One emphasised the role of parents in shaping children's dietary habits and daily routines. Study Two highlighted the potential influence of schools in promoting healthy behaviours through education, policies, and supportive environments. Study Three emphasised the importance of wider societal and policy-level actions, including public health campaigns, stronger policy implementation, and collaboration between different sectors.

Another important area of convergence relates to the influence of cultural and social factors. Study Three particularly highlighted how cultural norms and gender roles may limit opportunities for physical activity, especially among women. These cultural influences also appear indirectly in Study One through parental practices and family habits, and in Study Two through institutional priorities within schools. This suggests that cultural context should be considered when designing interventions aimed at improving children's health behaviours.

Overall, the convergence of findings across the three studies demonstrates that the home, school, and community environments are closely interconnected. Improvements in one environment alone may not be sufficient unless they are supported by changes in other settings.

**Divergence Between the Studies**

Despite these similarities, some differences were observed between the studies due to the different perspectives and contexts explored in each one. Study One focused mainly on parental behaviours and the home environment, particularly in relation to food availability and children's eating habits. Study Two examined institutional factors within schools, such as curriculum content, teacher knowledge, and the availability of sports facilities. In contrast, Study Three explored wider societal perspectives, including cultural influences, technological changes, and government policies related to obesity prevention.

Another difference relates to how responsibility for addressing childhood obesity was perceived. Parents in Study One tended to emphasise challenges within the home and neighbourhood environment. Teachers in Study Two focused on limitations within schools, including lack of resources and insufficient training. Meanwhile, stakeholders in Study Three highlighted the need for stronger government policies and better coordination between different sectors. These differences suggest that stakeholders may interpret the causes and solutions to childhood obesity according to their own roles and experiences

## 7.5 Integration of Key Findings Together by Applying Ecological System Theory

Ecological systems theory, proposed by Urie Bronfenbrenner, offers a framework for understanding how different environmental systems influence individual behaviour. According to this model, children's development and behaviour are shaped by multiple layers of influence, which range from immediate settings such as family and school to broader systems such as culture and societal policies.

### 1. Microsystem (Immediate Environment)

The microsystem refers to the immediate environment in which a child lives and interacts daily, consisting primarily of the family, school, and peers.

**Family Influence:** The research reveals that parents play a critical role in shaping children's nutrition and physical activity habits. While parents understand the importance of fruits and vegetables, the disconnect between knowledge and action reinforces how the home environment (including the availability of unhealthy snacks, food choices, etc.) significantly impacts children's eating habits. This falls under the microsystem in Bronfenbrenner's ecological model, with parental practices directly affecting children's behaviour. For example, the easy availability of unhealthy snacks (e.g., crisps and chocolate) in the home contributes to unhealthy eating habits (Dalrymple et al., 2020; Mantziou et al., 2012; Μάντζιου et al., 2012). The family environment can be targeted through educational programmes and interventions that empower parents to make healthier food choices and create healthier home environments.

**School Influence:** The research highlights the lack of structured education on healthy eating and physical activity in schools. Schools represent a critical part of the microsystem, as they influence children's daily habits. The lack of proper nutrition and PE programmes in schools limits children's opportunities to learn about healthy behaviours (Kliziene et al., 2021; Teo et

al., 2021). Furthermore, inadequate sports facilities and insufficient staff knowledge about healthy behaviours further undermine the effectiveness of school-based interventions. By enhancing their environments through better education programmes and improved infrastructure, schools can provide opportunities for learning and engagement in healthy behaviours, thereby becoming a more supportive part of children's microsystems.

## 2. Mesosystem

The mesosystem refers to the connections between different areas of a child's microsystem, such as the relationship between home and school or that between family and peers.

**Home–School Interaction:** The research's findings suggest that the combination of parents' lack of knowledge about nutrition and inadequate health education at school inhibits children's understanding of healthy behaviours. Accordingly, better communication and collaboration between families and schools are needed. For example, schools could engage parents in health education activities, such as workshops on nutrition or cooking classes, to reinforce the same messages at home. Such collaboration between home and school can bolster children's health behaviours and bridge the gap between knowledge and action (Lambrinou et al., 2020).

**Parental Influence on Peer Interactions:** If parents offer unhealthy snacks at home, children may also adopt these habits when interacting with peers, thereby influencing the social dynamics surrounding food and activity. The mesosystem helps to elucidate how these behaviours can influence children's peer groups and, in turn, how peer influence can affect children's own choices regarding food and physical activity.

## 3. Exosystem

The exosystem refers to the broader social settings that indirectly influence a child, such as the community, local policies, or parental workplace.

**Neighbourhood and Community Environment:** The research reveals the impact of unsafe neighbourhoods and a lack of recreational infrastructure on children's physical activity levels; neighbourhoods with limited access to parks or bike lanes are a significant barrier to children being physically active, even if parents want to encourage it. This exemplifies how the exosystem affects children's behaviour. Public health initiatives that promote safer and more accessible environments, such as the creation of parks, bike lanes, or supervised play areas, would help overcome these barriers and provide more opportunities for physical activity (Rahman et al., 2011; Sridhar & Gumpeny, 2024).

**School Infrastructure and Policies:** The lack of sports facilities and resources in schools is an exosystem factor that indirectly affects children's physical activity levels. Even though teachers may be knowledgeable about the importance of physical exercise, the limited resources prevent them from implementing effective programmes. Moreover, the inconsistent enforcement of school policies regarding healthy eating highlights the gap between policies and actual practices. These environmental factors must be addressed at the policy level for a more supportive school environment to be created.

**Government and Public Health Policies:** The research points out that while government and educational interventions are in place, consistent enforcement is often lacking. The exosystem layer includes policies around food and physical activity in schools and broader community initiatives; consequently, this has a significant impact on the effectiveness of efforts to promote healthy behaviours.

**Health Policies and Education:** The lack of a structured approach to nutrition and PE in schools is likely influenced by national or regional health policies; if public health and education systems do not prioritise health promotion, it is unlikely that schools will have the resources or support needed to implement effective programmes. The macrosystem includes the policies that dictate funding, curriculum design, and public health initiatives. To this end, research and advocacy are needed to influence health and educational policies promoting health education, improving infrastructure, and providing resources for schools to teach healthy behaviours effectively.

## 4. Macrosystem (Broader Societal and Cultural Context)

The macrosystem includes overarching cultural, societal, and policy-level factors that shape all other levels of influence, including economic systems, cultural values, and public policies.

**Cultural Attitudes Towards Health:** Cultural values and norms around diet, physical activity, and family roles influence how children and parents approach health. For example, in some cultures, food is closely tied to social events, and there may be fewer opportunities for physical activity (especially for mothers). The cultural context in Najran, Saudi Arabia, strongly affects both nutrition and physical activity behaviours; for example, the consumption of large portions of fatty foods at social gatherings and the societal importance of family gatherings contribute to unhealthy eating patterns. Shifting cultural norms around nutrition, physical activity, and family health responsibilities through mass media campaigns and community programmes can have a lasting impact on children's health habits.

For its part, the increasing reliance on technology (especially cars and electronic devices) promotes sedentary lifestyles, which contributes to obesity.

**Public Awareness and Education:** A key finding in the research relates to the lack of awareness regarding the health risks of childhood obesity. Broader societal and cultural

influences affect how individuals perceive and respond to health concerns. On this front, media campaigns, more transparent food labelling, and public health initiatives can help shift cultural perceptions towards healthier lifestyles.

According to our key findings, Figure 7.3 shows an example highlighting key barriers to implementing policies that encourage physical activity and outdoor play in Najran, Saudi Arabia, based on the Ecological Systems Theory. The policies aim to improve infrastructure, such as parks, sidewalks, and bike lanes, may face various challenges at multiple levels as shown in the model below.

