



University of
Sheffield

**Prevalence and Associated Predictors and
Determinants of Disordered Eating
Behaviours (DEBs) Among Female
Adolescents in Saudi Arabia**

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DISSEMINATION

Publications

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Poster Presentations (* indicates prize won)

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ABSTRACT

Background

Adolescence is associated with increased vulnerability to diet-related problems. Disordered eating behaviours (DEBs), in particular, are concerned with body image and weight dissatisfaction and can influence intake and growth. Literature on DEBs is scarce in Arab populations, especially in Saudi Arabia. The overall aim of this thesis was to assess the prevalence of DEBs in Saudi adolescents and to explore determinants contributing to these behaviours.

Methods

A systematic review assessing the evidence on the prevalence of DEBs in Saudi Arabia was followed by a sequential mixed-methods study comprising a quantitative survey and qualitative interviews. A survey of 416 female students aged 12–19 years in four Riyadh schools used the EAT-26 questionnaire to explore DEBs prevalence. In-depth interviews with 18 adolescents classified as high-risk of DEBs investigated the main determinants causing DEBs.

Results

The review found that DEBs rates nationwide ranged from 10.2% to 65.5%, with the eastern region having the highest prevalence. Older students had a higher prevalence than younger students, and males reported more DEBs than females. EAT-26 scores indicated that 29.6% of students reported a high-risk of DEBs. Age was a significant predictor of DEBs risk, with the older age group (16–19 years) reporting higher risk than the younger age group (12–15 years) ($P=0.017$). Interviews concluded that negative cognitions, conscious imitation/copying behaviours, bullying, comparisons, and negative comments were common determinants of DEBs. Some participants indicated that biological and familial variables may increase the risk of DEBs.

Conclusion

This thesis represents the first research exploring the prevalence and primary determinants of DEBs in Saudi female adolescents in Riyadh. The relatively high risk in this age group, and the importance of peers and family members as well as cognition, suggests that interventions to reduce risk need to address both individual factors and social pressures.

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LIST OF ABBREVIATIONS

AN- Anorexia Nervosa

ANSOCQ- AN Stages of Change

APA- American Psychiatric Association

ARFID- Avoidant/Restrictive Food Intake Disorder

ASD- Autism Spectrum Disorder

ATLS- Arab Teens Lifestyle Study

BED- Binge-Eating Disorder

BES- Binge Eating Scale

BMI- Body Mass Index

BN- Bulimia Nervosa

BPA- Bisphenol A

CDC- Centre for Disease Control and Prevention

DALYs- Disability Adjusted Life Years

DEBs- Disordered Eating Behaviours

DRI- Dietary Reference Intake

DSM-5- Diagnostic Statistical Manual of Mental Disorders

EAT- Eating and Activity in Teens and Young Adults

EAT-26- Eating Attitude Test

EDCs- Endocrine-Disrupting Chemicals

EDE-Q- Eating Disorder Examination Questionnaire

EDI- Eating Disorder Inventory

EDs- Eating disorders

EEC- Education Evaluation Comission

FFM- Five-Factor Model

HAES- Health At Every Size

Ht- Height

ICD-11- International Classification of Diseases and Related Health Problems

IOTF- International Obesity Task Force

JBI- Joanna Briggs Institute

LMICs- Low and Middle-Income Countries

MENA- Middle East and North Africa Countries

MMR-Mixed Methods Research

MoE- Ministry of Education

MOH- Ministry of Health

OSFED- Other Specified Feeding or Eating Disorder

PECO- Population, Exposure, Comparison, Outcome

PICOS- Population, Intervention, Comparator, Outcome, Study design

PIS- Participant Information Sheet

PPCT- Process-Parent-Context-Time

PRISMA- Preferred Reporting Items for Systematic Reviews and Meta-Analyses

Project EAT – Eating Among Teens

RCTs- Randomised Controlled Trials

RDA- Recommended Dietary Allowances

SCOFF- Sick Control One Fat Food

SNMHS- Saudi National Mental Health Survey

SPSS- Statistical Package for the Social Sciences

SR- Systematic Review

UAE- United Arab Emirates

UNICEF- United Nations Children’s Fund

UNICEF MENARO- UNICEF Middle East and North Africa Regional Office

US- United States of America

USDA- United States Department of Agriculture

WHO- World Health Organisation

Wt- Weight

YLDs- Years Lived with Disability

CHAPTER 1 INTRODUCTION

1.1 INTRODUCTION

The overall purpose of this thesis is to determine the prevalence of disordered eating behaviours (DEBs), as well as the determinants and causes of DEBs among female adolescents in Saudi Arabia. There is a dearth of research in Arab countries, despite the high prevalence of DEBs (Fatima and Ahmad, 2018). These behaviours have not been the subject of any prior review in Saudi Arabia, with only one study conducted more than 20 years ago in the city of Riyadh that identified a 15.9% prevalence of DEBs among female students (Al-Subaie, 2000). Similarly, research that has explored potential contributing factors of DEBs in the Saudi population is insufficient, with a limited number of factors examined, including socioeconomic status, family size, parental education, and occupation (Al-Qahtani and Al-Harbi, 2020; Al-Subaie, 2000).

Adolescence is the transitional phase from childhood to adulthood. It is considered a nutritionally sensitive stage, characterised by pubertal onset and rapid growth (Sawyer *et al.*, 2018). Adolescents tend to have elevated nutritional requirements compared with young children and adults. Energy, protein, calcium, and iron needs are increasing owing to the development of peak bone mass and changes in body composition (Das *et al.*, 2017). Health conditions and nutritional problems that occur in early childhood and persist into adolescence can influence adolescents' weight status (Charles Shapu *et al.*, 2020).

DEBs were first described in the psychological and medical literature in the late 1970s (Russell, 1979). Such behaviours, including binge eating, dieting, and other weight control practices, are frequent among adolescents and can manifest as either a singular DEB or several comorbid behaviours (Yoon *et al.*, 2020).

Despite differences in physical characteristics and weight status, DEBs are common in both males and females (Yu *et al.*, 2018). The highest percentage of DEBs is observed in mid-to-late adolescence (15–21 years), and these behaviours are observed across a wide range of racial, ethnic, socioeconomic, and cultural backgrounds (Larson *et al.*, 2021; Podar and Allik, 2009). Nevertheless, female adolescents demonstrate elevated rates of DEBs due to a greater preoccupation with body shape and physical appearance compared to their male counterparts (Mallick, Ray and Mukhopadhyay, 2014).

Eating disorders (EDs) are mental health conditions marked by DEBs, inconsistent patterns of food consumption, unhealthy strategies for managing weight, and a distorted perception of body weight and/or shape (Fernández-Aranda, Granero and Jiménez-Murcia, 2023; Frank, 2016). The significance of DEBs pertains to the progression of EDs, as these disturbed behaviours resemble those observed in EDs (Perris, 2020; Stice, 2016). Evidence from longitudinal cohort studies consistently indicates that individuals reporting DEBs are at a markedly increased risk of developing a full-syndrome ED, as specified in the Diagnostic Statistical Manual of Mental Disorders (DSM-5) and the International Classification of Diseases and Related Health Problems (ICD-11) (Neumark-Sztainer *et al.*, 2002; 2011; Yager *et al.*, 2005). In the US and Europe, between 10 and 20 percent of adolescent females reported having DEBs (Neumark-Sztainer *et al.*, 2002; Torstveit, Agedal-Mortensen and Stea, 2015). In Arab countries, the prevalence of DEBs among adolescents is comparable to that observed among adolescents from Western countries, with the incidence among female adolescents ranging from 16.2 to 42.7% (Azzeh, Peachey and Loney, 2022; Musaiger *et al.*, 2013). A range of screening tools exists to evaluate specific DEBs and aid in diagnosing EDs. However, most of these instruments have been developed and validated for use in adult populations. Only a few have been tailored to adolescents, including the Eating Attitudes Test

(EAT-26), the Eating Disorder Inventory (EDI-3), and the AN Stages of Change (ANSOCQ), which is typically administered post-diagnosis (Leti et al., 2020).

Determinants of DEBs are connected to several biological, social, parental, and psychological factors (Costa *et al.*, 2008). Adolescence is granted as a sensitive stage, marked by a growth spurt and rapid changes, that may trigger concerns about shape and negative body image (Gowers and Shore, 2001; Rogol, Roemmich and Clark, 2002). Interpersonal relationships with parents and peers have significant influences on eating behaviours and body concerns (Badaly, 2013; Giletta *et al.*, 2021; Rodgers and Chabrol, 2009). Furthermore, social media may increase body dissatisfaction and stimulate engagement in DEBs (Rodgers *et al.*, 2020).

1.2 STRUCTURE OF THE THESIS

This thesis presents a cohesive body of work, employing a publication format that comprises both traditional thesis chapters (e.g., introduction, background, methodology, and discussion) and three PhD primary studies as published manuscripts. Each manuscript has its own research aims and objectives. The manuscripts are outcomes of the student's original research, who is the principal author, conducting research since registration for doctoral studies at the University of Sheffield. The references for these papers are detailed in the dissemination section and relevant chapters. Particular authors' contributions and copyright details are specified in the introduction to each pertinent chapter. Commentaries serve as a means of connecting the thesis and outlining the works' coherence and relevance.

This thesis is composed of seven chapters:

Chapter 1 Introduction: This chapter provides an overview of the thesis and outlines its structure.

Chapter 2 Background: This chapter provides a general overview of adolescents, including both international data and information specific to the Middle East and North Africa (MENA) countries, particularly Saudi Arabia. It highlights major facts accompanying adolescence, focusing on the physical, cognitive, and psychosocial developmental phases. It explains adolescents' nutritional requirements and the importance of meeting macronutrient and micronutrient demands. Moreover, the chapter demonstrates common eating habits among adolescents internationally and in Saudi Arabia, and defines the concept of DEBs and its significance in relation to the widely known EDs. Then, the prevalence of DEBs and possible determinants are discussed. The chapter concludes by outlining the aims and objectives of this thesis.

Chapter 3 Methodology: This chapter provides a thorough overview of the methods utilised to address the PhD research aims and objectives. The mixed methods research paradigm is explained, followed by a description of the applied methodologies in systematic review (Study One), quantitative phase (Study Two) and qualitative phase (Study Three). The theoretical framework adopted for the qualitative approach, Bronfenbrenner's Bioecological Model, is then explained, accompanied by a justification for its application.

Chapter 4 Systematic Review (Study One): This chapter presents the first PhD primary study in the published manuscript format.

Chapter 5 Quantitative Phase (Study Two): This chapter presents the second PhD primary study, as outlined in the published manuscript format.

Chapter 6 Qualitative Phase (Study Three): This chapter presents the third PhD primary study, as published in the manuscript format.

Chapter 7 Discussion and Conclusion: This chapter provides an overview of the thesis's key findings, which are then described in terms of their integration with previous research in this area and other relevant literature. The final section highlights the thesis's overall strengths and limitations, followed by a discussion of the potential implications for addressing DEBs in adolescents, and suggests some future research directions.

CHAPTER 2 BACKGROUND

This chapter provides a general overview of adolescence, including its significance as a vulnerable life stage worldwide and in Saudi Arabia. It highlights major facts accompanying adolescence, focusing on the physical, cognitive, and psychosocial developmental phases. It explains adolescents' nutritional requirements and the importance of meeting macronutrient and micronutrient demands. It then discusses common eating habits among adolescents internationally and in Saudi Arabia, and defines the concept of DEBs and its significance. It also discusses common determinants that may increase adolescents' susceptibility to DEBs.

2.1 ADOLESCENCE

Adolescence is the phase extending from childhood to adulthood. It is identified as the broad age range from 10 to 24 years, which is classified into three stages following bodily transitions: early adolescence (10–15 years), late adolescence (15–18 years), and early adulthood (18–24 years) (Daly, O'Sullivan and Kearney, 2022). Commencing with puberty, adolescence is a period of substantial growth that concludes in the mid-20s (Backes and Bonnie, 2019).

Adolescence is associated with dramatic changes physically and cognitively and is characterised by the onset of puberty and growth spurts, where an adolescent's body experiences a complete physical transformation from a child to an adult (Sawyer *et al.*, 2018). Changes in weight and height are responsible for the shift in nutritional needs. Therefore, it is essential to meet these requirements to guarantee optimal growth and prevent nutritional risks (Lassi *et al.*, 2017a).

A robust body of literature details adolescent eating patterns and rarely met nutritional recommendations, with malnutrition (overnutrition/undernutrition/ micronutrient deficiencies

(hidden hunger)) classified as a common concern that can lead to several health conditions that may persist into adulthood (Charles Shapu *et al.*, 2020; Lassi *et al.*, 2017b; Rippin *et al.*, 2019). The triple burden of malnutrition may have severe consequences and can interfere with normal growth (Charles Shapu *et al.*, 2020).

Although adolescence is often perceived to be a healthy period of life, the rates of illnesses and deaths are substantial in adolescents. Azzopardi *et al.* (2019) tracked the progress in adolescent health from 1990 to 2016 and reported that a reduction in illness burden in many countries has been counterbalanced by population increase in nations with the most inadequate adolescent health indicators. In 2016, there were 250 million more adolescents residing in multi-burden nations, compared to 1990, where they encountered a significant and intricate burden of disease. Multi-burden nations included the majority of nations in sub-Saharan Africa, central, southern, and eastern Asia, as well as various countries in Latin America, Oceania, the Middle East, and northern Africa. Moreover, numbers indicated the speed of nutritional transition in countries such as China and India, with 324.1 million (18%) of the 1.8 billion adolescents worldwide being overweight or obese in 2016, an increase of 176.9 million compared to 1990, and 430.7 million (24%) had anaemia, a rise of 74.2 million compared to 1990 (Azzopardi *et al.*, 2019).

A substantial portion of the global burden of disease is attributed to mental health conditions among adolescents, with depression and anxiety disorders accounting for approximately 40% of mental disorders among adolescents aged 10–19 years (UNICEF, 2024). For adolescents and youth between the ages of 15 and 29 years, mental disorders, mostly anxiety and depression, make up almost half (45 %) of all diseases, with adolescent females having double the risk compared to males (Lancet, 2017). Epidemiological shifts from acute and infectious diseases to chronic and mental illnesses have been observed in Europe and

America and are predicted to happen worldwide, with mental illnesses regarded as one of the main causes of years of life lived with disability (YLDs) and of disability-adjusted life-years (DALYs) in adolescents (Baranne and Falissard, 2018).

In Europe, a significant and increasing proportion of health issues concerning children and adolescents are related to mental illness, such as emotional disorders, behavioural issues, and learning difficulties (Telhaj, 2019). In the Eastern Mediterranean Region, depression, self-harm, anxiety, and conduct disorders constitute four of the top leading causes of DALYs among girls and boys aged 15 to 19 years (Rahman *et al.*, 2019). Approximately 25% of the disabilities experienced by Arab adolescents are caused by mental and behavioural conditions, with depression ranked first (Dardas, 2021).

2.2 ADOLESCENT DEMOGRAPHICS

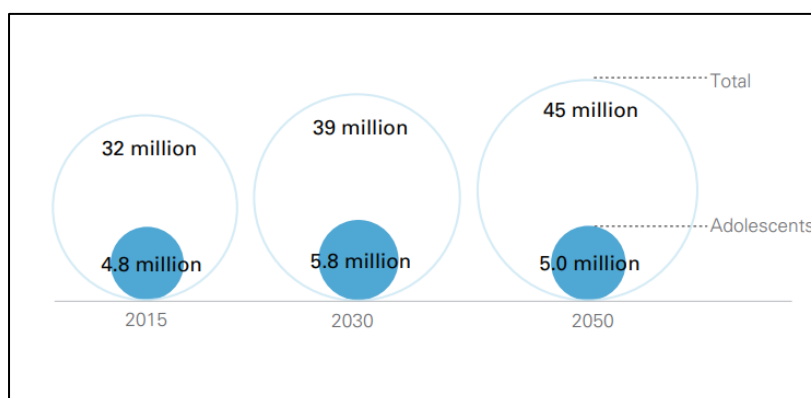
According to the United Nations, there are 1.3 billion adolescents globally, making up 16% of the overall population (UNICEF, 2022). Through 2050, the number of adolescents is anticipated to increase, particularly in low and middle-income countries (LMIC). Over half of all adolescents reside in Asia, while they make up the largest share of the population in sub-Saharan Africa (23%) (Cruickshank *et al.*, 2023).

In MENA countries, 50 percent or more of the population was comprised of children, adolescents and youth in every MENA nation, with the exception of Lebanon, Qatar, the United Arab Emirates (UAE), Kuwait, and Bahrain, where they made up more than 40% of the total population (UNICEF, 2019). In 2030, the total population and adolescents in MENA are expected to increase to 39 million and 5.8 million, respectively. However, the number of adolescents will gradually decline by 2050 based on the descending fertility rates (**Figure 1**,

UNICEF MENA Fact Sheet, 2019).

Figure 1 Number of the Total Population and Adolescents (10-19 years), 2015, 2030, and 2050 (in Millions).

Source. UNICEF MENA Fact Sheet (2019)

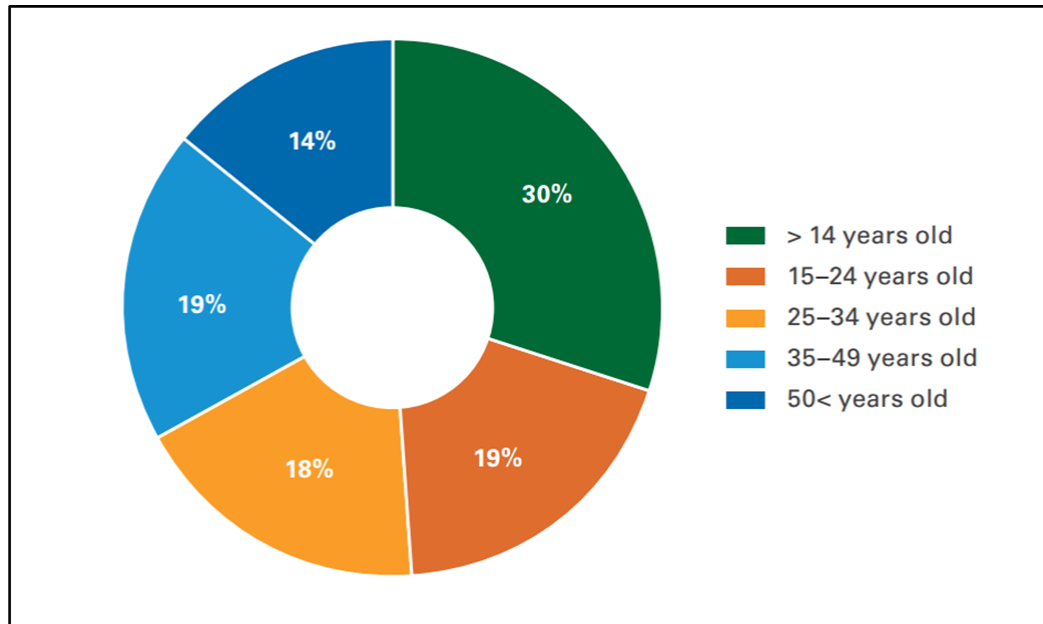


2.3 ADOLESCENTS IN SAUDI ARABIA

Saudi Arabia is the third-largest Arab nation and the third-largest country in the Middle East by land area, taking up the majority of the Arabian Peninsula. It shares borders with Yemen in the south, Oman in the southeast, Kuwait, Qatar, and the UAE to the east, and Jordan and Iraq to the north and northeast (Al-Hajoj, 2012). The General Authority of Statistics reported that the total population in 2018 was 33.4 million, comprising 20.7 million Saudi citizens and 12.7 million guest labourers. Males accounted for 51% of the Saudi population, while females accounted for 49%. Thirty percent of the population is under 14 years old, 19% is between the ages of 15 and 24, 18% is between the ages of 25 and 34, 19% is between the ages of 35 and 49, and 14% is over the age of 50 (**Figure 2**, UNICEF MENARO *et al.*, 2024). Estimates from the Saudi census 2022 indicated that the overall population is 32,175,224, with 61.2% males and 38.8% females (General Authority for Statistics, 2022).

Figure 2 Population Distribution According to Age in Saudi Arabia

Source. UNICEF MENARO *et al.* (2024) Integration of Mental Health and Psychosocial Support in Primary Healthcare for Children, Adolescents, Pregnant women and New Mothers in the Middle East and North African Region. Saudi Arabia Country Report.



Saudi Arabia is widely acknowledged as the birthplace of Islam, with its origins in the holy cities of Makkah and Al-Madinah in the western region. Therefore, Saudi Arabia holds universal value and respect among Muslims. On a worldwide scale, the country is considered religiously significant, which has a substantial impact on many of its internal and foreign policy decisions (Alharbi, 2024).

The Kingdom of Saudi Arabia is the largest nation on the Arabian Peninsula, with a population of over 30 million and an area of 2.14 million km² (Almatar, 2022, **Figure 3**). The city of Riyadh is the capital of Saudi Arabia, which is located at an average of 600 meters (2,000 ft) above sea level, with an estimated population of 7.6 million in 2019. It is the most populous city in Saudi Arabia and the third most populous in the Middle East (Alhumidan, 2021). As a part of the Saudi Vision 2030, Riyadh is experiencing rapid improvements in various sectors, including health and education. In 2019, 22.8% of Saudi Arabia's schools

were established in Riyadh region, with 1,887 private schools and 5,900 public schools. High numbers of schools are due to segregation based upon gender (Shehzad, 2021).

Figure 3 Locator Map of Riyadh, the Capital City of Saudi Arabia

Source. Wikimedia Commons contributors (2022). Created by Einstein, N. (2007).
This figure is under CC Attribution-Share Alike.



Due to the 1970 oil boom, the country experienced significant growth and rapid urbanisation (Osra and Jones, 2017). Saudi Arabia's rapid development and urbanisation have shifted nutritional and eating patterns, resulting in a significant nutritional transition, influencing the body mass index (BMI) of children and adolescents (Althayidi *et al.*, 2018; Habbab and Bhutta, 2020). The traditional Arabic diet, composed of conventional elements or primary products, is being supplanted by a Westernised diet characterised by protein-rich, energy-

dense foods (Al-Khusaibi, 2019). Saudi Arabian traditional foods commonly consist of wheat, rice, dates, chicken, vegetables, fruits, fish, and meat (Alshabanat *et al.*, 2021).

Adolescents in Saudi Arabia are exposed to a broad range of health-impairing behaviours, including poor nutritional intakes and sedentary lifestyles, lack of traffic safety measures (i.e. using seat belts, taking a car without permission), smoking, bullying and violence. Findings from 13 different regions in Saudi Arabia identified that 28% of adolescents had a chronic disease including diabetes, bronchial asthma, allergies, skin disorders, haematological disorders and musculoskeletal or genitourinary conditions, and 14.3% had depression-like symptoms, 30% were overweight or obese, and 95.6% had vitamin D deficiency (Albuhairan *et al.*, 2015).

Saudi adolescents are experiencing significant shifts in culture and social values. As a conservative country adhering to Islamic principles and values, globalisation plays a substantial role in modifying common cultural concepts, leading to greater challenges toward preserving cultural identity. The proliferation of the English language had a detrimental impact on the use of Arabic, accelerating the adoption of a Western lifestyle, particularly with the younger generation (Alsisy and Alsewiket, 2020). In particular, adolescent females are influenced by thinness since it has been viewed as the Western feminine ideal, transforming the traditional Arabic perception of a plump and attractive body. The preference for a thin body ideal raises body dissatisfaction and negative body image, increasing the likelihood of disordered eating (Latzer, Azaiza and Tzischinsky, 2014). Early research identified globalisation and Western media as two prevalent elements promoting the development of negative feelings about body and shape (Swami, 2015). AlShebali and colleagues (2021) confirmed that internalisation of Western values is linked with eating pathology, body image issues and psychological disorders in Saudi young females.

The Saudi Vision 2030, launched in April 2016, is centred on creating a sustainable future that will impact every sphere of society, ranging from planning and infrastructure to policy development and investment (Alnasser and Musallat, 2022). The Ministry of Health (MOH) is one of the key sectors in this vision that targets developing a healthy and competent generation by highlighting youth as the power of the future. With over half of the population falling below the age of 25 years, the MOH places a high priority on adolescent health, applying MOH guidelines as a principal reference. Adolescent health sets the foundation for adult health, fostering competence, fulfilment and well-being for the whole society (Salam and Rashid, 2022). Elevated rates of chronic diseases, due to increased obesity and sedentary behaviours among Saudi adolescents, reinforced the primary aim of promoting healthy lifestyles and habits for children and adolescents, by focusing on disease prevention rather than treatment (UNICEF MENARO *et al.*, 2024).

2.4 ADOLESCENT DEVELOPMENT

The phase of adolescence features significant physical and emotional transformations. This transitional phase is defined by intricate biopsychosocial processes modified by cultural factors (Jimenez *et al.*, 2024). Together with puberty and rapid dimorphic growth, personal and sexual identities are developing, and cognitive skills are starting to mature (Schulte *et al.*, 2019).

2.4.1 PHYSICAL DEVELOPMENT

Adolescence is indicated by the onset of puberty, wherein thyroid hormones, growth hormones, and androgens are released, triggering physical growth and development. On average, puberty starts in girls between the ages of 8 and 13 and in boys between the ages of 9 and 14 (Farello *et al.*, 2019). The development of breasts and/or the growth of pubic hair are initial indicators of puberty in girls, and menarche usually follows a few years later. Each

girl may have pubertal onset at a significantly different age (Knight *et al.*, 2020). The average age at puberty onset among Saudi adolescent females has been found to be 12.2 years (Shahatah *et al.*, 2021).

The patterns of puberty and growth change over time, and puberty appears to start earlier in girls. Girls tend to have menarche, the first menstrual period, between 12 and 13 years, at an average age of 12.4 years. A growth spurt occurs with the start of menarche and continues for approximately 4 years (Herman-Giddens *et al.*, 2012). During growth spurts, a series of changes occur rapidly along with significant increases in weight and height. Genetics play a role in this process and explain the growth differences among adolescents of the same age, with genetic variations specified to be associated with sex and race (Stang and Story, 2005; Tu *et al.*, 2015). Female adolescents are expected to reach 15–25% of their adult height, with an estimated ≥ 20 cm difference in the mean height among adolescents from 200 countries (Christian and Smith, 2018; Rodriguez-Martinez *et al.*, 2020). The average weight gain is estimated to range from 7 to 25 kg (15–55 lb). With menarche, the tendency to gain weight is increasing, with a specified increase of 10.39 kg compared to females in pre- and post-menarcheal phases (Chiasson, 2014; NCD Risk Factor Collaboration, 2017).

Over the last two decades, scientific evidence has demonstrated that puberty has begun at earlier ages, often 12 to 18 months earlier. This shift in the onset of puberty may be due to obesity and nutritional status, as well as the impact of extrinsic factors such as exposure to endocrine-disrupting chemicals (EDCs) (Farello *et al.*, 2019). The most prevalent chemical found in plastics, Bisphenol A (BPA), can cause irregular menstruation, hormone abnormalities, and decreased fertility (Kawa *et al.*, 2021).

2.4.2 COGNITIVE AND PSYCHOSOCIAL DEVELOPMENT

During adolescence, brain maturation involves the acquisition of advanced cognitive and social skills. Rather than growth in size, the brain undergoes myelination, primarily in the prefrontal cortex (Sharma *et al.*, 2013). Adolescents start to develop advanced thinking skills and a stronger sense of self-worth and independence. The most significant development occurs in the prefrontal cortex, the front part of the brain, which is mainly responsible for cognitive control and decision making. Moreover, the limbic system of the brain is also linked with hormonal shifts in adolescence, which controls emotions and behaviours. This system develops early, unlike the prefrontal cortex, which typically matures by the mid-20s (Blakemore and Choudhury, 2006).

Gavin *et al.* (2009) described these changes in the adolescent brain as a “rewiring” process, which continues until the age of 25. Hormones and neurotransmitters play a major role in controlling emotions and behaviours. Serotonin and dopamine are neurotransmitters that regulate mood swings, anxiety, and impulsive behaviour. Due to reduced neurotransmitter levels, adolescents are more vulnerable to erratic moods and experience more difficulty controlling their emotions (Dahl, 2003; Stang and Story, 2005). Melatonin is another neurotransmitter associated with sleeping and the sleep-wake cycle. It is the main neurotransmitter operating the circadian rhythm and guiding sleep patterns. Elevated melatonin levels in adolescents stimulate their need for sleep (Dahl, 2003).

With the emergence of new perceptions and recognitions, the ability to perceive risks is not sufficient. Risky behaviours, such as substance abuse and violence-related behaviours, are typically initiated during adolescence and expose young people to significant physical harm or death (Vannucci *et al.*, 2020). Adolescents aged 10 to 19 had a 12% higher death rate between 2013 and 2016, with the most common causes of injury being homicide, suicide, and

unintentional injury (Curtin *et al.*, 2018). Typically, these risky behaviours are mostly associated with peer pressure and seeking acceptance (Albert, Chein and Steinberg, 2013).

The observational analysis found that peer influence tends to be the common contributor to risky decisions (Steinberg and Monahan, 2007). Behavioural theories suggest that adolescents are comparable to adults in decision-making. Such actions depend on conceptualising possible rewards and negative consequences. However, adolescents have much more appreciation for social rewards and friendship than adults (Crone and Dahl, 2012).

Adolescents have strong desires to belong to groups and be approved. As they socially mature, they encounter conflicting emotions to confirm their personal independence and loyalty to their peers and family (Wiles, Bondi and Wiles, 2006). A recent meta-analysis of peer influence indicated that adolescents who have friends practising certain attitudes reported increases in similar attitudes and behaviours. Similarly, if adolescents' friends were practising certain behaviours less, they are expected to report decreases in these similar behaviours (Giletta *et al.*, 2021).

Significant changes in body shape and size increase awareness of sexuality and body image in adolescents. Growth spurts through adolescence vary between the sexes, but girls generally have their growth spurt two years earlier than boys (Rogol, Roemmich and Clark, 2002).

Owing to growth variations, adolescents may have low self-esteem and poor body image.

Graber (2013) highlighted that girls who mature early are more prone to teasing and bullying about their developing bodies. Thus, they are at an increased risk for EDs and other psychosocial problems (Graber, 2013).

2.5 NUTRITION AND WEIGHT DURING ADOLESCENCE

Adolescent nutrition is crucial for maintaining a normal body weight and promoting sufficient development. With elevated nutritional requirements, it is fundamental to ensure that macronutrient and micronutrient demands are being met. Nutritional deficiency may hinder the growth process and lead to severe medical conditions (Salam *et al.*, 2016).

Undernutrition hinders linear growth, reduces immunity, and increases the risk of diseases and infections (Christian and Smith, 2018). A systematic review examining the nutritional status of school-aged children and adolescents aged 5 to 19 years living in LMICs in seven global regions identified that, due to undernutrition, conditions such as stunting, thinness, anaemia, and other micronutrient deficiencies were evident (Wrottesley *et al.*, 2022).

Adolescents' disordered eating habits and poor nutritional knowledge might contribute to undernutrition (Tripathi and Gehlot, 2018; Widodo and Renyoet, 2023).

Overnutrition, characterised by excessive energy intake, is a major risk factor for morbidity and mortality. Overweight and obesity in children and adolescents have become increasingly common globally, placing them among the most prevalent chronic illnesses in this age range through adulthood (Horesh *et al.*, 2021). Obesity is significantly linked with the main diet-related medical conditions, including type-2 diabetes, hypertension, stroke, and cardiac diseases (Belay *et al.*, 2022). Obesity continues to be prevalent, with over 40% of US adolescents living with overweight and over 30% of children categorised as obese (Albrecht and Iyengar, 2021). In Central and Eastern Europe, results indicated that 24.7% of males and 18.6% of females were overweight or obese (Rodriguez *et al.*, 2022). Among Saudi adolescents, overweight and obesity constitute a substantial public health concern, with social determinants exerting a significant influence. Social determinants of health refer to the

circumstances in which persons are born, develop, reside, engage in employment, and age (Habbab and Bhutta, 2020). Social determinants, particularly dietary patterns, sedentary lifestyle, family history of obesity and urbanisation tend to have a positive relationship with the fluctuating rates of overweight and obesity among Saudi adolescents (Habbab and Bhutta, 2020). A study on Saudi adolescents living in the city of Riyadh reported that the prevalence of overweight/obesity was 40.5% (Al-Hazzaa and Albawardi, 2021).

2.5.1 NUTRITIONAL REQUIREMENTS DURING ADOLESCENCE

With adolescents' remarkable growth, nutritional requirements reach their peak. It is essential to meet macronutrient and micronutrient demands, as deficiency may cause irreversible medical conditions (Christian and Smith, 2018). The supply of particular nutrients supports the expected bone and muscle growth; for example, calcium and vitamin D are vital for bone growth, and amino acids are necessary for muscle development. Daily caloric needs are expanding with growth (Das *et al.*, 2017). However, caloric requirements are higher in boys than in girls owing to greater development in muscle mass, weight, and height. For adolescents aged 9 to 13 years, caloric intake must range from 1400 to 2200 kcal/day for female adolescents and from 1600 to 2600 kcal/day for male adolescents. For older adolescents, ages 14 through 18 years, the caloric requirements range from 1800 to 2400 kcal/day for adolescent females and about 2000 to 3200 kcal/day for adolescent males. The adequate daily caloric requirement for adolescents to maintain energy balance is based on the level of physical activity (sedentary, moderately active, active). If adolescents are moderately or very active, 200–400 kcal should be added to the daily total caloric intake (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020).

Based on dietary recommendations, 50% of the total daily calories should be consumed from carbohydrates and 25–35% from fat. The daily caloric intake from sugars must not exceed 10–25%. For protein, the recommended daily intake is 0.9 g per kilogram of body weight. If

adolescents are overweight or obese (BMI >25 kg/m²), the calculations should apply the normal body weight rather than the adjusted or ideal body weight (Richter *et al.*, 2019). Guidelines recommend balancing dietary intake to maintain normal growth (**Table 1**). Consuming whole grains and cereals rather than refined choices and reducing high-calorie meals and sugar-dense food are fundamental eating habits for controlling weight (Sanders *et al.*, 2021). In addition, consumption of fruits and vegetables is a significant indicator of healthy intake. Despite the high nutritional value of fruits and vegetables, adolescents' intake of these food groups is usually inadequate (Lange *et al.*, 2021).

The Recommended Dietary Allowances (RDA) for iron for individuals aged 14–18 years is 11 mg/day for boys and 15 mg/day for girls; the allowance is higher for girls, as they have increased iron needs with the onset of menstruation. For both sexes, the Dietary Reference Intake (DRI) for calcium and vitamin D is 1300 mg/day and 5 µg/day, respectively, while that for folate is 400 µg/day (Das *et al.*, 2017). A systematic review concluded that the use of micronutrient supplementation for adolescents can significantly reduce the prevalence of anaemia (Salam *et al.*, 2016).

Table 1 Estimated Daily Caloric Requirements of Macronutrients for Individuals Aged 9-18 Years

	Females		Males	
	9-13 years	14-18 years	9-13 years	14-18 years
Calories	1600 Kcal	1800 Kcal	1800 Kcal	2200 Kcal
Protein (g, kcal %)	34g, 10-30%	46g, 10-30%	34g, 10-30%	52g, 10-30%
Carbohydrates (g, kcal %)	130 g, 45-65%	130 g, 45-65%	130 g, 45-65%	130 g, 45-65%
Fat (kcal %)	25%–35%	25%–35%	25%–35%	25%–35%
Fibre (g)	22g	25g	25g	31g
Added Sugars (kcal %)	<10	<10	<10	<10

Source. Table. A1-2 Daily Nutritional Goals, Ages 2 and Older. U.S. Department of Agriculture and U.S. Department of Health and Human Services (2020) Dietary Guidelines for Americans, 2020-2025. 9th Edition. December 2020. Available at [DietaryGuidelines.gov](https://www.dietaryguidelines.gov).

2.5.2 EATING HABITS DURING ADOLESCENCE

Cognitive ability and decision-making skills begin to mature in adolescence (Moses-Payne *et al.*, 2021). Therefore, young people are capable, to some extent, of determining their health behaviours and eating habits, particularly in the context of the available choices (Mizia *et al.*, 2021). For fruit and vegetable intake, the average consumption by adolescents in North America, Europe, or Oceania is below the recommended daily intake of 400 grams or five portions/day (Rosi *et al.*, 2019). The median frequency of consuming fruits and vegetables among US adolescents aged 14 –18 years was 0.9 and 1.1 times per day, respectively.

Nationwide, only 2.0% of adolescents met the U.S. Department of Agriculture (USDA) recommendations for vegetables, and 7.1% met the recommendations for fruits (Lange *et al.*, 2021). In the Eastern Mediterranean Region, studies confirmed that adolescents aged 10–19 years have low intakes of fruits, vegetables, and fibre (Al-Jawaldeh, Taktouk and Nasreddine, 2020).

A multi-national comparison of 11 Middle Eastern countries showed inadequate fruit and vegetable intake across all countries. According to the Global School-Based Student Health Survey (2005–2009), the percentage of adolescents consuming fruits and vegetables at least five times a day was only 19.4%, with the highest intake noted in Djibouti (40.4%) and the lowest in Pakistan (10.0%). Most countries reported that boys consumed significantly more fruits and vegetables daily than did girls (Al Ani, Al Subhi and Bose, 2016).

In the Arabian Gulf, particularly the UAE, adolescent students aged 15 years and above have low consumption of fruits and vegetables, with significantly lower intake among females. Only 28% of the participants consumed the recommended amount of fruits and vegetables each day. They also reported a high consumption of fast food and soft drinks (Makansi *et al.*, 2018). Among Saudi adolescents, a study comparing dietary patterns and lifestyle behaviours between the 2009/2010 Arab Teens Lifestyle Study (ATLS-1) and 2019/2020 ATLS-2 findings found that fruit and vegetable intake increased by 10.3% and 3.2%, respectively (Al-Hazzaa and Albawardi, 2021). Another study implemented on middle and high school students aged 11–18 years in Madina and Jeddah concluded that about one-third of teenagers (28.5%) reported eating fast food more than twice a week (Mumena *et al.*, 2022).

Skipping breakfast is considered one of the common eating habits in adolescents (Insani, Kustiyah and Dwiriani, 2022). It is linked with an elevated risk of overweight or obesity, cardiometabolic conditions, and an unhealthy dietary pattern in children and adolescents (Ma

et al., 2020; Ricotti *et al.*, 2021). A meta-analysis indicated that cross-sectional studies identified that skipping breakfast raised the likelihood of being overweight or obese. Children and adolescents who skipped breakfast had a 43% higher risk of being overweight or obese than those who consumed breakfast regularly (Ardeshirlarijani *et al.*, 2019). In the US, 17.9% of students nationwide are skipping breakfast daily (Brenner, 2024). However, skipping breakfast was not a consistent behaviour among Australian adolescents (Smith *et al.*, 2017). Moreover, a systematic review investigated the trend of skipping breakfast in 33 different countries. Approximately 10–30% of adolescents were skipping breakfast, and this trend was more common in girls than in boys. In 94.7% of participants, skipping breakfast was linked with overweight and obesity, poor cognitive performance and reduced educational outcomes (Adolphus *et al.*, 2016; Hoyland, Dye and Lawton, 2009; Monzani *et al.*, 2019).

Similarly, skipping breakfast is common in Saudi Arabia (Al Tamimi *et al.*, 2022). Only 39% of secondary school female students aged 15–19 years are consuming breakfast daily (Alrayes *et al.*, 2018). Another study implemented in Jeddah found that almost 80% of participants skipped breakfast. However, this trend did not differ between the sexes or across ages (Al-Hazzaa *et al.*, 2020).

Unhealthy and energy-dense snacking is becoming prevalent in Saudi adolescents. Saudi adolescents and children frequently make unhealthy eating choices, as evidenced by their daily consumption of sugar-sweetened beverages, energy-dense foods, and sweets (Kutbi, 2021; Musaiger, 2011). A study was conducted in the Eastern region of Saudi Arabia to identify students' consumption of sugar-sweetened beverages. Approximately 40% of students reported consuming these drinks once a day, and nearly one-third (27.5%) reported consuming them twice a day. Most of them reported weekly consumption of soft drinks (69.6%), followed by energy drinks (40.6%), and sports beverages (25.6%) (Al Otaibi, 2017).

Among students in Jeddah, many foods have been identified as the most popular snacks, including chocolate (70%), salad (25%), popcorn (40%), potato chips (50%), biscuits (20%), fruits and vegetables (40%), and nuts (55%). Students who are not obese were more likely to eat salad than students who are obese. On the other hand, students who are obese were more likely to eat potato chips, popcorn and biscuits (Aljefree, Shatwan and Almoraie, 2022).