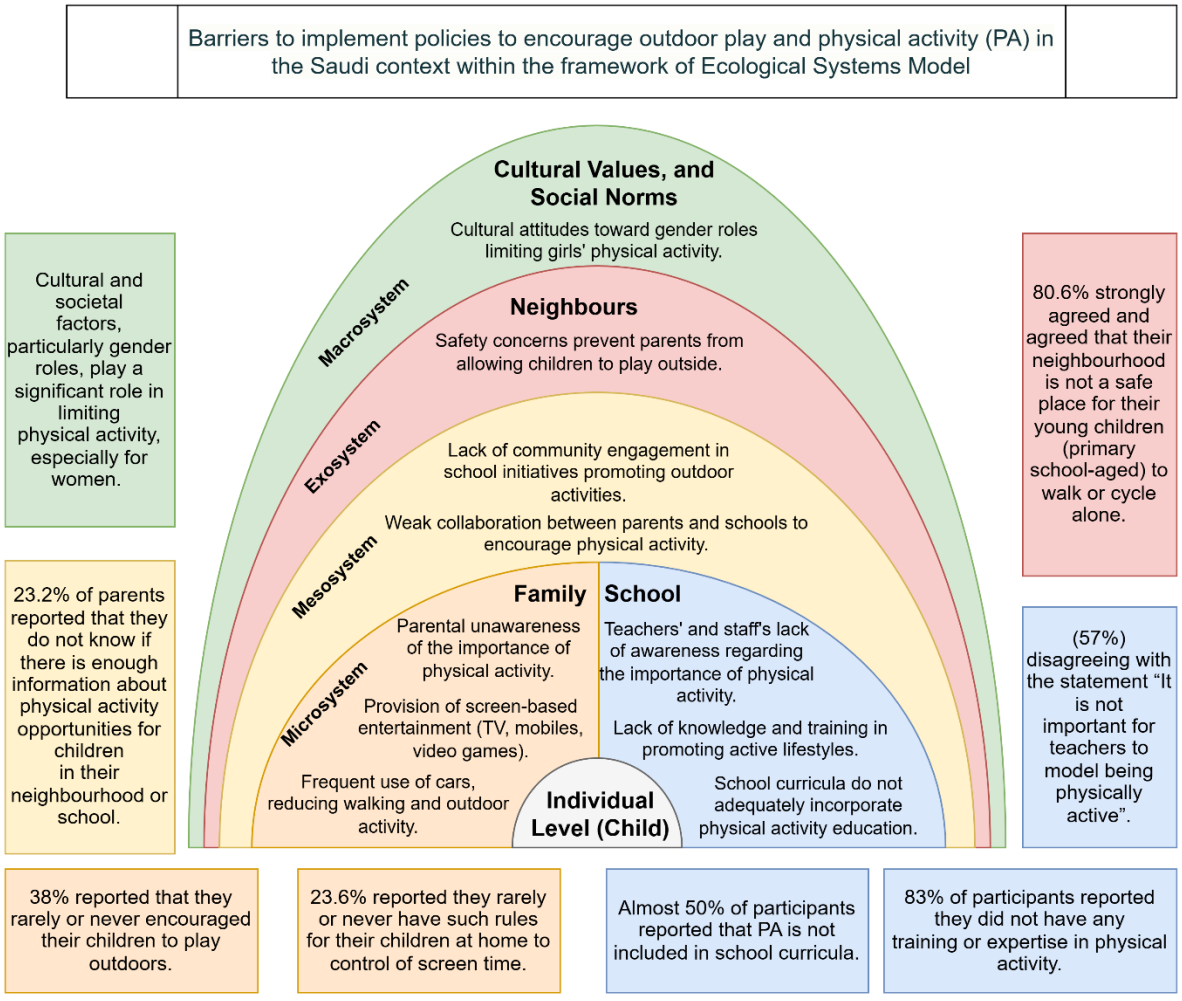


Figure 7.3 Example of barriers to implementing policies that encourage outdoor play and physical activity for children in Saudi Arabia.

## 7.6 Implications for Public Health

The implications of this research for public health are significant, as they underscore the need for comprehensive strategies to improve children's nutrition and physical activity habits. The findings identify eight key areas where public health interventions could make a meaningful impact.

1. **Enhanced Health Education and Awareness Campaigns:** A primary implication is the need for widespread health education initiatives targeting both parents and children. Public health campaigns should aim to bridge the gap between awareness and action, particularly regarding the recommended daily intakes of fruits and vegetables. These initiatives can use various platforms, including social media, community events, and school programmes, to promote practical strategies for integrating healthy eating into daily life. Ensuring that parents have access to easy-to-understand nutritional guidelines could help them make informed decisions about their children's diets.

2. **Improved Policy and Urban Planning:** The concerns raised about unsafe neighbourhoods, and the lack of play areas reinforce the importance of policy interventions aimed at creating safer and more accessible environments for physical activity. Public health authorities should collaborate with urban planners to improve infrastructure such as building parks, sidewalks, and bike lanes which encourage outdoor play and physical activity. By addressing the environmental factors that hinder children's physical activity, public health policies can promote healthier lifestyles and reduce sedentary behaviours (Bole et al., 2024).

3. **Addressing Cultural and Gender Barriers:** The role of cultural norms, especially regarding mothers' responsibilities, implies a need for public health programmes that are culturally sensitive. Public health initiatives should recognise the challenges mothers face in balancing family obligations with self-care and offer targeted support; this could include

community-based programmes offering both exercise opportunities and childcare, which would help mothers integrate physical activity into their routines without neglecting their family responsibilities.

4. **School Health Programmes:** The study reveals a clear gap in school curricula regarding physical activity and nutrition education. Public health policies should advocate for the introduction of comprehensive health education programmes in schools. These would involve not only teaching children about nutrition and physical activity but also equipping school staff with the knowledge and skills to support healthy behaviours. Additionally, a greater investment in school sports facilities and infrastructure is needed to ensure that all children have access to safe spaces for physical activity.

5. **Training for Educators and School Staff:** Public health authorities should support professional development for educators and school staff that teaches the importance of healthy eating and physical activity. Educators are key influencers of children's behaviours, and without proper training, they may be unable to encourage healthy habits effectively. Regular workshops and training programmes should be developed to ensure school staff are well-equipped to cultivate an environment that promotes health and well-being.

6. **Community-Level Interventions:** Community-based initiatives are also critical in fostering healthier environments. Public health agencies should promote community gardens, cooking classes, and local sports programmes that engage children and families in healthy activities. These programmes could help build support for healthier habits in the community and provide families with the resources they need to make better food choices and incorporate physical activity into their daily lives.

7. **Focus on Healthy Food Environments:** Public health campaigns to reduce the availability of unhealthy foods and increase access to nutritious options should target both

home and school environments. Promoting policies that limit the availability of unhealthy snacks in schools and communities while simultaneously supporting healthier food alternatives can have a positive impact on children's eating habits (Durão et al., 2024). Public health interventions could also include working with local food vendors to increase the availability of fresh fruits and vegetables in neighbourhoods.

8. **Long-Term Public Health Strategy:** Finally, this study suggests that addressing children's health behaviours requires a long-term, systemic approach that incorporates education, environmental changes, policy reforms, and community support. Public health organisations should advocate for coordinated efforts across sectors including health, education, urban planning, and social services to create environments that nurture healthy habits. This collaborative approach is essential for reducing the prevalence of childhood obesity and other related health issues, ultimately improving long-term health outcomes for future generations.

In conclusion, the implications of this research for public health are far-reaching. Public health interventions must consider both individual behaviours as well as the broader environmental and societal factors that shape those behaviours. By addressing knowledge gaps, improving the physical environment, providing support for families, and implementing effective school-based programmes, public health efforts can help promote healthier lifestyles for children and reduce the risk of obesity and other chronic diseases in the future.

## 7.7 Implications for Research

The implications for research from the work in this thesis indicate several important avenues for future inquiry, with the goal of deepening understanding and informing effective interventions for improving children's nutrition and physical activity habits. The thesis's findings both highlight gaps in the existing literature and raise new questions that could lead to more targeted and effective research. Nine key implications for future research are discussed here.

1. **Expanding Research on Parental Knowledge and Behaviour:** The disconnect between parental awareness of healthy eating guidelines and their actual behaviours in the home environment calls for further research into how parental knowledge influences children's food choices. Future studies could more deeply explore the specific factors that contribute to the gap between nutrition knowledge and behaviour, as well as examine how educational interventions could be tailored to different parent demographics. Research could also investigate how to best communicate dietary guidelines to parents or explore how to foster practical and sustainable changes in household food environments.

2. **Exploring the Impact of Home Food Environments:** The role of the home environment, particularly the availability of unhealthy snacks, has emerged as a significant factor influencing children's eating habits. Future research could further examine the relationship between the availability of specific types of food at home and children's long-term eating behaviours. To this end, longitudinal studies could help determine how changes in the home food environment over time impact children's nutrition and health outcomes. Additionally, studies could explore the effectiveness of interventions aimed at modifying food availability in the home, such as programmes encouraging healthier snack options or educating parents about the impact of their food choices on their children's health.

3. **Investigating Environmental and Societal Barriers to Physical Activity:** The thesis's findings reveal that environmental factors, such as unsafe neighbourhoods and a lack of play areas, are significant barriers to children's physical activity. Further research is needed to explore how these environmental constraints specifically impact children's activity levels in various contexts, particularly in urban versus rural settings. Additionally, researchers could investigate the role of local policies in facilitating or hindering children's opportunities for physical activity, as well as the impact of infrastructure changes (e.g., creating more parks, bike lanes, or safe walking areas) on children's physical activity.

4. **Cultural Influences on Health Behaviours:** The thesis's finding that cultural factors particularly gender roles may limit opportunities for physical activity especially among mothers indicates the need for more research into the cultural barriers to physical activity in various communities. Future studies could examine how cultural norms shape health behaviours (especially among mothers and other caregivers) and identify ways to address these barriers. Future research could also explore the development of culturally sensitive interventions that balance social expectations with promoting individual health, particularly in diverse settings.

5. **Evaluation of School-Based Health Programmes:** The thesis revealed several issues related to the lack of physical activity and healthy eating education in schools, as well as insufficient sports infrastructure. Future research could evaluate the effectiveness of different school-based health education programmes in promoting healthy eating and physical activity among children. Researchers could also explore which types of interventions (e.g., curriculum changes, after-school programmes, or partnerships with local health organisations) are most successful in improving children's health behaviours in the school context. Additionally, further investigation is needed into how school environments (e.g., availability of healthy meals, presence of PE programmes, and sports facilities) influence children's health outcomes.

6. **Impact of Teacher and Staff Training:** Given the identified lack of knowledge among school staff about healthy behaviours, future research could explore the effectiveness of professional development programmes for teachers and school personnel. Specifically, studies could assess how staff training in areas such as nutrition, physical activity, and obesity prevention impacts the ability of educators to promote healthy behaviours among students. Research could also explore how trained staff can help create supportive school environments that encourage children to adopt and maintain healthy habits.

7. **Intervention Effectiveness and Long-Term Impact:** Further investigation is needed into the efficacy of various intervention strategies (e.g., school-based programmes, community initiatives, home-based interventions) to improve children's nutrition and physical activity habits. Longitudinal research tracking the impact of these interventions over time is needed in order to assess their long-term effectiveness and sustainability. Additionally, more research is needed on how to scale up successful interventions to reach larger populations, particularly in areas with limited resources.

8. **Cross-Cultural Comparisons:** Since cultural norms and environmental factors play a significant role in shaping children's behaviours, research on this topic comparing different cultural contexts can provide valuable insights. Cross-cultural studies could explore how children's health behaviours differ across countries or regions, as well as which public health strategies have been most effective in different settings. This research could inform the development of more globally adaptable interventions to address issues related to childhood nutrition and physical activity.

9. **Use of Technology and Digital Health Tools:** With the increasing reliance on digital tools in everyday life, future research could examine the potential role of technology in promoting healthy behaviours among children. Such work could include studying the impact

of mobile health apps, online educational tools, or gamified fitness challenges on children's physical activity levels and eating habits. Research could also assess whether digital platforms can effectively encourage children and parents to make healthier choices, especially in contexts where traditional face-to-face interventions may be less feasible.

In conclusion, the implications for research offer several promising directions for future studies aimed at improving children's health behaviours. By addressing the gaps identified in this study such as the need for more targeted parental education, addressing environmental barriers, and evaluating school-based programmes researchers can contribute to the development of more effective public health strategies. Ultimately, such research efforts could help refine interventions that promote healthier eating and physical activity habits, leading to long-term improvements in children's overall health and well-being.

## 7.8 Recommendations for Culturally Relevant Interventions

### 1. Education and Awareness Campaigns

Education plays a key role in preventing childhood obesity. However, it is important to recognise that Saudi Arabia has a diverse population, with people from various cultural backgrounds. In large cities like Riyadh, Jeddah, and Dammam, where people tend to be more open-minded and exposed to global trends, campaigns can focus on modern views about healthy eating and fitness. In addition, using social media, TV, and public events can help spread awareness to urban youth, particularly with the involvement of influencers who resonate with this group.

By contrast, rural and tribal areas like Najran may be less familiar with global trends; therefore, to gain trust in these areas, it might help to involve local religious and community leaders to explain the importance of healthy living in reference to Islamic teachings. Islam emphasises balance in life, and incorporating this idea could encourage healthier habits in a way that fits with local values.

Mothers play a central role in shaping children's dietary habits, physical activity, and lifestyle behaviours. In the cultural context of Najran and other regions of Saudi Arabia, mothers are often the primary caregivers responsible for food preparation and daily supervision of children, making their engagement essential in addressing childhood obesity. However, limited engagement from some mothers may occur due to household responsibilities, time constraints, or limited awareness regarding the importance of participation in health research and obesity prevention initiatives.

To address this challenge, several culturally appropriate strategies may be considered. First, health education programmes can be delivered through primary healthcare centres and maternal and child health clinics, where mothers frequently attend for vaccination and routine child

health services. Second, schools can serve as an effective platform to reach mothers through parent meetings, school health campaigns, and awareness sessions about healthy nutrition and physical activity for children.

**2. Promotion of Traditional and Local Foods**

Saudi Arabia has a rich culinary tradition, with many traditional dishes being high in calories and fats. However, it is possible to make these meals healthier by using leaner meats and less oil, as well as adding more vegetables. In urban areas, programmes that teach people how to prepare healthy versions of traditional dishes such as kabsa or margoog could be very successful.

In rural areas, it is essential to maintain local food traditions while making them healthier. Many rural communities are familiar with growing their own food, so promoting the use of fresh local ingredients like dates, vegetables, and grains can be a useful strategy. These foods are not only nutritious but also culturally accepted, which makes them more likely to be embraced by these communities. Local markets could also promote healthier food options by providing people with affordable and familiar alternatives to processed snacks and sugary drinks.