Findings suggest a strong link between a sedentary lifestyle and frequent snacking. Increased screen time is markedly correlated with higher consumption of processed snack food and sugary sweetened drinks (Huo *et al.*, 2022). Sedentary behaviours are commonly associated with dramatic economic changes and a modernised way of life in Saudi Arabia. This lifestyle has been associated with increased screen time activities. Apart from using traditional devices, such as TVs and computers, adolescents use other devices, including smartphones, tablets, and other mobile devices, which can be used everywhere (Fairclough, 2021). A study examined physical activity and sedentary behaviours among adolescents aged 15–19 years from Saudi Arabia and the UK. Saudi adolescents were less active than UK adolescents. Accordingly, Saudi adolescents had a higher prevalence (36.5%) of overweight and obesity than UK adolescents (26.7% for Birmingham and 19.3% for Coventry). These conclusions among Saudi participants are attributed to both the increased dietary intake of fats, simple carbohydrates (rice, bread..), and more hours spent on screen-time activities (Al-Nakeeb *et al.*, 2012).

The evidence suggests that adolescents' eating patterns and behaviours are not optimal for their current and future well-being. Related to this, there is a distinct set of behaviours, defined as “disordered eating behaviours” (DEBs), which represent a significant risk to both over- and under-weight, and this is the focus of this thesis. These behaviours include self-induced vomiting, binge eating, weight loss dieting, intensive exercise, fasting and the use of

laxatives or diuretics (Neumark-Sztainer *et al.*, 2002; Toni *et al.*, 2017). These behaviours are prevalent among adolescents and can substantially impact growth and development, physical and mental health. The evidence suggests that female adolescents have a higher tendency to engage in such behaviours compared to males (Bould *et al.*, 2017a; Dunn *et al.*, 2022; Marinov, Najdenova and Dimitrova, 2020). Body image concerns, body dissatisfaction and preoccupation with weight and shape are significant factors predicting disordered behaviours and associated cognitions (Mallick, Ray and Mukhopadhyay, 2014; Micali *et al.*, 2015a; Nicholls and Viner, 2005). Further details on DEBs, including prevalence, determinants and consequences, are discussed below.

2.6 DISORDERED EATING BEHAVIOURS (DEBS)

The term “eating behaviours” relates to the psychology of food within an individual’s context, indicating an intricate connection between a person and food that involves both unconditioned reflexes and conscious decisions about the amount and content of food consumed under various circumstances (Eliashevich, Araukho and Drapkina, 2023; Johnstone and Stephen, 2020; Stover *et al.*, 2023). This particularly means a complex of feelings, beliefs, thoughts, and attitudes towards food (Alvarenga, Scagliusi and Philippi, 2012). Disordered eating (DE) refers to behaviours and attitudes acknowledged as a part of the eating disorder (ED) spectrum. The goal of DE is to reach a lean body weight and to compensate for widespread body dissatisfaction (Torstveit, Rosenvinge and Sundgot-Borgen, 2008). However, weight loss is not always the explicit goal; adolescents may engage in DEB for a variety of reasons, such as exposure to trauma, personal characteristics, and family pressures (Tocco and Mohiuddin, 2022). Additionally, social media can trigger DEBs through information manipulation and internalisation of ideal body images, which result in imitating risky behaviours (Vincente-Benito and Ramírez-Durán, 2023).

Adolescents frequently engage in DEBs, which can range from a single disordered behaviour to several comorbid behaviours. These behaviours include overeating, dieting, and extreme weight control behaviours (Yoon *et al.*, 2020). DEBs are described as obsessive and erratic behaviours or connections with food, that include chronic constrained eating, habitual dieting and compulsive eating (Kouris-Blazos, 2020). These behaviours are similar to those observed in actual EDs, and DE is frequently applied to characterise different eating behaviours that may not fulfil the diagnostic criteria for an ED. Nonetheless, despite the health implications of DEBs being sometimes minimised, they require careful assessment and monitoring as they can progress into EDs (López-Gil *et al.*, 2023).

A persistent controversy exists regarding the distinction between EDs and DEBs. EDs denote clinically diagnosable conditions, whereas DEBs encompass a range of visible maladaptive eating behaviours. Depending on frequency and severity, DEBs are classified as a subclinical indication of EDs (Chaves, Jeffrey and Williams, 2023). There is a need for additional research to determine which specific DEBs, or combinations of DEBs, are associated with a higher risk of progression to a clinical ED. This is due to the fact that DEBs can range from relatively common, less severe, and transient concerns (such as occasional dieting or body dissatisfaction) to more severe and persistent behaviours (such as chronic dieting or frequent induced vomiting) that meet the diagnostic criteria for an ED (American Psychiatric Association, 2013; Stice *et al.*, 2009).

2.7 EATING DISORDERS (EDS)

An ED is defined as a mental illness characterised by DEBs, irregular food intake, harmful methods of weight control and disturbance in body weight and/ or shape experience (Fernández-Aranda, Granero and Jiménez-Murcia, 2023; Frank, 2016). In Western countries,

the overall lifetime prevalence of EDs among adolescent females ranged from 3% to 13%, and from 1.2% to 1.5% among males (Keski-Rahkonen and Silén, 2019).

The classification of EDs is identified by the American Psychiatric Association (APA) Diagnostic Statistical Manual of Mental Disorders (DSM-5) published in 2013, and the World Health Organisation (WHO) International Classification of Diseases and Related Health Problems (ICD-11) approved in 2019 (APA, 2013; WHO, 2019). The category of Feeding and Eating Disorders comprises three established ED syndromes—anorexia nervosa (AN), bulimia nervosa (BN), and binge-eating disorder (BED)—as well as three conditions: pica, rumination disorder, and avoidant/restrictive food intake disorder (ARFID) that were revised and shifted from the Feeding and Eating Disorders of Infancy or Early Childhood section in DSM-4 (APA, 2000). Other Specified Feeding or Eating Disorder (OSFED) describes other disorders that are not classified as an ED. These modifications are also evident in the latest version of the ICD (Uniacke, Attia and Walsh, 2023).

AN is an ED marked by significant weight loss, which can lead to serious psychosomatic issues. The diagnostic criteria for AN encompass an extreme fear of weight gain, associated with severe weight loss and distorted body image perception (Iliadis *et al.*, 2020). AN has identical definitions in the two diagnostic systems, with a primary focus on significantly low body weight due to limited energy intake (First *et al.*, 2021; Quadflieg *et al.*, 2023).

BN, which is four times more prevalent than AN, is typified by binge eating followed by compensatory purging behaviours, such as self-induced vomiting, abusing laxatives, and diuretics (Nitsch *et al.*, 2021). BED is identified by recurrent binge eating, marked distress about binge eating and the absence of inappropriate compensatory behaviours that characterise BN and AN (Grilo and Juarascio, 2023). Binge eating is characterised by consuming abnormally large amounts of food while experiencing a subjective sense of loss of

control during the overeating episode (Grilo and Juarascio, 2023). According to the diagnostic systems, the definition of binge eating differs between the DSM-5 and the ICD-11. Although they both require a subjective experience of a loss of control overeating behaviour, the DSM-5 integrates an objective component, particularly specifying the amount of food consumed in a discrete period of time (e.g. a two-hour period) exceeding the usual amounts consumed by most individuals. On the contrary, the ICD-11 clearly specifies that the individual significantly consumes much more and/or differently than usual (First *et al.*, 2021).

Pica is the term used to describe the compulsive, ongoing desire for and consumption of foods that are typically regarded as inedible (Leung and Hon, 2019). This disorder is prevalent in preschool-aged children with Autism Spectrum Disorder (ASD), ASD traits, and intellectual disabilities (Fields *et al.*, 2021). Pica may indicate iron deficiency, with iron supplementation helping to alleviate symptoms (Gupta and Ankur, 2023). Pica has similar definitions in both ICD-11 and DSM-5 (First *et al.*, 2021).

Rumination disorder is a functional gastrointestinal condition defined by the effortless and repetitive regurgitation of previously consumed food from the stomach into the mouth cavity, followed by either spitting or re-swallowing (Absah *et al.*, 2017). In children and adolescents aged five years and older, the prevalence of rumination disorder ranges from 0% to 5.1%. This disorder is associated with severe social consequences, high absenteeism rates, and health complications, including weight loss (Martínez *et al.*, 2021). In diagnostic systems, this disorder is referred to as rumination-regurgitation disorder in ICD-11 and rumination disorder in DSM-5. However, comparable definitions are applied (First *et al.*, 2021).

ARFID is characterised by a chronic disruption in eating or feeding that can lead to growth impairment, severe malnutrition, substantial weight loss or inability to gain weight, and/or a

significant disruption in psychosocial functioning. Eating patterns are marked by avoidant or restrictive behaviours, yet no issues with weight or body image are experienced (Bourne *et al.*, 2020). The DSM-5 presented these behaviours as being associated with avoidance of food due to its sensory qualities, lack of interest in eating, and fear of unpleasant effects of eating (APA, 2013). Prevalence estimates for ARFID in children and adolescents vary greatly; non-clinical samples indicate rates ranging from 0.3% to 15.5%, while specialised eating disorder clinics report rates between 5% and 22.5% (Sanchez-Cerezo *et al.*, 2022). In both diagnostic systems, ARFID has similar definitions (First *et al.*, 2021).

Other Specified Feeding or Eating Disorder (OSFED) and Unspecified Feeding or Eating Disorder are further presentations that are not fully categorised as an ED. However, they do contribute to clinically substantial distress or impairment. OSFED captures significant eating disorders that do not fit with AN, BN, or BED criteria, which include atypical AN, subthreshold BN, subthreshold BED, purging disorder, and night eating syndrome. Unspecified Feeding or Eating Disorder defines cases where symptoms do not match presented criteria; when a condition does not fulfil a particular ED, or when further information is required to provide a more precise diagnosis (APA, 2013).

The incidence of these disorders is increasing among adolescents with a peak age of 13 to 18 years (van Eeden, van Hoeken and Hoek, 2021; Weaver and Liebman, 2011). The lifetime prevalence of AN is 4% for females and 0.3% for males, whereas BN prevalence is 3% and 1% for females and males, respectively (van Eeden, van Hoeken and Hoek, 2021). In Saudi Arabia, the SNMHS (Saudi National Mental Health Survey) identified the prevalence of ED among adolescents and young adults (15–22 years) of 7.41%, with specifically 2.04% AN, 3.26% BN and 2.73% BED (UNICEF MENARO *et al.*, 2024). OSFED is categorised as the most common disorder in Saudi Arabia, with females experiencing more severe symptoms

than males (Jawed, Harrison and Dimitriou, 2020). Adolescent ED is connected to characteristics related to body dissatisfaction, depression, female sex, low confidence and high BMI (Suarez-Albor, Galletta and Gómez-Bustamante, 2022).

2.8 PREVALENCE OF DEBS

DEBs are prevalent in females and males despite their physical and weight status differences (Yu *et al.*, 2018). These behaviours occur across diverse racial, ethnic, socioeconomic, and cultural backgrounds, with the highest proportion of DEBs detected in mid-to-late adolescence (15–21 years) (Larson *et al.*, 2021; Podar and Allik, 2009).

In the UK, a cohort study based on data from the Avon Longitudinal Study of Parents and Children on 1769 girls from 273 schools at the age of 16 years found that 40.7% reported some form of DEBs (purging, fasting, or binge eating) (Bould *et al.*, 2018). A 15-year longitudinal study in the US derived from the Project Eating and Activity in Teens and Young Adults (EAT) explored the prevalence of DEBs among 1,230 adolescents aged 11 to 18 years at baseline. DEBs that were most prevalent included the significance of weight and shape, frequent dieting, extreme unhealthy weight control behaviours, overeating, anxiety about overeating, lack of control during overeating, and frequency of overeating and loss of control. At baseline, 50.7% of females and 33.7% of males reported DEBs (Yoon *et al.*, 2020).

McDow and others (2019) investigated the weight loss trends among adolescents aged 16 to 19 years in the US from 2013 to 2016. The study demonstrated that the most common methods reported for losing weight were exercising (83.5%), followed by drinking a lot of water (52.3%) and reducing food intake (48.6%).

Furthermore, a cross-sectional study on European high-school students aged 15–17 years assessed the prevalence of DEBs. A comprehensive questionnaire was administered to 2451 adolescents, revealing that approximately 64% of female students engaged in DEBs. Almost 39% of girls reported three or more attempts to lose weight, and 15.6% reported using maladaptive weight-control methods, such as using diet pills, diuretics, or laxatives and inducing vomiting (Torstveit, Aagedal-Mortensen and Stea, 2015).

In the Middle East, DEBs are also common, with a prevalence higher than international rates. A cross-cultural study explored the prevalence of DEBs among adolescents aged 15–18 years from seven Arab countries, including Algeria, Jordan, Kuwait, Libya, Palestine, Syria, and the UAE. The prevalence of DEBs ranged from 16.2% to 42.7% among girls, with the highest prevalence reported in Kuwait (Musaiger *et al.*, 2013). A recent scoping review explored the prevalence of DEBs in the Middle East and retrieved 19 records from Egypt, Iran, Israel, Jordan, Kuwait, Libya, Oman, Palestine, Saudi Arabia, Syria, Turkey, and the UAE. It was concluded that the prevalence of such behaviours varied significantly between countries, with the lowest among adolescents in Israel (Females 8.2%; Males 2.8%) and the greatest among university students in Egypt (Females 75.8%; Males 69.6%) (Azzeh, Peachey and Loney, 2022).

2.9 PREVALENCE OF DEBS IN SAUDI ARABIA

In the last few decades, Arab countries, particularly Saudi Arabia, have experienced significant economic advancements. Developmental enhancements are associated with negative eating habits such as intake of sugar-sweetened beverages, fast-food consumption and chocolate/ sweets consumption, and sedentary lifestyles (Khalaf *et al.*, 2015). Dietary patterns have shifted toward consuming more animal products, refined foods, fast food, sweets and carbonated drinks, which are correlated with increased levels of excess weight

gain in children and adolescents (A.Amer *et al.*, 2022; Al-Rethaiaa, Fahmy and Al-Shwaiyatet, 2010).

Additionally, sedentary behaviour and physical inactivity among children and adolescents have significantly increased as a result of Saudi Arabia's marked socioeconomic development. Physical activities, particularly those conducted outdoors, may be limited due to environmental conditions (i.e. dry and hot climates) (Said and Alibrahim, 2022).

The thinness ideal as a symbol of beauty is no longer confined to Western countries, as this concept has diffused strongly in other non-Western countries (Mallick, Ray and Mukhopadhyay, 2014). Consequently, Saudi adolescent girls are encountering conflicts between the traditional full-body ideal from their Arabic culture and the thin ideal associated with Western culture (Hijji, Saleheen and AlBuhairan, 2021). Modifying body image concepts and adopting Western values increase the possibility of developing DEBs (Latzer Azaiza and Tzischinsky, 2014).

DEBs are suggested to be considerably prevalent in female Saudi adolescents. Fatima and Ahmed (2018) assessed the level of abnormal eating attitudes by applying the Eating Attitude Test (EAT-26). Data collected from 314 female Saudi adolescents aged 15–19 years from schools in Arar revealed that the trend of DEBs is increasing and is parallel to national and international findings, with approximately 26% of girls reporting engaging in DEBs.

Further research assessed the presence of DEBs and explored socioeconomic associations. This cross-sectional descriptive study included 393 high school female students aged 15–20 years in Madinah (Al-Qahtani and Al-Harbi, 2020). Using the EAT-26, the rate of DEBs was 42.5%, and the majority of girls (54.6%) who had DEBs were aged ≤ 16 years. Adolescents living with obesity (59.1%) reported more DEBs than did their counterparts with underweight (41.5%) and normal (42.4%) weight. The most common DEB practised by female

adolescents was binge eating (25.2%), followed by inducing vomiting (8.7%) and using laxatives (6.1%). In terms of socioeconomic factors, including family size, birth order, parental education, housing, and income, no significant results were found.

In contrast, Al-Subaie (2000) reported that sociodemographic features (age, educational level, prior contact with Western people, or the ability to speak a Western language) and family characteristics (father's education and occupation, mother's education and occupation, family size, and polygamous marriage) were associated with dieting behaviour. A sample of 1271 female adolescents aged 12–21 years in Riyadh completed the Eating Disorder Inventory (EDI) and a sociodemographic datasheet. Approximately 15.9% reported DEBs based on the EDI for the thinness subscale. Family factors, including small family size and advanced parental education and occupation, were significantly correlated with dieting behaviour. The impact of Westernisation, characterised by living in a Western country (e.g. US, UK, etc.) for at least six months or speaking a Western language (English, Spanish, etc) was also associated with dieting behaviour. This feature was explored, as many Saudis travel abroad and acquire their education from Western countries.

Anxiety, depression, feelings of guilt or shame, and lack of control are related to DEBs (Kuipers *et al.*, 2016). Thirty-eight percent of Saudi Arabian secondary school students reported depression, followed by anxiety (35.2%) and stress (14.7%) (Barnawi *et al.*, 2023). Depression and DEBs are connected; over a 15-year period, distinct characteristics such as overvaluation, obsession with weight and shape, and dissatisfaction were all found to predict DEBs and depressive symptoms (Sharpe, 2018). A survey was conducted among 1028 female adolescents from secondary schools in Riyadh to assess coping strategies. Findings indicate that 15% of girls reported binge eating as a mechanism to reduce depression and stress (Hafsa, 2014). Another study on 471 adolescent students in Makkah indicated a significant

positive relationship between stress levels and increased risks of DEBs. Female adolescents reported higher levels of stress than male adolescents (Ghafouri *et al.*, 2021).

2.10 DETERMINANTS AND PREDICTORS OF DEBS

Biological, social, parental, and psychological determinants seem to play a major role in the development of DEBs (Costa *et al.*, 2008; Posluszny, Quick and Worobey, 2021). A recent systematic review identified that the development of DEBs is particularly associated with psychological, body image, sociocultural, familial, and peer factors (Byrne, Basten and McAloon, 2024). Although studies have investigated all potential determinants, contrasting findings are present in the literature; further investigation is required to highlight the actual determinants leading to DEBs (Costa *et al.*, 2008; Solmi *et al.*, 2020). Potential determinants of DEBs are discussed in the next section.

2.10.1 PERSONALITY AND DEBS

For more than 20 years, research has focused on the association between personality and eating behaviour to gain a comprehensive understanding of the effect of personality traits on the occurrence, progression, and treatment of DEBs (Bruce and Steiger, 2005; Farstad McGeown and von Ranson, 2016; Gilmartin *et al.*, 2022). As mentioned earlier, engaging in DEBs could lead to the development of EDs and other psychological disorders, including depression, anxiety, and low self-esteem (Bryla, 2003; Tan *et al.*, 2023).

Although individuals have various ways of thinking and regulating their emotions, literature confirms that DEBs might be linked with common personality traits, such as perfectionism, drive for order, and cautiousness. Methodological approaches have been implemented to evaluate models related to personality and DEBs, since the study of personality dimensions and particular psychopathologies is quite complex (Anderluh *et al.*, 2009). These complex contexts are primarily shaped by the interaction of a range of genetic factors and

environmental experiences, which aid in understanding the development of adaptive and maladaptive personal traits and their aetiologies (Widiger and Mullins-Sweatt, 2009).

2.10.1.1 FIVE-FACTOR MODEL (FFM)

The FFM was created to highlight normal personality variations. It can be used to investigate personality pathology in adolescents and adults (Butrus and Witenberg, 2014; De Clercq and De Fruyt, 2012; Trull and Widiger, 2013). The theory describes individuals' thinking mechanisms, feelings, and emotions, as well as their interactions with others, in five broad domains. In each domain, six facets present a thorough conceptualisation of the personality's characteristics (Trull and Widiger, 2013).

The subscales of the FFM (**Figure 4**) include neuroticism (vs emotional stability), extraversion (vs introversion), openness (vs closedness), agreeableness (vs antagonism), and conscientiousness (vs disinhibition) (Widiger and Mullins-Sweatt, 2009). Neuroticism is characterised by the negative emotions associated with self-consciousness, vigilance, and impulsivity, with low levels indicating positivity and ability to manage impulses (Widiger, 2011). Extraversion explains positive emotions as assertiveness, kindness, and adventure, in contrast to being passive and cautious (Widiger and Costa, 2012). Openness relates to imagination, creativity, and emotionality, with the opposite condition associated with rigidity and inflexibility (Widiger and Costa, 2012). Agreeableness is concerned with interaction with others, with high agreeableness indicating modest, trusting, and cooperative behaviours and low agreeableness indicating cautious and critical practices (Widiger and Costa, 2012). Conscientiousness focuses on self-control, achievement, and regulation; low conscientiousness levels are related to negligence and impulsivity (Widiger and Costa, 2012).

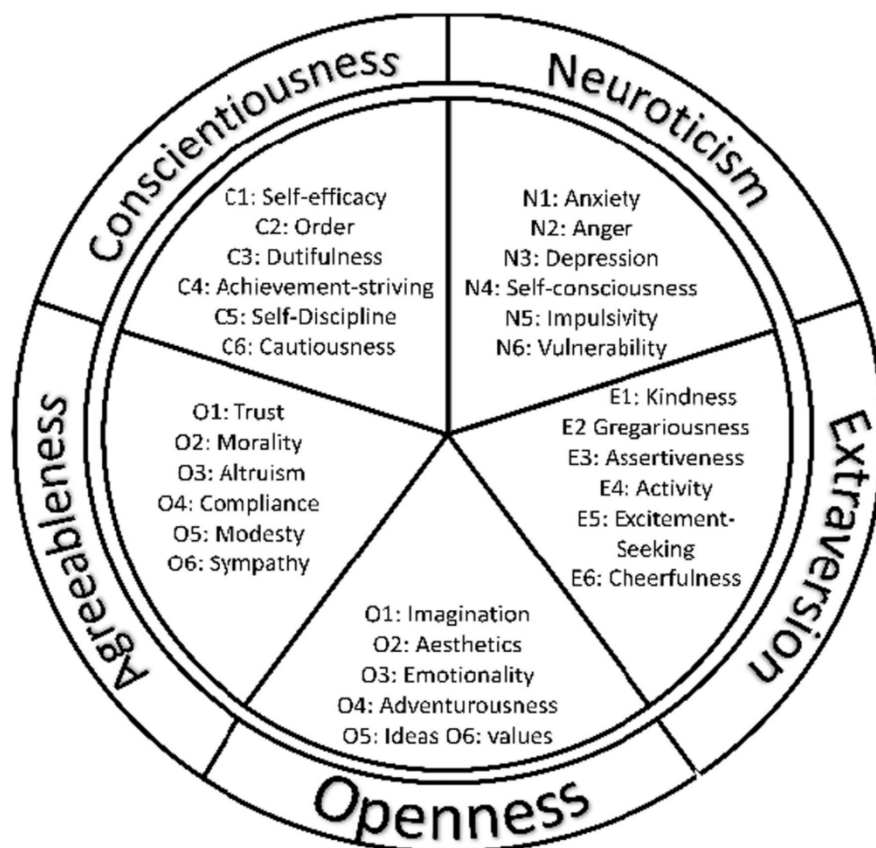
Previous literature has examined the nature of the relationship between the five personality domains and EDs. Neuroticism appeared to be the personality domain most consistently

interacting with EDs (Diaz-Marsa, Carrasco and Saiz, 2000; Ghaderi and Scott, 2000; Gilmartin, Gurvich and Sharp, 2022). It is strongly bound to DEBs, as it is consistently linked to binge, emotional, and restrictive eating. However, stronger connections were found with binge and emotional eating than with restrictive eating (Bollen and Wojciechowski, 2004; Eggert, Levendosky and Klump, 2007; Fischer *et al.*, 2017; Gade *et al.*, 2014).

Other domains also reported consistent associations with DEBs. Low levels of extraversion have been associated with purging, binge eating, and restrictive behaviours (Eggert, Levendosky and Klump, 2007). Such levels have also been observed with increased body image dissatisfaction and EDs (Allen and Robson, 2020; Tasca *et al.*, 2009). The associations

Figure 4 FFM Domains and Facets

The figure is provided by Gilmartin *et al.*, 2022 (open access publication under CC Attribution-Share Alike). Based on the information from (Widiger, 2011, Widiger and Costa, 2012).



with openness are contradictory; patients with EDs scored lower levels of openness, while individuals engaging in purging and restrictive eating scored higher levels of openness (Bollen and Wojciechowski, 2004; Dubovi, Li and Martin, 2016; Keller and Siegrist, 2015).

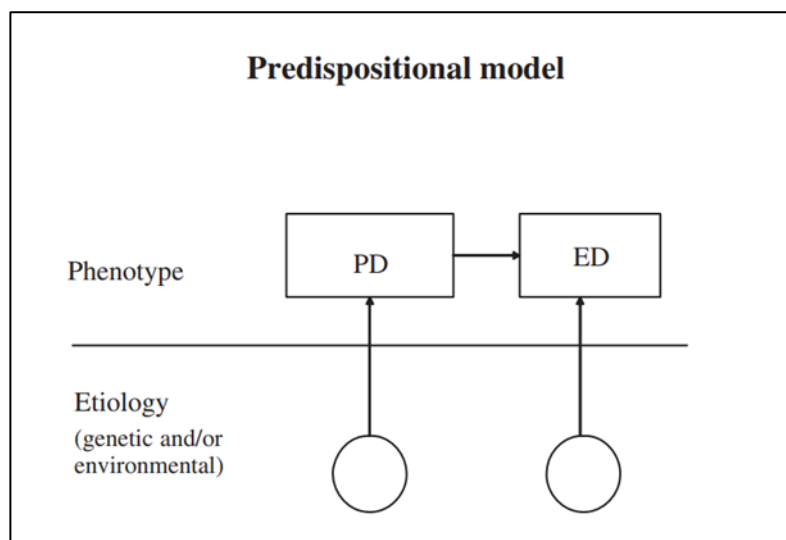
However, evidence concerning openness and its relationship with DEBs is not clear and requires further exploration (Gilmartin *et al.*, 2022). Similarly, the results on agreeableness and its relationship with disordered consumption are not adequate to draw conclusions (Farstad, McGeown and von Ranson, 2016). Nevertheless, a previous review rejected any relationship with agreeableness and DEBs (Gilmartin *et al.*, 2022). For conscientiousness, scores varied for restrictive and binge eating. Low conscientiousness levels were associated with binge and emotional eating, whereas higher levels were linked to restrictive eating (Gilmartin *et al.*, 2022).

2.10.1.2 PREDISPOSITIONAL MODEL

As there are several models in psychology that describe the relationship between personality and eating behaviour, the predispositional model has been implemented in early research on AN to explain the aetiology of temperament characteristics (Lilenfeld *et al.*, 2006; Strober, 1991). This model concentrates on personality traits or characteristics as a factor preceding and increasing the likelihood of the development of an ED. Moreover, aetiologies or pathophysiologies leading to personality disturbance or EDs are distinct and independent (**Figure 5**). However, with the application of this model, Strober (1991) concluded that personality traits may act as a mediator to environmental factors/conditions experienced by adolescents, increasing the risk of EDs occurrence (Lilenfeld *et al.*, 2006).

Figure 5 Predispositional Model of ED- Personality Disorder Relationship.

Adopted from (Lilenfeld *et al.*, 2006). **PD**: Personality Disorder, **ED**: Eating Disorder (*Appendix 1*)



2.10.2 WEIGHT CONCERNS AND WEIGHT SELF-STIGMA

Weight dissatisfaction, overvaluation, preoccupation, and overconcern with weight and shape are terms applied to define body image concerns. These labels are used interchangeably in people with or without EDs, which can lead to divergent conceptualisations of eating pathology (Askew *et al.*, 2020). Preference for a thin body ideal and the cultural stigma associated with being overweight can determine the development of such disorders. Weight gain and obesity have been explored as causes and risk factors for body dissatisfaction and DEBs (Gardner *et al.*, 2000; Jebeile *et al.*, 2021; McCabe *et al.*, 2019).

Body dissatisfaction and weight concerns are linked to disordered consumption symptomology. These cognitions intensify during adolescence, particularly among females in the late adolescence period (Calzo *et al.*, 2012; Escrivá *et al.*, 2021). Body dissatisfaction arises from a discrepancy between an individuals' internalised body ideal and their present self-image, triggering them to seek medical assessment to correct these perceived physical inadequacies (Damstetter and Vashi, 2015). A systematic review and meta-analysis of

observational studies explored the association between overweight and obesity with self-esteem and body dissatisfaction in children and adolescents (Moradi *et al.*, 2020). Twenty-eight retrieved studies with sample sizes ranging from 244 to 60252 participants concluded that overweight and obesity were positively associated with the risk of low self-esteem. Moreover, obesity and body dissatisfaction were significantly positively associated (Moradi *et al.*, 2020). Another study indicated that adolescents (12–13 years) who are overweight and obese have higher levels of body dissatisfaction compared to those who have a healthy weight (Wang *et al.*, 2020). Among Asian students, the risk of body dissatisfaction, which mediates the association with food behaviour modifications for weight loss, was significantly elevated with overweight and obesity (Gao *et al.*, 2019).

Weight self-stigma is a common concept related to DEBs. It mainly includes feelings of guilt, self-devaluation, and the belief of being subjected to discrimination based on one's weight, potentially resulting in aberrant eating patterns and binge eating (Palmeira, Pinto-Gouveia and Cunha, 2016). Weight stigma may detrimentally impact mental and physical health, increasing psychological distress (e.g. anxiety and depression) and depleting the self-regulatory mechanisms required for weight management (Alimoradi *et al.*, 2019; Major, Eliezer and Rieck, 2012). Adolescents are particularly vulnerable to weight stigma, with 90% of US high school students reporting weight stigma (Hand *et al.*, 2017). Among Asian students aged 9 to 14 years, weight stigma was linked to increased weight bias internalisation, which was linked to reduced core self-evaluation, and lower core self-evaluation was linked to more frequent DEBs (Chen, Ye and Guo, 2020). Furthermore, Saudi students who reported weight self-stigma expressed a significant reduction in food quantity and quality (Aladel *et al.*, 2023).

Due to social discrimination and the value placed on thinness, weight stigma can lead to DEBs, poor quality of life, low self-esteem, lack of social skills, and academic problems (Hartmann and Hilbert, 2013).

2.10.3 PSYCHOSOCIAL FACTORS AND BEHAVIOURS

Common emotions such as boredom, anger, or helplessness may act as cues for eating.

Dealing with food as a way to cope with life stressors can significantly lead to weight-related problems. It could also hinder adolescents' ability to learn constructive coping skills to resolve negative feelings (Brown, Schiraldi and Wroblewski, 2009). Depression, low self-esteem, and anxiety are associated with emotional eating behaviours (Dakanalis *et al.*, 2023).

A meta-analysis of longitudinal studies on the association between self-esteem and EDs found that EDs and low self-esteem have detrimental impacts on each other in a reciprocal manner; the results are consistent across age, gender, and sample type (Krauss, Dapp and Orth, 2023).

Literature on the association between depression and DEBs has been previously established for adolescents. A longitudinal cohort study explored the development of DEBs and comorbid depressive symptoms in 1386 adolescents aged 14, 16, and 19 years implemented from eight sites in Europe. It was concluded that DEBs and depressive symptoms develop together in adolescents, with alterations in frontal brain circuits shared by these conditions (Zhang *et al.*, 2020).

Another study conducted on 4,421 adolescents aged 10 to 15 years who completed the Centre for Epidemiological Depression Scale and the Eating Disorder Examination-Questionnaire (EDE-Q) indicated that depression and EDs share common indicators as weight dissatisfaction, desire to lose weight, and weight/shape preoccupation (Kenny *et al.*, 2021).

Furthermore, a cross-sectional study exploring the effect of BED on depression and self-esteem indicated that BED is linked to higher cognitive elements, such as eating and weight concerns, which are linked to lower self-esteem and depressed symptoms in individuals with obesity (Özdin *et al.*, 2020).

Personality, emotions, and mood can predict DEBs. Dingemans, Danner and Parks (2017) explained that the development and maintenance of binge eating are influenced by negative emotions and inappropriate emotion regulation techniques. Negative emotions that are associated with interpersonal encounters, such as disappointment, hurt, or loneliness, appear to be more pertinent, as are feelings of anger and despair. Psychopathological thoughts and symptoms are more common in individuals experiencing binge eating because they tend to repress and obsess over their undesirable emotions. Among university students, Barnhart Braden and Price (2021) indicated that difficulties in regulating emotions can lead to emotional eating, which is positively associated with DEBs. Emotional eating is characterised by the desire to eat in the absence of psychological hunger as a response to negative emotions. Higher negative emotional eating, driven by negative affect control, was linked to higher weight worries and global DEBs scores when emotion control difficulties were medium or elevated (Barnhart, Braden and Price, 2021).

Childhood abuse and emotional maltreatment are commonly correlated with DEBs (Armour *et al.*, 2016; Emery *et al.*, 2021; Kimber *et al.*, 2017). Childhood maltreatment refers to physical, sexual, or emotional abuse and neglect by parents, carers, or other adults. Verbal assaults, threats, or any demeaning actions directed at a child are considered emotional abuse. In addition, failure to meet a child's basic psychological and emotional needs, such as love and support, is described as neglecting natural emotional needs (Kumari, 2020). Engaging in DEBs is explained as a coping mechanism that reduces the intensity of strong emotions and a

method that blocks off these deteriorating feelings (McCuen-Wurst, Ruggieri and Allison, 2018). For example, it is recognised that patients with AN frequently experience positive feelings related to their illness, such as feeling special or proud and gaining a sense of control (Karlsson *et al.*, 2021).

2.10.4 FAMILY AND PEERS

Familial and parental characteristics are critical in the occurrence of DEBs (Hart *et al.*, 2015; Langdon-Daly and Serpell, 2017). Parents are key influencers on adolescents' views towards eating, weight, and body image. Frequent parental comments regarding eating and weight/shape were a highly significant predictor of DEBs and psychological distress (Dahill *et al.*, 2023). A scoping review explored the role of parenting on DEBs among adolescents up to 18 years and identified a link between the experience of negative parenting styles, which are defined by high levels of control and low levels of responsiveness, and symptoms of DEBs. However, this link was indirect and varied based on the sex of the parent and child (Hampshire, Mahoney and Davis, 2022).

Family context and connectiveness are correlated with a lower prevalence of DEBs (Haines *et al.*, 2016). Many studies have focused on the quality of family relationships and the outcome of DEBs (Cance, Loukas and Talley, 2015; McNamara *et al.*, 2022). A longitudinal study comparing children of mothers with and without a history of an ED confirmed that children who reported a higher level of family satisfaction between the ages of 10 and 12 years showed lower scores related to loss of control of eating through the 2-year study plan. Although factors contributing to family satisfaction were not clear in this research, it was significant that family connectiveness and satisfaction were protective factors against the occurrence of DEBs in adolescence (Allen *et al.*, 2014). Family support and connectedness may encourage a variety of favourable developmental outcomes, without being specifically related to eating problems. However, certain aspects of the family context pertaining to food,

eating, and weight, such as having meals together and refraining from commenting on weight, might be more specific to EDs and DEBs (Langdon-Daly and Serpell, 2017).

In terms of family composition, siblings may play a significant part in the development of DEBs. They are important contributors to family dynamics and fundamental units of the family structure, directly influencing development and having a substantial impact on the dietary preferences and eating patterns of children and adolescents (Ragelienė and Grønhøj, 2020). A prospective analysis related to the Stockholm Youth Cohort concluded that a larger number of full siblings yielded a reduced rate of DEBs. Inversely, an increased number of half-siblings indicated an elevated rate of DEBs (Ahrén *et al.*, 2013).

Family meals and eating environment tend to play an important role in preventing DEBs. Parental discussions and conversations on healthy eating and weight with their children resulted in a positive impact on eating attitudes (Berge *et al.*, 2013; Langdon-Daly and Serpell, 2017). A cross-sectional study investigated parental discussions about eating and weight and found that negative parental weight-related discussions increased the likelihood of adolescents engaging in negative dieting and weight-control behaviours. In contrast, adolescents discussing healthful eating with their mothers were less likely to diet. Generally, if both parents engage in healthful eating discussions, their adolescents with overweight and obesity will have lower odds of dieting and using unhealthy weight-control behaviours (Berge *et al.*, 2013). A five-year longitudinal study analysed data from Project EAT (Eating Among Teens) among participants with overweight and found that apart from family connectiveness, meal frequency associated with a positive atmosphere can act as a protective factor against DEBs. Notably, the levels of body satisfaction and self-esteem increased with family meals (Neumark-Sztainer *et al.*, 2009).

Peer groups among adolescents have been shown to have an impact on dietary and other health-related behaviours. Peer influences throughout adolescence, such as perceived social norms, might result in particular peer pressures that affect eating behaviours (Chung *et al.*, 2021). Particularly, adolescent EDs are significantly associated with peer factors.

Adolescents who experienced peer pressure had a 2.5 times elevated risk of DEBs than those who did not (Azrimaidaliza, Famelia and Nur, 2022).

Adolescents and their peers have similar weight perceptions and shape concerns (Webb and Zimmer-Gembeck, 2014). Particularly among female adolescents, peer pressure to be thin was notably stronger than pressure from family or media. Clique participants who bond with each other on a regular basis, compared with others in the same setting, reported comparable scores related to dieting, binge eating and extreme methods of weight loss (Hutchinson and Rapee, 2007).

Furthermore, peer pressure related to weight increased the possibility of DEBs, with elevated peer pressure scores for females compared to males (Al-sheyab, Gharaibeh and Kheirallah, 2018). Peer teasing related to weight in early to mid-adolescence indicated an elevated risk of DEBs in later adolescence (Fairweather-Schmidt and Wade, 2015). The bullying phenomenon among school children and adolescents is a persistent problem with significant short and long-term impacts on both physical and mental health (Tsitsika *et al.*, 2014).

Adolescents who are subjected to bullying or teasing are more likely to exhibit DEBs and have a negative perception of their bodies than adolescents who are not victims of such behaviour (Day *et al.*, 2021a).

With the common use of social media platforms among adolescents, peer pressure on eating habits can extend from in-person influence to social media influence (Chung *et al.*, 2021).

Social media platforms have been shown to affect both EDs and healthy eating, with 95% of

adolescents between the ages of 13 and 17 owning a smartphone, and 51%, 69%, 72%, and 85% using Facebook, Snapchat, Instagram, and YouTube, respectively (Chung *et al.*, 2021; Wong, Merchant and Moreno, 2014). Bullying has spread from the real world to the virtual one, and the internet has emerged as a new platform that allows adolescents to engage with each other with a certain amount of anonymity and little parental supervision. Cyberbullying is characterised by the intentional use of internet communication technologies to threaten, hurt, embarrass, or socially exclude another person (Ang, 2015). Among children and adolescents, cyberbullying is consistently linked to depression, substance use and suicide attempts, with girls being the most commonly affected (Bottino *et al.*, 2015; Hamm *et al.*, 2015). In relation to DEBs, cyberbullying victimisation was linked to binge eating, distress from binge eating, self-worth linked to weight, fear about weight gain, and inappropriate compensatory behaviours to prevent weight gain in a national sample of 10 to 14-year-old adolescents (Cheng *et al.*, 2023). Salazar (2021) explored cyberbullying experiences as a victim and a bully among 6,944 middle school students using email, mobile devices, and the internet. After adjusting for demographic variables like age, sex, and class, cyberbullying appeared to be a predictor of body image dissatisfaction, dieting behaviours, life satisfaction, and cyberbullying perpetration (Salazar, 2021).

2.10.5 MEDIA EXPOSURE

Media exposure can cause adolescents to internalise what society considers attractive for themselves, which raises the likelihood that they will experience body dissatisfaction and develop DEBs (Bryla, 2003; Uchôa *et al.*, 2019). Poor body image and DEBs are primarily caused by the Western perception of thinness as a sign of attractiveness and internalisation of the social ideal (Thompson, Poyrazli and Miller, 2020).

TV programmes and advertisements continuously disseminate the concept of being thin as attractive to the population. Adolescent girls are extremely influenced by these signals and

strive to diet and maintain a thin body (Hill, 2006). Fashion magazines are also common among female adolescents and can limit body satisfaction with frequent exposure (Hausenblas *et al.*, 2013). For instance, a study on 1011 adolescents indicated that the likelihood of body dissatisfaction is linked to an increased risk of developing EDs in both sexes. This is primarily due to exposure to mass media, which is associated with a larger probability of adolescents with body dissatisfaction (Uchôa *et al.*, 2019).

Using the internet and browsing websites may increase the likelihood of DEBs. Recent studies confirm that weight-focused websites are viewed more frequently than fashion magazines by undergraduate girls (Bair *et al.*, 2012). Advertisements and images on websites often demonstrate the stereotypical ideal of beauty by presenting figures of young and slim women (Slater *et al.*, 2012). Tiggemann and Miller (2010) concluded that increased internet usage in high school girls was correlated with a drive for thinness, body dissatisfaction, and elevated internalisation of the slim ideal.