**3. Encouragement of Physical Activity**

Physical activity is crucial for preventing and treating obesity. In cities, where there are more opportunities for fitness (e.g., gyms, sports clubs, and recreational parks), promoting physical activity can be done through school programmes and after-school activities. Urban parents should be encouraged to enrol their children in sports leagues, and public parks should be designed to accommodate families and encourage activities such as walking, jogging, or cycling.

In rural areas and tribal regions, however, access to such facilities is often limited. In these places, interventions should concentrate on encouraging traditional physical activities, such as camel riding, horse riding, or other forms of exercise tied to local customs. Schools in these areas could also promote walking or biking to school, providing children with more opportunities for outdoor play. Furthermore, community events such as sports days or cultural festivals with physical activities can make it easier for families to engage in active living together.

For women in tribal areas, it is particularly important to design solutions that respect their cultural and religious values while promoting physical activity. Women in these communities often face challenges to engaging in physical activities outside the home, due to social expectations and restrictions; therefore, solutions need to be adapted to their circumstances. For example, providing women with free access to private, women-only spaces for exercise could be an effective way to support them in maintaining their physical health. Activities such as indoor fitness classes, private walking groups, or home-based exercise routines could be promoted, ensuring that women feel comfortable while being active. Involving community leaders in supporting and encouraging women to engage in physical activities while still adhering to cultural and religious norms will be crucial to boosting participation.

**4. Government and Policy Interventions**

Public health strategies to address childhood obesity involve both policy-level interventions and individual behaviour change, consistent with the multi-level perspective of the Social Ecological Model. While individuals are encouraged to adopt healthier behaviours, policy interventions can create environments that support these choices. For example, fiscal policies such as the Mexican Sugar-Sweetened Beverage Tax and the Soft Drinks Industry Levy were introduced to reduce the consumption of sugar-sweetened beverages by increasing their price,

and evidence shows these policies have contributed to reductions in purchases of sugary drinks (Colchero et al., 2016; Scarborough et al., 2020). Similarly, national reformulation initiatives such as the UK Salt Reduction Programme have encouraged food manufacturers to reduce salt content in processed foods, contributing to reductions in population salt intake and improvements in cardiovascular health (He et al., 2014). Environmental policies, such as 20 mph speed limit zones in residential areas in the UK, can also promote safer neighbourhoods and support active travel among children (Jones & Brunt, 2017). These examples demonstrate how policy interventions complement individual responsibility by shaping healthier environments and may provide useful insights for developing public health strategies in Saudi Arabia.

Policy changes are necessary to effectively address childhood obesity in Saudi Arabia. In urban areas, the government can regulate the availability and marketing of unhealthy food, particularly those aimed at children. Schools could be required to provide healthier food options, and advertisements for junk food could be restricted. The government could also offer incentives to local food producers to create and sell healthier food options.

In rural areas, the government should prioritise improving access to nutritious food. For example, subsidies could be offered for healthier foods in local markets. Collaboration with local farmers to promote the production of fruits and vegetables could also be helpful. Additionally, local health departments could collaborate with schools to provide education on healthy eating habits that align with the local culture and traditional foods.

**5. Community-Based Approaches**

Engaging communities is important in both urban and rural areas. In cities, partnerships with private organisations (such as gyms and wellness centres) can be beneficial in promoting

healthy lifestyles. Community events and fitness programmes can also be organised to raise awareness about obesity and encourage healthy living.

In rural regions, it is especially important to involve local community leaders, such as tribal heads or religious leaders, in helping promote health messages. These leaders can play a vital role in making the community more open to adopting healthier lifestyles. Additionally, incorporating health messages into local festivals, celebrations, or cultural gatherings can help make health a natural part of social life, ensuring that people view health not as something foreign or difficult, but as a part of their daily routine.

## 7.9 Study Limitations

While this study provides important insights into the factors influencing childhood overweight and obesity within home, school, and community contexts in Najran, several limitations should be recognised. These limitations may impact the generalisability and applicability of the findings and should be considered when interpreting the results.

Firstly, the study was conducted exclusively in Najran city, which presents a significant limitation in terms of generalisability. Although Najran provides a valuable case study, its cultural, social, and environmental characteristics may not be representative of those in other regions of Saudi Arabia. Differences in urbanisation, socioeconomic status, lifestyle patterns, and access to recreational facilities across various cities and regions in the country could influence the findings. Therefore, caution should be exercised when attempting to apply the results of this study to the broader Saudi population. Future studies should consider conducting research in multiple regions to account for regional variations.

One of the key limitations of this study was the challenge posed by cultural norms in Najran, which made it difficult to conduct interviews with women. In Saudi Arabia, and particularly in more conservative regions like Najran, gender norms and societal expectations often restrict

women's participation in research, especially in face-to-face interviews with male researchers. These cultural sensitivities limited access to female participants, resulting in an underrepresentation of women's perspectives in the qualitative phase of the study.

Another limitation of this study is that children themselves were not directly surveyed or interviewed. The perspectives of children could have provided valuable insights into their dietary habits, physical activity behaviours, and experiences within the school and home environments. However, during the period of data collection, schools in Najran were closed due to regional conflict, which significantly limited access to students. As a result, the study relied on information obtained from parents, school staff, and key stakeholders to understand factors influencing childhood overweight and obesity. While these perspectives provided important contextual information, the absence of direct input from children may limit the depth of understanding of children's own experiences and behaviours. Future research should consider including children as participants when access to schools is possible in order to provide a more comprehensive understanding of the factors influencing childhood obesity

Lastly, while this study examined key environmental and behavioural factors influencing childhood obesity, it did not extensively explore genetic and biological contributors. While environmental and lifestyle factors play a crucial role in shaping obesity outcomes, genetic predispositions and metabolic differences may also influence a child's weight status. Future research should consider integrating genetic and physiological assessments alongside behavioural and environmental analyses for a more holistic understanding of obesity determinants.

## 7.10 Conclusion

This thesis provides a comprehensive analysis of the key factors contributing to childhood obesity in Saudi Arabia, specifically within the ecological contexts of home, school, and community. Our key findings highlight that childhood obesity is influenced by multiple interrelated factors, including parental knowledge and behaviours, school environments, cultural norms, and urban infrastructure.

One of the critical findings is the role of parental awareness in shaping children's dietary habits and physical activity levels. The study finds a lack of parental knowledge regarding nutrition and healthy lifestyles, which highlights the need for targeted educational interventions to create healthier home environments. Additionally, environmental barriers, such as unsafe neighbourhoods and limited public spaces for outdoor activities, restrict children's ability to engage in physical activity. Cultural norms, mainly those related to gender roles, further limit opportunities for physical activity, particularly for girls, necessitating culturally appropriate health promotion strategies.

Within the schools, our study shows significant gaps in physical education and nutrition awareness among teachers and staff. Many school environments in Najran lack adequate policies, resources, and infrastructure to support healthy behaviours among students. This calls for policy reforms that enhance school-based health education, improve access to physical activity opportunities, and strengthen teachers' role in promoting student well-being.

Furthermore, while some policies addressing childhood obesity exist, their implementation remains inconsistent, and inter-sectoral collaboration between government bodies, schools, and communities is limited. For effective intervention, legislators must ensure stronger enforcement of existing health policies, better coordination between relevant sectors, and increased public awareness to drive behavioural and environmental changes.

The findings of this thesis should be considered within the context of the ongoing transformation of the Saudi health system under Saudi Vision 2030, which aims to strengthen prevention and improve population health outcomes. Through the Health Sector Transformation Program, Saudi Arabia is shifting from a healthcare model focused primarily on treatment to one that prioritises disease prevention and health promotion.

As part of these reforms, national institutions such as the Saudi Ministry of Health and the Public Health Authority (Weqaya) are responsible for developing and implementing strategies to address major public health challenges, including childhood obesity and other non-communicable diseases.

The findings of this thesis highlight several issues that are directly relevant to these national priorities. Study One emphasised the influence of parental behaviours and the home environment on children's dietary habits and physical activity. Study Two demonstrated the important role of schools in promoting healthy behaviours, while also identifying limitations related to curriculum, teacher knowledge, and sports facilities. Study Three further highlighted the broader societal and environmental factors influencing childhood obesity, including cultural norms, sedentary lifestyles, and limited opportunities for physical activity.

Taken together, these findings suggest that addressing childhood obesity in Saudi Arabia requires coordinated efforts across multiple sectors, including health, education, and community organisations. Strengthening collaboration between the Saudi Ministry of Health, the Saudi Ministry of Education, and the Public Health Authority (Weqaya) could support the development of comprehensive prevention strategies that address the home, school, and community environments.

Overall, the findings of this research support the preventive focus of current public health reforms in Saudi Arabia and highlight the importance of multi-sectoral approaches to reduce childhood obesity and promote healthier lifestyles among children

## 7.11 Dissemination Plan

The findings of this study will be disseminated through several academic and professional channels to ensure that the results contribute to both research and practice. The primary dissemination of the findings is through this thesis, submitted as part of the requirements for the degree programme. In addition, initial findings from this research have been presented at relevant academic conferences, providing an opportunity to share the results with researchers and professionals working in the field of public health and childhood obesity. Furthermore, a manuscript based on this research is currently under preparation for submission to a peer-reviewed academic journal in order to reach a wider scholarly audience. The findings may also be shared with relevant stakeholders, including health professionals and public health authorities in Saudi Arabia, particularly those involved in childhood health promotion and obesity prevention programmes. Disseminating the findings through these channels may support evidence-based practice and contribute to ongoing efforts to address childhood obesity in Saudi Arabia.

## 7.12 Reflexivity and Positionality

Reflexivity is an important component of research, particularly in studies using mixed methods, as it requires the researcher to reflect on how personal background, experiences, and perspectives may influence different stages of the research process. In this thesis, which employed a mixed-methods approach combining quantitative surveys and qualitative

interviews, my positionality as a Saudi male researcher shaped both the data collection process and the interpretation of findings.

As a Saudi researcher, I occupied an insider position in relation to the cultural and social context of the study. Sharing a common language, cultural background, and social norms with participants helped facilitate communication and build rapport during data collection. The surveys and interviews were conducted in Arabic, which allowed participants to express their views more naturally and comfortably. My familiarity with Saudi cultural practices and social expectations also supported my understanding of the issues discussed, particularly those related to dietary habits, family roles, and attitudes toward physical activity. This insider position helped in interpreting participants' responses within the broader cultural and social context of Saudi society.

At the same time, my role as a doctoral student studying in the United Kingdom placed me in a partial outsider position. Exposure to international academic training and public health frameworks influenced how I approached the research topic and conceptualised childhood obesity as a public health issue. This academic perspective encouraged the use of theoretical frameworks and evidence-based approaches that may differ from common local understandings of health and lifestyle behaviours. While this perspective offered valuable analytical distance, it also required careful reflection to ensure that the analysis remained grounded in the lived experiences of participants.

Gender also played a role in shaping aspects of the research process. As a male researcher conducting research in the Saudi context, access to male participants was relatively straightforward due to shared social norms and communication styles. However, cultural considerations required sensitivity when interacting with female participants, particularly during the interview phase. Efforts were made to conduct these interactions respectfully and in

accordance with cultural expectations to ensure that participants felt comfortable sharing their perspectives.

My academic background in public health may have also influenced my initial assumptions regarding the causes of childhood obesity, particularly the role of diet, physical activity, and environmental factors. To minimise potential bias, reflexive practices were used throughout the research process. These included keeping reflective notes during data collection and analysis, carefully reviewing survey responses and interview transcripts, and discussing interpretations with academic supervisors. These practices helped ensure that the findings were grounded in the data rather than shaped by personal expectations.

The mixed-methods approach used in this thesis also contributed to strengthening the credibility of the research. The combination of quantitative survey data and qualitative interview insights allowed for triangulation of findings, enabling a more comprehensive understanding of childhood obesity in the Saudi context. By integrating multiple perspectives from parents, school staff, and stakeholders, the study aimed to reduce the influence of individual bias and provide a more balanced interpretation of the issues examined.

Overall, acknowledging my positionality as both an insider and outsider contributed to a more reflective and transparent research process. Recognising how my cultural background, gender, and academic training could influence the research helped ensure that appropriate steps were taken to maintain methodological rigour and accurately represent the perspectives of participants.

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# Appendixes

## Appendix A

**Parent survey-questions**

**1/ What is your gender?**

- Male
- Female

**2/How old are you?**

- 15-24
- 25-34
- 35-44
- 45-54
- 55-64
- +65

**3/ I am a:**

- Saudi
- Non-Saudi

4/**What is the highest level of education you have completed?**

- Primary school
- Intermediate school

- Secondary school
- Diploma (after secondary school)
- Bachelor's -university degree
- Postgraduate degree
- Other specify please (  )

**5/Which category below includes your family size?**

- 1-3
- 4-6
- 7-9
- +10

6/ **Employment Status**

*Are you currently...?*

- Government / Public Sector
- Private sector
- A student
- Self-employed
- Retired
- Not working

- Other  specify please (  )

7/What is your average monthly income?

- Less than 1000
- 1000-3000
- 4000-6000
- 7000-9000
- More than 9000
- Prefer not to say

**B) Food availability (Q8-Q16)**

***Question / How frequently do you buy (bring to your home/family)?***

***Beverages***

8/ Soft/Fizzy drinks

- Daily
- More than once a week
- Once a week
- Monthly
- Never

9/Fruit juice

- Daily
- More than once a week
- Once a week
- Monthly
- Never

10/Energy drinks

- Daily

- More than once a week
- Once a week
- Monthly
- Never

***Noncore food***

11/ Crisps

- Daily
- More than once a week
- Once a week
- Monthly
- Never

12/ Cakes, muffins, and donuts

- Daily
- More than once a week
- Once a week
- Monthly
- Never

13/ Savoury biscuits, sweet biscuits

- Daily

- More than once a week
- Once a week
- Monthly
- Never

14/ Chocolates

- Daily
- More than once a week
- Once a week
- Monthly
- Never

***Fruits and vegetables***

15/ Fruits

- Daily
- More than once a week
- Once a week
- Monthly
- Never

16/ Vegetables

- Daily
- More than once a week

- Once a week
- Monthly
- Never

**C) Healthy eating (Q17-Q31)**

**C1: Healthy eating attitude**

17/ My child eating fruit and vegetables every day is a high priority for me

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

18/ I find it difficult to get my child to eat fruit and vegetables every day

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

19/ There are no stores selling fresh fruit and vegetables within easy walking (i.e., 10 minutes walking) distance of our Home

- o Strongly agree
- o agree
- o not sure
- o disagree
- o strongly disagree

20/ Fresh fruit and vegetables are too expensive

- o Strongly agree
- o agree
- o not sure
- o disagree
- o strongly disagree

21/ There is not enough information about healthy eating for children in our neighbourhood and school.

- o Strongly agree
- o agree
- o not sure

- disagree
- strongly disagree

**C2: Healthy eating rules**

22/ Did the child(ren) watch TV at meal times?