With social media categorised as a distinct form of addiction, a recent systematic review found that extensive usage of social media is associated with body dissatisfaction, diminished self-esteem, harmful behaviours, and DEBs in adolescents (Vincente-Benito and Ramírez-Durán, 2023). Adolescents who frequently use TikTok, Instagram and X (formerly Twitter) reported more depressive symptoms compared to less and average-level users (Gentzler *et al.*, 2023). By stimulating negative emotions of body dissatisfaction and low self-esteem, social media may increase the vulnerability to DEBs (Bittar and Soares, 2020).

Whilst media viewers are affected by the content seen, individuals may also consciously control what they want to be exposed to. A strong association between DEBs and related media content may therefore be partly explained by reverse causality, as individuals with DEBs or EDs may specifically search for such content (Harrison, 2000).

2.11 CONSEQUENCES OF DEBS

Commonly, adolescents who continuously engage in DEBs are at an elevated risk of developing an ED. DEBs can lead to various physical and psychological complications, such as micronutrient deficiencies, growth retardation, anxiety, and depression (Bryla, 2003; Kärkkäinen *et al.*, 2018). It is crucial to emphasise that health issues can emerge due to malnutrition, either over- or undernutrition, and hinder the optimal growth process (Adesina *et al.*, 2012; Bibiloni, Pons and Tur, 2013; Collison *et al.*, 2010).

Generally, overweight and DEBs are major risk factors for EDs, and increased vulnerability to body dissatisfaction, poor self-esteem and depression (Jebeile *et al.*, 2021). Overweight and obesity in children and adolescents are associated with an elevated risk of low self-esteem and body dissatisfaction (Moradi *et al.*, 2020).

Dieting and persistent undernutrition can consequently cause wasting, stunting, and micronutrient deficiencies (Cai, 2014). Wasting refers to an acute case of malnutrition, characterised by a low body weight relative to height due to insufficient food intake (Bhutta *et al.*, 2017). It is particularly observed in developing countries that endure acute or chronic periods of food insecurity, with an overall estimate of 17.8% (Verma and Prasad, 2021).

Stunting occurs with chronic malnutrition and leads to growth retardation. It might be present even in areas or households with marked food security (Piwoz, Sundberg and Rooke, 2012). Among female adolescents, excessive caloric restriction can lead to development retardation and cessation of menstruation. When coupled with physical activity, these restrictions result in malnourishment, which causes protein deficiencies and disrupts the gastrointestinal, cardiovascular, renal, endocrine, integumentary, haematologic, and reproductive systems (Peterson and Fuller, 2019).

Continuous dieting and dietary restriction, as well as inadequate food patterns, may be associated with difficulty losing weight in the future due to weight cycling (Montani, Schutz and Dulloo, 2015). This is not necessarily restricted to children and adolescents who are overweight and obese, as it may include others who perceive themselves to be overweight or obese. However, continuous dieting and weight cycling are more common in individuals with normal body weight than in those who are classified as overweight or obese (Montani, Schutz and Dulloo, 2015).

With DEBs and dietary restriction, female adolescents may develop iron deficiency anaemia, which could be detrimental during rapid growth. Additionally, iodine deficiency significantly contributes to the burden of micronutrient deficiencies, and it is especially prevalent among female adolescents (Christian and Smith, 2018). Calcium and vitamin D deficiencies can hinder bone development and lead to poor bone quality. Adolescent females are more likely to have low vitamin D than males, which is linked to low serum calcium levels (Lopes *et al.*, 2022). Among patients with AN, the highest prevalence of deficiencies was found in zinc (64.3%) and vitamin D (54.2%) (Hanachi *et al.*, 2019).

2.12 LIMITATIONS OF CURRENT EVIDENCE

DEBs reflect behaviours and attitudes from the EDs spectrum that can contribute to the development of an ED (Alvarenga, Scagliusi and Philippi, 2006; López-Gil *et al.*, 2023; Torstveit, Rosenvinge and Sundgot-Borgen, 2008). Evidence revealed that mid-to-late stages of adolescence (15–21 years) had the highest likelihood of DEBs (Larson *et al.*, 2021; Podar and Allik, 2009). Understanding the significance of DEBs as a major risk factor for developing an ED is essential, as these behaviours may lead to severe consequences if left untreated. The focus of epidemiological research and systematic reviews has been on

measuring the prevalence of EDs and DEBs by highlighting the discrepancy between Western and non-Western regions (Rikani *et al.*, 2013).

Although DEBs are common in adolescence, few studies have been conducted in Arab countries, particularly Saudi Arabia (Fatima and Ahmed, 2018). To the best of our knowledge, no study has explored substantial determinants or predictors of DEBs in Riyadh. Nevertheless, only one study was conducted in Riyadh that investigated specific social and cultural correlations with dieting behaviour in secondary school girls (Al-Subaie, 2000).

2.13 AIMS & OBJECTIVES

This thesis will therefore explore a comparatively understudied topic. The primary aim of this thesis is to create a comprehensive understanding of the nature of DEBs in Saudi female adolescents by addressing the prevalence of DEBs and identifying the determinants contributing to such behaviours. To achieve this, the study employs a mixed-methods approach, giving equal weight to quantitative and qualitative data to ensure a thorough and integrated analysis.

Accordingly, the central research question guiding this thesis is: **What is the prevalence of DEBs among Saudi female adolescents, and what are the key determinants influencing these behaviours?**

In alignment with this aim and guiding question, the following objectives are formulated:

- 1) **To review the evidence assessing the prevalence of EDs/DEBs among adolescents and youth in Saudi Arabia.**
- 2) **To explore the prevalence of DEBs among adolescent female students in four intermediate and secondary schools in Riyadh, and to analyse predictors related to DEB, including age, BMI, and school regions.**

3) To examine common determinants and predictors contributing to the development of DEBs among Saudi adolescent females.

2.14 CHAPTER SUMMARY

Adolescence is characterised as a nutritionally vulnerable stage. A lack of physical activity and negative eating habits can notably contribute to several health problems (van Sluijs *et al.*, 2021). Health conditions and nutritional problems that occur in early childhood and continue in adolescence can define adolescents' weight status (Adesina *et al.*, 2012). Adolescents have a high prevalence of malnutrition, including overweight and underweight (Adesina *et al.*, 2012; Bibiloni, Pons and Tur, 2013; Leenstra *et al.*, 2005).

The significance arises from the fact that frequent DEBs can convert to an ED, wherein consequences are considered severe, particularly with females, since they are more focused on their weight and body image (Mallick, Ray and Mukhopadhyay, 2014). During this stage of sensitive growth, it is highly recommended to detect DEBs early to avoid further complications (Dunn *et al.*, 2022; Marinov, Najdenova and Dimitrova, 2020).

Highlighting the complex and intricate aetiology of the development of DEBs and EDs is crucial, as several determinants, including biological, social, parental, and psychosocial factors, are involved (Costa *et al.*, 2008; Posluszny, Quick and Worobey, 2021). Although DEBs are common during adolescence, there is a limited amount of literature on DEBs and determinants among Arab populations, particularly in Saudi Arabia. However, researchers acknowledge a problematic prevalence of DEBs in female Saudi adolescents (Al-Qahtani and Al-Harbi, 2020; Al-Subaie, 2000; Waseem and Leena, 2018).

The next chapter will focus on explaining the methodology and theoretical framework used to explore the nature of DEBs among Saudi adolescents. This is expected to enhance understanding of the occurrence and prevalence of DEBs in this group, particularly in light of

rapid cultural changes, increased affluence, and altered eating behaviours and shape concepts.

A clear understanding of the main determinants and predictors of DEBs may help in planning interventions and preventive programmes to reduce such behaviours among adolescents.

CHAPTER 3 METHODOLOGY

This chapter provides a comprehensive overview of the methodologies employed to address the PhD research questions. The research paradigm and mixed methods philosophical approach are explained, followed by a description of the systematic review (Study One), the quantitative phase (Study Two), and the qualitative phase (Study Three). Then, Bronfenbrenner's Bioecological Model, the theoretical framework adopted for the qualitative approach, is described, and the rationale for applying this theory is discussed. Methodological procedures, data analyses and ethical considerations are explained and justified for each phase, with a comprehensive presentation of each study in its corresponding chapter.

3.1 RESEARCH PARADIGM

A paradigm provides a collection of interpretations that a scientific community holds within a specific historical timeframe, identifying the types of scientific investigations that are worthwhile for establishing a shared methodological understanding of applying science (Dimmelmeier and Dow, 2021). It is a metaphysical framework that aids researchers in identifying and clarifying their beliefs regarding ethics, reality, knowledge, and methodology (Mertens, 2010). In other words, it is a collection of similar beliefs and agreements shared across scientists regarding how particular problems should be understood and addressed (Bibi, Khan and Shabir, 2022).

Employing a paradigm in research provides a variety of functions; it aids in directing researchers by highlighting significant problems confronting any discipline. It also encourages the generation of models and theories to overcome these problems. Furthermore, it specifies the required tools for research, such as methodology and methods, forms of instruments, and data collection, all of which are necessary to address these problems.

Moving forward, it offers the guidelines, protocols, and approaches to consider when comparable issues resurface (Keong, Husin and Kamarudin, 2023).

The philosophical question of whether there is just one knowable reality or if there are several realities is where understanding the differences in epistemology, methodology and ontology among research paradigms began. This scientific debate led to the emergence of two predominant paradigms, positivist and constructivist (Krauss, 2005). Positivism is the belief in the presence of a single concrete reality which can be defined, comprehended, and measured with an epistemological perspective that confirms the objectivity of knowledge (Bibi, Khan and Shabir, 2022). Positivism in research focuses on hypothesis testing, large sample sizes, generalisable inferences, replication, and controlled experimentation to guide scientific findings (Park, Konge and Artino, 2019). In essence, positivist researchers see the world as a “one-way mirror” (Healy and Perry, 2000). Constructivism (also known as Interpretivism) stands in stark contrast to positivism, contradicting the notion that there is a single, verifiable reality that is independent of our senses. Constructivism acknowledges the presence of different social realities and believes in creating reality through sense meditation rather than discovering it (Scotland, 2012). Studying human behaviour, attitudes, experiences, and emotions is the goal of qualitative research design, employing the constructivist paradigm to investigate social phenomena (Bibi, Khan and Shabir, 2022).

The epistemological distinctions between quantitative and qualitative paradigms are substantial, with positivism prioritising objectivity and a singular tangible reality, whereas constructivism emphasises many realities and produces subjective knowledge (Bibi, Khan and Shabir, 2022; Krauss, 2005). Nonetheless, some affirm that both methodologies may be suitable depending on the analytical depth and study objectives (Hasan, 2016). Pragmatism provides a balanced perspective, recognising the subjectivity inherent in reality and knowledge formation. Ideally, the selection of research methodology must align with the

philosophical assumptions and research aims of the investigation (Bibi, Khan and Shabir, 2022).

Pragmatism, as a research paradigm, adopts the use of a variety of techniques, analytical approaches, and abductive reasoning, directing researchers to generate socially valuable knowledge (Feilzer, 2010). Mitchell (2018) defines pragmatism as an attractive philosophical companion for mixed methods, integrating quantitative numerical values and qualitative cognitive reasoning, which leads to more comprehensive research outcomes and informed management decisions. The pragmatist approach in healthcare may elevate mixed methods by embracing lived experience and multifaceted approaches to complex social issues (Allemang, Sitter and Dimitropoulos, 2021). From a pragmatic perspective, implementing formal mixed methods designs enables health psychologists to identify the technical difficulties and determine the most suitable methodology for their research questions and objectives, while concurrently addressing the conceptual complexities of integrating qualitative and quantitative approaches (Bishop, 2015).

For this thesis, the pragmatic approach was deemed the most appropriate to serve the research aims and questions by integrating quantitative and qualitative measures to develop a clear and comprehensive understanding of DEBs in Saudi Arabia. This approach involved identifying patterns of DEBs among Saudi adolescents and then exploring the main determinants of such behaviours.

3.2 MIXED METHODS RESEARCH (MMR)

Mixed Methods Research (MMR) provides a framework for integrating methodologies that have swiftly proliferated in social and behavioural research (Timans, Wouters and Heilbron, 2019). It was referred to as a “third methodological movement” which was triggered by continuous methodological debates among researchers over the last three

decades (Teddle and Tashakkori, 2011). Johnson, Onwuegbuzie and Turner (2007) compiled 19 distinct definitions of MMR, with varying degrees of specificity from leaders in the field and developed a comprehensive definition:

“Mixed methods research is a type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth understanding and corroboration.” (Johnson, Onwuegbuzie and Turner, 2007, p.123).

Despite that quantitative methods are granted as the dominant strand applied in health research, qualitative analyses have been recognised and widely exploited by health practitioners. O’Cathain, Murphy and Nicholl (2007) confirmed that the proportion of studies using MMR in health research in England increased from 17% to 30% between the 1990s and the early 2000s. The pertinence of MMR through the integration of quantitative and qualitative approaches yields a superior comprehension of study issues compared to using either method separately. This affirms a more profound and comprehensive understanding of complex processes, hence strengthening readers’ confidence in study findings and conclusions (Adu *et al.*, 2022). Nevertheless, adopting MMR can be challenging and time-consuming as it necessitates the skills and expertise to perform several data collection approaches (Tariq and Woodman, 2013).

Currently, MMR is adopted by various disciplines within psychology, emphasising the philosophical significance of the rationale (why) and methodology (how) behind mixed methods, aimed at achieving methodological and conceptual integration (Javdani *et al.*, 2023). Johnson and Onwuegbuzie (2004) clarified that when conducting MMR, two factors should be considered: the dominance of data (quantitative vs. qualitative) and the timing of

implementation (quantitative and qualitative methods are implemented sequentially or concurrently). The full spectrum of quantitative and qualitative analyses is identified to meet one of the six research designs of MMR to enhance research understanding. These designs include explanatory sequential, exploratory sequential, convergent parallel, embedded, transformative and multiphase. “Explanatory sequential” is a two-phase mixed methods approach where the researcher first gathers and analyses quantitative data, then gathers and analyses qualitative data to help explain the initial quantitative findings. “Exploratory sequential” is a two-phase mixed methods design where the researcher first collects and analyses qualitative data before collecting and analysing quantitative data to confirm or extrapolate the initial qualitative findings. “Convergent parallel” is a design where the researcher employs concurrent timing to apply the quantitative and qualitative strands at the same stage of the research process, giving equal priority to each method, maintaining the strands’ independence throughout the analysis and combining the findings during the researcher’s overall interpretation of the data. “Embedded” is a design that includes gathering and examining both quantitative and qualitative data using a traditional quantitative or qualitative design. “Transformative” is a design that is created within a transformative theoretical framework to address the needs of a particular population and advocate for change. “Multiphase” is a design that incorporates concurrent and sequential strands, gathered over time, and the development of significant phases within an overall research programme. These designs vary according to the time and prioritisation of strands, aligning with the principal rationale for employing an MMR method (Cresswell and Plano Clark, 2011; Zoellner and Harris, 2017).

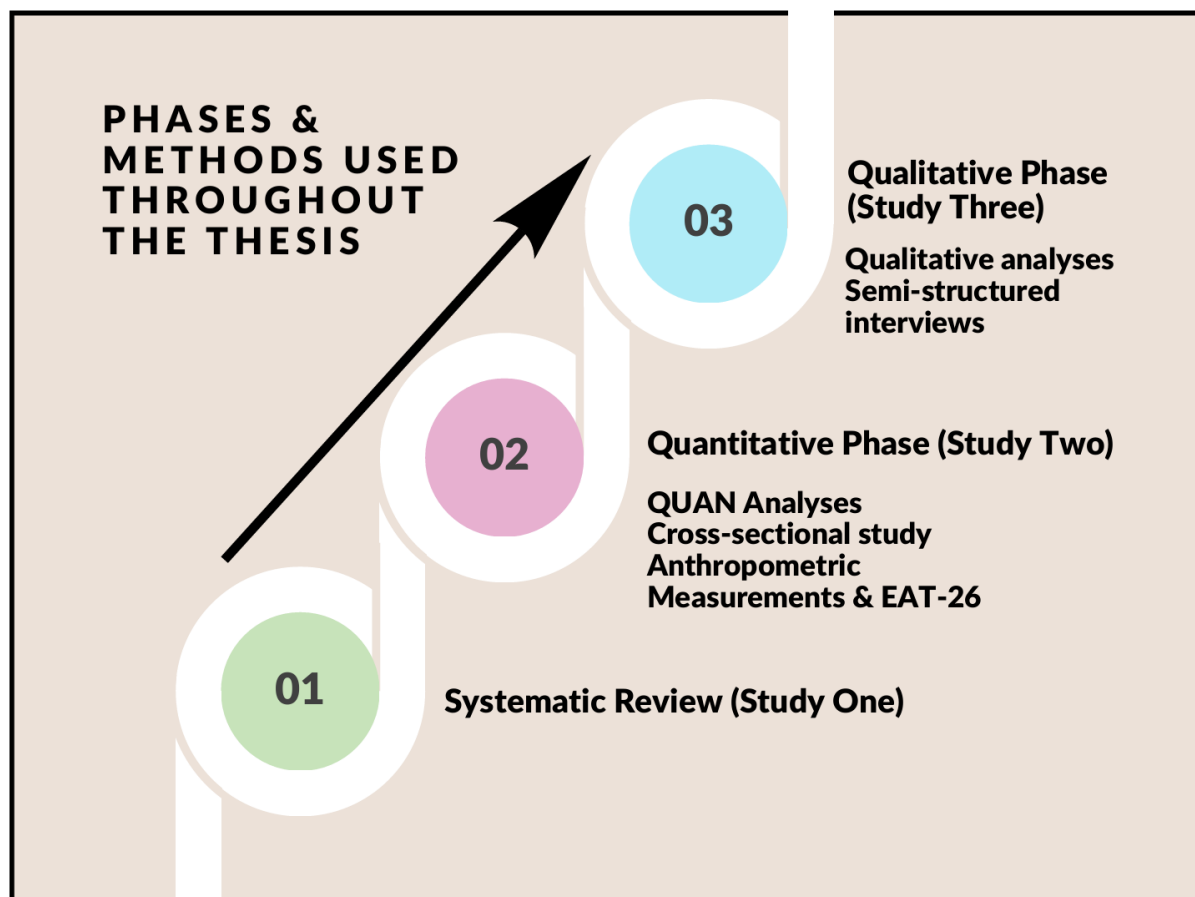
Even though adopting an MMR methodology may alleviate the constraints inherent in single-method approaches, specifically when addressing complex issues, it is essential to have a thorough awareness of the strengths and limitations of each MMR (Cresswell and Plano

Clark, 2011; Zoellner and Harris, 2017). The determination of sample size is a key consideration, as it is implemented through the analytical power to investigate statistical relations in quantitative designs, whereas qualitative analyses depend on data saturation. Presenting the most viable sample plan depends on being realistic and pragmatic about the breadth of the research and resources available (Zoellner and Harris, 2017).

To serve the aims and purposes of this thesis, the explanatory sequential design was deemed the most appropriate. In light of the systematic review (Study One), this two-phase mixed methods design employed the quantitative component (Study Two) as the first phase of data collection and analysis followed by the qualitative component (Study Three) (*Figure 6*), to facilitate a more profound understanding of the quantitative data (Zoellner and Harris, 2017). Initiating with a quantitative design was essential to gather survey responses first, facilitating recruitment for the qualitative phase (interviews) and allowing for the refinement of the topic guide according to the findings of the survey data. Therefore, none of the other designs would have been as suitable or as practical, since the ideal methodology requires a sequential application of the quantitative phase followed by the qualitative phase.

Evidence on DEBs in Saudi Arabia is not clear; therefore, the quantitative strand is being implemented first to explore the prevalence of DEBs among adolescent female students in Riyadh and to identify those who are classified as at risk of DEBs. The second qualitative strand is focused on female students identified at risk of DEBs, to study their subjective perspectives on DEBs and the primary determinants causing such behaviours. This design aided in comprehending the significance of DEBs in female adolescents and in generating a thorough understanding of the perceptions of female adolescents experiencing different issues/contexts related to DEBs and facing many challenges in distinct living environments.

Figure 6 Outline of the Thesis



3.3 METHODS

3.3.1 SYSTEMATIC REVIEW (STUDY ONE)

Throughout the 1970s and 1980s, systematic reviews (SRs) started to be published in the medical field. Reviews have become increasingly popular since the 1990s, with the rise of organisations such as Cochrane and the Joanna Briggs Institute (JBI), both in terms of the quantity implemented and in terms of popularity (Munn *et al.*, 2018). An SR provides a significant overview of existing scientific evidence to answer a particular question, emphasising best practices in medicine and clarifying clinical controversies (Gupta *et al.*, 2018). It aims to identify, appraise, summarise and synthesise the empirical evidence that

fulfils a predefined eligibility criteria to address specific research questions. Explicit methods are employed when conducting an SR to generate more reliable results that can guide decision-making (Higgins *et al.*, 2024; Krupinski, 2019).

Designing or implementing new research should only be produced if existing research is not duplicated or repeated. Consequently, before starting new primary research, an SR should usually be conducted. It will identify and synthesise the existing research on a specific research question or topic. It may also identify limitations in earlier research that could be addressed in further research (Higgins *et al.*, 2024).

3.3.1.1 SR COMPARED TO SCOPING OR NARRATIVE REVIEW

Depending on research questions and purposes, an SR was preferred over a scoping and a narrative/ traditional review, as the most robust way to identify and synthesise all the evidence on DEBs among Saudi adolescents and explore the trends and patterns of DEBs in the current evidence. According to Munn *et al.* (2018), an SR reveals patterns, inadequacies, and gaps in empirical evidence, which can support and guide further studies and decision-making. It examines the feasibility, suitability, significance, or efficacy of a particular procedure or treatment. A scoping review identifies particular characteristics or concepts in research, as well as in the mapping, summarising, or reporting of these concepts. It provides an overview of the evidence that is currently available rather than a critical appraisal. It can be implemented as a preliminary stage supporting SR by formulating and validating inclusion criteria. A narrative/ traditional review presents a subjective summary, as it is based on researchers' prior knowledge and experience; it typically does not provide a thorough and unbiased comprehensive report of research.

Therefore, the SR was conducted as the first study in this thesis to identify what was already known about the prevalence of DEBs, the types of behaviours explored, and the

questionnaires used with adolescents and young adults in Saudi Arabia. A comprehensive presentation of the SR is provided in Chapter 4.

3.3.1.2 PICOS & PECO

The Cochrane Collaboration clarifies the significance of a well-crafted research question in directing a review process (Morgan *et al.*, 2018). A key element of conducting SRs is creating clear and structured questions, and the PICOS framework (Population, Intervention, Comparator, Outcome, Study design) is widely recognised as a useful instrument for this purpose. Using PICOS as a search strategy tool enhances the review procedure and confirms that all pertinent facets of the question are covered (O'Connor *et al.*, 2014; Ridderikhof and Hollmann, 2020; Stoop, Scholten and Besselink, 2020). Recent research proposes alternatives to the traditional PICOS paradigm for developing clinical questions in SR. The PECO framework (Population, Exposure, Comparison, Outcome) is recommended for observational studies, substituting “Intervention” with “Exposure” to better fit non-interventional research (Mintzker, Blum and Adler, 2022; Morgan *et al.*, 2018).

In PECO, the population component refers to a particular set of people or subjects on which the research question is centred. Such traits may include age, gender, ethnicity, or certain medical issues (Morgan *et al.*, 2018). The exposure component can be related to any type of exposure, including genetic factors or medical conditions (Mintzker, Blum and Adler, 2022). The comparator is predetermined by what the observed data will reveal, covering all exposure levels, including incremental increases (Morgan *et al.*, 2018). Outcomes are the particular impacts that the evaluation seeks to quantify, which are clinically significant and pertinent to the research question. In order to guarantee thorough analysis and reporting, it is also essential to pre-specify primary and secondary outcomes (Stoop, Scholten and Besselink, 2020; Virgili *et al.*, 2016). The study design element outlines the types of studies that are part of the review, including observational studies, randomised controlled trials (RCTs), and other

pertinent designs. This aids in evaluating the quality and reliability of the evidence (Stoop, Scholten and Besselink, 2020).

Despite its usefulness in structuring SRs, these frameworks tend to be limited in examining differences within populations or interventions, comprehending mechanisms of action, or taking contextual factors into account. It may be necessary to use both configurative and aggregative synthesis techniques to solve these issues. This could be achieved by integrating quantitative and qualitative research. For example, an aggregative synthesis of quantitative research can test a theory generated from a configurative qualitative synthesis, revealing the active components of multicomponent interventions, such as behaviour modification strategies to promote healthy eating or treatment adherence (Anderson *et al.*, 2013).

Conducting an SR as a first study in this thesis, the PECO framework was adopted to identify the inclusion and exclusion criteria to direct the assessment of the prevalence of EDs/DEBs among Saudi adolescents and young adults. The components identified were the Population, Exposure, Context, Outcome and Study design. The comparator was modified to context to serve the aims and purposes of the review.

3.3.1.3 PRISMA (PREFERRED REPORTING ITEMS FOR SYSTEMATIC REVIEWS AND META-ANALYSES)

There have been variations in the quality of flow diagrams used to report SRs results. A ten-year study evaluating the quality of flow diagrams found substantial variation in reporting components, with many reviews excluding important information, such as manual searches and duplicate removal techniques (Vu-Ngoc *et al.*, 2018). One essential tool for reporting the procedure of SRs and meta-analyses is the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram. It acknowledges reproducibility and transparency by describing the information flow through the sequential stages of a review (Kahale *et al.*, 2021a; Kahale *et al.*, 2021b).

According to the original PRISMA version that was released in 2009, two reporting guidelines were published that offer specific instructions on how to report the literature search components of SRs and related review types: PRISMA 2020 and PRISMA-S (Rethlefsen and Page, 2021). These guidelines are an extension of PRISMA, focusing solely on reporting the SR search components. PRISMA-S suggests developing a flow diagram in the “records identified through database searching” box that displays the quantity of records retrieved from each database. Furthermore, in the “records identified through other sources” box, PRISMA-S instructs the quantification of records retrieved from each additional information location. In the results section, PRISMA-S also recommends listing the total number of references obtained from all sources, as well as the total number of references from every database (Rethlefsen *et al.*, 2021; Rethlefsen and Page, 2021).

Currently, SR researchers apply the PRISMA 2020 flow diagram for new SRs, including searches of databases, registers, and other sources, by following the process of identification, screening, eligibility and inclusion on the flow diagram (Page *et al.*, 2021). For this thesis, the PRISMA 2020 flow diagram was applied for reporting the results of the SR. A detailed description of the SR (Study One) can be found in Chapter 4 and has been published in the peer-reviewed journal *Nutrients* (Alsheweir *et al.*, 2023).

3.3.2 QUANTITATIVE PHASE (STUDY TWO)

Quantitative research refers to a variety of methodologies for conducting systematic investigations of social issues, applying statistical or numerical data. It is intended to measure the phenomenon being studied, collect data through measurement, examine it for trends and linkages, and validate the measurements made (Watson, 2015).

Through the generation of numerical data, quantitative research methodology is used to quantify attitudes, views, actions, and other specific factors in order to generalise findings

from a broader sample population (Mohajan, 2020). Quantitative research is classified as experimental/ interventional and non-experimental/ observational. Experimental studies compare groups of participants experiencing various interventions/treatments. On the other hand, observational studies are comprised of descriptive studies (case report, case series and cross-sectional) and analytical studies (case-control and cohort) (Indu and Vidhukumar, 2020).

3.3.2.1 CROSS-SECTIONAL STUDIES

Cross-sectional studies are observational studies collecting data from a population at a particular point in time. Due to their simplicity and cost-effectiveness, they are valuable for determining the prevalence of health outcomes, comprehending health factors, and describing the characteristics of the study population (Kesmodel, 2018; Pandis, 2014; Wang and Cheng, 2020). They provide a snapshot of a population at a specific point in time, which allows drawing inferences about a specific phenomenon across large populations (Spector, 2019).

Despite their strengths, cross-sectional studies have their limitations. The most significant limitation is their difficulty in demonstrating causal links. Because these studies collect data at a single point in time, they lack a temporal component, making it challenging to assess if an exposure caused an outcome. Due to this restriction, there may be problems with reverse causality, in which the presumed cause-and-effect relationship is inverted (Kesmodel, 2018). Cross-sectional designs are also susceptible to biases, including selection, information and confounding biases, which may cause biased or misleading estimates of associations and prevalence (Belbasis and Bellou, 2018; Munafo *et al.*, 2016).

Owing to the scarcity of references regarding DEBs in Arab nations, particularly Saudi Arabia, the prevalence might be underestimated. Furthermore, the scarcity of national surveys on DEBs indicates that no datasets are available for secondary data analysis. Consequently, a

cross-sectional quantitative design was implemented to measure the prevalence of DEBs using a self-reported questionnaire (Eating Attitudes Test EAT-26) and to understand adolescents' characteristics regarding age, weight, BMI (weight kg/height m²) and risk of DEBs. To reduce the possibility of selection bias in this phase, participants were selected from governmental schools in different regions of the city of Riyadh to ensure the obtaining of a representative sample of the population. Further information on participant selection, recruitment, methods and materials, and ethical considerations is presented below.

3.3.2.2 PARTICIPANTS

Adolescent female students were deemed appropriate participants for recruitment, ensuring a more comprehensive understanding of DEBs across the broader adolescent spectrum. The literature consistently demonstrates that females exhibit heightened concern about body weight, which correlates with a higher prevalence of DEBs (Mallick, Ray and Mukhopadhyay, 2014; Neumark-Sztainer et al., 2002; Torstveit, Agedal-Mortensen and Stea, 2015). By including females from varied age brackets, researchers can better identify shifts in body image perception, and vulnerability to DEBs that may emerge or intensify at different stages of adolescence. Even though SR findings (Study One) indicated a higher prevalence in adolescent males, limited and inconsistent data were available for male adolescents—often constrained by small sample sizes and publication bias—confirmed that focused research on females offers a more stable foundation for identifying DEB patterns and risk.

Moreover, female students aged 12 to 19 years were selected from intermediate and secondary schools in Riyadh. Even though SR (Study One) indicated that prevalence rates of DEBs appear higher among university students (29–66%) compared to school-aged adolescents (10–48%), the relationship between age and DEBs is not conclusively established, due to studies targeting narrow age ranges (Jones et al., 2001; Ward et al., 2019).

Identifying risk in school-aged populations is crucial for addressing key gaps about DEBs throughout adolescence. Younger groups are frequently overlooked in research, despite being at a pivotal developmental stage where early signs of DEBs often surface.

Saudi Arabia has several educational stages, and all Saudi nationals and foreign residents are entitled to free education. After six years of primary school, students are enrolled in a three-year intermediate stage, where the age ranges from 12 to 14 years. After completing the intermediate level, students start a three-year secondary school (known as high school), the last phase of public education, where the age ranges from 15 to 19 years (Alharbi, 2024).

Convenience sampling was conducted by dividing each school's population based on their grade (intermediate: grade 7, grade 8, grade 9, secondary: grade 10, grade 11 and grade 12), followed by selecting students from each grade. Convenience sampling, which is a non-probability sampling technique identified by a non-random selection of units or participants from the population, was considered functional and purposeful to serve the objectives of the study (Etikan, Musa and Alkassim, 2016). All female students who brought their parental approval to participate from all grades were recruited, excluding those with chronic diseases, such as hypertension, diabetes and hyper/hypothyroidism, or diagnosed with an ED. Further details on participants and sample size are presented in Chapter 5.

3.3.2.3 LOCATION & RECRUITMENT

Sampling procedures and sample sizes are crucial in quantitative research, as they facilitate accurate conclusions and ensure the validity of the study (Guetterman, 2020). Quantitative studies use probability sample designs with key characteristics derived from randomness (Griffith, 2013).

The city of Riyadh was selected as it increases the likelihood of gathering a varied demographic segment and thus promotes the prospect of representation for the entire Saudi

population. It comprises all of the government ministries and organisations, including significant healthcare cities, commercial and trading firms, and other major statutory figures enhancing the quality of life and creating job opportunities. Consequently, a growing number of people are migrating to Riyadh from rural and suburban areas (Tabassum and Shaiba, 2018). It is estimated that by 2030, the population of Riyadh would range from 15 to 20 million, requiring a substantial increase in residential units to navigate this growth (Alhefnawi *et al.*, 2023).

Additionally, choosing Riyadh was convenient and feasible since the researcher is a Saudi citizen residing in Riyadh and is acquainted with the educational system, authorities, and policies that must be followed to carry out the research in schools. Knowledge of legal and regulatory frameworks can save time and effort when navigating them, which helps in increasing the effectiveness and efficiency of research activities.

To increase the likelihood of selecting a representative sample of the Saudi population, female students were selected from four schools, two intermediate and two secondary schools, located in the northern, eastern, and western regions of Riyadh. Schools were assigned via convenience sampling, which is a valuable sampling method, particularly when randomisation is not feasible (Etikan, Musa and Alkassim, 2016). Given the limited number of schools that could be included, convenience sampling was preferred over random sampling as it is considered to be more practical to maintain easy access to the chosen schools and to improve the likelihood of representativeness of the relevant population.

The education system is administered by the Ministry of Education (MoE) in Saudi Arabia. Therefore, after selecting schools, a formal letter was electronically sent via King Saud University to the Ministry of Education, requesting permission to implement research in the assigned schools. The letter included ethical approvals, research methodology, participant

information sheets, consent forms, and questionnaires. The process of ethical considerations is further explained in the section below.

Following the permission letter from the Ministry of Education and in partnership with the school heads and teachers, parent participant information sheets (PIS) were handed to students to deliver to their parents, detailing the purpose of the study, the data gathered, the tools and techniques employed, and an informed consent form requesting parents' consent for their daughters to participate in the research by signing and returning it to the school (*Appendix 2,3 for parent PIS and parent consent forms/ Quantitative phase*). Students who brought consent from their parents were assembled in an available classroom and handed a PIS and consent forms after attending an introductory session that detailed the purposes and procedures of the research (*Appendix 4, 5 for student PIS and student consent forms/ Quantitative phase*).

3.3.2.4 MEASURES AND PROCEDURES

This section comprises information on the procedures implemented in this phase, including anthropometric measurements (weight, height, BMI) and the EAT-26 self-reported questionnaire, with further details provided in the corresponding chapter.

ANTHROPOMETRIC MEASURES

HEIGHT HT (CM) & WEIGHT WT (KG)

Evidence indicated a level of bias in overreporting height (Ht) and underreporting weight (Wt), reflecting misleading BMI calculations (Brenner *et al.*, 2003; Jayawardene, Lohrmann and Youssef Agha, 2014). Therefore, Ht and Wt measurements were taken for each student separately on school premises using a portable stadiometer (Seca 217 Mobile Stable Stadiometer-Portable Height Measurement Rod) and an electronic weighing scale (Salter Ultimate Accuracy, Bilston, UK). Standing on the scale can be troublesome due to fear of weight gain and weight stigma, particularly for adolescent females undergoing rapid

developmental changes and experiencing weight gain; thus, they were not permitted to read the scale (Alimoradi *et al.*, 2019; Hand *et al.*, 2017; Major, Eliezer and Rieck, 2012).

The decision to prevent students from reading the scale was based on evidence that adolescence is the most prevalent onset stage for EDs and DEBs (Brown *et al.*, 2020; Kinasz *et al.*, 2016; Nagata *et al.*, 2020; Omidvar *et al.*, 2016), with approximately 20% of adolescents reporting concerns over their weight and shape. These concerns are linked to fear of negative evaluation, which typically exacerbates as adolescents transition into adults (Trompeter *et al.*, 2018). Moreover, it was considered to limit any possible incidents of weight teasing among students. Peer and familial weight teasing during adolescence has been linked to binge eating, unhealthy weight control, and negative body image in females (Puhl *et al.*, 2017).

BODY MASS INDEX (BMI)

BMI is a common tool used globally to assess different levels of obesity and indicate body fat content. It is a simple, affordable, and non-intrusive way to screen for weight classifications (Mohajan and Mohajan, 2023).

The classification of BMI in adolescents can be identified according to Centre for Disease Control and Prevention (CDC) charts by plotting values on the BMI-for-age chart for girls aged between 2 and 20 years and classifying them based on BMI cut-offs as underweight (<5th percentile), normal (5 to 84th percentile), overweight (85 to 94th percentile) and obese ($\geq$ 95th percentile) (CDC, 2022). Literature indicates that the assessment of adolescents' weight can be complicated due to rapid growth during this phase. CDC growth charts, the growth references of the WHO, and the standards of the IOTF (International Obesity Task Force) are all used to classify BMI. Although these references have varied means of defining BMI, they all turned out to be comparable and have similar interpretations (Li *et al.*, 2016). In this phase, the WHO recommendations for BMI classifications were applied, as they are

frequently followed in comparable populations. BMI was calculated using the Quetelet equation (Wt kg/ Ht m^2) and classified based on four categories: underweight ($\text{BMI} < 18.5 \text{ kg/m}^2$), normal weight ($18.5\text{--}24.9 \text{ kg/m}^2$), overweight ($25.9\text{--}29.9 \text{ kg/m}^2$), and obese ($\geq 30 \text{ kg/m}^2$) (Allihaibi, 2015; Al-Qahtani and Al-Harbi, 2020; Al-Subaie, 2000; Alsubaie *et al.*, 2020; Ghafouri *et al.*, 2021).

EATING ATTITUDES TEST (EAT-26)

The Eating Attitudes Test (EAT) is among the most commonly used tools for self-reporting EDs, with the early introduction of EAT-40 consisting of 40 items to measure symptoms of AN (Garner and Garfinkel, 1979). Following that, the EAT-26 was introduced as a modified version of the EAT-40 applied for both nonclinical and clinical contexts not particularly linked to EDs (Garner *et al.*, 1982). The purpose of this tool is not to diagnose an ED or to replace the advice of a professional; it is frequently employed as a screening tool to evaluate the risk of EDs and DEBs (Gleaves *et al.*, 2014; Wade, 2016). It consists of 26 questions subdivided into three subscales: dieting (13 items), bulimia/ food preoccupation (5 items), and oral control (7 items). Five additional questions related to food habits in the last six months are found at the end of the questionnaire. The EAT-26 employs a cut-off score of 20 or above to indicate a potential risk for an ED. Individuals scoring 20 or above on the questionnaire are considered to fall within the clinical range, suggesting the need for further evaluation or referral (*Appendix 10 EAT-26 Questionnaire*).

The Arabic version of the EAT-26 was used in this phase. As a reliable instrument for EDs/DEBs, it was used with the Saudi population and has been previously validated as a highly sensitive tool for EDs/DEBs screening (Al-Adawi *et al.*, 2002; Albrahim *et al.*, 2019; AlHazmi and AlJohani, 2019; Al-Qahtani and Al-Harbi, 2020; Alwosaifer *et al.*, 2018). This tool exhibits high criterion-related validity and internal consistency ($\alpha = 0.90$), which was validated particularly in the Saudi population (Al-Subaie *et al.*, 1996).

Due to the importance of ensuring the reliability of the questionnaire, a pilot study was conducted. A pilot study is carried out prior to utilising it in actual fieldwork, as a preliminary investigation, to evaluate the suitability of a study instrument. Additionally, pilot studies assist in evaluating features related to the selected study design, study measures, research processes, recruiting criteria, and other operational techniques to be applied to larger populations (Moore *et al.*, 2011). It is an essential step implemented to confirm that research aims and purposes are fulfilled through a realistic perspective. The measure of internal consistency and reliability is determined by Cronbach's alpha, which was originally founded by Cronbach (1951) to assess a psychometric instrument's reliability. When assessing the internal consistency of a questionnaire or one of its domains, Cronbach's alpha values (ranging from 0 to 1) indicate that questions or a set of items are measuring the same variable. High values indicate that the questionnaire has high internal consistency and validity, implying that items are focused on a particular variable. Conversely, low values signify inconsistency and improper reflection of a variable or dimension (Bujang *et al.*, 2024).

In this phase, a pilot study was implemented on ten students in one of the schools to test the Arabic EAT-26's applicability and level of understanding before the actual data collection. Reliability analysis indicated good internal consistency and reliability ($\alpha = 0.774$) (*Appendix 11 The Arabic version of EAT-26 Questionnaire*).

It is essential to note that several screening tools can be applied to assess specific DEBs and determine EDs (some tools are identified in **Table 2**). Reviewing screening tools, the majority of them were implemented and applied for adult populations. Only three tools assessed adolescent populations: EAT-26 (over 16 years), EDI-3 (over 13 years) and ANSOCQ (used after the diagnostic process) (Leti *et al.*, 2020). Among studies in Saudi Arabia, EAT-26 was the most prominent questionnaire used among adolescent and young adult populations as a

validated tool for assessing EDs/DEBs, with 11 studies out of 14 applying it (Study One). Therefore, EAT-26 was selected for this study as it was deemed appropriate for the aims, purposes and study group. As the most commonly used screening tool, its Arabic version has proven to be both highly sensitive and reliable for identifying EDs/DEBs within the Saudi population, making it a highly suitable tool for this study.

Table 2 Screening Tools Identified in Studies for Assessing EDs/DEBs

Screening Tool	Characteristics
Sick Control One Fat Food (SCOFF)	• A five-item test to assess the possibility of an ED diagnosis. • It has very high sensitivity. • Insufficient data to assess the validity, reliability, and feasibility of screening for EDs in the general population (Leti <i>et al.</i>, 2020).
Eating Disorder Examination Questionnaire (EDE-Q)	• A 28-item self-administered questionnaire that assesses the severity of behaviours associated with the diagnosis of an ED • Divided into four subscales (Restraint, Eating Concern, Shape Concern, and Weight Concern) (Berg, 2016; Leti <i>et al.</i>, 2020).
Eating Disorder Inventory (EDI)	• Evaluates specific characteristics of AN and BN. • The third version is currently used (EDI-3), featuring 91 items and 12 subscales to assess specific aspects, such as drive for thinness, bulimia, body dissatisfaction scores and symptoms of DEBs (Coakley, 2022; Leti <i>et al.</i>, 2020).
AN Stages of Change (ANSOCQ)	• A 20-item self-reported questionnaire evaluating readiness and motivation to change • Among individuals diagnosed with AN (Leti <i>et al.</i>, 2020).

3.3.2.5 DATA ANALYSIS

In this thesis, both quantitative and qualitative elements were equally weighted. This balanced approach was intentionally chosen to ensure a comprehensive understanding of the DEBs among Saudi female adolescents. Quantitative data provided measurable insights into the prevalence and patterns of DEBs, while qualitative data offered depth and context by exploring determinants and factors causing DEBs among this population.

As a sequential design, the quantitative data were analysed and findings were described prior to qualitative data collection. The Statistical Package for the Social Sciences (SPSS) software (version 29) was used to enter and analyse data. Means, standard deviations, frequencies, and percentages were used to display descriptive statistics. In order to mirror the general demographics of intermediate versus secondary school students and to facilitate comparisons between study categories, the study group was divided into younger (12–15 years old) and older (16–19 years old). On the basis of their EAT-26 scores, participants were also classified into two groups: high-risk ($\text{EAT-26} \geq 20$) and low-risk ($\text{EAT-26} < 20$). This classification was based on previous literature assessing the prevalence of EDs/DEBs among Saudi adolescents and youth. Among university students, Albrahim *et al.* (2019) and Alwosaifer *et al.* (2018) categorised them into having risk or no risk of EDs according to their scores on the EAT-26, while AlHazmi and AlJohani (2019) used the classification of high risk and no risk. Among secondary school students, Al-Qahtani and Al-Harbi (2020) used the classification of having a risk or no risk of DEBs and Alsubaie *et al.* (2020) used high risk versus low risk categorisation. Regression analyses and Chi-square tests were performed to identify differences in scores and responses. A full description of the quantitative phase is presented in Chapter 5 and has been published in the peer-reviewed journal *Nutrients* (Alsheweir, Goyder and Caton, 2024).

3.3.3 QUALITATIVE PHASE (STUDY THREE)

Qualitative methodology is regarded as ideal to examine a new topic of study or to ascertain and theorise key issues (Creswell and Poth, 2016; Jamshed, 2014; Strauss and Corbin, 1998). It is a research approach that investigates and delivers more in-depth insights into real-world issues (Tenny, Brannan and Brannan, 2017). Qualitative research captures information about individuals' experiences, perceptions, and behaviour. Instead of "how many" or "how much", it addresses the "how"s and "why"s, which highlights the main aim of this exploratory study (Tenny, Brannan and Brannan, 2017).

Qualitative research is distinguished by its flexibility, openness, and responsiveness to context; the data collection and analysis procedures are not as distinct and sequential as they are in quantitative research (Busetto, Wick and Gumbinger, 2020). Sampling, data collection, analysis, and interpretation processes are linked in a cyclical (iterative) fashion rather than a sequential and linear approach (Fossey *et al.*, 2002). Qualitative research has been shaped by a variety of epistemological and theoretical approaches, and detailed explanations of some of the important influences are provided (Moriarty, 2011). Creswell (2009) stated that qualitative research is a method for investigating and comprehending the meaning that people or groups attribute to a social or human problem, supporting the concept of interpretivist and constructivist paradigms (Thanh and Thanh, 2015; Mogashoa, 2014).

The qualitative framework was deemed to be appropriate for addressing research questions, particularly exploring the main determinants and factors causing the development of DEBs in female adolescents. Below is a description of the adopted theoretical model, measures, procedures and data analyses.

3.3.3.1 ECOLOGICAL THEORIES

Determinants and predictors in mental health are linked to various factors (e.g. individual and social) in their interactions. Therefore, it is prudent to conceptualise the underlying biological, psychological, and sociocultural perspectives associated with mental conditions (Kendler, 2008; Sturgeon, 2006). According to WHO, targeting different multi-layered factors is important to reduce illness and improve mental health. To understand the causal pathways for interrelated, multi-layered determinants, a theory must be applied (Eriksson, Ghazinour and Hammarström, 2018).

Ecological theories emerged from different disciplines focusing on individual and contextual systems and emphasising their interdependent relations. However, ecological theories from psychology, such as community and developmental psychology, were introduced to health research (Eriksson, Ghazinour and Hammarström, 2018). Bronfenbrenner's Bioecological Model is a widely recognised framework in developmental psychology that highlights the interaction between individuals and their environments. It was adopted for this qualitative phase to aid in explaining determinants of DEBs in light of multi-layered systems present in the individual's ecological environment and understanding the complex interplay of factors contributing to such behaviours.

BRONFENBRENNER'S BIOECOLOGICAL MODEL OF HUMAN DEVELOPMENT

The bioecological theory, which was initially termed the ecological model, was produced by the developmental psychologist, Urie Bronfenbrenner, and explained the process of human development through the interaction of the individual and context. This theory had significant modifications since its inception in the late 1970s until Bronfenbrenner's death in 2005 (Rosa and Tudge, 2013).

In the first phase (1973–1979), Bronfenbrenner formulated his theory and defined it as the ‘ecological model of human development’, where the ecology is described as the fit between the human and his/her environment (Rosa and Tudge, 2013). He pointed out that:

“The ecology of human development involves the scientific study of the progressive, mutual accommodation between an active, growing human being and the changing properties of the immediate settings in which, the developing person lives, as this process is affected by relations between these settings, and by the larger contexts within which the settings are embedded.” (Bronfenbrenner, 1979, p.21).

Systems in Bronfenbrenner’s Bioecological Model

The ecological environment was specifically classified into four interconnected systems (microsystem, mesosystem, exosystem, and macrosystem). Below is a detailed description of each system (*Figure 7*).

Microsystem

The microsystem addresses the immediate setting in which the individual interacts. It focuses on the individual’s surrounding relations, such as family, school, and friends (Bronfenbrenner, 1977). The microsystem is the deepest structure, in which early development typically centres around the family. Adolescents, on the other hand, tend to develop a sense of independence and prefer spending more time apart from their families (Burns and Gottschalk, 2019). Therefore, in addition to the family of origin, the microsystem may consist of other adults and close friends who are actively involved in causing DEBs. Bronfenbrenner indicated that regular interactions over a long period of time, with an increase in complexity over this time, play an essential part in personal development (Lindstedt *et al.*, 2018).

Mesosystem

The mesosystem highlights the interrelations between the individual and major settings, such as relations among family and school. This can be clarified as relationships in adolescents' environment between schools, teaching centres, etc. and home. Strong interactions between microsystems can positively impact adolescents' behaviour, whereas weak relationships can be negative (Rosa and Tudge, 2013). Consistent follow-up and reinforcement across teachers in schools and parents at home can be beneficial, as it is considered the primary mesosystem of interest for Saudi adolescents.

Exosystem

The exosystem includes social structures, both formal and informal, as they do not contain the developing individual; perhaps they control the immediate setting where the individual is present. Neighbourhoods, mass media, and government agencies are constituents of the exosystem. This system indicates specific settings in which adolescents are not present but are yet impacted by their functions and/or regulations. Mass media is considered a significant factor contributing to DEBs (Bryla, 2003; Uchôa *et al.*, 2019). Adolescents who are influenced by the media may internalise standards of physical attractiveness and become dissatisfied with their bodies as a result of not meeting these standards. Specifically, they may start engaging in risky behaviours that could lead to the development of disordered behaviours in their ongoing quest for the ideal body (Uchôa *et al.*, 2019).

Macrosystem

The macrosystem is the outermost system focusing on concepts and social ideologies specifically related to the intended population. It consists of the blueprints of any population, including laws and regulations. It also accounts for the unprinted, informal rules and norms carried in the minds of the population's members and practised in daily life (Bronfenbrenner, 1977). Adolescents in Saudi Arabia are experiencing significant

modifications in the definitions of beauty and attractive weight. The traditional Arabic values and preferences are being replaced by Western conceptions of physical appearance in Saudi adolescents, which may have a detrimental effect on the risk of EDs/ DEBs in the next generation (Afifi-Soweid, Najem Kteily and Shediak-Rizkallah, 2002; Latzer, Azaiza and Tzischinsky, 2014; Musaiger, 2014).

Chronosystem

In the second phase (1980–1993), Bronfenbrenner added the concept of a chronosystem to his ecological model. This mainly considers changes over time with the individual and the environment in which the individual is present. It includes changes in children's achievement and social behaviour in school due to parents' work status (full-time vs. part-time), as parents' working hours would influence the child-parent communication and this type of communication would affect the child's progress in return (Bronfenbrenner, 1986; Eriksson, Ghazinour and Hammarström, 2018). Bronfenbrenner and Ceci (1994) also emphasised the role of genetic material as a major factor interacting with environmental experiences and guiding developmental outcomes.

In relation to adolescents, the chronosystem is classified as the way that personal and environmental alterations throughout time might affect their course of development. Adolescents experience significant changes physically and psychologically, generating feelings of irritability and anxiety, which persist when changes occur during early adolescent years. Due to rapid physical and cognitive development, they acquire a sudden sense of independence and maturity, and they are more likely to engage in risky behaviours compared to other age groups (Williams, 2022).

Techno-sub System

Prior to the internet revolution, Bronfenbrenner's Bioecological Model (1979) considered the

psychological effects of technology, such as television, on the individual's microsystem. As technology advances and increases in complexity and availability, Johnson and Pupilampu (2008) suggested the ecological techno-subsystem as a component of the microsystem. The techno-subsystem is considered a mediator in the bidirectional interaction between the individual and the microsystem, accounting for interactions with direct or immediate contexts with living and non-living components through using the internet and recreation technology (e.g. computers, phones, software, portable devices).

From an ecological standpoint, the techno-subsystem mediates the bidirectional relationship between the individual and the microsystem. Adolescents interact with both living (e.g., peers) and non-living (e.g., hardware) parts of communication, information, and recreation technologies in their immediate or direct surroundings (Johnson and Pupilampu, 2008).

According to estimates, there are 3 billion users of social media globally, with adolescents and young adults classified as the most active users (Schønning *et al.*, 2020). Literature indicated that prolonged use of social media by adolescents can elicit negative emotions related to body image and self-esteem, increasing vulnerability to DEBs (Bittar and Soares, 2020; Vincente-Benito and Ramírez-Durán, 2023). A scoping review explored the risks associated with the use of social media in children and adolescents and found that the most common risk was associated with psychological problems, with 19 reports related to depression, 15 related to dieting, and 15 related to psychological problems (Bozzola *et al.*, 2022).

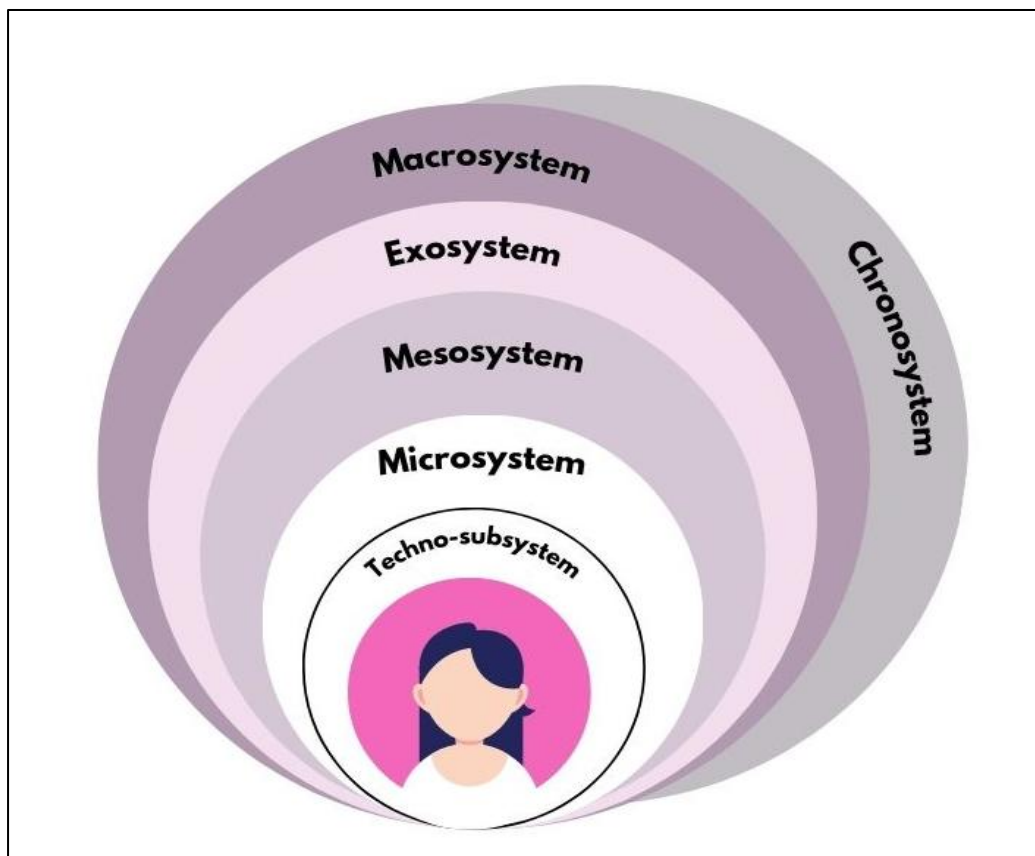
Time and Proximal Process

The third phase (1993–2006) was associated with the growth of the proximal process concept. It specifically defines the reciprocal interaction between the developing individual and certain persons, objects, and symbols found in the immediate environment. These processes include reading, playing, etc., as activities that occur between children and

children, and between children and parents. According to that, the PPCT (Process-Parent-Context-Time) model evolved (Tudge *et al.*, 2009). Process identifies activities that regularly occur and interact with significant persons, objects, and symbols. Person relates to assessing individual characteristics (e.g. age, gender, intelligence) and their effect on proximal processes. Context is detailed based on the four interrelated systems: microsystem which is defined as the immediate environment, characterised by the occurrence of the proximal process, mesosystem formulates the interrelations in different microsystems surrounding the developing individual, exosystem involves a context that influences the individual indirectly, and macrosystem includes context with shared norms and beliefs. Time indicates changing over time, which ideally requires at least two measurements occurring in significant time periods, as in longitudinal studies (Eriksson, Ghazinour and Hammarström, 2018; Tudge *et al.*, 2009).

Figure 7 The Proposed Theoretical Framework of Bronfenbrenner's Bioecological Model of Human Development with the Techno-Subsystem

Created based on Bronfenbrenner (1979) and Johnson and Puplampu (2008)



BRONFENBRENNER'S BIOECOLOGICAL MODEL AS A THEORETICAL FRAMEWORK

In this qualitative phase, Bronfenbrenner's Bioecological Model is presented to provide a comprehensive theoretical framework for exploring DEBs in adolescent females by proposing the aspect of the techno-subsystem as a key element in the microsystem. This model focuses on the interaction among intrapersonal characteristics, interpersonal relationships, environmental context, and time, and their role in shaping and modifying individuals' attitudes and behaviours. It provides a framework centred on adolescents and their DEBs emerging from distinct contexts placed in these four interrelated systems.

The rationale for selecting Bronfenbrenner's Bioecological Model is that it presents a comprehensive description of the intricate relationships between the adolescent and the surrounding environmental systems. This model is relevant and effective in studying adolescents, as it places a strong focus on the dynamic interactions that occur over time between biological, social, and environmental factors (Kaushik, Garg and Mishra, 2023). The model has been successfully used to understand a number of adolescent life issues, such as prosocial behaviours, health education, and awareness of pubertal changes. These studies demonstrate how well the model adapts to various social and cultural contexts (Bates *et al.*, 2023; Cala and Soriano, 2014; Kaushik, Garg and Mishra, 2023). Moreover, it has been proven to be helpful with investigating eating behaviours, body image and restrictive EDs (Harris, 2015; Hochgraf and Ruggiero, 2021; Lindstedt *et al.*, 2018).

3.3.3.2 PARTICIPANTS

Purposive non-probability sampling was applied to select a subset of students aged 13 to 16 years who participated in the first study (Thomas, 2022). These students are characterised as being at high risk of DEBs, reporting a high score on EAT-26 (score ≥ 20).

Purposive sampling is based on selecting participants depending on the purpose of the research. It is classified as a non-probability sampling in which the likelihood of selecting

each member in the population for the sample is undefined (Bhardwaj, 2019). This method is commonly employed in qualitative research and should be applied when the research relies on distinct characteristics, behaviours, personalities, or skills (Obilor and Isaac, 2023). It was employed in this qualitative phase to ensure the collection of the needed data for exploring DEBs. This is pertinent to students who reported a higher risk of DEBs than others, ensuring that the findings are significant and reliable. These participants are characterised as proper responders, since they have the necessary knowledge and comprehend the explored subject (Bhardwaj, 2019).

Purposive sampling significantly improves credibility, transferability, dependability, and confirmability while also supporting methodological rigour and trustworthiness in qualitative research by aligning with the research methodology, goals, and objectives (Campbell *et al.*, 2020). However, it has drawbacks, mainly because it is subjective in sample selection and therefore not very representative of the population; it can be helpful in situations when researchers' time, resources, and workforce are limited (Etikan, Musa and Alkassim, 2016).

3.3.3.3 RECRUITMENT

In qualitative research, sampling procedures are essential for preserving the validity of the study by enabling an in-depth investigation of the phenomenon (Guetterman, 2020). There is typically a balance between size and complexity, with larger sample sizes for quantitative designs and smaller samples for qualitative investigations. Qualitative studies use nonprobability sample designs with key characteristics derived from a predefined goal (Griffith, 2013).

Depending on the school selection in the first phase, the second phase continued at northern region schools in Riyadh, which were recruited through convenience sampling.

Similarly, in the qualitative phase, PIS and parent consent forms were delivered to parents via identified potential students (classified as high risk of DEBs in Study Two) under the supervision and coordination of teachers (*Appendix 6,7 for parent PIS and parent consent forms/ Qualitative phase*). Students who returned consent from their parents received student PIS and consent forms prior to participation (*Appendix 8,9 for student PIS and student consent forms/ Qualitative phase*). Parents and potential participants were informed that the study's purpose was to explore and understand eating behaviours in female adolescents.

3.3.3.4 MEASURES AND PROCEDURES

In this phase, interviews were adopted to explore the determinants of DEBs among female students. This section explains the process of selecting interviews as a data collection method, as well as the rationale for formulating the interview guide by applying Kallio *et al.*'s (2016) framework.

INTERVIEWS

Qualitative data collection methods yield comprehensive and rich information needed to explore a specific phenomenon in its natural context. Focus groups, observations, interviews, bibliographies, conversation recordings, and documentary and historical records are examples of qualitative data collection approaches (Howitt and Cramer, 2020).

The most common types of qualitative approaches are observations, focus groups and interviewing, which are designed to provide an in-depth and thorough comprehension of the issues through their textual interpretation (Creswell and Poth, 2016; Denny and Weckesser, 2022). Focus groups are widely used for qualitative data collection, with the researcher acting as a moderator or facilitator, directing and fostering discussion among all group participants. A focus group should not last more than two hours and typically consists of approximately six to 10 people.

Observations where the researcher acts as an outsider entering a homogeneous group, observing them, and reporting their behaviours and comments. The observation session should be limited in time and focus on a specific concept of one aspect (Howitt and Cramer, 2020).

Interviews are commonly used for collecting data in qualitative research. While conducting interviews, information may be gathered in the form of field notes, audio and video recordings, images, or documents that are subsequently transcribed and analysed (Noble and Smith, 2013). Interviews are classified into three common types: structured interviews, semi-structured interviews and unstructured interviews. Structured interviews are rigid, employing a strict list of questions and avoiding probing or asking for more information. Semi-structured interviews are flexible, using the list of questions as a guide while offering a chance for further questions and discussions. Unstructured interviews are the most flexible type in which the researcher asks arbitrary questions based on their subjective viewpoint and without a predefined list of questions (Mwita, 2022). Semi-structured interviews tend to be the most preferred method of interviews in health service, mental health and psychology research, enabling researchers to gather open-ended data and explore participant feelings, beliefs and attitudes (DeJonckheere and Vaughn, 2019; Mueller and Segal, 2015).

Interviews as a Method for Data Collection

In this phase, the preliminary plan for collecting qualitative data was based on conducting focus groups to explore adolescents' DEBs and study the main determinants. However, the procedure was modified to implement semi-structured interviews as the most appropriate method after conceptualising the sensitivity of disclosing information related to weight and DEBs among adolescents. The sensitivity of a phenomenon/ issue being studied can restrict the use of focus groups, as the group setting may not be ideal for discussing sensitive issues. Similarly, if the issue is confidential, focus groups may not be appropriate, considering that

participants must share a comparable level of access and knowledge concerning the issue (Harrell and Bradely, 2009).

Sensitive data refers to significant personal experiences, imposing substantial risk and vulnerability to participants expressing them. Collecting sensitive data could be challenging, as it might cause psychological harm, emotional distress, and desensitisation of emotional feelings. Particularly, discussing personal experiences with participants can increase the likelihood of distress (Bahn and Weatherill, 2013). Adolescents may be sensitive towards their weight and physical appearance as they frequently embrace the idea that their weight and shape are significant because they want a particular appearance (slender or slim), and they are dissatisfied when their weight or shape deviates from their ideals. Particularly, internalised weight-related biases may exist from an early age, which aggravates feelings of shame about the physical changes they experience as they grow from childhood into adolescence. Since EDs and DEBs are categorised as highly stigmatised behaviours, adolescents who engage in such behaviours may feel sensitive and ashamed, which could make it difficult and challenging to discuss them in a face-to-face setting (Parker *et al.*, 2023).

Interview Guide

The interview guide was developed according to Kallio *et al.*'s (2016) framework for synthesising qualitative semi-structured interviews to increase the reliability of research and credibility of findings. This framework is built upon five interrelated phases: identifying the prerequisites for using semi-structured interviews; retrieving and using previous knowledge; formulating the preliminary semi-structured interview guide; pilot testing the interview guide; and presenting the complete semi-structured interview guide.

Identifying the Prerequisites for Using Semi-structured Interviews

The first phase aimed at assessing the suitability of semi-structured interviews and ensuring

that it is the most appropriate procedure for attaining research aims and purposes. As explained earlier, due to the sensitivity of the studied issue and vulnerability of adolescents, it was sought that semi-structured interviews were the ideal option for data collection.

Retrieving and Using Previous Knowledge

The second phase is retrieving the previous knowledge by searching the foundation of literature and constructing a comprehensive background to effectively formulate the intended interview guide. Assessing adolescents and youth with possible EDs/DEBs can be complex and challenging. Therefore, scientific evidence based on qualitative analyses pertaining to adolescents and youth were reviewed, and many interview guides were checked to understand the concept of interviewing adolescents with DEBs to gain insight on interviewing adolescents with DEB (Bould *et al.*, 2017b; Budd, 2007; Kinnear *et al.*, 2023, Nevenon and Broberg, 2000).

Formulating the Preliminary Semi-structured Interview Guide

The third phase is associated with formulating preliminary interview guide questions was attained by reflecting on the EAT-26 domains and structuring ten questions related to usual eating pattern, importance of body image and physical appearance, engagement in DEBs (with the focus on specific behaviours including dieting, bingeing, induced vomiting, consuming laxatives and intensive exercising), effect of age on DEBs and main causes/determinants of DEBs.

Pilot Testing the Interview Guide

Piloting the preliminary interview guide is the fourth phase, which involves applying necessary modifications, thereby improving the quality of data collected. Stronger scholar-practitioner identities and greater academic rigour can emanate from pilot testing, which can also guarantee validity and reliability, limit bias, and mentally prepare researchers for gathering data (Tate *et al.*, 2023). It is considered a “test run” where researchers pilot their

methods for gathering and evaluating data on a small sample of participants who meet the same or comparable inclusion criteria as those in the primary study. Administering questions and asking participants for feedback would aid in developing a clear and concise guide, through revising question wording, reporting the time required for interview completion, discarding vague questions and modifying others that are not answered as expected (Chenail, 2011). Pilot testing can be applied through three types: internal testing- reviewing the interview guide by members of the research team, field testing- testing the interview guide with possible study participants, and expert assessment- reviewing the interview guide by an expert or a specialist outside the research team (Kallio *et al.*, 2016).

Pilot testing was conducted through internal testing and field testing. Internal testing meetings were implemented with supervisors, presenting the guide and discussing the needed adjustments. After the third internal meeting, the guide was approved for field testing with potential adolescents. Five Saudi female adolescents aged 12 and 13 years agreed to participate. Interviews were conducted for each participant, asking questions in Arabic and ranging approximately from 30 to 40 minutes. At the start of the interview, privacy and anonymity were highlighted, and the study's aims were explained. These interviews were not recorded, and responses were not used in the main thesis. The only purpose was to examine the clarity and the flow of questions through the interview process. As a result, the primary questions were modified to consider the general population of adolescents and their experiences with eating, thoughts on weight and shape, and participation in DEBs. Additional prompt questions focusing on individual experiences were included to facilitate the flow of the interview.

Presenting the Complete Semi-structured Interview Guide

The fifth phase is presenting the complete semi-structured interview guide. Developing a rigorous interview guide can aid in increasing the credibility and trustworthiness of the study

(Kallio *et al.*, 2016). By reflecting on the earlier stages, the final interview guide was presented (*Appendix 12 Semi-structured interview guide*)

3.3.3.5 DATA ANALYSIS

Approaches to qualitative research are immensely varied and intricate. Braun and Clarke (2006) categorised qualitative procedures into two categories: those originating from a theoretical framework or epistemology, like narrative analysis (Smith, 2016) or grounded theory (Charmaz, 2015), and those that are independent of theory, like thematic analysis (Braun and Clarke, 2006).

In the field of qualitative research, thematic analysis is one of the most popular methodologies. It focuses on finding patterns, which are subsequently presented as themes created by the researcher (Lochmiller, 2021). It was selected as an approach exploring determinants of DEBs as it offers fundamental skills relevant to a range of qualitative analyses that can be modified to fit different theoretical frameworks (Clarke and Braun, 2017). It provides comprehensive, in-depth insights together with flexibility and theoretical freedom (Majumdar, 2022).

Thematic analysis was conducted by applying the theoretical framework of Bronfenbrenner's Bioecological Model of human development with the techno-subsystem. The process of thematic analysis was followed according to the six stages highlighted by Braune and Clarke (2006). Following the stages was not linear; rather, it was a recursive process that involved going back and forth through the stages as needed.

Stage 1 Familiarisation with the Data

Familiarisation with the data is the first stage, through engaging with the data and becoming familiar with the scope of the information through repeated reading and transcription. This started during the interviews and continued with collecting data and transcribing. Despite

being a lengthy process, repeated reading and transcribing aided in identifying general themes or patterns.

Stage 2 Generation of Initial Codes

The second stage is generating initial codes from the data. Coding can be implemented either manually or by a software program by going through the entire data set methodically, paying close attention to every single item. Then, searching for intriguing features in the data items that could serve as the foundation for recurring patterns (themes) in the data. Transcripts were imported into MAXQDA 24, as it is the only available software supporting Arabic. This software provides a great level of versatility and eliminates the need to learn new terminologies (Kuckartz and Rädiker, 2019). The process of creating the first codes on MAXQDA involved finding patterns in the data that would be of interest and classifying them into appropriate groupings.

Stage 3 Searching for Themes

The third stage is associated with searching for themes by sorting the identified codes into possible themes and compiling all of the pertinent coded data extracts within the themes that have been generated. The inductive approach in thematic analysis was followed. Inductive data collection begins with specific information, progresses to broader generalisations, and ultimately leads to theories (Alhojailan, 2012).

Stage 4 Reviewing Themes

Reviewing themes is the fourth stage, which comprises reviewing and refining on two levels. The first level occurred on the coded data extracts, ensuring that collected data for each is adequate to support the theme and maintain a coherent pattern. The second level involved the same function of re-reading and reviewing, but for the full data set, taking into account the validity of individual themes in relation to the data set, as well as whether the potential

thematic map appropriately reflects the data set's overall meaning. Additionally, this stage determines overlooked data in previous coding stages that can be coded.

Stage 5 Defining and Naming Themes

The fifth stage is defining and naming the themes. Concentrating on each theme by determining the story it tells and relating it to the broader story of the data, as originally intended by the research aims and purposes. Consequently, a thematic map of themes and sub-themes was produced as a result of the process of refining sub-themes and the contribution to each theme.

Stage 6 Producing the Report

In the final stage, a clear and comprehensive thematic analysis report was presented. It tells the whole story within and across themes, based on research questions and supported by data extracts. These extracts were selected based on their relevance to research questions and addressed in the final analytical narrative. A complete presentation of the qualitative phase (Study Three) is depicted in Chapter 6 and has been published in the peer-reviewed journal *Nutrients* (Alsheweir *et al.*, 2024).

3.4 ETHICAL CONSIDERATIONS

Throughout the research process, ethical considerations were determined to comply with the principles outlined in the 1975 Declaration of Helsinki (Hellmann *et al.*, 2014; Sawicka-Gutaj *et al.*, 2022). Ethical approvals were attained from two academic institutions: the University of Sheffield and King Saud University. The procedure commenced with obtaining ethical approval from the Research Ethics Committee at the University of Sheffield (***Reference Number 050493, Appendix 13 Ethical Approval from the University of Sheffield***).

Subsequently, the ethical approval was granted from the institutional review board at the University Medical City in King Saud University in Riyadh (sponsor) (***Ref. No.***

23/0105/IRB, Project No. E-23-7551, Appendix 14 Ethical Approval from King Saud

University). Upon the researcher's request, King Saud University contacted the Ministry of Education via an official electronic letter regarding research implementation and school selection. The letter included research aims and purposes, methodology, defined measures, the EAT-26 questionnaire, a semi-structured interview guide, and a request to permit school visits to recruit students from the selected schools.

Although adolescent participants can sign a consent form, they are deemed vulnerable, and therefore, parents were informed about the study, and parental consent was also sought. After receiving administrative approvals from the Ministry of Education and the selected schools, parent PIS and consent forms were delivered to parents through the school's administration and students. These forms explained the nature of the study, data collected, and tools/methods used. Furthermore, it asks parents' permission for their daughters' participation in the study by signing the form and returning to school. To improve the likelihood of recruitment and reduce the level of burden on parents, a parental consent form (opt-in consent) was used. After parents' consent, eligible students were asked to join an introductory session with the main researcher. The Student PIS was explained step by step, and students were given the consent forms to read and complete in the session so they could ask questions. Some specific risks were identified for the interview process. In order to reduce risk, students were asked to stand backwards on the electronic weighing scale, as it is acknowledged that measuring weight can be stressful for adolescent students experiencing rapid body changes (Bahn and Weatherill, 2013). Moreover, risk could relate to inconvenience and time consumption, as students had to skip some classes to participate. Additionally, DEBs could be a sensitive topic for adolescents, as being interviewed and discussing eating patterns, disordered behaviours, and previous experiences with such behaviours could be challenging (Parker *et al.*, 2023).

Highest levels of privacy and confidentiality were considered, starting from contacting parents to disseminating findings. DEBs were explained and referred to as eating behaviours in PIS and informed consents. Adolescents and their parents were instructed about the confidentiality and the privacy of participant identities and any discussed details in PIS consent forms. However, if the researcher believed that the student is exposed to potential risk/harm (when the participant is showing or expressing a severe DEB), confidentiality would be breached, and parents would be contacted and notified. For quantitative measurements, each student was given a unique ID number for the data collection, and anthropometric measures and questionnaire answers were entered in accordance with the ID to ensure confidentiality. Interviews were conducted separately for each female using Google Meet. Confidentiality is enhanced by the Google Meet recordings that are automatically preserved on the university's Google Drive. During the interview, students were reminded that confidentiality is maintained and that the information mentioned will only be used for research purposes. Interview recordings were securely transcribed, and transcripts were anonymised.

Pertaining to ethical standards, the optimal degree of security was obtained. Anthropometric measurements and questionnaire responses were entered into a password-protected spreadsheet. Interview recordings were saved on the university's Google Drive. Digital files, including spreadsheets and transcripts, were saved on the university's X Drive. Hard copies of questionnaires and informed consents were stored in a safe, password-protected location and shredded in a confidential waste disposal after data entry. Interview recordings and transcripts will be deleted within 10 years after publication. Following Research Council UK Guidance, consent forms were stored securely electronically for 10 years, hard copies were scanned and saved on the university's X Drive, and then paper copies were disposed of at a confidential waste disposal. After 10 years, electronic data, including spreadsheets,

recordings, and transcripts, will be deleted from devices and servers. Anonymised transcripts will be kept available for future research on the University of Sheffield's data repository, ORDA. Participants were informed (PIS and informed consents) that anonymised data would be made available for analysis by other researchers. Parent PISs, parent consent forms, student PISs and student consent forms are presented in the appendix for both quantitative phase (Study Two) and qualitative phase (Study Three).

3.5 REFLEXIVITY

Qualitative research emphasises not just the objective aspects of behaviour but also its subjective interpretations, including people's narratives of their attitudes, drives, and actions (Aspers and Corte, 2019). Likewise, a researcher's values, beliefs and attitudes influence the research process, producing different interpretations and unique findings (Dodgson, 2019). This is referred to as reflexivity, which is defined by Berger (2015) as "turning the researcher's lens back onto oneself to recognise and take responsibility for one's situatedness within the research and the effect that it may have on the setting and people being studied, questions being asked, data being collected, and its interpretation" (Berger, 2015, p. 220).

Reflexivity is considered a defining aspect in qualitative research, in contrast with quantitative research, which perceives subjectivity as an indicator of bias and a limitation. By integrating personal, professional, and disciplinary elements, reflexivity in qualitative psychology research enhances research procedures and outcomes, enriching understanding (Gough, 2017).

The following section includes personal information to present a thorough overview of the application of reflexivity. Therefore, the first person is used in this section.

My choice of topic for my doctoral thesis highlights my longstanding interest in adolescents' nutrition and behaviour change. My initial interest in these specific topics stemmed from my experiences in both the academic and professional fields. After earning my bachelor's degree in nutritional sciences from the Applied Medical Sciences College at King Saud University in Riyadh, I started working there as a teaching assistant. Then, I pursued my master's degree in nutrition education at California State University, Chico, in the United States, and subsequently returned to work as a lecturer at King Saud University. Continuous interaction with students and patients at the college and the university hospital has tremendously shaped my skills in communication, counselling and teaching. I have taught many courses related to nutrition principles, communication skills and nutrition management in acute and chronic conditions; I typically set up the final 30 minutes of my classes for debates and critical thinking. I also had training in hospitals, clinics, and nursing homes, where I interacted with specialists from different disciplines in the medical field. I was a speaker at multiple venues, and I contributed some nutrition-related columns to the college's monthly paper related to mindful eating and body diversity. I gave a few talks on intuitive eating and Health At Every Size (HAES) (Bacon and Bacon, 2010).

With all my experiences as a student, a teacher, and a mother, I have come to understand that a person's physical and psychological well-being is intimately intertwined (Hernandez *et al.*, 2018). Both psychological and physical aspects should be considered when developing a theoretical understanding of how to achieve behavioural change (Davis *et al.*, 2014). I initiated applying this to myself by acknowledging how important it is to appreciate physical variations in body composition and to challenge the concept of the slender, attractive figure.

As an adolescent, I struggled with accepting my body and went through dieting and food restriction. I believe that being the eldest daughter, nurtured in a caring and supportive home, encouraged the sense of being the best academically and socially. I gradually started

perceiving myself as a role model, which contributed to the development of a perfectionist mindset. I applied this principle to all aspects of my life, even when I was a teenager with a maturing body shape. The image of perfection revolved around having a slender and slim figure. There were moments when I thought I was flawless in every way (bright student, loving daughter,...etc) except for my body, which was the only obstacle to perfection. Despite all the positive comments and compliments I received, I was just listening to my inner voice.. “that is not quite perfect”.. “You always need to do more.”.

This affected my confidence and body image, causing me a lot of stress when I felt like I did not meet the standards I had set for myself. I started changing these unrealistic ideas and goals and just focused on appreciating my own body and building a positive image. By focusing on nutrition, I became a specialist with the goal of influencing behaviours and enhancing wellbeing, especially among girls. I constantly make an effort to instil in my daughters and my students the value of appreciating your body and embracing variations in body types. To further develop my understanding of the topic, I explored adolescents' eating behaviours and habits in my master's dissertation.

From there, I decided to focus my doctoral thesis on DEBs in Saudi adolescents in my home city. I recognised depression and anxiety in the eyes of some teenage students when they were asked to stand on the scale, and I related to their comments .. “I know I didn't lose weight”.. “I'm always struggling”.. “I hate standing on the scale”... It took me back in time to my adolescent years, where I see myself irritated and depressed, simply because of my weight. During the interviews, I deeply related to those girls, and I had the impression that I was experiencing all of their emotions once more. I felt compelled to help them enjoy and be proud of their bodies and to transform the way they perceive themselves.

After completing the research interviews, I supported some of the participants who were expressing negative emotions and thoughts about their bodies by sharing my experience with the journey of body acceptance. I remarked on how I was self-critical, resentful of my shape and negative towards it. I emphasised my feelings of regret for doing so and my desire to go back in time to change this mindset.

Growing up, I experienced teasing and negative commentary on my weight and shape, particularly from relatives and school peers. I believe that my personal experiences may have influenced the process of interviewing. My early experiences may have increased my attention to adolescents' discussions regarding their weight and shape with family members and relatives. Appreciating familial and school relationships may have been overemphasised in interview questions, as I asked more questions related to family members, relatives, and peers, ultimately collecting more data centred on family and peer-related concepts. It may also have affected which quotes from adolescent participants captured my attention during transcribing, coding and defining themes. Reflecting on how my own experiences could have influenced the research, particularly the qualitative data collection and analysis, was very helpful. This self-awareness prompted crucial discussions about my data and its interpretation with colleagues and supervisors, to ensure potential biases were considered.

CHAPTER 4 SYSTEMATIC REVIEW (STUDY ONE)

This chapter presents the first PhD primary study in the published manuscript format. a SR was selected over scoping or narrative/traditional reviews as the most rigorous and effective method for identifying and synthesising existing evidence on EDs/DEBs among Saudi adolescents. This study was conducted to identify what was already known about the prevalence of DEBs, the types of behaviours explored, and the questionnaires used with adolescents and young adults in Saudi Arabia.

This review was guided by a clearly defined research question and a specific objective that shaped its scope and methodology.

Research Question: What is the prevalence of DEBs among Saudi female adolescents in Saudi Arabia?

Specific objective: To review the evidence assessing the prevalence of EDs/DEBs among adolescents and youth in Saudi Arabia.

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The content of this chapter is the same as the published version. The manuscript was produced by four co-authors: Azzah Alsheweir, Elizabeth Goyder, Ghada Alnooh and Samantha J. Caton. The author contribution section in this chapter clarified the tasks conducted by each author.

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Prevalence of Eating Disorders and Disordered Eating Behaviours amongst Adolescents and Young Adults in Saudi Arabia: A Systematic Review

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4.1 ABSTRACT

Eating disorders (EDs) and disordered eating behaviours (DEBs) are significant health problems related to body image and weight dissatisfaction among adolescents and young adults worldwide. During this stage of sensitive development, these behaviours may hinder the optimal growth process and can consequently lead to wasting, stunting, and micronutrient

deficiencies. However, there is a limited amount of literature on DEB among Arab populations, particularly in Saudi Arabia. This review aims to assess the prevalence of EDs/DEB and to develop a clear understanding of the epidemiology of such conditions among adolescents and youth in Saudi Arabia. Five databases were systematically searched and 14 papers met the inclusion criteria. The Eating Attitudes Test (EAT-26) was the predominant tool used for evaluating aberrant eating behaviours, indicating a high prevalence of EDs/DEB ranging from 10.2% to 48.1%. The highest prevalence of EDs/DEB was reported in the eastern region ranging from 29.4% to 65.5%. In terms of age and sex, the prevalence was higher among older students compared to younger school students and males reported more EDs/DEB compared to female students. These disorders are found to be prevalent in Saudi Arabia, and the risk of developing such conditions is high across the whole age range.