- Always
- often
- sometimes
- rarely
- Never

23/ Were the child(ren) encouraged to eat fruit and vegetables?

- Always
- often
- sometimes
- rarely
- Never

24/ Were limits set on the types of drinks the children can drink regularly?

- Always
- often

- sometimes
- rarely
- Never

25/ Were limits set on the types of food (snacks) the children can eat regularly?

- Always
- often
- sometimes
- rarely
- Never

26/ Were the children reminded to drink water?

- Always
- often
- sometimes
- rarely
- Never

27/ Did an adult sit down with the children when they ate meals?

- Always

- often
- sometimes
- rarely
- Never

28/ Did you make something else if the children did not like what was being served?

- Always
- often
- sometimes
- rarely
- Never

**C3: healthy eating child behaviour**

29/ Serves of fruit consumed each day by your child

- Does not eat it daily
- 1
- 2
- 3
- 4
- 5 or more

30/ Serves of vegetables consumed each day by your child(ren)

- Does not eat it daily
- 1
- 2
- 3
- 4
- 5 or more

31/ Drink child selects when thirsty

- Fruit juice
- Fruit drink
- Soft/fizzy drink
- Milk
- Water
- Other, please specify (  )

D) **Physical activity**

**D1: Physical activity attitude**

32/My child being physically active on most days of the week is not a high priority for me.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

33/ It is not safe for primary school-aged children to walk or cycle alone in our neighbourhood during the day.

- Strongly agree

- agree
- not sure
- disagree
- strongly disagree

34/ The closest park/playground from home is safe for primary school-aged children to play in.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

35/There are enough recreation/sports facilities (e.g., football courts, park, and playground) in our neighbourhood to encourage children to be physically active.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

36/There are playgrounds and parks within easy walking distance of our home.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

37/ There is enough information about physical activity opportunities for children in our neighbourhood /schools.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

38/There is enough variety of equipment at home for children to use to be physically active.

- Strongly agree
- agree
- not sure

- disagree
- strongly disagree

**D2: Activity rules**

39/ Were the children encouraged to play outdoors?

- Always
- often
- sometimes
- rarely
- Never

40/ Were limits set on the amount of time the children can (watch TV, use other electronic devices, and play video games)?

- Always
- often
- sometimes
- rarely
- Never

41/ Did adult family members walk or cycle to get to or from places (e.g., work, shops)?

- Always
- often
- sometimes
- rarely
- Never

**E: knowledge of healthy eating and physical activity**

42/ Recommended daily serving of fruits and vegetables for children is:

- Less than 1
- 1-2
- 3–5
- 5 at least

43/ How much physical activity do you think your child needs every day to stay healthy? At least

- Less than half an hour
- Half an hour
- One hour
- One hour and a half
- Not sure

44/ Maximum daily screen time (e.g., TV, Video games) recommended for children is:

- One hour
- Two hours
- Three hours
- Four hours
- Not sure

**F: Other questions and comments**

45/Do you struggle to keep meals healthy and varied?

- Yes
- No
- Not sure

46/Do you think that eating healthy is expensive?

- Yes
- No
- Not sure

47/Which of the following perhaps makes it harder for you and your family to live a healthier lifestyle? (Please tick as many as apply to you)

- Too many fast food shops around us

- Too busy/do not have enough time
- Not enough places to go out and play
- Sports facilities are expensive/or not available
- Customs, traditions, and social life norms
- Please tell us other reasons if you have any ( …….. )

Thank you for your time, and please feel free to add any comments or suggestions

(……)

# Appendix B

**Teacher survey -questionnaire**

1/ Gender

- Male
- Female

2/ In which level (school) do you work/teach?

(You can pick more than one option if applicable.)

- Primary
- Intermediate
- Secondary

3/ Nationality

- Saudi
- Non-Saudi

4/What is your role/job?

- Administrative
- Supervision
- Teaching

(For teachers, please specify the subject you teach.)

5- Do you think that childhood obesity is considered an issue in our society?

- Yes
- No
- Don't know

**B) Child exposure**

**Healthy eating (HE)**

6) HE is a priority in this school

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

7) Are there classroom lessons about HE?

- Not used

- Once a term
- Weekly
- daily

8) Is there homework about HE?

- Not used
- Once a term
- Weekly
- daily

9) Is HE embedded into school curricula?

- None
- Little
- Some
- a lot

**Water:**

10) Do you encourage students to bring/use water bottles in school?

- None
- Once a term
- Weekly
- Daily

**Fruit and vegetables:**

11) Are there fruit and vegetable cooking sessions?

- None
- Once a term
- Weekly
- Daily

12) Are there "growing fruit/vegetable" activities?

- None
- Once a term
- Weekly
- daily

13) Are there fruit and vegetable tasting activities?

- None
- Once a term
- Weekly
- daily

14) Are there "visits to fruit/vegetable growers" activities?

- None
- Once a term

- Weekly
- daily

**Physical activity (PA):**

15) PA is a priority in this school

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

16) We are teaching fundamental movement skills

- None
- Once a term
- Weekly
- daily

17) Are there classroom lessons about PA?

- None
- Once a term
- Weekly
- daily

18) Is there homework based on PA?

- None
- Once a term
- Weekly
- daily

19) Is PA used in school curricula?

- None
- Little
- Some
- a lot

20) There are enough facilities to encourage students to be active during break times.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

21) The school offers a wide variety of physical activities.

- Strongly agree

- agree
- not sure
- disagree
- strongly disagree

**C) Teacher skills/attitude/perception**

**Healthy Eating (HE):**

22) Do you have HE training or expertise?

- Yes
- No

23) We use HE programmes or resources in teaching

- None
- Once a term
- Weekly
- daily

**Fruit and vegetables:**

24) I am motivated to teach students the importance of eating fruit and vegetables every day.

- Strongly agree
- agree
- not sure

- disagree
- strongly disagree

25) Unsure of my ability to teach students the importance of eating fruit and vegetables.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

26) Encouraging kids to eat fruit and vegetables is the responsibility of the family, not the school.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

27) There is little support from external professionals/organisations to promote fruit and vegetable eating in schools.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

28) Kids who eat more fruit and vegetables behave better.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

29) It is important for teachers to role model eating fruit and vegetables.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

**Physical activity:**

30) Do you have PA training or expertise?

- Yes
- No

31) We use PA programs or resources in teaching.

- None
- Once a term
- Weekly
- daily

32) Active play during lunchtime is important.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

33) It is not important for teachers to role model being physically active.

- Strongly agree
- agree
- not sure

- disagree
- strongly disagree

34) It is better for students to walk or cycle to school.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

35) There is little support from external professionals/organisations to promote PA in schools.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

36) Confident in the ability to include PA opportunities for kids in the classroom.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

**D) Teacher knowledge**

37) How many serves of fruit and vegetables does a primary school-aged child need daily? (A serving is approximately the amount they can fit into the palm of their hand.)

- Less than 1 serving
- 1-2 servings
- 3-4 servings
- At least 5 servings
- Not sure

38) How much PA do primary school-aged child needs daily?

- Less than half an hour
- Half an hour
- One hour
- One hour and a half

- Not sure

39) The maximum daily screen time (i.e., TV, video games) recommended for children is:

- Half an hour
- One hour
- Two hours
- Three hours
- Not sure

**E) Other question**

**School environment:**

40) The school encourages its PA facilities to be used by the wider community.

- Strongly agree
- agree
- not sure
- disagree
- strongly disagree

Thank you for your time, and please feel free to add any comments or suggestions.

(……)

# Appendix C

**Interview guidelines/ questions**

**Participant information**

**1. Tell me about yourself.**

How long have you been working in the city/county government?

How long have you been in your current position?