4.2 KEYWORDS

eating disorders; disordered eating behaviours; weight; body image; EAT-26; EDI-DT; EDE-Q; SCOFF; Saudi Arabia

4.3 INTRODUCTION

Eating disorders (EDs) appear to be one of the most significant problems concerning adolescents and young people (Rikani *et al.*, 2013). According to the Diagnostic Statistical Manual of Mental Disorders (DSM-V) and the International Classification of Diseases and

Related Health Problems (ICD-11), EDs are characterised by troubled eating habits and detrimental practices of weight control (Herpertz-Dahlmann, 2015; Perris, 2020). They are ranked as the third most common pathological diagnoses in adolescents worldwide, following asthma and obesity (Smolak and Levine, 2015). The WHO and the American Psychiatric Association (APA) classified anorexia nervosa (AN), bulimia nervosa (BN), and binge eating disorder (BED) as the most common EDs globally (American Psychiatric Association, 2013; Giallonardo, 2019; Wilfley *et al.*, 2007). AN is defined as a lack of desire to eat and loss of appetite combined with compensatory behaviours towards thinness and fear of gaining weight (Wilfley *et al.*, 2007). A recent review of epidemiological studies confirmed that the incidence of AN is increasing in young individuals worldwide, particularly those who are below 15 years of age, with a peak age of 13–18 years at onset (Van Eeden, van Hoeken and Hoek, 2021; Weaver and Liebman, 2011). The lifetime prevalence of AN is 4% among female populations and 0.3% among male populations. AN has the highest mortality rate among all psychiatric illnesses (Moskowitz and Weiselberg, 2017; Van Eeden, van Hoeken and Hoek, 2021). BN is delineated by recurrent binge eating, followed by purging behaviours (self-induced vomiting and laxative or diuretic use) (Abebe *et al.*, 2012; Wilfley *et al.*, 2007). The lifetime prevalence of BN is up to 3% among female populations and over 1% among male populations, with symptoms increasing among girls from 14 to 16 years of age and among boys from 16 years of age onwards (Hoste, Labuschagne and Le Grange, 2012; Van Eeden, van Hoeken and Hoek, 2021). BED is described as persistent binge eating episodes

combined with feelings of shame and depression, rather than purging or other compensatory behaviours (diet pill intake, intensive exercise, and diet restriction) (Abebe *et al.*, 2012; Pereira and Alvarenga, 2007). In the former DSM-IV, BED was counted as a significant diagnosis categorised under eating disorders not otherwise specified (American Psychiatric Association, 2000). However, in the current version of the manual (DSM-V), BED is considered a distinct diagnosis and a substantial disorder along with anorexia and bulimia (American Psychiatric Association, 2013; Mancuso *et al.*, 2015). Binge eating and other behaviours in adolescents have an estimated lifetime prevalence of 4.8% (Le Grange *et al.*, 2012). Although girls account for the majority of cases of EDs, 10% of cases have been reported by boys over the last few years (Sigel, 2005).

Disordered eating behaviours (DEBs) are significant behaviours and attitudes from the ED spectrum (Alvarenga, Scagliusi and Philippi, 2006; American Dietetic Association, 2006).

These disordered behaviours and negative attitudes towards food can be practised by individuals without being diagnosed with a specific ED (American Dietetic Association, 2006). Neumark Sztainer *et al.* (2002) explained that behaviours such as binge eating, purging, fasting, and using laxatives are parallel to the behaviours manifested in clinical EDs.

The literature has focussed on EDs more than on DEB, since EDs can be diagnosed by a multidisciplinary team under clinical conditions through physical and psychological screening (Bryla, 2003; Wilfley *et al.*, 2007). The DSM-V and ICD-11, which are validated diagnostic tools, can detect the prevalence and severity of such disorders (Perris, 2020; Yager

et al., 2005). By contrast, detecting DEB is not feasible, as clinical professionals and even individuals are not aware of the symptoms, and treatment plans are lacking (Bryla, 2003).

This review highlights the current knowledge on the prevalence of EDs and DEBs, with variation in prevalence associated with sex, age, region, and types of tools used. DEBs are found to be a major health concern related to body image and weight dissatisfaction in adolescents (Neumark-Sztainer *et al.*, 2002). These behaviours have been reported in both sexes among various cultural, ethnic, racial, and socioeconomic backgrounds (Podar and Allik, 2009). However, female adolescents tend to have higher rates of DEB because they are more concerned about their body shape and physical appearance than males (Mallick, Ray and Mukhopadhyay, 2014). In the US and Europe, approximately 10–20% of female adolescents engage in DEB, and estimates may reach 40% for certain behaviours (Neumark-Sztainer *et al.*, 2002; Torstveit, Aagedal-Mortensen and Stea, 2015). As adolescents experience remarkable growth and increased nutrient requirements, failure to meet such requirements can impair normal growth and sexual maturation (Adesina *et al.*, 2012; Bibiloni, Pons and Tur, 2013; Collison *et al.*, 2010). Energy restriction can be problematic for adolescents, as it may lead to binge eating and an increased risk of EDs (Stang and Stotmeister, 2017).

Podar and Allik (2009) indicated that the highest proportion of DEB was detected in mid-to-late adolescence (15–21 years). According to the current literature, EDs often appear in adolescence or early adulthood, with reported median onset ages between 12 and 22 years

(Micali *et al.*, 2015a; Smink, Van Hoeken and Hoek, 2012). It is therefore highly plausible that the transition into and out of adolescence is related to an increased risk of EDs (Jahrami *et al.*, 2019). Yearly estimates indicated that for both males and females, the highest mean prevalence of EDs occurred at the age of 21 years, with the majority of cases (95%) occurring by the age of 25 for the first time (Ward *et al.*, 2019).

The literature indicated that EDs and pathological concerns with body image and food are present in Western Europe and North America (Rikani *et al.*, 2013). However, these behaviours are also documented in other regions in Asia (Pike and Dunne, 2015; van Hoeken, Burns and Hoek, 2016). In Taiwan, results revealed that more than one-third (43.2%) of college students tend to have a higher prevalence of developing an ED (Yeh *et al.*, 2009). A review from Singapore confirmed a marked increase in the prevalence of EDs over the past ten years, compared to older studies, and linking it to Westernisation and body dissatisfaction, both of which appear to be frequent among Singaporean Chinese schoolgirls (Ung, 2003).

The Middle East and North Africa (MENA) countries have widely documented DEBs among adolescents and young adults (Afifi-Soweid, Najem Kteily and Shediak-Rizkallah, 2002; Al Sabbah *et al.*, 2010; Attouche *et al.*, 2021; Taha, Abu-Zaid and Desouky, 2018). These countries are categorised as emerging economic countries, considering that they are experiencing significant transitions in culture, diet, and sex roles (Lesthaeghe, 2020; Pike and Dunne, 2015). A study assessed eating attitudes among adolescents aged 15–18 years ($n = 4698$) as a part of the ARAB Eating Among Teens project in seven cities in Arab countries

(Algeria, Jordan, Kuwait, Libya, Palestine, Syria, and the UAE). It was concluded that DEB was highly prevalent in both male (13.8–47.3%) and female (16.2–42.7%) adolescents (Musaiger *et al.*, 2013). The prevalence of DE among Arab adolescents is comparable to that in adolescents from Western countries (Azzeh, Peachey and Loney, 2022).

DEB could be attributed to the significant shifts in eating habits and lifestyles in Saudi Arabia (Al-Rethaiaa, Fahmy and Al-Shwaiyat, 2010; Khalaf *et al.*, 2015). Unhealthy eating habits and lack of physical activity can be detrimental to health during adolescence (Al-Hazzaa *et al.*, 2011). Moreover, Saudi adolescents are preoccupied with the thinness body ideal rather than the culturally preferred full body shape, which may also increase the possibility of EDs (Latzer, Azaiza and Tzischinsky, 2014; Mallick, Ray and Mukhopadhyay, 2014).

Epidemiological studies and systematic reviews have focussed on Western and non-Western distinctions in measuring the prevalence of EDs and DEB (Rikani *et al.*, 2013). Furthermore, little epidemiological research has fully observed the association between urban region residence and disordered behaviour, confirming that the relationship between urbanisation and EDs is complex, not directly causal, and likely to vary between different contexts/populations (Hay and Mitchison, 2021).

No previous review has focussed on such disorders in populations in Saudi Arabia. In this regard, a systematic review is imperative to develop a clear understanding of the epidemiology of EDs and DEB among adolescents and young adults in Saudi Arabia.

The objective of this review is to assess the prevalence of EDs and DEB, among Saudi adolescents and young adults, with an emphasis on variations related to sex, age, region, and types of tools used. As this is an exploratory study, these variables (sex, age, region) were emphasised to understand the demographic differences in relation to the prevalence of EDs/DEB in Saudi Arabia.

4.4 MATERIALS AND METHODS

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines framework was used in conducting and reporting this systematic review (Page *et al.*, 2021).

This systematic review is registered and approved by Prospero (CRD42022359970).

4.4.1 DATA RETRIEVAL STRATEGIES

The search strategy for this systematic review was developed in consultation with an academic librarian. A comprehensive literature search was conducted in relevant databases to reduce the likelihood of missing evidence. Five online databases were selected for this review: MEDLINE via Ovid, Scopus, Web of Science, Psych Info, and ProQuest via ASSIA (1990–2022). Internet search engines were checked, and reference lists of selected papers were manually cross-checked to identify studies missed in the original search.

Keywords and search terms used in the databases search were related to eating disorders, disordered eating, adolescents, youth, and Saudi Arabia. MeSH terms, as well as appropriate

synonyms, were applied. These terms were linked using the Boolean operators AND and OR.

Search strategies were entered in February 2023 (Supplementary File S1- *Appendix 16*).

4.4.2 INCLUSION AND EXCLUSION CRITERIA

Studies were assessed and included based on the following eligibility criteria following the

PICOs from the JBI manual for evidence synthesis (Moola *et al.*, 2017) (*Table 3*). As

clarified in the table, only studies that serve the aim of this systematic review are included,

recruiting healthy adolescents from Saudi Arabia and defining the prevalence of EDs/DEB

using a validated tool. As the inclusion criteria resulted in the identification of studies using a

range of different methods to measure prevalence, the heterogeneity of studies meant that

meta-analysis was not considered appropriate.

Table 3 Inclusion and Exclusion Criteria for Studies Included in the Review

Components	Inclusion Criteria	Exclusion Criteria
Population	Healthy adolescent and young adult participants aged 10–24 years.	Participants with certain metabolic or mental/psychiatric disorders (Attention Deficit Hyperactivity Disorder (ADHD), Obsessive Compulsive Disorder (OCD)).
Exposure	Studies assessing eating disorders, disordered eating, feeding disorders, appetite disorders, anorexia nervosa or bulimia nervosa, binge eating, disturbed eating, weight control, or purging.	Studies assessing orthorexia disorder, Pica, and rumination disorder.
Context	Collected samples from Saudi Arabia	Samples from outside Saudi Arabian borders
Outcome	Studies measuring the prevalence of EDs/DEB with a validated tool: self-reported questionnaire (EAT-26, EDE-Q....)	Studies focussed on clinical assessment, interviews, or weight-history taking to assess the prevalence of ED/DEB
Study design	Cross-sectional and longitudinal studies are both eligible. Journal articles published in peer-reviewed journals and conference papers.	Qualitative studies (case reports), books, editorials, dissertations, systematic/narrative reviews.

4.4.3 SCREENING AND DATA EXTRACTION

Retrieved records were exported to EndNote 20 to remove duplicate studies. Studies were initially screened by title and then by abstract for relevance. Two reviewers (AA and GA) manually screened the titles and abstracts of the records retrieved from the search. References that did not meet the inclusion/exclusion criteria were withdrawn and the remaining references that met the search criteria went through a full-text assessment. Two authors (AA, GA) independently screened all potential full-articles, and the final decision was made by consensus. Any discrepancies were resolved by a third and a fourth reviewer (SC, EG). This systematic review is one of the outputs of AA's Ph.D. project, supervised by SC and EG, who provided expert guidance based on extensive systematic review experience.

Data from each record meeting the inclusion criteria were inserted into a table that has the following classifications: Author, City/Area, Study Design, Setting, Sample Size, Sex Distribution (F/M), Age Group (Mean Age $\pm$ SD), Screening Tool, Disorder Screened, and Prevalence (N and/or %). Disorder screened was identified according to the selected papers' purpose which included ED, DEB, and DEA. However, DEB and DEA included the same behaviours.

4.4.4 QUALITY ASSESSMENT TOOL

The quality of retrieved records was independently assessed and collectively verified by two authors (AA, GA) using the Joanna Briggs Institute (JBI) critical appraisal tool for cross-sectional studies (Moola *et al.*, 2017). Sections assessed include eight identified criteria: (Q1) inclusion in the sample, (Q2) study subjects and the setting, (Q3) methods of measuring the exposure, (Q4) criteria used for measurement of the condition, (Q5) confounding factors, (Q6) strategies to deal with confounding factors, (Q7) methods of measuring the outcomes, and (Q8) statistical analysis used. It is important to note that criteria five and six (Q5 & Q6) were rated as not applicable, as they are concerned with confounding factors and strategies to deal with confounding factors. After deleting Q5 and Q6, scores were calculated depending on 6 criteria, where a score of 1 is assigned to each criterion. A score of 5–6 indicates high-quality research, a score of 3–4 indicates medium quality, and 1–2 scores indicate low quality.

4.4.5 DATA SYNTHESIS

Since studies are employing similar tools (questionnaires) to ascertain the prevalence rate of such conditions, attention was placed on EDs/DEB. Data were analysed first by grouping studies by type of questionnaire: Eating Attitudes Test (EAT-26) (Garner *et al.*, 1982; Gleaves *et al.*, 2014), Eating Disorder Inventory—Drive for Thinness (EDI-DT) (Garner, Olmstead and Polivy, 1983; Garner, 1991), Eating Disorder Examination—Questionnaire (EDE-Q) (Cooper and Fairburn, 1987; Fairburn, 2008; Luce and Crowther, 1999), and Sick, Control,

One, Fat, Food questionnaire (SCOFF) (Kagan and Melrose, 2003; Luck *et al.*, 2002; Morgan, Reid and Lacey, 1999). Then, data were interpreted according to region, sex, and age. It is important to note that educational setting is used rather than age group per se because the main interest was identifying whether prevalence was different in school and college/university settings.

4.5 RESULTS

4.5.1 STUDY SELECTION

The initial search strategy yielded 493 records from five common databases (MEDLINE via Ovid, Scopus, Web of Science, Psych Info, and ProQuest via ASSIA) and 4 additional papers were retrieved from other additional sources (**Figure 8**). Ten duplicates were removed electronically followed by a manual removal of nine more duplicates. Following records screening, 53 records were further excluded (Books (n = 34) and dissertations (n = 19)). Two reviewers (AA) and (GA) manually screened the title of the remaining 425 records and eliminated 394 records. A reliability test was carried out to evaluate the level of agreement for title screening and showed substantial agreement ($K = 0.6$). Then, the two reviewers screened the abstracts of the remaining 31 studies and further eliminated 14 records. The level of agreement was tested for abstract screening and revealed perfect agreement ($K = 0.9$). Thus, 17 full-text records were assessed for eligibility. Three records were excluded for not meeting the required age group (Alfhaid *et al.*, 2021; Naguib *et al.*, 2020; Taha, Abu-Zaid and Desouky, 2018). The final review included 14 papers that fulfilled the inclusion criteria

(**Table 4**). All studies were published from 2000 onwards. This review process was implemented separately and then results were compared and agreement was concluded. The third and the fourth reviewer (SC, EG) resolved discrepancies. Table. 4 summarises the key information from the included studies.

4.5.2 QUALITY APPRAISAL

No studies were excluded based on quality assessment. Criteria for inclusion/exclusion (Q1) was clear for most of the studies, except for four studies (Alhazmi and Al Johani, 2019; Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Alsubaie *et al.*, 2020), where no information was included on participants' exclusion. Most studies met the criteria for the subjects and setting described in detail (Q2), excluding Al-Subaie (2000), which was rated unclear.

All studies met the third criterion (Q3) of measuring the exposure in a valid and reliable way, as they all applied validated self-reported questionnaires. The fourth criterion (Q4) concerned with objective and standard criteria used for measurement of the condition was met in the selected studies, except for Allihaibi (2015), which was not clear. The seventh and eighth criteria were related to outcome measurement (Q7) and appropriate statistical analyses (Q8), and all 14 studies met their criteria (Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019; Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Al-Subaie, 2000; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy, Al-Ghamidi, 2015; Fatima and Ahmad, 2018; Ghafouri *et al.*, 2021; Loni *et al.*, 2022; Tomar and

Antony, 2021). Overall, all studies were classified as high quality, except for Allihaibi (2015), which was classified as medium quality (Supplementary File S2- *Appendix 17*).

4.5.3 STUDY CHARACTERISTICS

Studies involved students from schools and universities from distinct regions in Saudi Arabia, including central (Albrahim *et al.*, 2019; Al-Subaie, 2000; Loni *et al.*, 2022), western (Alhazmi and Al Johani, 2019; Allihaibi, 2015; Al-Qahtani and Al-Harbi, 2020; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Ghafouri *et al.*, 2021), eastern (Alwosaifer *et al.*, 2018; Tomar and Antony, 2021), southwestern (Alsubaie *et al.*, 2020), northwestern (Almuhlaifi *et al.*, 2018), and northern regions (Fatima and Ahmad, 2018).

Variances in age and sex distribution were noted. Participants' ages ranged from 10 to 24 years (Daly, O'Sullivan and Kearney, 2022), with five studies examining university and college undergraduates, including two on females (Albrahim *et al.*, 2019; Alwosaifer *et al.*, 2018), two on both males and females (Alhazmi and Al Johani, 2019; Loni *et al.*, 2022), and one on males (Tomar and Antony, 2021). Nine records assessed school adolescent students, including eight on females (Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Al-Subaie, 2000; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Fatima and Ahmad, 2018), and only one on both sexes (Ghafouri *et al.*, 2021).

Most studies were focussed on female students (Albrahim *et al.*, 2019; Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Al-Subaie,

2000; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Fatima and Ahmad, 2018). Only three studies investigated both male and female students (Alhazmi and Al Johani, 2019; Ghafouri *et al.*, 2021; Loni *et al.*, 2022); one record examined males (Tomar and Antony, 2021). Studies selected in this review identified the prevalence of different disorders categorised under EDs and DEB, distributed according to questionnaires implemented (EAT-26 (Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019; Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Fatima and Ahmad, 2018; Loni *et al.*, 2022), EDI-DT (Al-Subaie, 2000), EDE-Q (Tomar and Antony, 2021), and SCOFF (Ghafouri *et al.*, 2021)), region, sex, and age.

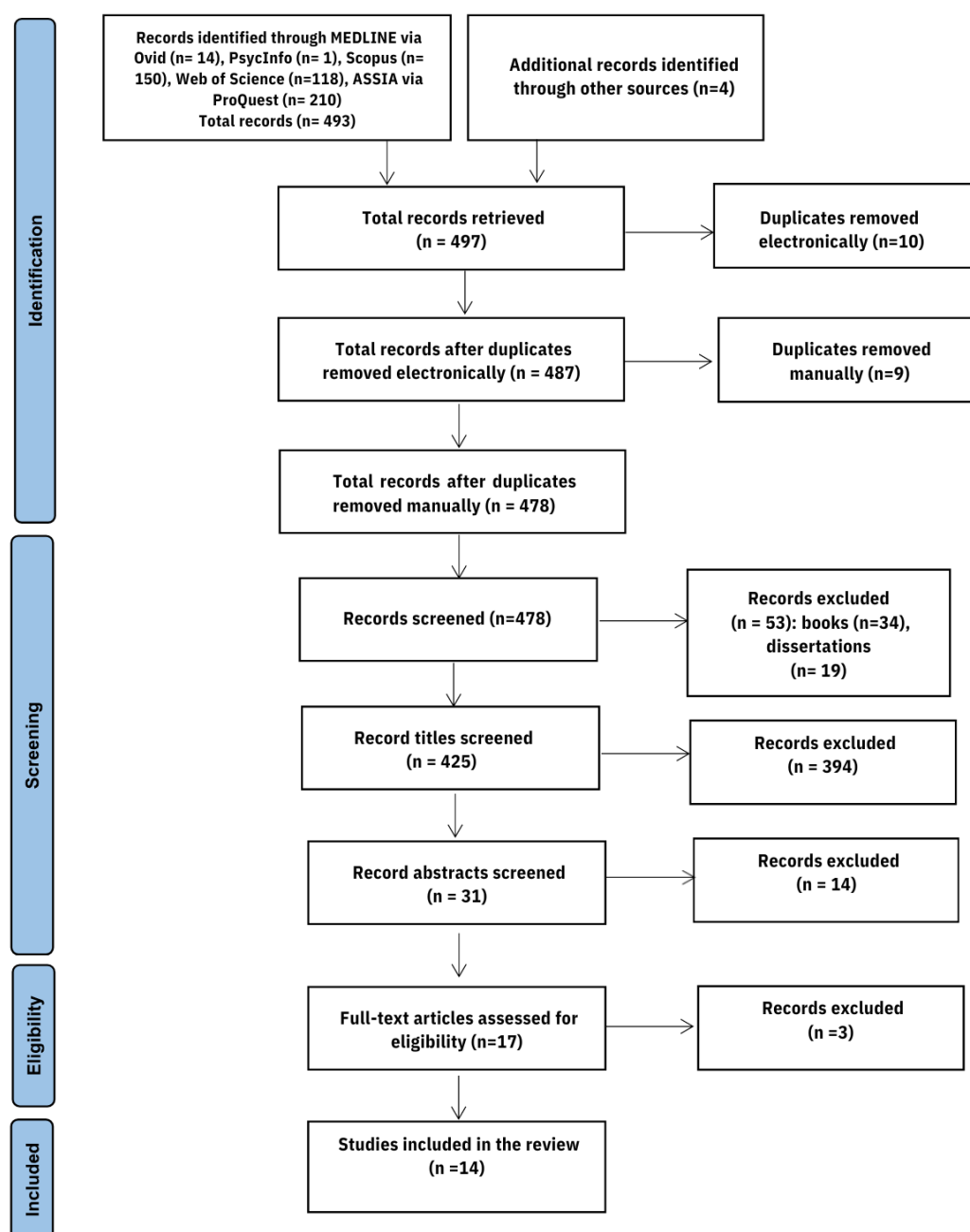


Figure 8 PRISMA Flow Diagram Showing the Process of Study Selection (Page *et al.*, 2021)

4.5.4 QUESTIONNAIRES

4.5.4.1 PREVALENCE OF DISORDERS ASSESSED BY THE EAT-26

The estimated prevalence of EDs/DEB for 11 studies was measured using EAT-26 (Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019; Allihaibi, 2015; Almuhlafl *et al.*, 2018; Al-Qahtani

and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Fatima and Ahmad, 2018; Loni *et al.*, 2022). Across studies, EAT-26 was the predominant tool used for evaluating aberrant eating behaviours. Of the 11 studies, 5 studies focussed on assessing the prevalence of EDs (Alhazmi and Al Johani, 2019; Alsubaie *et al.*, 2020; Alwosaifer *et al.*, 2018; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Loni *et al.*, 2022) and the other 6 determined the frequency of DEBs (Albrahim *et al.*, 2019; Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; El Shikieri, 2022; Fatima and Ahmad, 2018). Among studies, the prevalence of these disorders was classified to be particularly high, ranging from 10.2% to 48.1%. As shown in Table 4, most studies included female students and college undergraduates. Only two studies examined both male and female students (Alhazmi and Al Johani, 2019; Loni *et al.*, 2022). Differences between males and females were inconsistent with one study reporting a higher prevalence in females (38.0% females, 19.3% males (Alhazmi and Al Johani, 2019)) and one in males (33.3% females, 40.0% males (Loni *et al.*, 2022)).

4.5.4.2 PREVALENCE OF DISORDERS ASSESSED BY THE EDI-DT

As shown in Table 4, only one study assessed the prevalence of dieting using the EDI-DT (Al-Subaie, 2000). According to Al-Subaie (2000), the study recruited 1179 female students aged 12 to 21 years ($M = 16.13$ years, $SD = 2.09$) who completed the EDI-DT. In proportion to students who scored more than 14, about 16% of the sample reported DEB.

Table 4 Characteristics of Studies Included in This Systematic Review.

Author (Year)	City/Area	Study Design	Setting	Sample Size	Sex Distribution (F/M)	Age Group (Mean Age $\pm$ SD)	Screening Tool	Disorder Screened	Prevalence (N and/or %)	Quality Assessment Score
Albrahim <i>et al.</i> (2019)	Riyadh/central	Cross-sectional	Undergraduate students from Prince Nora University	396	396/0	18–24 (20.1 $\pm$ 1.55)	EAT-26	DEAs	EAT-26: ≥ 20 (n = 145, 36.8%), impulse to vomit after meals (2.08 $\pm$ 1.14), dieting (0.26 $\pm$ 0.66), bingeing (0.52 $\pm$ 0.92)	High
AlHazmi and AlJohani (2019)	Madina/west	Cross-sectional	Health specialities students at Taiba University	342	171/171	NR (NR) ≤ 22 (n = 221, 64.4%)	EAT-26	EDs	EAT-26: ≥ 20 (n = 75, 33.9%), F (n = 65, 38%), M (n = 33, 19.3%)	High
Allihaibi (2015)	Makkah/west	Cross-sectional	Secondary schools	180	180/0	15–19 (16.83 $\pm$ 0.94)	EAT-26	DEAs	EAT-26: ≥ 20 (n = 47, 26.1%)	Medium
Almuhlaifi <i>et al.</i> (2018)	Tabuk/northwest	Cross-sectional	High schools	399	399/0	NR (16.8 $\pm$ 0.9)	EAT-26	DEBs: Binge eating, purging, laxatives	EAT-26: ≥ 20 (n = 192, 48.1%) DEB: Binge eating (n = 123, 30.8%), purging (n = 28, 7%), laxative use (n = 21, 5.3%)	High
Al-Qahtani and Al-Harbi (2020)	Madina/west	Cross-sectional	Secondary schools	393	393/0	15–20 (17.24 $\pm$ 1.03)	EAT-26	DEBs	EAT-26: ≥ 20 (n = 167, 42.5%), self-reported frequency of EA in the last 6 months (binge eating: (≤ 3 = 43.4%, > 3 = 56.6%) SIV: (≤ 3 = 44.1%, > 3 = 55.9%), laxatives or diuretics: (≤ 3 = 45.8%, > 3 = 54.2%) EAT-26: ≥ 20 (n = 85, 34%), older age females (17–19) had a significantly higher score of EAT-26 (n = 35, 43.8%) than the younger age (12–16) group (n = 50, 29.4%)	High
Alsubaie <i>et al.</i> (2020)	Abha/southwest	Cross-sectional	Intermediate and secondary schools	224	224/0	12–19 (15.9 $\pm$ 3.7)	EAT-26	EDs		High
Al-Subaie (2000)	Riyadh/central	Cross-sectional	Grades 7 to 11 from Intermediate and Secondary schools	1179	1179/0	12–21 (16.13 $\pm$ 2.09)	EDI-DT	DEB: Dieting	EDI-DT > 14 (n = 188, 15.9%)	High
Alwosaifer <i>et al.</i> (2018)	Dammam/East	Cross-sectional	Imam Abdulrahman bin Faisal University	656	656/0	18–23 (18.7 $\pm$ 0.74)	EAT-26	EDs	EAT-26: ≥ 20 (n = 179, 29.4%), problematic eating behaviours (n = 277, 45.5%)	High
ElShikieri (2022)	Madina/west	Cross-sectional	Public and private female elementary, intermediate, and high schools	381	381/0	10–18 (M = 13.6, SD = 2.6)	EAT-26	DEAs	EAT-26: ≥ 20 (n = 39, 10.2%)	High
Fallatah, Al-Hemairy and Al-Ghamidi, (2015)	Jeddah/west	Cross-sectional	Secondary schools	425	425/0	15–18 (16.6 $\pm$ 0.98)	EAT-26	EDs	EAT-26: ≥ 20 (n = 140, 32.9%)	High

Fatima and Ahmed (2018)	Arar/north	Cross-sectional	Schools	314	314/0	15–19 (17.0 ± 1.14)	EAT-26	DEAs	EAT-26: ≥20 (n = 80, 25.4%)	High
Ghafouri et al. (2021)	Makkah/ west	Cross-sectional	Private and public secondary schools	471	399/72	NR (17.28 ± 1.27)	SCOFF	EDs	SCOFF ≥ 2 (n = 136, 46%), SCOFF 0 or 1 (n = 216, 29%) EAT-26: ≥20 (n = 44, 35.2%), M (n = 14, 40%), F (n = 30, 33.3%), binge eating (M = 42.9%, F = 57.8%), exercised more than 60 min (M = 60%, F = 54.4%), SIV (M = 5.7%, F = 13.3%)	High
Loni et al. (2022)	Majmaah/ central	Cross-sectional	Majmaah University	125	90/35	18–25 (F (22.9 ± 4.9), M(25.6 ± 5.1)	EAT-26	EDs		High
Tomar and Antony (2022)	Dhahran/ east	Cross-sectional	King Fahad University for petroleum and minerals	60 (obese participants (BMI) ≥ 30 kg/m ²)	0/60	18–25 (19.67 ± 0.90)	EDE-Q	EDs	High EDE-Q global score (n = 36, 65.5%)	High

NR: Not reported, EDs: Eating Disorders, DEAs: Disordered Eating Attitudes, DEBs: Disordered Eating Behaviours, EAT-26: Eating Attitudes Test, EDE-Q: Eating Disorder Examination- Questionnaire, EDI-DT: Eating Disorder Inventory Drive for Thinness, SCOFF: (Sick, Control, One, Fat, Food) questionnaire, SIV: Self-induced Vomiting.

4.5.4.3 PREVALENCE OF DISORDERS ASSESSED BY THE EDE-Q

Only one study investigated the prevalence of EDs using EDE-Q (Tomar and Antony, 2021).

Tomar and Antony (2021) recruited 60 university students with obesity in Dhahran (eastern province in Saudi Arabia) aged 18 to 25 years. EDE-Q scores indicated that 36 out of 60 participants (65.5%) are considered to have a high prevalence of EDs.

4.5.4.4 PREVALENCE OF DISORDERS ASSESSED BY SCOFF

As demonstrated in Table 4, only one study implemented the SCOFF questionnaire on private and public secondary school students (Ghafouri *et al.*, 2021). Adolescent boys (n = 72) and girls (n = 399) were selected in Makkah (western province in Saudi Arabia) to examine the prevalence of EDs by applying the SCOFF questionnaire. According to the SCOFF scores, Ghafouri and colleagues (2021) classified that almost half of the sample (46.0%) scored two or more and might be anorexic or bulimic.

4.5.5 REGION

As mentioned in Table 4, six studies were conducted in the western region. Specifically, three studies were implemented in Madina (Alhazmi and Al Johani, 2019; Al-Qahtani and Al-Harbi, 2020; El Shikieri, 2022), two studies in Makkah (Allihaibi, 2015; Ghafouri *et al.*, 2021), and one in Jeddah (Fallatah, Al-Hemairy and Al-Ghamidi, 2015). Three studies were administered in the central region, including two studies in Riyadh (Albrahim *et al.*, 2019; Al-Subaie, 2000) and one in Majmaah (Loni *et al.*, 2022). In the eastern region, only two studies were implemented, one in Dammam (Alwosaifer *et al.*, 2018) and one in Dhahran

(Tomar and Antony, 2021). One study was found in the southwestern region, in the city of Abha (Alsubaie *et al.*, 2020). Similarly, one study was implemented in the northwestern region, in Tabuk (Almuhlaifi *et al.*, 2018), and one study was administered in the northern region, in Arar (Fatima and Ahmad, 2018). The prevalence of EDs/DEB in the western region is classified as ranging from 10.2% to 46.0% (Alhazmi and Al Johani, 2019; Allihaibi, 2015; Al-Qahtani and Al-Harbi, 2020; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Ghafouri *et al.*, 2021). According to the central region, the prevalence ranged from 15.9% to 36.8% (Albrahim *et al.*, 2019; Al-Subaie, 2000; Loni *et al.*, 2022). The prevalence in the eastern region was reported to range from 29.4% to 65.5% (Alwosaifer *et al.*, 2018; Tomar and Antony, 2021). In the southwestern, northwestern, and northern regions, the prevalence was reported as 34.0% (Alsubaie *et al.*, 2020), 48.1% (Almuhlaifi *et al.*, 2018), and 25.4% (Fatima and Ahmad, 2018), respectively.

4.5.6 SEX

Ten studies were administered on female students (Albrahim *et al.*, 2019; Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Al-Subaie, 2000; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Fatima and Ahmad, 2018). Three studies recruited both females and males (Alhazmi and Al Johani, 2019; Ghafouri *et al.*, 2021; Loni *et al.*, 2022), and one study was implemented on male students (Tomar and Antony, 2021). The prevalence of disorders ranged from 10.2% to 48.1% among female students (Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019;

Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Al-Subaie, 2000; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Fatima and Ahmad, 2018; Ghafouri *et al.*, 2021; Loni *et al.*, 2022) and from 19.3% to 65.5% among male students (Alhazmi and Al Johani, 2019; Ghafouri *et al.*, 2021; Loni *et al.*, 2022; Tomar and Antony, 2021).

4.5.7 AGE

As clarified in Table 4, the study setting involved school and university students. Nine studies recruited school students with ages ranging from 10 to 21 years (Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Al-Subaie, 2000; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Fatima and Ahmad, 2018; Ghafouri *et al.*, 2021). Five studies recruited university students aged from 18 to 25 years (Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019; Alwosaifer *et al.*, 2018; Loni *et al.*, 2022; Tomar and Antony, 2021). For school students, the reported prevalence of ED/DEB was from 10.2% to 48.1% compared to university students who reported a prevalence ranging from 29.4% to 65.5%.

4.6 DISCUSSION

This is the first systematic review on the prevalence of EDs and DEB among students and young adults in Saudi Arabia from 2000 onwards. This review was implemented to explore the epidemiology of EDs and DEB among adolescents and young adults in Saudi Arabia with

the aim of assessing the prevalence of EDs/DEB in Saudi adolescents and young adults according to the type of questionnaires, region, sex, and age.

The prevalence of EDs/DEB seems to be a major concern in Saudi Arabia. In this review, different regions of Saudi Arabia were investigated to assess the prevalence of EDs/DEB according to the questionnaires applied (EAT-26, EDI-DT, EDE-Q, and SCOFF). About 79% of studies (11 out of 14) utilised EAT-26 to determine the presence of such disorders, with a prevalence ranging from 10.2% to 48.1% (Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019; Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Fatima and Ahmad, 2018; Loni *et al.*, 2022). The other tools include the EDI-DT, SCOFF, and EDE-Q, yielding prevalence rates of 15.9%, 46.0%, and 65.5%, respectively (Al-Subaie, 2000; Ghafouri *et al.*, 2021; Tomar and Antony, 2021). Amongst studies, EAT-26 was the dominantly used questionnaire to identify the prevalence of DEB. It is evident that different questionnaires produced different prevalence estimates between studies, which could be linked to the age, sex, or social/cultural/economic/regional factors of the studied population (Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019; Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Al-Subaie, 2000; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Fatima and Ahmad, 2018; Ghafouri *et al.*, 2021; Loni *et al.*, 2022; Tomar and Antony, 2021).

Differences can be also attributed to study methods such as the recruitment process and administration of questionnaires. Comparing types of questionnaires, SCOFF showed no significant difference in detecting prevalence rates when compared to EAT-26, and both questionnaires' scores were positively associated (Noma *et al.*, 2006). Another study compared EAT, EDI, and EDE-Q questionnaires among female adolescents, confirmed that they perform well in estimating prevalence, and also indicated that EDI is the questionnaire with the highest sensitivity and specificity (Engelsen and Laberg, 2001).

Equivalent proportions were identified from other countries in the Middle East. Depending on EAT-26/EAT-40, students from the UAE reported a prevalence of DEB from 23.4% to 41.2% (Eapen, Mabrouk and Bin-Othman, 2006; Musaiger *et al.*, 2013; Musaiger, 2014). Moreover, using EAT-26 as a screening tool for DEBs, it has been reported that the prevalence of such disorders among high school students was 31.6%, 44.7%, 26.7%, 31.7%, and 22.9% in Jordan, Kuwait, Libya, Palestine, and Syria, respectively (Musaiger *et al.*, 2013). Another study on Jordanian students found that 40.5% reported DEB depending on EAT-26 scores (Mousa *et al.*, 2010). Al-Adawi *et al.* (2002) concluded that 29% of Omani school students reported DEB.

References from Iran indicated that DEB prevalence ranged from 15% to 24.2% (Garrusi, Baneshi and Pakgozar, 2016; Jalali-Farahani *et al.*, 2015; Rauof *et al.*, 2015; Sahlan *et al.*, 2021). Surprisingly, Egypt indicated the highest proportion of DEB, with 73.3% reported prevalence (El-Bagoury, Hassan and AbouSeif, 2017). Considering Egypt as a less

economically developed country scoring higher rates than other developed countries, the author explained that overreporting in self-administered questionnaires is a possibility that could not be avoided (El-Bagoury, Hassan and AbouSeif, 2017). Overall, EAT-26 findings from countries in the Middle East and Saudi Arabia were comparable. Additionally, research from the United States, Europe, and Asia is frequently comparable to findings from Saudi Arabia (Neumark-Sztainer *et al.*, 2002; Torstveit, Agedal-Mortensen and Stea, 2015; Ung, 2003; Yeh *et al.*, 2009).

4.6.1 REGION

Most studies were conducted in the western region of Saudi Arabia including Madina (Alhazmi and Al Johani, 2019; Al-Qahtani and Al-Harbi, 2020; El Shikieri, 2022), Makkah (Allihaibi, 2015; Ghafouri *et al.*, 2021), and Jeddah (Fallatah, Al-Hemairy and Al-Ghamidi, 2015), with a reported DEB prevalence ranging from 10.2% to 46%. EAT-26 was the predominant questionnaire applied in western region studies, except for Ghafouri *et al.*, who conducted the SCOFF questionnaire on secondary school students and found the highest prevalence of EDs in the region (46%) (Ghafouri *et al.*, 2021). There is no clear explanation for the western region's predominance in studies, which could be due to feasibility and convenience for data collection.

Three studies were implemented in the central region (Albrahim *et al.*, 2019; Al-Subaie, 2000; Loni *et al.*, 2022), followed by two studies in the eastern region (Alwosaifer *et al.*, 2018; Tomar and Antony, 2021). One study was carried out in the southwestern region

(Alsubaie *et al.*, 2020), one in the northwestern region (Almuhlaifi *et al.*, 2018), and one in the northern region (Fatima and Ahmad, 2018). Although a meta-analysis was not conducted, it was still evident from the individual study results that the overall prevalence was highest in the eastern region ranging from 29.4% to 65.5%, followed by the northwestern region (48.1%), and the lowest prevalence was found in the northern regions (25.4%).

Regions in Saudi Arabia reported comparable rates of EDs/DEB with the eastern region reporting the highest prevalence. Despite the differences in selected cities in relation to size, climate, and population count, they all demonstrated a high-risk prevalence of EDs/DEB.

This is in contrast to Takimoto *et al.*, which found levels of thinness among adolescent girls aged 15–19 years to be higher in larger cities compared to smaller cities (Takimoto *et al.*, 2004). They also indicated that adolescents living in larger cities have more possibility of engaging in DEB compared to their peers who are residing in smaller cities (Takimoto *et al.*, 2004).

In relation to urbanisation and affluence, there was a lack of variation between studied cities in relation to prevalence rates. The central region has the highest levels of urbanisation and affluence (Albrahim *et al.*, 2019; Al-Subaie, 2000; Loni *et al.*, 2022), followed by the eastern and western regions, although this was not projected on prevalence rates (Alhazmi and Al Johani, 2019; Allihaibi, 2015; Al-Qahtani and Al-Harbi, 2020; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Ghafouri *et al.*, 2021; Tomar and Antony, 2021).

These conclusions were unexpected and worth further investigation. A recent scoping review on urbanisation and EDs demonstrated that urbanisation is not directly associated with an increased prevalence of such disorders (Hay and Mitchison, 2021).

4.6.2 SEX

In relation to sex, the majority of studies recruited female students (Albrahim *et al.*, 2019; Allihaibi, 2015; Almuhlafi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Al-Subaie, 2000; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Fatima and Ahmad, 2018), with only four studies including male students (Alhazmi and Al Johani, 2019; Ghafouri *et al.*, 2021; Loni *et al.*, 2022; Tomar and Antony, 2021). Tomar and Antony (2021) focused their research on male university students only, while the other three records selected both female and male students (Alhazmi and Al Johani, 2019; Ghafouri *et al.*, 2021; Loni *et al.*, 2022). Figures on males indicate that DEB is apparent, with AlHazmi and AlJohani (2019) reporting that 19.3% reported DEB and Tomar and Antony (2021) had results as high as 65.5%. Ghafouri *et al.* (2021) interpreted results for the total sample and did not report them according to sex. Surprisingly, Loni *et al.* (2022) confirmed that males reported a higher prevalence of DEB (40%) compared to female participants (33.3%), which is contradictory to many findings that classify females with higher prevalence.

Overall, the focus on females in most studies is expected, as the literature continuously stresses on females being more concerned with their body weight and exposed to a higher

prevalence of DEB (Afifi-Soweid, Najem Kteily and Shediak-Rizkallah, 2002; Elgin and Pritchard, 2006; Ferreiro, Seoane and Senra, 2014; Mallick, Ray and Mukhopadhyay, 2014; Musaiger, 2014; Neumark-Sztainer *et al.*, 2002; Torstveit, Agedal-Mortensen and Stea, 2015).

Females are more likely to have disordered consumption, and the literature has attention on females globally (Afifi-Soweid, Najem Kteily and Shediak-Rizkallah, 2002; Elgin and Pritchard, 2006; Ferreiro, Seoane and Senra, 2014). A study assessing the prevalence of EDs among medical students in Karachi, Pakistan found that 87.9% of females and 12.1% of males were classified as being at high risk of developing an ED (Memon *et al.*, 2012).

Another study examined the prevalence of DEB in a considerable European sample and concluded that females tend to be 2.96 to 5.9 times more prone to practicing DEB than males (Bartholdy *et al.*, 2017). In Finland, results confirmed that young females have higher odds compared to young males to be affected by EDs (Lähteenmäki *et al.*, 2014). Studies in Iran, Jordan, Palestine, and Israel have concluded similar findings (Al-Kloub *et al.*, 2019; Al Sabbah *et al.*, 2010; Al-Sheyab, Gharaibeh and Kheirallah, 2018; Katz, 2014; Maor *et al.*, 2006; Mohammadi *et al.*, 2020; Rauof *et al.*, 2015). In this review, the results were not conclusive as Loni *et al.*'s (2022) conclusions were contradictory. However, it is essential to address that EDs/DEB is common among Saudi male adolescents and young adults and might be underreported (Alfhaid *et al.*, 2021; Alhazmi and Al Johani, 2019; Ghafouri *et al.*, 2021; Loni *et al.*, 2022; Tomar and Antony, 2021). Young males with EDs/DEB explained that these

feminised cultural constructs of EDs inclined them (as well as those around them—relatives, peers, and health and education experts) to ignore symptoms (Sweeting *et al.*, 2015).

4.6.3 AGE

In terms of age, this review indicated that the reported prevalence ranged from 29.4% to 65.5% for university students and 10.2% to 42.5% for secondary and intermediate school students (Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019; Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy, M. and Al-Ghamidi, 2015; Fatima and Ahmad, 2018; Loni *et al.*, 2022). Clearly, older adolescents have higher prevalence of EDs/DEB compared to younger adolescents. Alsubaie *et al.* (2020) clarified that Saudi older female students scored higher prevalence rates of DEB (43.8%) compared to younger students (29.4%). These findings support conclusions that indicate that the peak of DEB occurs in late adolescence and early adulthood (Ward *et al.*, 2019). University/college students encountered a higher prevalence of EDs/DEB when compared to school students. A study on the UK population indicated that the peak age for developing disordered behaviours ranges from 15 to 19 years (Micali *et al.*, 2013). Another study investigated the estimated prevalence of EDs in a US cohort and found that the prevalence of these disorders was reported to be the highest at the age of 21 years for both sexes (Ward *et al.*, 2019). The majority of first-time cases (95%) are developed by the age of 25 years (Ward *et al.*, 2019). Inconsistent findings were reported among Korean adolescents, as they concluded that DEB and distorted body image were more

prevalent in adolescents aged 10–17 years than young adults (18–24 years), with the highest prevalence found among females aged 10–12 years (Hong *et al.*, 2015). A clear contradiction was found in relation to age and EDs, as some studies clarified such behaviours to be common among younger adolescents, while other studies confirmed they are most prevalent in older adolescents (Seepersad, 2012).

Based on our review, Saudi Arabia's prevalence estimates tend to be also higher than those reported in other Asian and European countries (Elal, Sabol and Slade, 2004; Graber, Tyrka and Brooks-Gunn, 2003; Jones *et al.*, 2001; Nishizawa *et al.*, 2003; Sanlier, Yabanci and Alyakut, 2008; Sanlier *et al.*, 2016; Szweda and Thorne, 2002; Tsai *et al.*, 2011; Vardar and Erzengin, 2011; Yang, Choi and Lee, 2001). Several studies on Turkish school and university students revealed that the prevalence of DEB ranged from 9.8% to 22.8% (Elal, Sabol and Slade, 2004; Sanlier, Yabanci and Alyakut, 2008; Sanlier *et al.*, 2016; Vardar and Erzengin, 2011). In Japan, the Japanese version of EAT-26 confirmed that 11.2% of females experienced eating problems (Nishizawa *et al.*, 2003). In Korea and Taiwan, disturbed eating attitudes were recorded in 10.3% and 10.4% of students, respectively (Tsai *et al.*, 2011; Yang, Choi and LEE, 2001). Szweda and Thorne (2002) confirmed a marked prevalence of EDs amongst all female student groups in the UK. They revealed that 20% of nursing students showed DEB patterns with no significance reported when compared to medical students (19%) and art students (21%). In the US, up to 26% of school students had elevated EAT-26 scores (Graber, Tyrka and Brooks-Gunn, 2003). In Canada, 16% of females aged 15–18 years

and 13% of females aged 12–14 years scored above the cut-off point in the EAT-26 (Jones *et al.*, 2001). Collectively, rates of EDs/DEB from Asian countries, the UK, the US, and Canada appear to be lower than indicated in Saudi Arabia (Graber, Tyrka and Brooks-Gunn, 2003; Jones *et al.*, 2001; Szweda and Thorne, 2002).

Originally, research indicated that DEBs and related disorders have been acknowledged in Western countries since the late 20th century (Cooper and Fairburn, 1987; Garner and Garfinkel, 1980). Early studies claimed that an ED was a common diagnosis in white women from Western countries with only a few cases recognised from non-Western countries (Makino, Tsuboi and Dennerstein, 2004). However, recent studies demonstrated that DEB problems are increasing dramatically in non-Western countries, particularly in Saudi Arabia (Alhazmi and Al Johani, 2019; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Naguib *et al.*, 2020; Taha, Abu-Zaid and Desouky, 2018; Makino, Tsuboi and Dennerstein, 2004). There is no clear rationale to explain the marked rise in ED/DEB conditions in Saudi Arabia, as it relies on complex aetiologic interactions within genetic, social, cultural, and psychological causes that elevate the possibility of encountering these distinct, culturally bound syndromes (Keel and Klump, 2003).

Many researchers delineated extended trends of EDs/DEB to be affected by Westernisation and the preference of a thin body physique (Keel and Klump, 2003; Rauof *et al.*, 2015).

Culturally, Arab populations including Saudi Arabia valued plumpness, as they believed it

conveys fertility, wealth, and health (Abdollahi and Mann, 2001; Abou-Saleh, Younis and Karim, 1998). However, Saudi Arabia and other Middle Eastern countries have experienced dramatic economic developments and sociocultural shifts in the last decades (Fatima and Ahmad, 2018; Fath Al Alim, Noon and Abdelghani, 2012; Musaiger and Al-Mannai, 2014). Consequently, Saudi adolescents and young adults are exchanging Arabic traditional values and adopting Western concepts in relation to weight and physical appearance, which can negatively influence the possibility of developing EDs/DEB in young generations (Afifi-Soweid, Najem Kteily and Shediak-Rizkallah, 2002; Latzer, Azaiza and Tzischinsky, 2014; Musaiger, 2014).

4.7 STRENGTHS AND LIMITATIONS

This is the first review to assess the prevalence of EDs/DEBs among Saudi adolescents and young adults. Records selected for this review revealed consistency in terms of study design, setting, and screening tool (Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019; Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Al-Subaie, 2000; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Fatima and Ahmad, 2018; Ghafouri *et al.*, 2021; Loni *et al.*, 2022; Tomar and Antony, 2021).

Self-reported questionnaires were used as screening tools to evaluate the prevalence of such disordered behaviours. Questionnaires are practical tools but appear to be insufficient in

confirming an ED diagnosis, and suspected cases require further clinical assessment (D'Souza, Forman and Austin, 2005). Thus, only studies that applied self-reported instruments were selected. Other methods might also be practical in examining the presence of DEB, including interviews and weight history taking.

Although some studies included the target age group (10–24 years) identified in the inclusion/exclusion criteria, they had to be excluded in the selection process, since they decided that overall conclusions were connected with older participants' findings (faculty members and employees), limiting the ability to draw inferences on adolescents and young adults (Alfhaid *et al.*, 2021; Naguib *et al.*, 2020; Taha, Abu-Zaid and Desouky, 2018). Most selected studies focussed on female adolescents, as they are more vulnerable to engaging in DEB (Mallick, Ray and Mukhopadhyay, 2014; Neumark-Sztainer *et al.*, 2002; Torstveit, Aagedal-Mortensen and Stea, 2015). Particularly, four of the selected studies included male adolescents and yielded contradictory results (Alhazmi and Al Johani, 2019; Ghafouri *et al.*, 2021; Loni *et al.*, 2022; Tomar and Antony, 2021).

In terms of region, most studies were conducted in the western region of Saudi Arabia, which could limit the generalisability of the findings to the wider Saudi population (Alhazmi and Al Johani, 2019; Allihaibi, 2015; Al-Qahtani and Al-Harbi, 2020; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Ghafouri *et al.*, 2021).

Despite how each study presented valuable findings in relation to DEB among school students and adolescents in Saudi Arabia, the cross-sectional nature of the studies increases

the possibility of bias and may limit the generalisability of the findings (Wang and Cheng, 2020). Further research on adolescent males and young people is essential to fill the gaps in the present epidemiological evidence and develop a thorough contextual comprehension of the nature of ED/DEB on the whole population.

In relation to the inclusion/exclusion criteria, some studies did not exclude participants with chronic physical and mental conditions (Alhazmi and Al Johani, 2019; Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Alsubaie *et al.*, 2020). Yet, they did not plan any considerations for them. A specific ED/DEB could be the result of another ailment. It is necessary to exclude them and analyse the prevalence in those with another condition separately (Colton *et al.*, 2004; Froreich *et al.*, 2016; Signal and Hofman, 2022).

These studies were all characterised to have a one-stage process, particularly in relation to the self-reported questionnaires (Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019; Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Al-Subaie, 2000; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Fatima and Ahmad, 2018; Ghafouri *et al.*, 2021; Loni *et al.*, 2022; Tomar and Antony, 2021). No clinical interviews or diagnoses were applied. Few studies linked the lack of clinical diagnostic interventions with limited resources (Allihaibi, 2015; Fatima and Ahmad, 2018).

In some studies, the limited sample size may pose difficulty in generalising the results to general populations (Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Alsubaie *et al.*, 2020; El

Shikieri, 2022; Fatima and Ahmad, 2018). Self-reported questionnaires are considered applicable and affordable tools; however, they have a likelihood of overestimation and may be prone to bias (Althubaiti, 2016). Moreover, it is difficult to exclude the possibility of publication bias, for example, it may be possible studies finding a high prevalence in males are more likely to be published.

4.8 CONCLUSIONS

To our knowledge, this systematic review is the first to explore the prevalence of EDs/DEBs among adolescents and young adults in Saudi Arabia and provide a clear comprehension of the nature of EDs/DEBs by describing them among the Saudi population.

These disorders are found to be a significant problem in this country and the risk of developing such conditions is high across the whole age range included in this review.

Therefore, this noticeable increase in Saudi Arabia must motivate researchers, physicians, and dietitians to develop scientifically based guidelines for assessing, evaluating, and treating these unhealthy behaviours. Saudi adolescents and young adults require educational awareness of healthy food consumption and the possible consequences of DEB.

4.9 Supplementary Materials

The following supporting information can be downloaded at:

<https://www.mdpi.com/article/10.3390/nu15214643/s1>, File S1: Search strategies for

MEDLINE via Ovid, Scopus, Web of Science, Psych Info, and ProQuest via ASSIA

(*Appendix 16*), File S2: JBI quality appraisal (*Appendix 17*).

4.10 AUTHOR CONTRIBUTIONS

Conceptualisation, A.A.; methodology, A.A.; software, A.A.; study selection, A.A. and G.A.; quality assessment, A.A. and G.A.; resources, A.A.; data curation, A.A.; writing— original draft preparation, A.A.; writing—review and editing, A.A., S.J.C. and E.G.; visualisation, A.A.; supervision, S.J.C. and E.G.; funding acquisition, A.A. All authors have read and agreed to the published version of the manuscript.

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4.12 Institutional Review Board Statement

Not applicable.

4.13 Informed Consent Statement

Not applicable.

4.14 Data Availability Statement

Not applicable.

4.15 Acknowledgments

We would like to thank the University of Sheffield Institutional Open Access Fund for its support.

4.16 Conflicts of Interest

The authors declare no conflict of interest.

CHAPTER 5 QUANTITATIVE PHASE (STUDY TWO)

This chapter presents the second PhD primary study, as outlined in the published manuscript format. Due to the limited availability of research on DEBs in Arab countries—especially within Saudi Arabia—the true prevalence of these behaviours may be underestimated. The absence of national surveys further highlights a lack of accessible datasets for secondary analysis. In response to this gap, a cross-sectional quantitative design was adopted to directly assess the prevalence of DEBs among adolescents. This was implemented through the use of a self-reported questionnaire (EAT-26) to assess the risk of DEBs. Data on age, weight, body mass index (BMI), and school region were also collected as predictors of DEB risk.

This study was guided by a clearly defined research question and a specific objective that shaped its scope and methodology.

Research Question: What is the prevalence of DEBs among Saudi female adolescents in Riyadh?

Specific objective: To explore the prevalence of DEBs among adolescent female students in four intermediate and secondary schools in Riyadh, and to analyse predictors related to DEB, including age, BMI, and school regions.

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The content of this chapter is the same as the published version. The manuscript was produced by three co-authors: Azzah Alsheweir, Elizabeth Goyder and Samantha J. Caton. The author contribution section in this chapter clarified the tasks conducted by each author.

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***The Prevalence of Disordered Eating Behaviours (DEBs) among Adolescent Female
School Students in Riyadh, Saudi Arabia: A Cross-Sectional Study***

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5.1 ABSTRACT

Adolescence is a sensitive stage of life that is particularly vulnerable to nutritional problems, including DEBs. This cross-sectional study aims to explore the prevalence of DEBs among adolescent female school students in four intermediate and secondary schools in the city of Riyadh and to examine predictors associated with DEBs, including age, BMI and school regions. A total of 416 female students aged 12–19 years took part in this study. Weight and height were measured for students before the EAT-26 test was completed. Overweight and obesity were observed among 37.7% (n = 157) of students, 50.7% (n = 211) had a normal BMI and 11.5% (n = 48) were underweight. Results indicated that 123 (29.6%) students reported an EAT-26 score of 20 or more, indicating a high risk of DEB. Age was a significant

predictor of DEB risk (OR = 3.087, 95% CI = 1.228–7.760), with the older age group (16–19 years) reporting a higher risk than the younger age group (12–15 years) ($p = 0.017$). DEB risk partially differed by school region, but BMI was not a statistically significant predictor. The high risk group reported more bingeing ($p = 0.008$), induced vomiting ($p < 0.001$), laxative consumption ($p < 0.001$) and exercising ($p < 0.001$) compared with the low-risk group.

Further research is warranted to understand DEB current patterns and predictors.

5.2 KEYWORDS

adolescents; disordered eating behaviours; eating disorders; age; weight; BMI; region; EAT-26; Saudi Arabia

5.3 INTRODUCTION

Disordered eating behaviours (DEBs) are behaviours and attitudes acknowledged as a part of the eating disorder (ED) spectrum (American Dietetic Association, 2006). Such behaviours (binge eating, dietary restriction, self-induced vomiting, diet and hunger-repressive pills, diuretics and laxatives) are practiced by approximately 10–20% of adolescent females in Western countries, with estimates reaching 40% for some behaviours (Neumark-Sztainer *et al.*, 2002; Torstveit, Aagedal-Mortensen and Stea, 2015). Micali and colleagues (2014) identified that the peak age of onset for such behaviours is between 15 and 19 years of age among females.

These behaviours may result in the development of a fully diagnosable eating disorder, such as binge-eating disorder (BED), anorexia nervosa (AN) or bulimia nervosa (BN), which can have major psychological and physiological complications (Harrison *et al.*, 2020; Pereira and Alvarenga, 2007).

Adolescence is seen as a particularly nutritionally susceptible stage of life (Spear, 2002; Stang and Stotmeister, 2017). The substantial increase in physical growth and development, as well as the shift in lifestyle and eating habits of adolescents, all contribute to an increased demand for nutrients that affects both nutrient intake and requirements (Spear, 2002).

Restricting energy consumption can be concerning for adolescents, as it may lead to binge eating, irritability, impaired growth and sexual maturation and an elevated risk of DE (Stang and Stotmeister, 2017).

Adolescent females are identified to be more prone to DEBs compared with males or other age groups (Yu and Tan, 2016). Particularly, these behaviours are commonly considered the most prevalent health problem associated with obesity in female adolescents (Stabouli *et al.*, 2021; Yu and Tan, 2016). A multi-dimensional assessment of disordered eating and body dissatisfaction found that Asian females exhibited more body dissatisfaction and DEB than American females (Jung and Forbes, 2006). In other studies concerned with measuring the risk of DEB among adolescents in Arab countries, the risk of DEB in Arab female adolescents was found to be similar to that reported in Western countries and twice as high as reported in South-East Asian countries (Francisco *et al.*, 2015; Haines *et al.*, 2011; Musaiger

et al., 2013; Nishizawa *et al.*, 2003; Yang, Choi and Lee, 2001). BMI and shape concerns can have a direct or indirect association with DEB (Fan *et al.*, 2010).

Evidence indicates that weight gain contributes to elevated body concerns and dieting behaviours in adolescents (Al Sabbah *et al.*, 2009; Franklin *et al.*, 2006; Lynch *et al.*, 2007).

Weight control behaviours and shape concerns increase the possibility of the onset and persistence of ED (Jacobi *et al.*, 2004; Kotler *et al.*, 2001; Neumark-Sztainer *et al.*, 2006). It is imperative to understand that shape concerns and weight control behaviours may act as mediators between BMI and ED symptoms (Fan *et al.*, 2010).

Studies that focused on DEB prevalence rates and age have varied greatly depending on the methodology used and the sample analysed (Jones *et al.*, 2001). Early research indicates that female adolescents engage in more DEBs as they age since they tend to make more social comparisons related to shape and appearance (Hoare and Cosgrove, 1998; Martin and Kennedy, 1993; Rosenblum and Lewis, 1999). A meta-analysis assessed the level of DEB in children and adolescents aged 7 to 18 years from 16 different countries, including Saudi Arabia, and found that more practices of disordered eating were reported with increasing age (López-Gil *et al.*, 2023). The findings from our systematic review, focusing specifically on Saudi Arabia, were also consistent with the age pattern and DEB, as it was noted that older university students had more DEBs (29.4–65.5%) compared with school students (10.2–42.5%) (Alsheweir *et al.*, 2023).

Regional variances and DEB were distinctive in the literature by Western and non-Western classifications (Rikani *et al.*, 2013). Only a few research studies have explored the relationship between urban region residence and DEB, acknowledging that the connection between urbanisation and ED is complex rather than causal and likely to vary across contexts/populations (Hay and Mitchison, 2021). It should be noted that Saudi Arabia has undergone fast economic expansion over the last four decades, accompanied by a dramatic improvement in living standards and the adoption of a “Westernised” lifestyle characterised by unhealthy eating habits and less physical activity (Al-Mendalawi and Asghar, 2010). Our systematic review indicated that the prevalence ranged from 29.4% to 65.5% in the eastern region compared with 48.1% in the northwestern region (Alsheweir *et al.*, 2023). The northern regions had the lowest prevalence (25.4%) (Alsheweir *et al.*, 2023). This is an increasingly important public health concern globally, and surveys in Arab countries, including Saudi Arabia, confirm this concern in the context of increasing overweight and obesity in both adult and school-age populations and high levels of DEB in school-age populations (Alsheweir *et al.*, 2023; López-Gil *et al.*, 2023).

Despite the significant prevalence of DEBs, few studies have been carried out in Arab nations (Fatima and Ahmad, 2018). The city of Riyadh, the capital of Saudi Arabia, was selected for this study to explore the prevalence of DEB among adolescent females in intermediate and secondary schools, as we identified a lack of research (with only one other study conducted there more than 20 years previously). That study identified that already 15.9% of female

students from intermediate and secondary schools in Riyadh reported DEBs (Al-Subaie, 2000). We know from studies in other parts of Saudi Arabia and other Arab countries that prevalence was likely to have increased since that study and therefore a further study was warranted (Alsheweir *et al.*, 2023). This piece of research presents a novelty in the world of scientific evidence, as it provides an in-depth exploratory analysis of EAT-26 scores, its subscales and the behavioural questions embedded among female adolescents in a city that has never been thoroughly explored regarding DEB. Therefore, the present cross-sectional study is an exploratory study aiming to assess the prevalence and identify predictors of DEB among adolescent female school students in intermediate and secondary schools in Riyadh. The objectives addressed in this study include: (1) identifying the prevalence of DEB in Saudi female adolescents; (2) measuring the prevalence of unhealthy weight (under- and overweight); (3) examining the differences in EAT-26 scores and variations in age groups, BMI categories and school regions; (4) identifying the differences in behavioural questions according to variations in age groups, BMI categories, EAT-26 categories (low risk/high risk) and school regions; (5) examining the correlation between EAT-26 subscales (dieting scale, oral control scale and bulimia and food preoccupation scale) with age and BMI.

5.4 MATERIALS AND METHODS

5.4.1 STUDY DESIGN AND SETTING

This cross-sectional study included self-administered surveys and anthropometric measurements. It was implemented in intermediate and secondary governmental schools in

the city of Riyadh (the capital and largest city in Saudi Arabia) in March/April 2023. Ethical approval was provided by the Research Ethics Committee at the University of Sheffield (Reference Number 050493- *Appendix 13*) and the Research Ethics Committee at King Saud University in Riyadh (No. E-23-7551- *Appendix 14*), with adherence to the principles outlined in the Declaration of Helsinki 1975.

5.4.2 PARTICIPANTS AND RECRUITMENT

In Saudi Arabia, the education system is regulated by the Ministry of Education (MoE) and the Education Evaluation Commission (EEC). In the education system in Saudi Arabia, the formulated school years start with elementary (6–11 years), then intermediate (12–14 years), followed by secondary school (15–17 years). Intermediate education comprises three years (grades seven, eight and nine), and secondary education consists of three years (grades ten, eleven and twelve). Schools were selected from different regions in the city of Riyadh to detect differences in DEB and region. All selected schools were governmental schools, so the students were representative of the local population. Four schools were selected from the northern, western and eastern regions to ensure a more representative sample by including all regions of Riyadh. However, no schools were selected from the southern regions, since the majority of students in this area are non-Saudis. Population projections from mid-2021, as reported by the General Authority of Statistics, showed that non-Saudis made up 36.4% of the overall population (General Authority for Statistics, 2021). A total of 416 female students, aged 12–19 years, were recruited from the following schools: the 128 Secondary School

(North) and the 213 Intermediate School (North) in AsSahafa district, the 59 Secondary School (East) in ArRawda district and the 40 Intermediate School (West) in AsSuwaidi.

Girls with chronic diseases, such as hypertension, diabetes and hyper/hypothyroidism, or diagnosed with an eating disorder were excluded.

In order to estimate the minimum number of participants to estimate the prevalence of DEB and associated behaviours, the sample size was calculated using Open Epi software, Version 3 for epidemiologic statistics (Supplementary Material File S1- *Appendix 18*). It was accessed through the CDC website as a statistical calculator for cohort and cross-sectional designs (Epi Info™, 2022; Dean, Sullivan and Soe, 2013). The smallest number of participants required to estimate the prevalence of DEB calculated at a 95% confidence level was 207 students, assuming a prevalence of 16% (Al-Subaie, 2000). However, 416 students were recruited to explore differences in DEB prevalence between age groups and BMI categories.

5.4.3 PROCEDURE

After receiving a formal letter from the MoE with the schools' names enclosed, the schools were visited and parental consent forms were delivered. Collaborating with school heads and teachers, students gave their parents an information sheet that explained the nature of this study, data collected, tools/methods used and an informed consent form that asked parents' permission for their daughters' participation in this study by signing the form and returning it to school. It was highlighted that all data collected would be anonymised and only used for

this research study and no individual data would be shared by the researcher. Recruited students were invited to join an introductory session guided by the main researcher. During this session, this study was explained in full and student participants were given a participant information sheet and consent form that they were required to complete before partaking in the research. The data collection process in this study included anthropometric measurements and self-reported questionnaires.

After collecting the signed consent forms from students, they were called individually for anthropometric measurements, including measuring the students' weight and height. The Eating Attitudes Test (EAT-26) was then distributed to students in an available classroom. They were reminded about the objectives of this study and the confidentiality of the acquired data.

5.4.4 ANTHROPOMETRIC DATA

Weight was measured in kilograms (kg) to the nearest 0.1 kg using an electronic weighing scale (Salter Ultimate Accuracy, Bilston, UK). The scale was calibrated and checked prior to the data collection session. A portable stadiometer (Seca 217 Mobile Stable Stadiometer-Portable Height Measurement Rod) measured height in centimetres (cm) to the nearest 0.1 cm. Students were asked to take off their shoes and empty their pockets of any heavy items. To maintain confidentiality, students were asked to stand backwards on the weighing scale, and a piece of paper was attached below the reading (as a shield) to limit students' ability to view the reading. BMI was calculated using the reported reading by following the Quetelet

equation: $\text{BMI} = \text{weight (kg)} / \text{height (m}^2\text{)}$. The WHO guidelines were used, as these are commonly used in similar populations, and BMI was classified as underweight ($\text{BMI} < 18.5 \text{ kg/m}^2$), normal weight ($18.5\text{--}24.9 \text{ kg/m}^2$), overweight ($25.9\text{--}29.9 \text{ kg/m}^2$) and obese ($\geq 30 \text{ kg/m}^2$) (Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019; Allihaibi, 2015; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Al-Subaie, 2000; Alwosaifer *et al.*, 2018; Ghafouri *et al.*, 2021).

5.4.5 QUESTIONNAIRE: EATING ATTITUDES TEST (EAT-26)

The EAT-26 is a validated tool that has been used for evaluating DEB (Garner *et al.*, 1982; Gleaves *et al.*, 2014). It consists of 26 questions subdivided into 3 subscales: dieting (13 items), bulimia/food preoccupation (5 items) and oral control (7 items). Questions have 6-point Likert-scale responses, with scores ranging from 0 to 3 (“Never”, “Rarely” and “Sometimes”: 0; “Often”: 1; “Very often”: 2; “Always”: 3), with question 26 scored conversely (“Often”, “Very often” and “Always”: 0; “Sometimes”: 1; “Rarely”: 2; “Never”: 3). Scores range from 0 to 78, and a score ≥ 20 indicates DEB (Garner *et al.*, 1982). Five additional behavioural questions related to food habits in the last six months are found at the end of the questionnaire. Four questions are related to the frequency of binge eating, self-induced vomiting, using laxatives and exercising, with answers: never, once a month or less, 2–3 times a month, once a week, 2–3 times a week and once a day or more. The fifth question is a yes/no question related to losing 9 kg or more in the last six months.

The Arabic version of EAT-26 was used as it has been previously validated as a highly sensitive tool for ED screening (Al-Adawi *et al.*, 2002; Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019; Al-Qahtani and Al-Harbi, 2020; Alwosaifer *et al.*, 2018). This tool has high criterion-related validity and internal consistency ($\alpha = 0.90$) validated for the Saudi population (Alsubaie *et al.*, 2020). A pilot study was implemented on ten students prior to data collection to ensure validity. Reliability analysis was implemented to determine the validity of the Arabic EAT-26 test used in this study and the test showed good internal consistency and reliability ($\alpha = 0.774$).

5.4.6 DATA ANALYSIS

Data were entered and analysed using the Statistical Package for the Social Sciences software SPSS (version 29). Descriptive statistics were presented as means, standard deviations, frequencies and percentages. For research purposes and to facilitate comparisons between study categories, students were grouped into younger (12–15 years) and older (16–19 years) groups to reflect the general demographics in intermediate versus secondary school.

Participants were also grouped according to their EAT-26 scores into a high-risk (EAT-26 $\geq$ 20) and a low-risk group (EAT-26 $<$ 20) (Garner *et al.*, 1982; Gleaves *et al.*, 2014). A regression analysis was used to investigate the differences in scores among age, BMI and schools (regions). Responses for EAT-26 subscales and behavioural questions were reported as means and standard deviations for the total sample of students. A Chi-square test (χ^2) was used to determine the differences in responses across age groups, BMI groups and EAT-26

categories. A Pearson correlation was used to evaluate the link between the continuous scores of EAT-26 subscales with age and BMI. A p-value of <0.05 was considered statistically significant.

5.5 RESULTS

5.5.1 DEMOGRAPHIC CHARACTERISTICS

A total of 416 students took part in this research, selected from four governmental intermediate and secondary schools in the city of Riyadh. The mean age of all students was 14.56 years (SD = 1.89), with a minimum age of 12 and a maximum of 19 years. The mean BMI was 22.56 kg/m² (SD = 4.92). Half of the students had a normal BMI (n = 211, 50.7%), followed by overweight students (n = 102, 24.5%). Fifty-five students were obese (13.2%) and forty-eight were classified as underweight (11.5%). Other demographic data are presented in Table 5.

Table 5 Demographic Characteristics of the Study Population.

Variable	N	%
Age (n=416)		
12–13 years	172	41.3
14–15 years	95	22.8
16–17 years	121	29.1
18–19 years	28	6.7
Mean±SD	14.56±1.89	
School (Region)		
128 Secondary School (North)	63	15.1
213 Intermediate School (North)	135	32.5
59 Secondary School (East)	117	28.1
40 Intermediate School (West)	101	24.3
Grade		
Intermediate Grade 7	174	41.8

Grade 8	55	13.2
Grade 9	7	1.7
Secondary		
Grade 10	83	20
Grade 11	41	9.9
Grade 12	56	13.5
Weight Mean±SD	56.39±13.71	
Height Mean±SD	157.8±6.32	
BMI Mean±SD	22.56±4.92	
Underweight	48	11.5
Normal	211	50.7
Overweight	102	24.5
Obese	55	13.2

5.5.2 EAT-26 SCORES

Across the study population, 123 students (29.6%) reported a score of 20 or more, indicating a high risk of DEB. Three-quarters (n = 293, 70.4%) of the study population scored lower than 20, reporting a low risk of DEB.

To determine the prevalence of DEB risk across age groups, BMI categories and school regions, a binary logistic regression was used. Table 6 demonstrates the distribution of age, BMI and school region across EAT-26 categories. Age significantly predicted DEB risk (OR = 3.087, 95% CI = 1.228–7.760), with a higher risk reported among the older age group compared with the younger age group (p = 0.017). BMI was not a statistically significant predictor of DEB. However, students in the obese category (38.2%) reported the highest risk, followed by students in the normal weight category (29.4%). For variations in EAT-26 scores among schools, only the 213 Intermediate School in the north (OR = 3.109, 95% CI = 1.016–

9.509, $p = 0.047$) and the 40 Intermediate School in the west ($OR = 3.071$, 95% CI = 1.016–9.282, $p = 0.047$) showed significant difference compared with the reference group.

Table 6 Distribution of EAT-26 Scores by Age, BMI and School

EAT-26 Categories			P-Value	OR	95% CI
High risk (EAT-26≥20)	Low risk (EAT-26<20)				
Age					
Younger (12–15 years)	74 (27.7%) ¹	193 (72.3%)	0.017*	3.087	1.228-7.760
Older (16–19 years)	49 (32.9%)	100 (67.1%)			
BMI					
Underweight ^{\$}	11 (22.9%)	37 (77.1%)	0.322		
Normal	62 (29.4%)	149 (70.6%)	0.430	1.349	0.641-2.837
Overweight	29 (28.4%)	73 (71.6%)	0.433	1.382	0.616-3.103
Obese	21 (38.2%)	34 (61.8%)	0.080	2.194	0.911-5.286
School (Region)					
128 Secondary School (North) ^{\$}	18 (28.6%)	45 (71.4%)	0.185		
213 Intermediate School (North)	40 (29.6%)	95 (70.4%)	0.047*	3.109	1.016-9.509
59 Secondary School (East)	34 (29.1%)	83 (70.9%)	0.607	1.202	0.596-2.424
40 Intermediate School (West)	31 (30.7%)	70 (69.3%)	0.047*	3.071	1.016-9.282

¹ Results are explained in n (%), [§] Reference group, * Significant P value

5.5.3 EAT-26 SUBSCALES (DIETING, ORAL CONTROL AND BULIMIA AND FOOD PREOCCUPATION)

According to students' responses on the dieting subscale from the EAT-26 test, the higher means were reported for statements that related to burning calories while exercising (1.33 ± 1.31), followed by the fear of being overweight (1.07 ± 1.25) and preoccupation with the

desire to be thinner (1.06 ± 1.26). Responses to oral control subscale statements revealed that displaying self-control around food had the highest mean (1.37 ± 1.23), followed by thoughts from other people of being too thin (0.92 ± 1.24) and taking longer than others to eat meals (0.72 ± 1.11). Based on the bulimia and food preoccupation subscale, feelings that food controls life (0.50 ± 0.93) had the highest mean, followed by being preoccupied with food (0.38 ± 0.79) (*Table 7*).

Table 7 Students' Responses to EAT-26 Dieting Subscale, Oral Control Subscale, Bulimia & Food Preoccupation Subscale

Students' Responses to EAT-26 Dieting Subscale		
Q	Dieting Scale Questions	Mean± SD
1	I am terrified about being overweight	1.07± 1.25
6	Aware of the calorie content of food that I eat	0.64±1.06
7	Particularly avoid food with a high carbohydrate content (i.e. bread, rice, potatoes..etc)	0.28±0.71
10	Feel extremely guilty after eating	0.48±0.99
11	Am preoccupied with a desire to be thinner	1.06±1.26
12	Think about burning up calories when I exercise	1.33± 1.31
14	Am preoccupied with the thought of having fat on my body	0.67±1.09
16	Avoid foods with sugar in them	0.32±0.72
17	Eat diet foods	0.35±0.79
22	Feel uncomfortable after eating sweets	0.62±1.06
23	Engage in dieting behaviour	0.26±0.73
24	Like my stomach to be empty	0.53±1.0
26	Enjoy trying new rich foods	0.74± 0.99
Students' Responses to EAT-26 Oral Control Subscale		
Q	Oral Control Scale Questions	Mean± SD
2	Avoid eating when I am hungry	0.44± 0.87
5	Cut my food into small pieces	0.42±0.89
8	Feel that other would prefer if I eat more	0.59±1.05
13	Other people think that I am too thin	0.92±1.24
15	Take longer than other to eat my meals	0.72±1.11
19	Display self-control around food	1.37± 1.23
20	Feel that other pressure me to eat	0.71±1.16
Students' Responses to EAT-26 Bulimia & Food Preoccupation Subscale		

Q	Bulimia & Food preoccupation Scale Questions	Mean± SD
3	Find myself preoccupied with food	0.38± 0.79
4	Have gone on eating binges where I feel that I may not be able to stop	0.20±0.63
9	Vomit after I have eaten more	0.14±0.52
18	Feels that food controls my life	0.50±0.93
21	Give too much time and thought to food	0.32±0.83
25	Have the impulse to vomit after meals	0.22±0.68

5.5.4 BEHAVIOURAL QUESTIONS

For behavioural question responses, Table 8 shows the frequency of binge eating, induced vomiting, using laxatives, exercising and losing weight among students. Approximately 4% of students (n = 16) reported having binge episodes once or more per day and 3.6% (n = 15) reported doing so two to six times per week. In the previous six months, about 9% of students claimed to have experienced two or more induced-vomiting episodes.

Thirteen students (3.1%) reported consuming laxatives to control weight two times or more and 173 students (41.5%) claimed to work out for 60 min two times or more in the last six months in an effort to reduce or maintain their weight. In terms of weight loss in the previous six months, approximately 15% of students (n = 61) reported dropping 9 kg.

Table 8 Responses to Behavioural Questions Based on the Six Past Months

Behavioural Questions	(n,%)					
	Never	Once a month or less	2-3 times a month	Once a week	2-6 Times a week	Once a day or more
QA: Gone on binges where you feel that you may not be able to stop?	258, 62%	81, 19.5%	33, 7.9%	13, 3.2%	15, 3.6%	16, 3.8%

QB: Ever made yourself sick (vomited) to control your weight or shape?	358, 86%	22, 5.3%	7, 1.7%	10, 2.4%	4, 1%	15, 3.6%
QC: Ever used laxatives, diet pills or diuretics (water pills) to control your weight or shape?	395, 95%	8, 1.9%	5, 1.2%	3, 0.7%	1, 0.2%	4, 1%
QD: Exercised more than 60 minutes a day to lose or control your weight?	160, 38.5%	83, 20%	51, 12.3%	58, 13.9%	37, 8.9%	27, 6.4%
		Yes	No			
QE: Lost 9 kilograms or more in the last 6 months.		61, 14.7%	355, 85.3%			

5.5.5 BEHAVIOURAL QUESTIONS (QA BINGE EATING, QB VOMITING, QC LAXATIVES, QD EXERCISING) AND AGE

Figure 9 shows students' responses by age group. Among behaviours, binge eating and exercising differed significantly across age groups. In relation to binge eating, 8 younger students reported binge eating two to six times a week (3%) and 13 reported binge eating once a day or more (4.9%) versus 7 (4.7%) students and 3 (2%) students from the older group, respectively ($\chi^2 (5) = 24.174$, $p < 0.001$). Exercising more than 60 min per day differed significantly, with more students in the younger group exercising two to six times a day ($n = 20$, 7.5%) compared with students in the older group ($n = 17$, 11.4%), and more students in the younger group ($n = 22$, 8.2%) exercising once a day or more compared with students in the older group ($n = 5$, 3.4%) ($\chi^2 (5) = 11.601$, $p = 0.041$).

5.5.6 Behavioural Questions (QA Binge Eating, QB Vomiting, QC Laxatives, QD Exercising) and BMI

Only exercising was associated with the BMI category ($\chi^2 (15) = 35.685, p = 0.002$) (**Figure 10**). Students in the overweight category reported the highest percentage for those exercising two to six times a week (14.7%) and once a day or more (7.8%) in the previous six months, followed by students in the normal weight category, with 8.5% exercising two to six times a week and 7.1% exercising once a day or more. Among those classified as obese, 5.5% reported exercising two to six times a week and 3.6% reported exercising once a day or more compared with 2.1% and 4.2% of students in the underweight category.

Figure 9 Responses to Behavioural Questions According to Age Group.

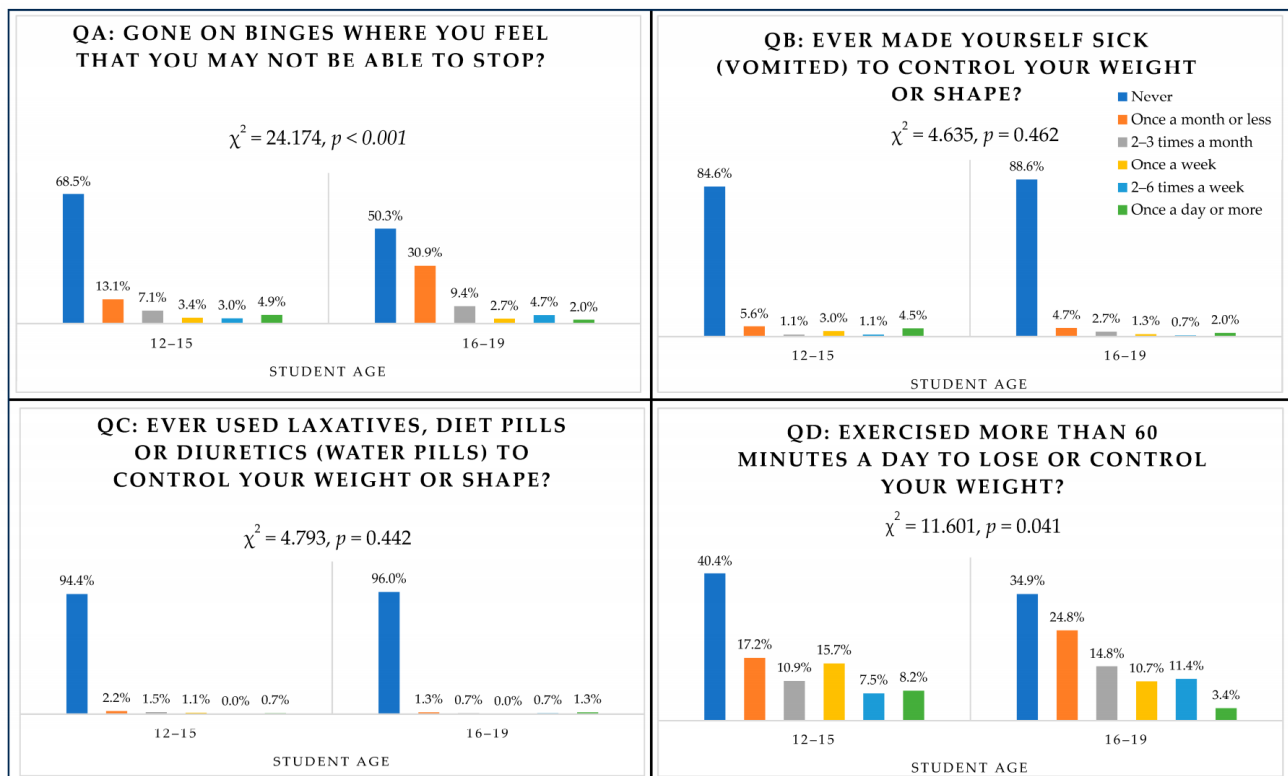


Figure 10 Responses to Behavioural Questions According to BMI Group.