**About Childhood Obesity**

**2. Do you believe that childhood obesity is a problem in the community?**

Yes ( ) No ( )

Why do you believe this?

OR

What have you seen or heard that leads you to believe this?

Examples:

Lack of physical activity among young people, such as infrequent walking, biking, or participation in sports.

Food and drink choices (diet) among young people include frequently eating fast food, not consuming fresh fruits or vegetables, or consuming sugary drinks.

3. **Have policies been proposed or implemented in the community/schools to prevent childhood obesity?**

Could you tell about it?

4. **Do you believe that childhood obesity policy efforts in the community/schools have been effective?**

If yes, how?

If not, why not?

5. **Is there anything else about policies that can reduce or prevent childhood obesity in the community that you would like to share?**

**About Active Living**

6. **Do you believe that a lack of physical activity is a problem in the community?**

**Yes ( ) No ( )**

***If yes*:**

a) Why do you believe this?

OR

b) What have you seen or heard that leads you to believe this?

Examples:

a. Absence or inaccessibility of walkways, trails, or bike paths for walking.

b. Absence or inaccessibility of playgrounds.

c. Lack of organised sports activities

**7. How important do you believe active living is to the public in the community?**

**8. What does the public want in active living policy?**

**9. Are you aware of current programs related to active living in the community?**

**Yes ( ) No ( )**

***If yes*,** what programmes are available?

**10. What active living policies have been proposed or implemented in the community/schools to prevent childhood obesity?**

**11. Do you believe that active living policy efforts in the community/schools have been effective?**

***Probe:***

a) If yes, how?

b) If not, why?

**12. Do you know of any specific "champion" or "champions" for active living policy in the community?**

a) Who do they represent?

b) What is their interest in supporting active living policies?

c) Do you think this individual/group is knowledgeable about active living issues?

d) In your view, is this individual/group trustworthy?

**13. *(If not addressed in #10)* Do you believe this administration/board/office works with other agencies and organizations in the community to support active living? Why or why not?**

**14. What do you believe are the barriers to legislating policies and creating community supports related to active living?**

**15. In your view, who *opposes* the adoption of policies related to active living in the community?**

Why do you think they oppose active living policies?

**16. Is there anything else about policies that can improve active living in the community that you would like to share?**

**About School Active Living Environment**

**17. What policies or procedures do schools have in place to:**

a. Encourage active transportation to and from school

b. Make their facilities available to children, adolescents, and adults outside of school hours or when school is not in session for physical activity programs (e.g., before school, after school, evenings, weekends, or school vacation)?

18. **How could these policies and practices be improved?**

**About Active Living Environment**

19. **What policies or procedures does the local government have in place to**:

- Provide an integrated network of on- and off-street ped/bike facilities and low-speed streets throughout the community with adequate signage?
- Complete the sidewalks and streets with pedestrian and bicycle-friendly facilities that support walking and biking.
- Ensure that all city policies, plans, codes, and programs are implemented to take advantage of every opportunity to create a more pedestrian- and bicycle-friendly community.
- Lower vehicle speeds in neighborhoods.
- Promote safe design in all types of locations and facilities *(e.g., visibility, lighting, natural surveillance, emergency telephones)* and other supports for public safety *(e.g., uniformed police or security personnel, crossing guards, hospitality patrols).*

**About Healthy Eating**

**20. Do you believe that unhealthy eating habits are a problem in the community?**

Yes ( ) No ( )

If yes:

Why do you believe this?

OR

What have you seen or heard that leads you to believe this?

Examples:

a. Frequent consumption of fast food among young people.

b. Frequent consumption of sugary beverages by young people.

c. Lack of healthy food choices in area convenience stores.

d. Inaccessibility of places that sell healthy food, such as grocery stores or farmers' markets.

**21. How important do you believe healthy eating is to the community?**

What does the public want in a healthy eating policy?

**22. Are you aware of current programs related to healthy eating in the community?**

Yes ( ) No ( )

If yes, what programs are available in your community?

**23. What healthy eating policies have been proposed or implemented in the community/schools to prevent childhood obesity?**

Examples:

a) Community and/or school gardens

b) Farm-to-school programs

c) Increasing healthy food options in vending machines in schools and/or recreational areas

d) Increasing healthy food options in local convenience stores

e) (Specify other healthy eating strategies that your partnership is considering)

**24. Do you believe that healthy eating policy efforts in the community/schools have been effective?**

a) If yes, how?

b) If not, why?

**25. Do you believe this administration/board/office works with other agencies and organizations in the community to support healthy eating? Why or why not?**

**26. What do you believe are the barriers to legislating policies and creating community supports related to healthy eating?**

**27. In your view, who opposes the adoption of policies related to healthy eating in the community?**

**28. Is there anything else about policies that can improve healthy eating in the community that you would like to share?**

# Appendix D

**Figure 5.4: Matlab Code**

```
% Read the Excel file

data = readtable('C:\Users\Zaid\Desktop\Zaid\chapter 2\school
study\Processed_Dataset_Renamed.xlsx');

% Define the questions of interest

teaching_levels = {'Question_2', 'Question_3', 'Question_4'};

pa_questions = {'Question_17', 'Question_18', 'Question_19', 'Question_20', 'Question_21',
'Question_22', 'Question_23'};

% Initialize matrices to store results

num_levels = length(teaching_levels);

num_pa = length(pa_questions);

correlation_matrix = zeros(num_levels, num_pa);

p_value_matrix = zeros(num_levels, num_pa);

% Compute Spearman correlations

for i = 1:num_levels

    for j = 1:num_pa

        x = table2array(data(:, teaching_levels{i}));

        y = table2array(data(:, pa_questions{j}));
```

```
        valid = ~isnan(x) & ~isnan(y);
        x = x(valid);
        y = y(valid);

        [rho, p] = corr(x, y, 'Type', 'Spearman');
        correlation_matrix(i,j) = rho;
        p_value_matrix(i,j) = p;
    end
end
% Create correlation and p-value tables
correlation_table = array2table(correlation_matrix, ...
    'RowNames', {'Primary Level', 'Intermediate Level', 'Secondary Level'}, ...
    'VariableNames', {'PA Priority', 'Fundamental Movement Skills', 'PA Lessons', ...
                      'PA Homework', 'PA in Curriculum', 'Break Time Facilities', ...
                      'PA Variety'});
p_value_table = array2table(p_value_matrix, ...
    'RowNames', {'Primary Level', 'Intermediate Level', 'Secondary Level'}, ...
    'VariableNames', {'PA Priority', 'Fundamental Movement Skills', 'PA Lessons', ...
                      'PA Homework', 'PA in Curriculum', 'Break Time Facilities', ...
                      'PA Variety'});
```

```
% Display results

disp('Spearman Correlation Matrix:');

disp(correlation_table);



disp('P-value Matrix:');

disp(p_value_table);



% Visualization

figure;

heatmap(correlation_table.Properties.VariableNames, ...

    correlation_table.Properties.RowNames, ...

    correlation_matrix, ...

    'ColorbarVisible', 'on');

title('Spearman Correlation: Teaching Levels vs Physical Activity');
```