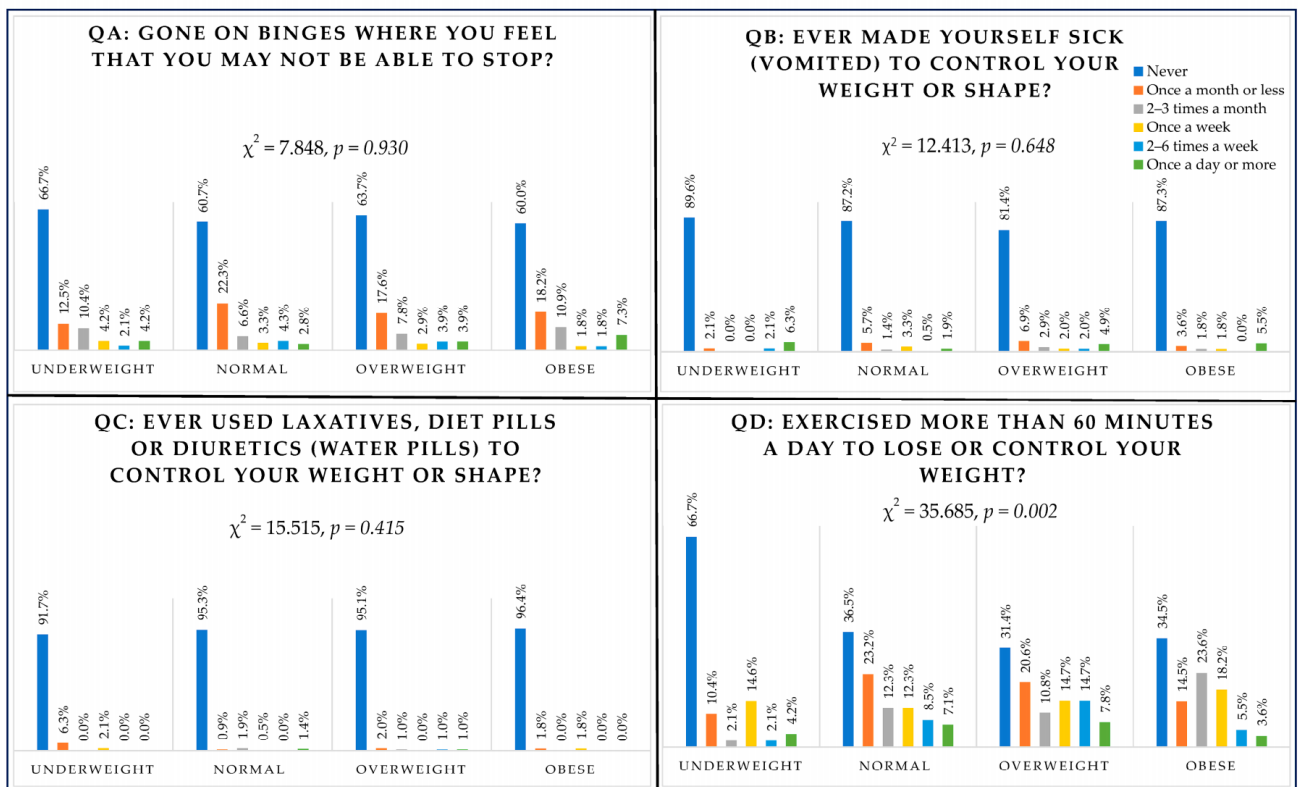
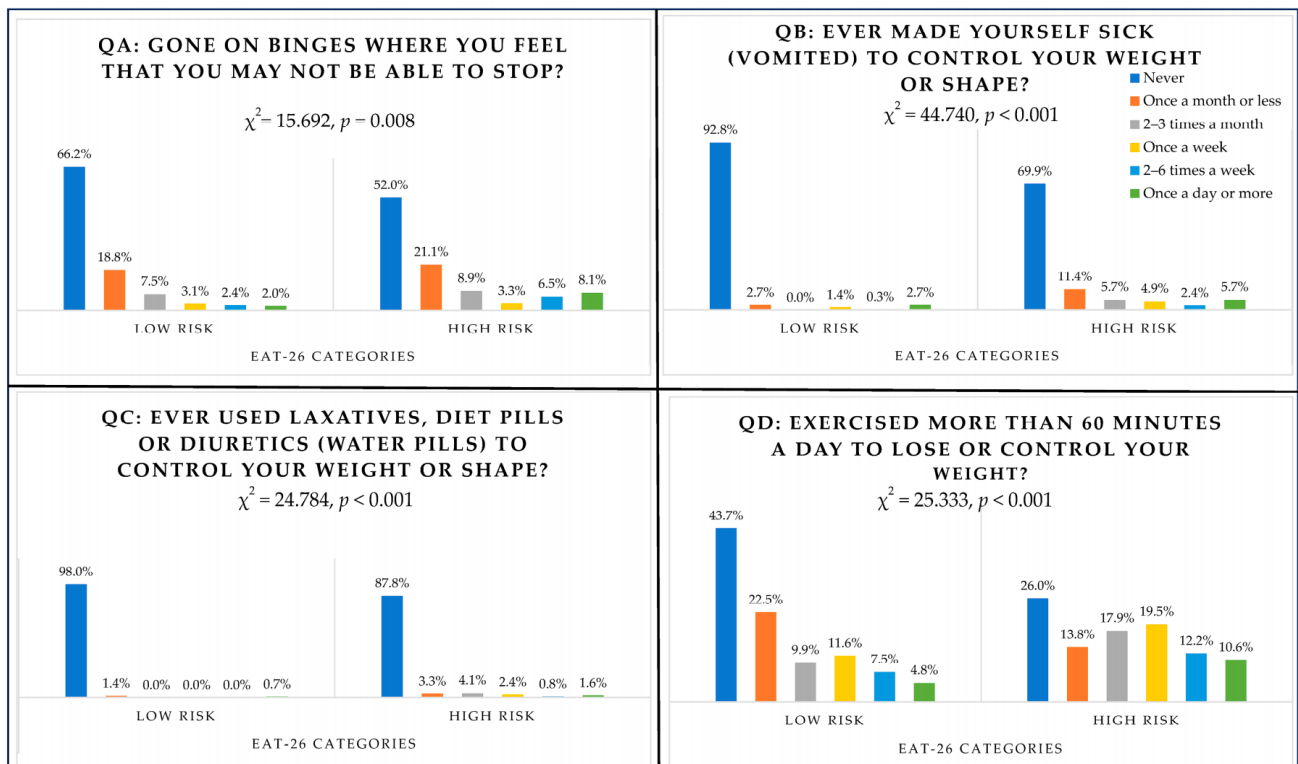


Figure 11 Responses to Behavioural Questions According to EAT-26 Categories



5.5.7 BEHAVIOURAL QUESTIONS (QA BINGE EATING, QB VOMITING, QC LAXATIVES, QD EXERCISING) AND EAT-26 SCORES (HIGH RISK/LOW RISK)

As shown in Figure 11, responses to behavioural questions were categorised according to EAT-26 scores. All behavioural questions revealed significant differences between high-risk and low-risk groups. Binging was greater among the high-risk group, which scored 20 or more on the EAT-26 test, with 3.3% ($n = 4$) binging once a week, 6.5% ($n = 8$) of students binging two to six times a week and 8.1% ($n = 10$) binging once a day or more ($\chi^2 (5) = 15.692$, $p = 0.008$). Induced vomiting was reported once a week by six high-risk students (4.9%) ($\chi^2 (5) = 44.740$, $p < 0.001$). Three high-risk students reported inducing vomiting two to six times a week (2.4%) and seven students reported it once a day or more (5.7%).

Consuming laxatives appeared to be the least common behaviour experienced by students, with only three high-risk students (2.4%) using laxatives once a week, one student (0.8%) using them two to six times a week and two students (1.6%) consuming them once a day or more ($\chi^2 (5) = 24.784$, $p < 0.001$). Exercising for 60 min or more for the sake of losing weight was reported once a week by 19.5% of high-risk students ($n = 24$), 12.2% ($n = 15$) exercised two to six times a week and 10.6% ($n = 13$) exercised once a day or more ($\chi^2 (5) = 25.333$, $p < 0.001$).

5.5.8 BEHAVIOURAL QUESTION E (WEIGHT LOSS) AND AGE, BMI, EAT-26 SCORES (HIGH/LOW RISK)

As shown in Figure 12, weight loss did not differ significantly across age groups ($p = 0.362$) and BMI categories ($p = 0.207$). However, weight loss varied significantly with EAT-26 categories ($\chi^2 (1) = 17.987, p < 0.001$). Out of the high-risk group, 32 students (26%) reported losing 9 kg or more in the last six months.

5.5.9 BEHAVIOURAL QUESTIONS AND SCHOOLS (REGIONS)

In relation to students' responses to behavioural questions across schools, none of the behaviours showed significant differences, except for binge eating ($\chi^2 (15) = 35.556, p = 0.002$). The proportion of students who reported binge eating once a day or more ranged from 3% to 7% within schools, with the highest percentage reported by students from the 40 Intermediate School in the west ($n = 7, 7\%$), followed by the 128 Secondary School in the north ($n = 2, 3.2\%$). The proportion of students who had binge-eating episodes 2–6 times a week ranged from 2% to 4.4% across schools, with the highest percentage reported from the 213 Intermediate School in the north ($n = 6, 4.4\%$) followed by the 59 Secondary School in the east ($n = 5, 4.3\%$).

5.5.10 CORRELATION BETWEEN EAT-26 SUBSCALES WITH AGE AND BMI

Pearson correlation was used to evaluate the associations between the EAT-26 Dieting scale, oral control scale and bulimia food preoccupation scale with age and BMI (Fatima and Ahmed, 2018). As shown in Table 9, age was not associated with any of the EAT-26

subscales. BMI had a Positive association with the dieting scale ($p < 0.001$) and a negative association with oral control ($p < 0.001$).

Figure 12 Responses to Behavioural Question E According to Age, BMI and EAT-26 Categories

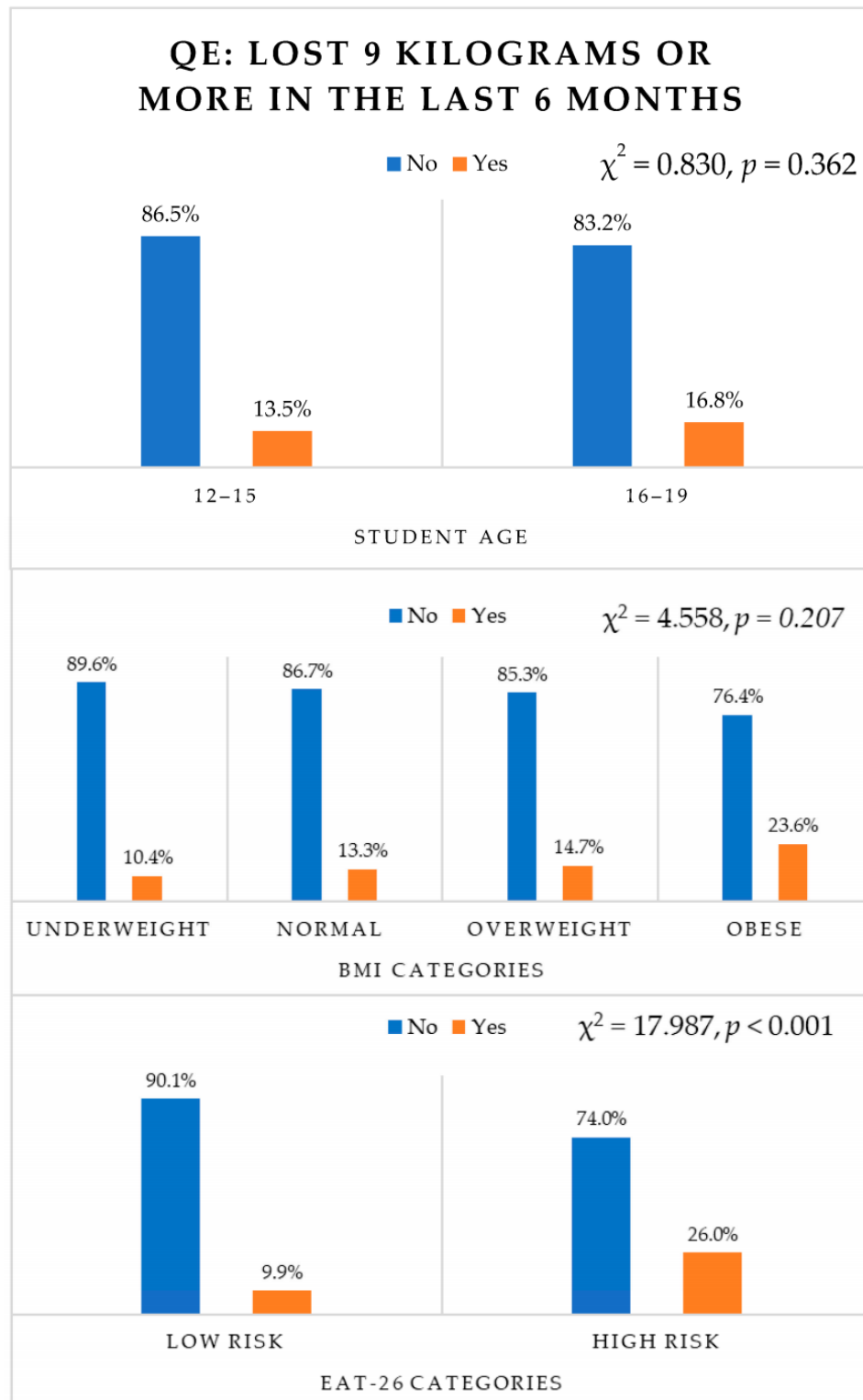


Table 9 Correlation of Students' EAT-26 Subscales with Age and BMI

	Dieting scale	Oral Control Scale	Bulimia and Food Preoccupation Scale
Age	0.069	-0.069	0.075
BMI	0.347*	-0.299*	0.074

* p-value is ($p < 0.001$)

5.6 DISCUSSION

This is the first study that explores Saudi female adolescents in the city of Riyadh and their DEBs using the EAT-26 test by assessing each individual's behaviour (binging, induced vomiting, consuming laxatives, intensive exercising and losing weight) and exploring variations with age, BMI, EAT-26 scores (high/low risk) and regions employing a comprehensive analysis of results. The main objectives highlighted in this research include identifying the prevalence of DEB; measuring the prevalence of unhealthy weight (under- and overweight); examining the variations of EAT-26 scores in relation to age, BMI and school regions; identifying the differences in behavioural question responses according to age groups, BMI categories and EAT-26 categories (high/low risk); and determining the correlation between EAT-26 subscales (dieting scale, oral control scale and bulimia and food preoccupation scale) with age and BMI.

Overall, the results of the current study showed that the prevalence of DEB in Saudi female adolescents is 29.6%. Unhealthy weight (under- and overweight) prevalence was 24.7%, with

55 students categorised as obese (13.2%) and 48 students categorised as underweight (11.5%). According to the EAT-26 scores, only age was identified as a significant predictor of DEB, with a higher risk reported among the older age group compared with the younger age group. For behavioural questions, bingeing and exercising showed significant variations among the older and younger groups, with older girls demonstrating more bingeing and exercising compared with younger girls. Exercising was the only behaviour that varied significantly across BMI categories, with girls categorised as overweight demonstrating the highest levels of exercising, followed by the obese category. Significant variations were noted among high- and low-risk groups concerning all behaviours—bingeing, induced vomiting, consuming laxatives, exercising and losing weight—with the high-risk group demonstrating more engagement. The tested correlation between EAT-26 subscales with age and BMI found that only BMI was positively associated with the dieting scale and negatively associated with oral control.

One significant finding was that 29.6% of female school students in Riyadh were categorised as a high risk of DEB, attaining a score of 20 or more on the EAT-26. This rate was significantly higher than the 15.9% reported by Al-Subaie, who recruited female students from intermediate and secondary schools in Riyadh (Al-Subaie, 2000). However, Allihaibi (2015) concluded that the prevalence was 26.1% among female secondary students in Makkah (western region of Saudi Arabia), which was only slightly lower than our findings. On the other hand, Al-Qahtani and Al-Harbi (2020) identified a higher prevalence of such

behaviours in female secondary students in Madina (western region of Saudi Arabia), at 42.5%.

These variations in prevalence rates could be due to methodological differences between studies, populations and settings. Specifically, the tool that was employed may have contributed to the variations in the research findings in Riyadh; for example, while we used the EAT-26, Al-Subaie (2000) employed the EDI-DT.

Age appeared to be a significant predictor of DEB, with older adolescents at a higher risk compared with younger adolescents. This was consistent with earlier and recent findings that confirmed that the prevalence and intensity of DEB increased with age (Bartholdy *et al.*, 2017; Hoare and Cosgrove, 1998; López-Gil *et al.*, 2023; Martin and Kennedy, 1993; Neumark-Sztainer *et al.*, 2002; Rosenblum and Lewis, 1999).

It was also compatible with our systematic review findings that identified an elevated risk of DEB among older Saudi students compared with younger counterparts (Alsheweir *et al.*, 2023). A rationale for this distinct pattern is the age-related increase in self-consciousness, including interior and exterior aspects of self, associated with concerns of social acceptance and self-presentation (Rankin *et al.*, 2004). For that, mid-adolescence (14–17 years) is a critical stage for females to be at a significant risk for emotional and dietary disturbances (Ferreiro, Seoane and Senra, 2012). However, it is important to acknowledge that the literature findings were not conclusive in relation to age, as most studies were focused on

comparing adolescents and young adults rather than the full age spectrum of adolescents (Jones *et al.*, 2001).

Our results from this cross-sectional survey that the BMI category was not a significant predictor of DEB appeared inconsistent with previous evidence, suggesting that higher BMIs are a potential risk factor for DEBs. However, in our analysis, BMI was significantly associated with dieting subscale scores and inversely associated with oral control subscale scores. Despite non-significant findings, the results indicated that students with obesity were at almost double the risk of DEB compared with students who were underweight.

Significant BMI with dieting subscale scores indicated that students with overweight and obesity tended to diet and restrict food and were preoccupied with thinness more than their counterparts with normal and underweight BMI (Garner *et al.*, 1982; Ocker *et al.*, 2007).

Moreover, BMI was inversely associated with oral control subscale scores, indicating that students with lower BMI had more self-control overeating and experienced higher levels of pressure from others to gain weight compared with students with overweight and obesity (Garner *et al.*, 1982; Ocker *et al.*, 2007). Studies from Saudi Arabia and Arab countries have confirmed a significant connection between BMI and DEB risk with adolescents living with overweight and obesity, showing a higher risk of DEB compared with normal BMI adolescents (Fatima and Ahmed, 2018; Musaiger *et al.*, 2013; Musaiger *et al.*, 2016). It was noted that, regardless of gender, adolescents with obesity had a two-to-three times higher likelihood of having a DEB than adolescents who were non-obese (Fatima and Ahmed,

2018). In Kuwait, when comparing students who were obese and non-obese, both genders of students with obesity were at a twofold-increased risk of developing DEB (Musaiger *et al.*, 2016). Similarly, studies from the UK and the US reported significantly more DEB in groups that were overweight and obese (Nagata *et al.*, 2018; Solmi *et al.*, 2014).

School regions in Riyadh did not appear to be a strong predictor of DEB, with only two schools showing significant variations—the 213 Intermediate School in the north and the 40 Intermediate School in the west. Due to the lack of literature that focuses attention on the epidemiology of DEB and region, explaining differences can be complex (Alwosaifer *et al.*, 2018). Hay and Mitchison (2021) highlighted in their scoping review that urbanisation can be associated with increasing DEB risk when it is linked with other sociodemographic factors. Miller and Pumariega (2001) confirmed that cultural beliefs can be major contributors to the development of DEB and suggested that cultural change may be related to an increased sensitivity to disordered behaviours, particularly when physical appearance concepts are implicated.

All individual DEBs, including bingeing, induced vomiting, consuming laxatives, exercising and losing weight, were significantly higher among students who scored 20 or more on the EAT-26. Among the high-risk group, bingeing was reported once a day or more by 8% of students and 6.5% reported bingeing two to six times a day. About 6% engaged in induced vomiting once a day or more and 26% reported losing 9 kg or more in the last 6 months.

Comparable rates were presented in other studies using the same test in Saudi Arabia and Western countries (Al-Qahtani and Al-Harbi, 2020; Jones *et al.*, 2001). A Saudi cross-sectional study addressing the prevalence of DEB among 393 high-school female students aged 15 to 20 years in Al-Madinah City, Saudi Arabia, identified that 25.2% practiced bingeing behaviour, followed by induced vomiting (8.7%) and the use of laxatives (6.1%) (Al-Qahtani and Al-Harbi, 2020). Another study evaluated the prevalence of such disorders among female students aged 12–18 years from schools in the Western population, particularly in Canada (Jones *et al.*, 2001). Out of 2483 adolescent females, bingeing was reported by 15% of students, induced vomiting was reported by 8.2% and diet pills by 2.4% (Jones *et al.*, 2001).

While social, political and economic issues that impact the prevalence of disordered eating have received a lot of attention, there has been relatively little focus on eating disorder prevention in eating disorder research (Austin, 2000). The increased prevalence of DEB among Saudi adolescents confirms the need for developing primary preventive strategies in intermediate and secondary schools to limit such behaviours at vulnerable ages.

5.7 LIMITATIONS

Due to the cross-sectional design, causal inferences cannot be made. This study was characterised by collecting data at one specific point in time using a self-reported test; no interview or other diagnostic tools were used to confirm the risk. More information on school

characteristics and participants' socioeconomic characteristics, including parental income and education and individual psychological and lifestyle factors, could have explained some of the differences by school. However, this was not collected, as this was not the primary aim of this study. Non-response bias among students who were overweight and obese was also possible due to shame, denial or secrecy (Mitchison and Mond, 2015).

5.8 CONCLUSIONS

To our knowledge, this is the first study exploring the prevalence of DEBs and associated predictors in intermediate and secondary schools in Riyadh using EAT-26. About 30% of female school adolescents in Riyadh reported scores in EAT-26 that identified them to be at a high risk of developing a DEB. This suggests it is imperative to increase adolescents' awareness on healthy eating practices. Early detection and diagnosis could play a major role in limiting complications and avoiding the progression to an ED. The EAT-26 test can be applied in schools as a preliminary screening tool for early detection and referral to promptly deliver the required medical intervention. The nature of the relationship between BMI and DEB requires further clarification; this could include qualitative research to investigate the complexities of how current BMI is related to DEB, as this is likely to be a bi-directional relational rather than a simple causal association in which current BMI is the cause for DEB or vice versa. Further research is needed to explore major determinants and contributors causing DEB in the Saudi population. This would support the development, implementation

and evaluation of specific preventive programmes related to body weight and proper eating practices.

5.9 SUPPLEMENTARY MATERIALS

The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/nu16020281/s1>, File S1. Sample Size Calculation using

EpiInfo- (*Appendix 18*).

5.10 AUTHOR CONTRIBUTIONS

Conceptualization, A.A.; methodology, A.A.; software, A.A.; validation, A.A.; resources, A.A.; data curation, A.A.; writing—original draft preparation, A.A.; writing—review and editing, A.A., S.J.C. and E.G.; visualization, A.A.; supervision, S.J.C. and E.G.; funding acquisition, A.A. All authors have read and agreed to the published version of the manuscript.

5.11 Funding

This study is one of the outputs of AA's PhD project, which was funded by the Saudi Arabian Cultural Bureau in the UK. The views and opinions mentioned in this manuscript are those of the authors and do not necessarily reflect those of the Cultural Bureau.

5.12 Institutional Review Board Statement

The Ethical statement was approved by the Research Ethics Committee at the University of Sheffield (Reference Number 050493- *Appendix 13*) on 20 March 2023 and approved by the

Research Ethics Committee at King Saud University in Riyadh (No. E-23-7551- *Appendix 14*) on 9 February 2023.

5.13 Informed Consent Statement

Prior to data collection, written informed consents were collected from parents and students.

5.14 Data Availability Statement

Data are contained within the article and supplementary materials.

5.15 Acknowledgments

We would like to thank the University of Sheffield Institutional Open Access Fund for its support.

5.16 Conflicts of Interest

The authors declare no conflicts of interest.

CHAPTER 6 QUALITATIVE STUDY (STUDY THREE)

This chapter presents the third PhD primary study, as published in the manuscript format.

Following the review of available evidence regarding the prevalence of EDs/DEBs in Saudi Arabia and a quantitative cross-sectional study on the prevalence of DEBs among female adolescents attending intermediate and secondary schools in Riyadh, the next critical step for this thesis was to qualitatively address the main determinants influencing DEBs.

The qualitative framework was considered appropriate for further exploring the key determinants and underlying factors contributing to the development of DEBs among female adolescents. To guide this phase, Bronfenbrenner's Bioecological Model—an established framework in developmental psychology—was employed. This model emphasises the dynamic interaction between individuals and their surrounding environments. Its adoption enabled a nuanced interpretation of DEB determinants by examining the multi-layered ecological systems influencing adolescents, and by capturing the complex interplay of personal, social, and environmental factors shaping these behaviours. Adolescents' DEBs have been associated with a number of determinants, including biological, social, parental, and psychosocial elements. Chapter 6 aims to provide a clear explanation of the primary determinants and factors contributing to the development of DEBs among female students identified as being at high risk of DEBs, as determined through semi-structured interviews.

This study was guided by a clearly defined research question and a specific objective that shaped its scope and methodology.

Research question: What are the key determinants and factors influencing DEB?

Specific objective: To examine common determinants and predictors contributing to the development of DEBs among Saudi adolescent females.

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Alsheweir, A., Goyder, E., Alzahrani, M. and Caton, S.J. (2024) Determinants of Disordered Eating Behaviours (DEBs) among Adolescent Female School Students in Riyadh, Saudi Arabia: A Qualitative Study. *Nutrients*, 16(13), p.2119.

The content of this chapter is the same as the published version. The manuscript was produced by four co-authors: Azzah Alsheweir, Maha Alzahrani, Elizabeth Goyder and Samantha J. Caton. The author contribution section in this chapter clarified the tasks conducted by each author.

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Determinants of Disordered Eating Behaviours (DEBs) among Adolescent Female School Students in Riyadh, Saudi Arabia: A Qualitative Study

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6.1 ABSTRACT

The risk of DEB is more prevalent in girls, particularly during adolescence. The onset of DEB can be triggered by many inter-related factors, including biological, social, parental, and psychosocial. To date, very little is known about the determinants of DEBs in Saudi adolescent girls. Using a qualitative analysis, this study explored potential determinants of DEB among adolescent girls in Riyadh. Eighteen semi-structured interviews were carried out with adolescent girls (mean age = 14.06, SD = 0.87) who reported a high risk of DEB (EAT-26 $\geq$ 20) in intermediate and secondary schools in Riyadh. The mean weight was 51 kg (SD =

11.8) with BMI ranging from 14.18 kg/m² to 27.51 kg/m². EAT-26 scores ranged from 21 to 42 (M = 26.8, SD = 5.6). Data were transcribed and revised, then themes and sub-themes were assigned using MAXQDA 24. The most common DEBs reported were dieting and bingeing, followed by induced vomiting. Major themes were related to negative cognitions, conscious imitation/copying behaviours, bullying, comparisons, and negative comments. Some participants identified the possibility of biological and familial factors in increasing the likelihood of DEB. Our findings provide a framework that could be used to increase understanding of DEB and inform the development of interventions to address underlying causes of DEB in Saudi adolescent girls.

6.2 KEYWORDS

adolescents; disordered eating behaviours; determinants; interview; confidence; body dissatisfaction; body image; Saudi Arabia

6.3 INTRODUCTION

Disordered eating behaviours (DEBs) are ranked as a highly prevalent public health concern related to body dissatisfaction and weight control in adolescents (Neumark-Sztainer *et al.*, 2002). The literature indicates that disordered eating (DE) is prevalent across various racial, ethnic, cultural, and socioeconomic backgrounds with the highest proportion occurring in adolescents, particularly in mid to late adolescence (Podar and Allik, 2009). These behaviours include dieting and food restriction, binge eating, induced vomiting, consuming laxatives

and diet pills, and intensive exercising. These behaviours are considered maladaptive behaviours, yet they seem to be goal directed toward fulfilling intrapersonal (e.g., regulating emotions) or interpersonal (e.g., seeking attention or care) purposes (Wedig and Nock, 2010). Girls are reported to be more vulnerable to DE as they are more likely than boys to be preoccupied with body image and physical appearance (Mallick, Ray and Mukhopadhyay, 2014). Since normal body weight lies on a continuum, pressure to reach the alleged perfection can elicit emotions of distress (Rodgers, O'Flynn and McLean, 2019).

Several determinants have been associated with DE in adolescents, including biological, social, parental, and psychosocial factors (Costa *et al.*, 2008). Research suggests that growth spurt and rapid changes in body shape and size may play a significant role in DEB, as adolescents may have low self-esteem and negative body image due to growth variations (Rogol, Roemmich and Clark, 2002). Graber (2013) clarified that girls who show early signs of maturation are more likely to experience bullying and teasing regarding their changing bodies. Consequently, the likelihood of developing DEB is increased.

Furthermore, negative emotions and poor mental health (e.g., depression, anxiety, stress, poor self-esteem, etc.) are associated with DE (Santos, Richards and Bleckley, 2007).

For example, Hafsa (2014) reported that adolescent girls (15%) in Riyadh are engaging in binge eating episodes to reduce feelings of stress and depression. Another study targeted 471 high school students in Makkah to explore the risk of DEBs. A key finding indicated that high levels of stress are significantly associated with an increased risk of DE (Ghafouri *et al.*,

2021).

Despite individual differences in thinking and emotional regulation, some personality traits tend to be associated with DEB, like perfectionism and cautiousness (Anderluh *et al.*, 2009). Childhood personality traits, particularly perfectionism and rigidity, increase vulnerability to such disorders (Anderluh *et al.*, 2003). A review focusing on personality traits and ED confirmed that personality disorders, such as perfectionism, obsessive compulsiveness, and negative emotionality, are common among people diagnosed with ED (Cassin and von Ranson, 2005).

Shape concerns, negative body image, and the preference of a thin body ideal are considered significant determinants of DEB (Gowers and Shore, 2001). A growing proportion of adolescent girls feel overweight or fat and have a strong desire to lose weight. These feelings may trigger adopting the “dieting mentality” and increase vulnerability to DEB (Rome *et al.*, 2003). A longitudinal study focused on understanding the aetiology of body dissatisfaction in adolescent girls aged 14 to 18 years concluded that their body dissatisfaction is linked to the desire to be thinner, weight control practices, negative comments about weight, and BMI (Dion *et al.*, 2014). However, in our recent study involving adolescent girls aged 12 to 19 years attending intermediate and secondary schools in Riyadh, BMI did not appear as a significant predictor of DEB practices (Alsheweir, Goyder and Caton, 2024). This does not necessarily indicate that adolescent girls with obesity face the same risk as girls who are underweight. It should be noted that the risk is not directly related

to BMI and weight status, yet it is affected by weight status perception and body dissatisfaction. A study on European adolescent girls explored body perceptions and weight status and confirmed that girls with BMI $\leq$ 50th percentile tend to overestimate their weights and struggle with feeling unattractive (Sadowska *et al.*, 2020).

The prevalence of DE is strongly linked to familial and parental factors (Field *et al.*, 2001; Rodgers and Chabrol, 2009). Parents' comments on body, weight, and physical appearance have a substantial influence on eating patterns and body concerns, emphasising that both mothers and fathers are significant sources of influence on their children (Rodgers and Chabrol, 2009). Coercive parental control and critical family environment are precursors to the development of DEBs (Haworth-Hoepfner, 2000). Similarly, peers and friends can strongly impact adolescents' engagement in risky or harmful behaviours (Giletta *et al.*, 2021). Adolescents and their peers have comparable perceptions of weight and shape, which are primarily caused by peer influence (Badaly, 2013).

Vulnerable adolescents are persuaded by the media to adopt negative attitudes and behaviours related to their bodies (Bryla, 2003). Recent evidence suggests that media pressure has the greatest influence on body dissatisfaction among female students, followed by peer and parental pressure (Shin, You and Kim, 2017). A study examining the role of social media on eating behaviours and body concerns among 681 adolescents confirmed that using social media is associated with body dissatisfaction, DE, and muscle-building activities

(Rodgers et al., 2020).

Within the last decades, the Kingdom of Saudi Arabia has experienced a marked transition in dietary habits and food choices due to economic accelerations and sociocultural changes in the Arabian region. From 2003 to 2013, Saudi Arabia experienced significant modernisation, which improved the wealth and wellbeing of the society (Al-Kibsi *et al.*, 2015). In 2014, Saudi Arabia was ranked to be the world's 19th highest economy and classified as one of the leading economic countries. Household income increased noticeably by 75%, owing to the improved public employment sector and wages. The degree of urbanisation is elevated compared to other European countries, with almost 83% of Saudi society living in cities (Al-Kibsi *et al.*, 2015). These changes resulted in negative modifications to diet and food choices, with dietary patterns being adjusted drastically to mimic Westernised behaviours, which are significantly associated with elevated rates of obesity (Musaiger, 2011). The thin body ideal is one of the significant Western concepts that continues to diffuse in society, replacing the favourable full body from Arabic culture (Latzer, Azaiza and Tzischinsky, 2014; Mallick, Ray and Mukhopadhyay, 2014). With rapid cultural shifts to emulate Western values in weight and shape, Saudi adolescents have more vulnerability to eating pathology, body image, and psychological conditions (AlShebali, AlHadi and Waller, 2021).

Although research has explored potential determinants of DEBs, the findings are

contradictory and require further investigation (Jacobi *et al.*, 2004). The nature of these behaviours and their prevalence are not clearly explored in Saudi Arabia. Our recent study on adolescent girls attending intermediate and secondary schools in Riyadh indicated that about 30% of students reported a high risk of DEB (Alsheweir, Goyder and Caton, 2024). Overall, there is a paucity of research that has examined factors that might contribute to the development of DEB in Saudi adolescents. Few studies have particularly examined key factors such as socioeconomic status, family size, parental education, and occupation (Al-Qahtani and Al-Harbi, 2020; Al-Subaie, 2000).

To date, no study has explored DE in the Saudi female adolescent population within a qualitative context. Therefore, more formative research that promotes understanding the equivocal interplay of factors contributing to DEB is required, by closely examining female students' experiences with DE to identify contributors and factors triggering such behaviours. This study provides preliminary insights into the potential causal inferences associated with DEBs. A general exploratory scheme is applied to identify the common determinants and factors causing the development of DEBs. The objective of this study was to take an initial step toward addressing potential determinants and predictors of DEBs among female adolescents in the city of Riyadh, Saudi Arabia.

6.4 MATERIALS AND METHODS

6.4.1 THEORETICAL FRAMEWORK

Determinants and predictors in mental health are linked to various factors (e.g., individual and social) and their interactions. Therefore, it is prudent to conceptualise the underlying biological, psychological, and sociocultural perspectives associated with mental conditions (Kendler, 2008; Sturgeon, 2006). According to the WHO (2012), targeting different multi-layered factors is important to reduce illness and improve mental health (Eriksson, Ghazinour and Hammarström, 2018).

In this study, the theoretical framework for exploring determinants and predictors of DEBs was formulated by Bronfenbrenner's Bioecological Model (Bronfenbrenner, 1977; Bronfenbrenner, 1986; Bronfenbrenner and Ceci, 1994). Based on concepts derived from psychology and social ecology, it is necessary to comprehend an individual's behaviour and psychological development within their social environment (Austin, 2000).

The bioecological model developed by Bronfenbrenner focuses on the social environment addressing the interaction among intrapersonal characteristics, interpersonal relationships, environmental context, and time, with their role in shaping and modifying an individual's attitudes and behaviours (Austin, 2000).

Bronfenbrenner's Bioecological Model is designed according to four interconnected systems presented in concentric circles. The developing individual is located at centre of the diagram surrounded by inter-related systems. The inner circle (microsystem) classifies

direct and immediate relations with family, friends, and objects. The inner circles (mesosystem and exosystem) describe several environments experienced by the developing individual as they interact with and influence the microsystem. The outer circle (macrosystem) is identified by cultural values and dominant norms. The immediate ring surrounding the individual refers to the techno-subsystem, which indicates technology and the use of devices (phones, computers, social media, etc.) and their capacity to shift many direct interactions, as they act as mediators in an individual's interactions with others (Johnson and Puplampu, 2008; Vélez-Agosto *et al.*, 2017).

6.4.2 STUDY DESIGN AND SETTING

This qualitative study focused on interviewing adolescent female students who reported a high risk of DEB. Participants, from intermediate and secondary governmental schools in the city of Riyadh, were selected from a previous study (Alsheweir, Goyder and Caton, 2024). Data were collected between December 2023 and January 2024. Ethical approval for this project was granted by the Research Ethics Committee at the University of Sheffield (Reference Number 050493- *Appendix 13*) and the Research Ethics Committee at King Saud University in Riyadh (No. E-23-7551- *Appendix 14*), following the principles articulated in the 1975 Declaration of Helsinki.

6.4.3 PARTICIPANTS AND RECRUITMENT

In the early quantitative study, four governmental intermediate and secondary schools were selected and 416 female students were recruited to measure the prevalence of DEB by

using the Arabic version of the Eating Attitudes Test (EAT-26) (Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019; Al-Qahtani and Al-Harbi, 2020; Alwosaifer *et al.*, 2018; Garner *et al.*, 1982; Gleaves *et al.*, 2014). Students who reported a high score on the EAT-26 test (score ≥ 20), classified as high risk of DEB, were interviewed. The ages of the students ranged from 13 to 16 years, who were recruited from two schools in Riyadh, the 128 Secondary School (North) and the 213 Intermediate School (North) in AsSahafa district.

6.4.4 PROCEDURE

Following approval from the Ministry of Education (MoE) in Riyadh to visit the designated schools and interview students, school principals were contacted to distribute the participant information sheets (PISs) and parental consent forms to identified potential participants. With permission from the class instructor, students who returned the signed consent form were contacted and an interview time was arranged. Interviews were carried out in the school environment. At the beginning of the interview, each student received a student PIS and an informed consent form. The PIS, which comprised information on the study, the process of the interview, and confidentiality, was explained and the student was asked to sign the informed consent before starting the interview and the audio recording.

6.4.5 INTERVIEWS

In this study, semi-structured interviews were carried out. The duration of the interviews ranged from 30 to 40 min. The interview guide questions were developed by applying Kallio's *et al.* (2016) five phase framework for semi-structured interviews. As a first phase,

semi-structured interviews were identified as a thorough and suitable approach to gathering data on the DEBs. In the second phase, prior knowledge was comprehensively retrieved and understood, addressing the need for empirical research on DEBs among Saudi adolescents. In the third phase, ten preliminary questions were formulated for the interview guide considering the EAT-26 questions and applying resources aimed at assessing adolescents with eating disorders (Bould *et al.*, 2017b; Leffler, Riebel and Hugheset, 2015). The fourth phase included pilot testing the interview guide through internal testing and field testing. Three internal testing meetings and two field tests were implemented to evaluate interview questions. Internal testing meetings were held by the principal investigator (PI) (A.A.) and two reviewers (S.J.C. and E.G.) to examine interview questions and make needed adjustments. Field tests were conducted by a PI (A.A.) with five Saudi adolescents aged 12 and 13 years. In the fifth phase, a list of questions was presented in the complete semi-structured interview guide (Supplementary Material File S1- *Appendix 12*). The final guide was then translated to Arabic by the PI and used for the interviews.