**Figure 5.5: Matlab Code**

```
% Read the Excel file

data = readtable('C:\Users\Zaid\Desktop\Zaid\chapter 2\school

study\Processed_Dataset_Renamed.xlsx');



% Define the questions of interest

questions = {'Question_1', 'Question_5', 'Question_22', 'Question_30', ...

            'Question_24', 'Question_37', 'Question_38', 'Question_39'};



question_labels = {'Gender', 'Obesity Perception', 'HE Training', 'PA Training', ...

                   'Motivation for F&V Teaching', 'F&V Serving Knowledge', ...

                   'Daily PA Recommendation', 'Daily Screen Time'};



% Initialise matrices to store results

num_questions = length(questions);

correlation_matrix = zeros(num_questions);

p_value_matrix = zeros(num_questions);



% Compute Spearman correlations and p-values

for i = 1:num_questions

    for j = 1:num_questions
```

```
        x = table2array(data(:, questions{i}));
        y = table2array(data(:, questions{j}));
        valid = ~isnan(x) & ~isnan(y);
        x = x(valid);
        y = y(valid);

        [rho, p] = corr(x, y, 'Type', 'Spearman');
        correlation_matrix(i,j) = rho;
        p_value_matrix(i,j) = p;
    end
end

% Create correlation and p-value tables
correlation_table = array2table(correlation_matrix, ...
    'RowNames', question_labels, ...
    'VariableNames', question_labels);

p_value_table = array2table(p_value_matrix, ...
    'RowNames', question_labels, ...
    'VariableNames', question_labels);
```

```
% Display results
disp('Spearman Correlation Matrix:');
disp(correlation_table);

disp('P-value Matrix:');
disp(p_value_table);

% Visualization
figure('Position', [100, 100, 800, 600]);

h = heatmap(question_labels, question_labels, correlation_matrix, ...
    'ColorbarVisible', 'on');
h.Title = 'Spearman Correlation: Gender, Perceptions, Training and Knowledge';
```

**Regression: Matlab Code**

```
% Read the Excel file

data = readtable('C:\Users\Zaid\Desktop\Zaid\chapter 2\school

study\Processed_Dataset_Renamed.xlsx');



% Model 1: Motivation to Teach F&V (Q26)

X1 = [table2array(data(:, 'Question_1')), ...   % Gender

     table2array(data(:, 'Question_2')) + ...  % Primary Level

     table2array(data(:, 'Question_3')) + ...  % Intermediate Level

     table2array(data(:, 'Question_4')), ...   % Secondary Level

     table2array(data(:, 'Question_29')), ...  % External Support Perception

     table2array(data(:, 'Question_31'))];     % Role Modeling Importance



y1 = table2array(data(:, 'Question_26'));       % Motivation to Teach F&V



% Model 2: PA Program Utilization (Q33)

X2 = [table2array(data(:, 'Question_32')), ...  % PA Training
```

```
    table2array(data(:, 'Question_38')), ...  % Confidence in PA Opportunities
    table2array(data(:, 'Question_22'))];     % School Facilities Perception

y2 = table2array(data(:, 'Question_33'));       % PA Program Utilization

% Remove rows with NaN values
valid_rows1 = ~any(isnan([X1, y1]), 2);
valid_rows2 = ~any(isnan([X2, y2]), 2);

X1 = X1(valid_rows1, :);
y1 = y1(valid_rows1);

X2 = X2(valid_rows2, :);
y2 = y2(valid_rows2);

% Add constant term
X1 = [ones(size(X1,1), 1), X1];
X2 = [ones(size(X2,1), 1), X2];

% Perform regression for Model 1
```

```
[b1, bint1, r1, rint1, stats1] = regress(y1, X1);

% Perform regression for Model 2
[b2, bint2, r2, rint2, stats2] = regress(y2, X2);

% Variable names for each model
var_names1 = {'Constant', 'Gender', 'Primary Level', 'Intermediate Level', 'Secondary Level',
'External Support', 'Role Modeling'};
var_names2 = {'Constant', 'PA Training', 'PA Confidence', 'School Facilities'};

% Truncate variable names to match coefficient lengths
var_names1 = var_names1(1:length(b1));
var_names2 = var_names2(1:length(b2));

% Calculate t-statistics and p-values for Model 1
se1 = sqrt(diag(inv(X1'*X1) * var(r1)));
t_stats1 = b1 ./ se1;
p_values1 = 2 * (1 - tcdf(abs(t_stats1), size(X1,1) - size(X1,2)));

% Calculate t-statistics and p-values for Model 2
```

```
se2 = sqrt(diag(inv(X2'*X2) * var(r2)));

t_stats2 = b2 ./ se2;

p_values2 = 2 * (1 - tcdf(abs(t_stats2), size(X2,1) - size(X2,2)));



% Display results for Model 1

disp('Model 1: Motivation to Teach F&V');

results_table1 = table(...

    var_names1', ...

    b1, ...

    t_stats1, ...

    p_values1, ...

    'VariableNames', {'Variable', 'Coefficient', 't_Statistic', 'p_Value'});

disp(results_table1);

disp(['R-squared: ', num2str(stats1(1))]);



% Display results for Model 2

disp('Model 2: PA Program Utilization');

results_table2 = table(...

    var_names2', ...

    b2, ...
```

```
    t_stats2, ...
    p_values2, ...
    'VariableNames', {'Variable', 'Coefficient', 't_Statistic', 'p_Value'});
disp(results_table2);
disp(['R-squared: ', num2str(stats2(1))]);
```

# Appendix E

University of Hertfordshire UH

**UNIVERSITY OF HERTFORDSHIRE**
**HEALTH & HUMAN SCIENCES**

## ETHICS APPROVAL NOTIFICATION

**TO** Zaid Alsaqour

**CC** Dr Raheelah Ahmad

**FROM** Dr Richard Southern, Health and Human Sciences ECDA Chairman

**DATE** 15/10/15

---

Protocol number: **LMS/PGT/UH/02038**

Title of study: A systems approach to tackling obesity-translating learning to Saudi context

Your application for ethics approval has been accepted and approved by the ECDA for your School.

This approval is valid:

From: 15/10/15

To: 01/01/16

**Please note:**

**Approval applies specifically to the research study/methodology and timings as detailed in your Form EC1. Should you amend any aspect of your research, or wish to apply for an extension to your study, you will need your supervisor's approval and must complete and submit form EC2. In cases where the amendments to the original study are deemed to be substantial, a new Form EC1 may need to be completed prior to the study being undertaken.**

**Should adverse circumstances arise during this study such as physical reaction/harm, mental/emotional harm, intrusion of privacy or breach of confidentiality this must be reported to the approving Committee immediately. Failure to report adverse circumstance/s would be considered misconduct.**

**Ensure you quote the UH protocol number and the name of the approving Committee on all paperwork, including recruitment advertisements/online requests, for this study.**

# Appendix F

Kingdom of Saudi Arabia
MINISTRY OF HEALTH
(275 / 1100 )
General Directorate for Health Affairs
of Najran Region
Public Health

بسم الله الرحمن الرحيم
وزارة الصحة
Ministry of Health

المملكة العربية السعودية
وزارة الصحـــة
(١١٠٠/٢٧٥)
المديرية العامة للشئون الصحية بمنطقة نجران
الصحـة العـامـة

| Name | Degree | University |
|---|---|---|
| Zaid M. Alsaqour | PhD | University of Hertfordshire/ UK |

**To whom it may concern**

This is to certify that the above mentioned student is looking forward to collect data and meet our staff at general directorate of health affairs in Najran region/KSA. Therefore, we are pleased to give Mr.Alsaqour permission to approach staff and collect data for his PhD studies.

If you have any questions, please do not hesitate to contact us.

Email : PHealth-PS-Najran@moh.gov.sa

Your sincerely,

**Abdullah H. Almehthel, Msc, MPH**

**Deputy assistance of general director**

**Department of Public Health**

المديرية العامة للشؤون الصحية بمنطقة نجران
وزارة الصحة Ministry of Health
إدارة الصحة العامة

الرقـــم :
التاريـــخ : / / ١٤هـ
المرفقات :