6.4.6 DATA ANALYSIS

Data were analysed using Braun and Clarke's thematic analysis guide applying Bronfenbrenner's Bioecological Model as a theoretical framework (Braun and Clarke, 2006; Bronfenbrenner and Ceci, 1994). Arabic responses were transcribed verbatim by the PI (A.A.) with the involvement of a reviewer (M.A.) who is an Arabic native speaker, revising 10% of Arabic transcripts. Themes were generated independently and the final themes and

sub-themes were reached by consensus (A.A. and M.A.). Quotes, themes and sub-themes were then translated into English and reviewed by two reviewers (S.J.C. and E.G.). MAXQDA 24 software was used for retrieving responses and coding themes. Themes and sub-themes were subsequently classified according to Bronfenbrenner's Bioecological Model systems.

6.5 RESULTS

6.5.1 *SAMPLE*

Eighteen interviews were conducted in total, two students aged 16 years from the 128 Secondary School took part, and 16 students aged 13–15 years from the 213 Intermediate School in Riyadh (mean age = 14.06, SD = 0.87). Height (Ht) ranged from 144 cm to 165 cm (mean Ht = 155.2 cm, SD = 5.7 cm) and weight (Wt) ranged from 31.9 kg to 69 kg (mean Wt = 51 kg, SD = 11.78 kg). Participants' BMI ranged from 14.18 kg/m² to 27.51 kg/m² with a mean of 21.03 kg/m² (SD = 3.99 kg/m²). EAT-26 scores varied among participants, ranging from 21 to 42 (mean = 26.78, SD = 5.59).

6.5.2 *COMMON DEB*

Adolescent girls described the most prevalent behaviours as personally experienced or observed in other girls (sisters, friends, or relatives). Dieting and bingeing to control weight/shape were reported as the most prevalent behaviours, followed by induced vomiting. Using laxatives or diuretics and engaging in intensive exercises were the least behaviours reported.

“Like the one who deprives herself of food all day long, and when the night comes, she eats. . . and literally eats twice as much as she can eat in the morning”. Participant 2

“There are girls like that in school, and sometimes they never eat. They say, “I want to lose weight.” I mean. . . and they say that “I only eat a little bit”. Participant 5

“Every time she eats, she goes to the bathroom and deliberately vomits. . . . She does not like this thing, and she is trying to stop, but that’s it! since she started doing this thing, she continues because she doesn’t want to reach. . . . She doesn’t want to gain more weight”.

Participant 17

Adolescent girls explained dieting as fasting or a state of food deprivation. Some even discussed that they might eat once a day as they lack the appetite to eat or they feel that there is no need to eat.

“My stomach is telling me “don’t eat”. . . I don’t feel like eating. . . It seems like there is something inside but there is nothing. . . The feeling of nausea. . . the pain. . . I get pain from here to there (she points from the throat to the stomach). . . and heat. . . I don’t want to eat. . . I don’t want to taste anything” Participant 4

Many girls reported experiencing dizziness and fainting due to food avoidance and lack of nourishment. Girls who reported dieting indicated that they engage in bingeing episodes by the end of the day after depriving themselves of food for the entire day.

“I fainted, maybe two or three times, I swear I don’t remember. . . One time I fainted in my room and no one knew”. Participant 7

“I stopped eating, but I didn’t get any bingeing episodes. I stopped for a long time and continued doing that until I became dizzy every time I went to school”. Participant 11

Girls described that vomiting could be induced after a bingeing episode to reduce feelings of shame and guilt. Girls who engaged in vomiting explained that induced vomiting is an easier way to control weight and suppress appetite.

“But if my family forced me to eat something, I would vomit after it so that they would make me. . . I mean, they would see me vomiting. . . No, you won’t eat anything anymore. Okay, you want to vomit, then I will give it to you and let you vomit. After that, I started vomiting without anything. . . without deliberately doing it. I vomit. . . I let myself vomit”. Participant 7

Some students mentioned intensive exercising as a method for burning calories and losing weight.

“My cousin. . . I remember one time she was dizzy and they took her to the hospital because she had done exercising. . . and had not eaten anything all day. . . I told her, “Why did you do that?” She said, “I want to lose weight”. Participant 3

Similarly, diet pills were also not common; however, many students claimed that they were considering taking appetite-suppressant pills or injections to control their weight.

“I mean, more than one girl talked about injections that suppress the appetite and said that they should go talk to a doctor and see if they can use them or not”. Participant 12

Concerning the frequency of engaging in DEB with age, responses differed among

participants. Most adolescent girls believed that DEB would be reduced with age, with some students linking this reduction to comprehension and understanding. They clarified that by growing older they will come to understand the complexities of these behaviours and perceive their consequences clearly and accurately. A few students thought that DEBs would increase with age as they anticipated growing older to be associated with aggravated feelings of desiring to be thin and attractive. However, some students were not sure if DEBs would increase or decrease, as they stated that it is dependent on multiple underlying factors (current weight, confidence level, family's motivation and acceptance, etc.).

6.5.3 VIEWS ON WEIGHT AND SHAPE

In terms of personal weight and shape, the majority of adolescent girls indicated that they are not happy and content with their weight/shape, with the majority of adolescent girls stating that they need to lose or gain weight. Height was also mentioned; a few girls specified their height and described that they would prefer to have a taller body and continue to wear platform trainers to appear taller.

"I suffer from my body a lot, with clothes and how I see myself, and in terms of what people say to me. . . so I suffer from obesity." Participant 12

"Yes, when I was in my first year of intermediate school, I used to say that I wanted to be thinner, and until now, I want to be" Participant 16

In terms of others' weight and shape, a few students believed that girls their age like their weight and are comfortable with their shape, while most students thought girls their

age are not content and want to be slimmer. Some students stated that girls are afraid of their weight even if they have a normal weight. They described that girls are afraid of standing on the scale as they constantly have this desire to reach the “perfect body”. They defined the perfect body as the ideal weight, sculpted waist and attractive height.

“They see this slim, tall, sculpted body. . . is the perfect body that every woman dreams of”

Participant 2

“I mean most girls now. . . are afraid of their weight. . . I mean. . . they are afraid that someone will see their weight. . . I see them getting nervous and afraid when they are asked about their weight” Participant 5

6.5.4 DETERMINANTS OF DEB

Adolescent girls discussed the main determinants and factors causing DEBs. Analysing responses generated six main themes and 12 sub-themes (**Table 10**). Below is a description of each theme/sub-theme and designated bioecological model system, together with pertinent illustrative quotes retrieved from adolescent girls’ responses.

Table 10 Themes/Sub-themes and Bronfenbrenner’s Bioecological Model System

Themes	Sub-Themes	Codes	Bioecological Model System
1 Negative cognitions	Self-esteem and confidence issues negative body image	1a	Microsystem— individual
		1b	
2 Conscious imitation/copying behaviours	Real-life models Social media—TikTok and Instagram	2a	Microsystem and techno-subsystem— individual
		2b	
3 Bullying	Traditional bullying- Siblings and school peers Cyberbullying	3a	Microsystem and techno-subsystem— individual, family, school, friends, and neighbourhood
		3b	
4 Comparisons and negative comments	Intrapersonal comparisons Interpersonal comparisons and comments	4a	Microsystem— individual, family, school, friends, and neighbourhood
		4b	
5 Biological determinants	Puberty and hormonal changes Fear of chronic diseases	5a	Microsystem— individual
		5b	
6 Family-related determinants	Family situation/house environment Care and attention	6a	Microsystem— individual and family
		6b	

1. Negative Cognitions

Participants explained that negative cognitions and thoughts would be significant in causing DEBs. Overthinking was defined by girls as a pathway for developing negative thoughts and cognitions.

“I’m afraid that I’ll start thinking. . . I’m thinking again and more thoughts will go on and on” Participant 7

“Overthinking for sure. . . I mean, I feel like if you don’t occupy your time, you’re definitely thinking about anything that it’s not good, so I don’t know. . . I think that” Participant 18

1a. Self-esteem and confidence issues

Participants defined negative cognitions as a core factor distorting their level of confidence. They see their bodies as different or strange compared to a slim body, which aggravated feelings of shame, self-doubt, and low confidence.

“Confidence. . . no confidence. . . I want to be like normal girls and become a beautiful girl with confidence. . . ” Participant 4

Negative self-talk is another aspect highlighted by adolescent girls that can significantly impair their confidence level. Negative self-talk is related to appearance/shape and worn clothes. Many students expressed that although they desire to wear tight clothing and show off their bodies, they feel uncomfortable doing so since they lack confidence.

“She is trying to bring down her confidence level by saying I feel that I do not look nice. . . and today I feel that my clothes are not nice. . . It is like my clothes aren’t suitable for my body. . . This clearly shows that she is not confident”. Participant 17

1b. Negative Body Image

Girls linked negative body image with clothing. They expressed their feelings when they try new clothes or buy large sizes. They feel embarrassed about how big they are and ashamed of always buying and trying large sizes. They consider their bodies as abnormal and are tired of wearing large sizes.

“If I try clothes on. . . I look at myself. . . I mean I say I don’t. . . That’s it, I don’t want to eat anymore”. Participant 4

“I see girls in school. . . and I watch them. . . I see them. . . I mean, they are all skinny and they wear things like that, but. . . I don’t know. . . I feel that I want to be skinny, I don’t want this body”. Participant 11

Even if girls are thin, they have a problem with negative body image and want to lose more weight. They are afraid of their weight and they avoid standing on the scale.

“I see that they have normal bodies, but even though they are ashamed of this thing. . . It doesn’t matter if she is fat or thin. . . In general, she is ashamed of her body and makes sure that no one is behind her to see the scale”. Participant 17

2. Conscious Imitation/Copying Behaviours

Adolescent girls expressed that when looking at other people and their bodies, they want to imitate them and copy their behaviours either in real-life or on social media.

“It is a trend and they want to go with it. . . You see people, I mean. . . a group of people is doing this behaviour and you are going to do the same. . . ” Participant 12

2a. Real-life Models

Girls discussed that when they notice a girl with a beautiful body they want to be like her and imitate her behaviours. They explained that they wanted to be admired and complimented for their looks like her. Some of the participants indicated that they are ignored and unseen by others (e.g., family, friends, and school peers), but they will be noticed when they become a copy of any attractive girl.

“I don’t hear anything positive about me and no one is complimenting me. . . so I will go

and become like her. . . lose weight. . . I do and do and do. . . just to become a copy and paste of her”. Participant 2

“They imitate each other. . . Just like one of my friends, she is copying my other friend. . . She wants to be like her, you know” Participant 8

“But there are pretty girls, so it’s normal for you to say that she is pretty. . . And how can I be like her”? Participant 16

2b. Social Media—TikTok and Instagram

Girls identified the role of social media and conveyed messages of the ideal body and perfect life. They explained that with social media’s consistent focus on the slim and sculpted body, they doubt their appearance and weight until believing that they are neither beautiful nor attractive. They live under persistent psychological pressure to lose weight and become prettier by imitating what they see on screens.

“Girls can see things that affect them. . . like, for example, they look at magazines. . . or they can watch TV. . . they see bodies. . . they say her body is beautiful. . . or she looks beautiful. . . I want to change myself or I want to be like her. . . She could say “Oh wow, I want a beautiful body, sculpted waist and attractive height” Participant 3

“Okay, this one may have a passion for getting slimmer, but then it becomes her obsession all the time is just like. . . like the manic stage, that she can’t stop thinking about her body. . . ” Participant 7

“I mean, anything that comes out as a new trend, they don’t care if it’s good or not

good. . . Any trend that comes out on TikTok. . . they will copy it right away, they don't care if it's good or not good. . . If it's harmful or not harmful". Participant 12

Most adolescent girls mentioned the influence of Korean celebrities and K-pop. They explained that they are imitating their diets and exercises to have skinny and attractive bodies like them, despite how challenging it is to stick to diets that limit their intake of calories and other nutrients.

"The K-pop diets. . . So wake up in the morning and eat half an apple, then wait until the afternoon and eat half a banana and two nuts. . . Don't eat lunch or rice. . . Cut out something called rice". Participant 16

"In intermediate school, we had the Korean girls trend. . . You know. . . We want to be like them and they are soo skinny. . . They have different kinds of diets, but they are so so so strict and they exercise all the time. . . " Participant 18

3. Bullying

Adolescent girls identified the negative effects of bullying on weight and appearance in real-life or social media (cyberbullying). Bullying is a major issue that adds more pressure to be slimmer and lose weight.

"Of course, she feels pressured and sad from the bullying that happened to her. . . The more the pressure, the greater the desire to go on a more restricted diet" Participant 1

3a. Traditional bullying—Siblings and School Peers

Girls identified traditional bullying as deliberate and continuous acts of verbal aggression

from siblings at home or other peers in school. They confirmed that it can severely impact their mental condition and academic achievement. Many participants explained that bullying based on weight and shape will eventually lead to depression, isolation, lack of school punctuality, and persistent absence.

“Girls like to bully. . . when they see a fat girl. . . they join on her. . . they gather around her. . . for no reason. . . and then they shout at her and raise their voices and laugh. . . they say you are fat. . . ” Participant 3

“If you are bullying me then that’s it! She no longer wants to talk to anyone, she becomes isolated. . . She leaves her relationships. . . She leaves everything. . . She is afraid. . . She is afraid that she will hear more harsh words. . . She starts crying in school, crying at home, crying in the bathroom. . . ” Participant 7

3b. Cyberbullying

The girls reported that cyberbullying concerning weight and appearance that occurs through social media and apps causes more harm than traditional methods of bullying. These actions are identified on social platforms by posting negative/abusive comments on weight, shape, or appearance by anonymous and unknown accounts.

“She was fake, so I did not know. . . She used to send messages and I was afraid. . . I was afraid of the whole society. . . I no longer wanted to be close to anyone. . . I was afraid to trust anyone and then they will do the same, so I was afraid. . . I would go back. I would not talk to anyone. . . ” Participant 7

“For sure she is going through a state of depression, but she does not know who is this person insulting her. . . She can’t confront him or talk to him”. Participant 17

Many girls mentioned a popular app used by students called Tell, which allows enrolled students at a certain school to text each other about homework, assignments, and tests. They explained that it is similar to Instagram; however, it lacks the feature of posting photos.

Participants have encountered many incidents of cyberbullying through sending aggressive and abusive texts related to weight and shape from anonymous accounts that are visible to other students in the school.

“It’s on Tell, someone from school. . . So I thought I would always come to school like this! So, who is she?! You know I deleted it because I couldn’t handle that anymore, I was frustrated and tired. . . so tired of it” Participant 18

4. Comparisons and Negative comments

Adolescent girls explained that comparisons and negative comments can be destructive, leading to an increasing the risk of DEB. As it may occur from the immediate surrounding environment including family and relatives (interpersonal), it could also originate within the individual (intrapersonal).

“Comparison takes a person to a stage that no one can imagine except this person. Comparison is never a good thing”. Participant 9

4a. Intrapersonal Comparisons

Adolescents described how they struggle with self-comparisons in relation to their

weight perceptions and body image. Comparisons stem from feelings of shame, jealousy, and a strong desire to be slimmer.

“Because I see all the people now. . . Why am I the only one who is fat? I compare myself with these people. . . Personality doesn’t matter to me. . . Personality doesn’t matter to me as much as I care about appearance.” Participant 16

“She sees someone whose body is thin, for example, and she is a little fat. . . so she starts comparing, why is she thinner than me and I am fatter than her”? Participant 17

4b. Interpersonal comparisons and comments

Comparisons from family, particularly parents, were identified by the girls as the most intense source followed by siblings and relatives. Most girls even agreed that comments from the mother would hurt more than the father or siblings. Comparisons could be made with other people or a thinner or younger version of oneself.

“Like when my mother says, “Be like your sister. . . like the comparison. . . I had a friend before, and her mother used to compare her to the school girls. . . the school girls!” You don’t know them. . . She didn’t care about herself and was not well” Participant 2

“My relatives used to compare a cousin of mine with a girl. . . She was really affected by this thing. . . she stopped eating and tried to lose weight. . . They are used to telling her”

Look at her, she is your age. . . Look at her weight and how she is taking care of herself and her shape” Participant 9

“Even my family got upset and said that they saw how I was skinny before, and now they

see how I have a strong appetite, and how I can't stop eating" Participant 12

5. Biological determinants

Some adolescent girls described the role of biological determinants including puberty /hormonal changes and fear of chronic disease as factors causing DEBs.

5a. Puberty and hormonal changes

The girls explained that during puberty appearance and body shape change rapidly, making it difficult to accept and embrace these changes. At the same time, they expressed being temperamental and sensitive with hormonal shifts.

"I feel that at this age you become extremely sensitive. . . especially at the beginning of puberty. . . you become sensitive. . . My personality was not like that at all when I was young. . . I had a different personality. . . I don't know. . . but it is my teenage period".

Participant 8

"I feel that with intermediate years, all this age is difficult with puberty. . . In intermediate years the entire appearance changes so they won't be willing to fully accept these changes"

Participant 17

5b. Fear of chronic diseases

Few adolescent students mentioned that DEBs could be practised due to fear of developing diabetes or other serious conditions. They see weight gain and obesity as a danger stage, which is linked to many diseases.

"They are afraid that they will become diagnosed with a serious disease. . . I mean, for

example, they are afraid that they will get. . . a lot of these things. They are afraid from eating too much unhealthy food. . . Maybe. . . they will get cancer. . . They will get diseases.

So they try so hard”. Participant 1

“Diseases. . . A cousin of mine used to eating all the time and she said it’s OK, suddenly she got diabetes. . . This thing scared me. . . because I used to eat a lot every once in a while, so I started not. . . eating, and I started telling my friends. . . ” Participant 5

6. Family-related Determinants

Some students discussed the role of family-related determinants in engaging in DEBs. They considered the nature of the relationships among family members and the environment of the house as the main factors interacting with DEBs. They also mentioned that DEBs could be a method of attracting attention when they feel neglected or ignored.

6a. Family situation/house environment

Girls identified problems that occur between family members, especially parents, as major factors leading to DEBs. Living in a negative environment and experiencing aggressive and stressful conditions can generate feelings of sadness and insecurity, which eventually lead to DEBs.

“I can’t say that all the mothers and fathers understand each other and so on. . . I mean, their problems. . . I mean, the problems that happen between them still affect the family”.

Participant 15

“Problems in general. . . The girl comes with zero appetite, she didn’t eat for two days

because of the problems happened at home. . . I mean the screaming and talking you hear from them is. . . enough. . . I don't want to eat. . . or when are sitting on the table for lunch, and they start arguing. . . everyone gets up” Participant 16

6b. Care and attention

Some adolescents defined practising DEBs as a way of getting attention and being seen. They explained that DEB would have an impact on their appearance and overall health, making them look pale and poorly, which would motivate parents to nurture them and provide additional care and attention.

“If you become tired and sit alone. . . sad and depressed. . . and your weight goes down. . . your family says what's wrong with you. . . they start treating me kindly and stop pressuring me” Participant 2

“She attracts attention. . . I feel that at this age some mothers treat their daughters as if they were adults” Participant 8

“Some girls do that, because their families neglect them, so they do this. . . they want them to care more” Participant 10

6.6 DISCUSSION

This qualitative design aimed to explore the determinants of DEB, according to Bronfenbrenner's Bioecological Model, by interviewing Saudi female adolescents attending intermediate and secondary schools in the city of Riyadh, Saudi Arabia. The process in this

study (selecting schools and participants) was based on a quantitative study implemented previously using the EAT-26 test (Alsheweir, Goyder and Caton, 2024). Adolescent girls indicated that dieting, bingeing, and induced vomiting were the most common behaviours practised. A key finding of this study was that negative cognitions, conscious imitation /copying behaviours, bullying, comparisons, and negative comments were identified as primary determinants of DEBs. Other determinants that could increase the likelihood of DEBs were biological, including puberty and hormonal changes and fear of chronic diseases, and familial, including family situation and seeking care/attention. As Bronfenbrenner's Bioecological Model demonstrated, these determinants are part of the microsystem involving individuals, family, friends, school, and neighbourhood.

Dieting and bingeing appeared to be the most experienced DEBs followed by induced vomiting. Most adolescent girls confirmed that they are not content with their weight and shape. Similarly, most of them believed that girls their age are not happy with their weight and appearance, and would rather lose weight. Most of them perceived that the frequency of DEBs would be less with age, as they explained that the level of comprehension and consciousness would increase with age, improving the ability to control emotions and actions and develop better recognition in addressing risk and detrimental effects associated with such behaviours. Contrary to our previous finding, age is a predictor of DEB with older students reporting a higher risk compared to younger students (Alsheweir, Goyder and Caton, 2024).

Likewise, the results of the current study do not align with our systematic review finding that identified a higher risk of DEB reported among older students compared to younger students (Alsheweir *et al.*, 2023). It is possible that the elevated frequency of DEBs with age would be due to increased self-consciousness and awareness, which might aggravate concerns related to body image and social acceptance (Rankin *et al.*, 2004).

Most adolescent girls identified that negative cognitions, conscious imitation/copying behaviours, bullying, comparisons, and negative comments are the most common determinants of DEBs. Additionally, some adolescents mentioned that biological and family determinants can play a role in increasing the risk of DEBs.

Identifying discussed determinants through Bronfenbrenner's Bioecological Model, the microsystem, which consists of the individual and the immediate environment—including family, friends, school peers, and neighbourhood—is the primary system encompassing the majority of DEB determinants (Bronfenbrenner, 1977; Bronfenbrenner, 1986; Bronfenbrenner and Ceci, 1994). It is essential to emphasise the role of the techno-subsystem surrounding the individual, with the continuous use of devices and phones shaping and modifying concepts/perceptions on weight and redefining the standards of beauty and attractiveness (Johnson and Pupilampu, 2008; Vélez-Agosto *et al.*, 2017). The connections of the meso-system, mass media in the exosystem, and social contexts in the macrosystem provoke the phenomenology of DEBs by increasing the pressure of having a thin and slender

body supported by mass media. This creates a framework of dieting and body dissatisfaction, which could be defined as a preliminary stage for DEBs and eating disorders (Derenne and Beresin, 2006).

Negative cognitions were primarily focused on confidence issues and negative body image. These cognitions, according to the girls, are associated with emotions of depression, anxiety, and an immediate urge to change their appearance and/or lose weight. The role of negative cognitions and self-beliefs has been confirmed in the literature as a causal factor leading to eating disorders (Santos, Richards and Bleckley, 2007; Yiend *et al.*, 2014).

Mediational analyses on adolescents demonstrated that negative self-image and body dissatisfaction have both direct and indirect influences on DEBs through self-esteem and aversive emotional status (Cruz-Sáez *et al.*, 2018). A group of US eighth- and ninth-grade adolescent girls completed measures related to self-cognitions and self-esteem. Based on self-schema, the cognitive framework of self-beliefs and self-information that directs an individual's perceptions, adolescent females who exhibit high levels of eating disorder symptoms experience more negative self-beliefs and schemas (APA, 2018; Cooper, Rose and Turner, 2006). DEBs are influenced by cognitive schemas, low confidence, and skewed information processing, which creates a demand for control and an idealised desire for body shape and weight (Eiber, Mirabel-Sarron and Urdapilleta, 2005).

Conscious imitation and copying behaviours emerge as a result of admiration and preference

of other individuals' appearance or shape. Adolescent girls explained that this can either happen in real-life by imitating the behaviours of friends/schoolmates or on social media by copying celebrities' actions on Instagram or TikTok (Badaly, 2013; Bryla, 2003; Giletta *et al.*, 2021). They intentionally mimic their behaviours and copy their actions to resemble their body image and to reach a comparable physique. Furthermore, they emphasised that severe methods of exercising and dieting practised by Korean celebrities are imitated. Korean celebrities or K-pop stars, as called by adolescents, have large popularity among female adolescents in Saudi Arabia, notably among intermediate school students, aged 12–14 years.

As they are captivated by their bodies and shapes, they follow them on apps and start copying their strict dieting behaviours to lose weight. Recent systematic reviews have indicated that adolescents' usage of social media increases their vulnerability to DEB by contributing to body dissatisfaction and low self-esteem (Bittar and Soares, 2020; Vincente-Benito and Ramírez-Durán, 2023). The dilemma that adolescents experience when imitating or copying a behaviour stems from feelings of inferiority and inadequacy, since they do not measure up to their models, associated with fear of social rejection or dislike (Cunha, 2007).

Bullying among school-age children and adolescents is an ongoing phenomenon that has substantial short- and long-term effects on mental and physical health (Tsitsika *et al.*, 2014). Adolescent girls identified bullying—either through traditional bullying methods or cyberbullying—as a common determinant of DEBs. It can be detrimental, leading to severe

consequences due to its direct association with suicidal thoughts and depressive/hopeless moods, with sadness serving as a mediating factor between bullying and suicidal thoughts (Sutter *et al.*, 2023). Compared to their peers of normal weight, adolescents who are overweight and obese have a higher likelihood of experiencing bullying (Brixval *et al.*, 2012). A study that explored the impact of bullying and DEBs on Australian adolescents aged 11–19 years concluded that bullying concerned with weight and shape increased the frequency of DEB, particularly induced vomiting (Day *et al.*, 2021b).

Current research has indicated a positive association between bullying and risk of DEBs, with bullied and teased adolescents having higher susceptibility to DEBs and negative body image compared to adolescents who are not bullied (Day *et al.*, 2021a; Graber, 2013). Due to technology and social media, adolescents are increasingly experiencing cyberbullying, which has been linked to symptoms of eating disorders (Cheng *et al.*, 2023).

Comparisons and negative comment sources were addressed by adolescent girls as either intrapersonal (originating from oneself) or interpersonal (originating from parents, siblings, relatives, and friends). Intrapersonal comments are focused on internal cognitive criticism of weight and/or shape and negative self-talk related to body image. Findings suggest that self-criticism and low self-differentiation are strong and significant determinants of disordered symptoms (Doba *et al.*, 2018; Fennig *et al.*, 2008). Interpersonal comparisons and comments are negative verbal messages on weight or appearance delivered by others. Interpersonal comparisons and comments from parents were defined by girls as the most

destructive. Parental comments have a detrimental effect on adolescents by directly contributing to distorted body image and significantly causing DEBs (Rodgers and Chabrol, 2009; Rodgers, Faure and Chabrol, 2009). A study explored the association of parental comments with DEBs among Asian young adults aged 18 to 25 years and confirmed that parental comments on weight and shape can have a substantial influence on increasing body dissatisfaction and DEBs (Chng and Fassnacht, 2016).

Some students mentioned biological determinants, including puberty and hormonal changes and fear of chronic diseases, as potential determinants of DEB. Among the most commonly cited risk phases for the emergence of eating issues is puberty, suggesting that psychological influences—body dissatisfaction and low confidence—can be significant mediating sources of risk in this sensitive stage (Graber, 2013; Klump, 2013; Rogol Roemmich and Clark, 2002). Early pubertal timing increases this risk of DE and its symptoms, as it is related to a higher risk of dieting (Harden, Mendle and Kretsch, 2012).

This is explained due to hormonal shifts during puberty; progesterone and estradiol are secreted in females, and increases in the amounts of steroids in circulation have a direct impact on psychological and behavioural characteristics, such as anxiety and eating habits (Zehr *et al.*, 2007). Research has indicated the role of reproductive hormones on the symptoms of eating disorders; however, the effect elucidated in the literature is insufficient, and longitudinal research is required to measure changes in these hormones and their pathogenic mechanism (Harden *et al.*, 2014). Adolescent girls described fear of chronic

diseases, particularly weight-related diseases, mainly diabetes and hypertension. No literature has explored the fear of chronic disease as a determinant of DEB; however, fear of weight gain is defined as the core of eating disorders (El-Radhi, 2015).

Family-related determinants were mentioned by adolescent girls as possible causes leading to DEBs. Family situation and other family-related factors can play a role in the development of DEBs (Field *et al.*, 2001; Le Grange *et al.*, 2010; Rodgers and Chabrol, 2009).

A systematic review compared family functioning in families with eating disorders and control families and found families with EDs to be less functional (Holtom-Viesel and Allan, 2014). A positive family meal atmosphere was associated with a lower likelihood of DEBs in adolescents (Neumark-Sztainer *et al.*, 2004). Adolescent girls also stated that they could engage in DEBs to seek attention and care from their parents.

Determinants leading to DEBs are complex, originating from a reciprocal interaction with biological, psychological, and societal causes (Costa *et al.*, 2008). Currently, there is a dearth of empirical research on the prevalence of determinants of DEBs among adolescents, ultimately leading to classify this study as a novel piece of research for understanding DEB and its main determinants. To clearly grasp the causal relationship and identify the primary and mediating components, it is necessary to address determinants across a wider spectrum.

DEBs appeared to be common in adolescents attending intermediate and secondary schools

in Riyadh, Saudi Arabia (Alsheweir *et al.*, 2023; Alsheweir, Goyder and Caton, 2024).

Comprehending determinants that cause DEBs would be immensely beneficial to minimise risk and to create primary preventive approaches appropriate for school settings to limit such behaviours.

6.7 LIMITATIONS

A significant proportion of older adolescent girls, for whom consent was given, declined to participate. Specifically, more than half of students from the 128 Secondary School declined to take part. The low response rate may in part be explained by the adolescents' tendency to be shy and avoid discussing personal experiences. However, it might also be explained by the parents' concerns and anxiety about the wellbeing of their daughters.

Despite the low response rate and given the qualitative nature of the study, we are confident that saturation, the point at which no more major nuances or insights can be found, can be achieved with 16 to 24 interviews (Vasileiou *et al.*, 2018). The students participated differently in the interviews, which could be due to social acceptability biases, as some may convey information that is regarded to be socially acceptable (Bergen and Labonté, 2020). Although focus groups may be the optimal method for data collection in other topic areas, individual interviews were deliberately chosen to facilitate greater transparency regarding thoughts and emotions on body image and personal experiences with DEBs (Kruger *et al.*, 2019). The data collected might not be representative of the population of

adolescents. A more diverse sample might increase the accuracy and diversity of responses.

6.8 CONCLUSIONS

This study, to the authors' knowledge, is the first study exploring the determinants of DEBs among adolescent girls in intermediate and secondary schools in Riyadh, Saudi Arabia. The interview process included 18 students with a high risk of DEB. Negative cognitions, conscious imitation/copying behaviours, bullying, comparisons, and negative comments, as well as biological and family determinants, are the determinants identified by adolescent girls as causing DEB. This study can be considered as an initial guide, providing a framework to increase understanding of the determinants of DEB in adolescent girls in Saudi Arabia. The findings could be used to inform the development of interventions to address underlying causes of DEB in schools and other relevant settings.

6.9 SUPPLEMENTARY MATERIALS

The following supporting information can be downloaded at: <https://>

www.mdpi.com/article/10.3390/nu16132119/s1, File S1. Semi-structured Interview Guide-
Appendix 12

6.10 AUTHOR CONTRIBUTIONS

Conceptualization, A.A.; methodology, A.A.; formal analysis A.A.; software, A.A.; validation, A.A., E.G., M.A. and S.J.C.; resources, A.A.; data curation, A.A.; writing—

original draft preparation, A.A.; writing—review and editing, A.A., E.G. and S.J.C.; visualisation, A.A.; supervision, E.G. and S.J.C.; funding acquisition, A.A. All authors have read and agreed to the published version of the manuscript.

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6.12 Institutional Review Board Statement

This research was approved by the Research Ethics Committee at the University of Sheffield (Reference Number 050493, approval date 20 March 2023- *Appendix 13*) and the Research Ethics Committee at King Saud University in Riyadh (No. E-23-7551, approval date 1 February 2023- *Appendix 14*). Ethical approvals and the research methodology were submitted to the MOE in Riyadh, requesting data collection in particular schools in Riyadh.

6.13 Informed Consent Statement

Prior to data collection, written informed consents were collected from parents and students.

6.14 Data Availability Statement

For the purpose of open access, the author has applied a Creative Common Attribution (CC BY) licence to any Author Accepted Manuscript version arising. All data generated or analysed during this study are included in this published article.

6.15 Acknowledgments

We would like to thank the University of Sheffield Institutional Open Access Fund for its support.

6.16 Conflicts of Interest

The authors declare no conflicts of interest.

CHAPTER 7 DISCUSSION AND CONCLUSION

The overall aim of this thesis was to explore the prevalence of DEBs in Saudi female adolescents and to identify the primary determinants and factors contributing to the development of DEBs. This chapter highlights findings from each chapter and summarises the thesis outcomes and implications. The first section of the discussion defines the key findings of this thesis, followed by a description of how these findings can be integrated with previous research in this topic area and other relevant literature. The latter section of this chapter focuses on the overall strengths and limitations of the thesis, followed by a discussion of the potential implications for addressing DEBs in young people and some proposed directions for future work.

7.1 SUMMARY OF MAIN FINDINGS

When considered collectively, the three studies in this thesis offer a comprehensive and in-depth understanding of DEBs among Saudi adolescent females. Prevalence rates varied widely by region, age group, and sex, with higher rates reported in older adolescents and males, as indicated in the SR (Study One). While highlighting measurement inconsistencies, the disparity in tools and study designs reaffirmed concerns that DEBs are becoming more prevalent among Saudi youth. The most commonly used tool was EAT-26, which demonstrates its usefulness in this context.

Building on this, the quantitative phase (Study Two) collected primary data from female students in Riyadh, revealing that nearly 30% were at high risk for DEBs. Age was a significant predictor, but BMI had no direct association, implying that the relationship between BMI and DEBs is more complex than expected. To explore this further, the qualitative phase (Study Three) investigated the determinants of DEBs in light of the experiences of high-risk students.

Using Bronfenbrenner's Bioecological Model, the study uncovered a range of personal and environmental factors — including family dynamics, peer influence, technology use, and biological changes — that contribute to the development of DEBs. Interestingly, while the quantitative data showed increased risk with age, participants in the qualitative phase perceived a decline in DEBs as they became older, attributing this to greater awareness and understanding. This contrast emphasises the importance of combining quantitative and qualitative approaches in order to fully capture the nuances of adolescent DEB experiences.

Below is a detailed description of the findings of each study.

Chapter 4 Systematic Review (Study One)

The systematic review aimed to identify and synthesise studies of the prevalence of EDs/DEBs in young people in Saudi Arabia, with a focus on differences according to sex, age, location and tools used. The results showed comparable rates of EDs/DEBs across regions in Saudi Arabia, with the highest prevalence reported in the eastern region (29.4% – 65.5%), followed by western (10.2% – 46%) and central (15.9% – 36.8%) regions. In terms of

sex, the prevalence of EDs/DEBs was higher among male adolescents compared to their female counterparts. In terms of age, the prevalence was higher among older adolescents than among younger adolescents.

The results of the review indicated that EDs/DEBs are of significant concern among adolescents in Saudi Arabia, with an elevated risk across the whole age range of adolescence, including younger and older adolescents (10.2%–65.5%). EAT-26 was used in approximately 79% of studies (11 out of 14) to assess the presence of these disorders, with a prevalence ranging from 10.2% to 48.1%. The EDI-DT, SCOFF, and EDE-Q were other tools that generated prevalence rates of 15.9%, 46.0%, and 65.5%, respectively. The review results indicated that more research is needed to explore the factors contributing to the development and persistence of EDs/DEBs.

Before thesis submission, the review was updated, and search strategies were re-entered in the selected databases (Medline via Ovid, Psych Info, Scopus, Web of Science, and ProQuest via ASSIA) at the end of 2024 to explore the availability of additional records. The subsequent discussion is based on the updated review findings.

Search strategies were re-entered, specifying the period from February 2023 to December 2024. Medline Via Ovid identified 12 additional records, with five meeting the inclusion criteria (Alhuwaydi, 2024; Alhuwaydi *et al.*, 2024; Almutairi *et al.*, 2023; Alrahili *et al.*, 2024; Makki *et al.*, 2024; *Appendix 19: Additional Records Identified from the Updated Systematic Review Search in Selected Databases (Medline via Ovid, Psych Info, Scopus,*

Web of Science, and ProQuest via ASSIA). Updated searches on other databases did not yield any additional records meeting the inclusion criteria that were not already identified in the Medline search.

These studies indicate that estimates of the prevalence of EDs and DEBs among Saudi adolescents and young adults vary between 5.5% and 53.6%, which is likely to reflect differences in the population sampled and outcomes measured, as well as real underlying differences in prevalence. As the prevalence estimates in Study One ranged from 10.2% to 65.5%, the overall updated range is from 5.5% to 65.5%. It is clear that prevalence rates differed among all studies identified in Study One (Albrahim *et al.*, 2019; Alhazmi and Al Johani, 2019; Allihaibi, 2015; Almuhlaifi *et al.*, 2018; Al-Qahtani and Al-Harbi, 2020; Alsubaie *et al.*, 2020; Al-Subaie, 2000; Alwosaifer *et al.*, 2018; El Shikieri, 2022; Fallatah, Al-Hemairy and Al-Ghamidi, 2015; Fatima and Ahmad, 2018; Ghafouri *et al.*, 2021; Loni *et al.*, 2022; Tomar and Antony, 2021), and the updated search (Alhuwaydi, 2024; Alhuwaydi *et al.*, 2024; Almutairi *et al.*, 2023; Alrahili *et al.*, 2024; Makki *et al.*, 2024), and these variations can be attributed to several factors related to the population and outcome measures used. Additionally, these discrepancies highlight heterogeneity among the studies, affirming that a meta-analysis would be inappropriate because of their differing designs and/or outcomes (Ruppar, 2020).

Population differences are observed in the age and sex distribution among the studies' samples. As clarified in Study One, participant ages spanned from school age to university

level, with the majority of studies recruiting female students, and only four studies recruiting male participants. Of the more recent additional references, Alhuwaydi (2024) and Alrahili *et al.* (2024) recruited both females and males, while other studies only recruited female adolescents. As these studies were cross-sectional, the recruitment methods may have introduced a risk of selection bias. This bias occurs when the process of choosing participants or data for a study is related to the exposure or outcome being measured, resulting in a non-representative sample (Smith, 2020). Consequently, this may lead to developing conclusions that do not accurately reflect the actual population in relation to DEBs, particularly when those at higher risk are less likely to participate.

Differences among studies were identified in the outcomes (specific DEB measured or general risk to EDs/DEBs), surveys or methods used, and how they were measured. The explicit distinction among the studies in Study One was emphasised, as they evaluated several conditions (DEBs, EDs, DEAs, dieting, binge eating), and used different measurement tools (EAT-26, EDE-Q, SCOFF, EDI-DT).

Different outcomes were also measured in the additional records. Alhuwaydi (2024) and Alhuwaydi *et al.* (2024) explored binge eating disorder and its prevalence. Almutairi *et al.* (2023) and Alrahili *et al.* (2024) examined the prevalence of EDs risk. Makki *et al.* (2024) measured the risk of DEBs. Survey tools used varied across studies, including the Binge Eating Scale (BES), EAT-26, and the Patient Health Questionnaire Eating Disorders Scale.

Self-reported paper surveys were applied in all studies except for Alrahili *et al.* (2024), which used computerised questionnaires through social media.

CHAPTER 5 QUANTITATIVE PHASE (STUDY TWO)

This study aimed to explore the prevalence of DEBs among female adolescents in intermediate and secondary schools in Riyadh and determine the role of age, BMI, and school region as predictors of DEBs. Results indicated that about 30% of female school students are categorised as high risk of DEBs, reporting a score of 20 or more on the EAT-26. Age was a key predictor of DEBs, indicating a positive link between age and increased risk of DEBs. However, school region was partially significant (i.e. only two schools showed significant variations), and BMI was not a significant predictor.

According to reported DEBs, including binge eating, induced vomiting, consuming laxatives and exercising, only binge eating and exercising differed significantly between younger students (12 –15 years) and older students (16 –19 years). Compared to older students, younger students reported more binge eating once a day or more. Likewise, more younger students exercised two to six times a day compared to older ones.

Exercising was the only significant behaviour that differed across BMI categories, with overweight students reporting the highest percentage for those who exercised twice to six times per week and at least once per day during the last six months, followed by students in the normal weight group. Students who were classified as high risk reported more bingeing, induced vomiting, laxative consumption and exercising compared to low-risk students.

According to the EAT-26 subscales (dieting, oral control, bulimia, and food preoccupation), BMI was negatively correlated with oral control and positively correlated with dieting. However, none of the scales showed any correlation with age.

Considering that DEB's primary goal is weight loss, the non-significant association between BMI and DEBs suggests that this interaction is complex and requires further research to fully understand the nature of the relationship and define other mediators. To further explore this complex interaction, a qualitative study was undertaken to identify the key determinants of DEBs and develop a conceptual understanding of the relationship between BMI and DEBs.

CHAPTER 6 QUALITATIVE PHASE (STUDY THREE)

This study explored the potential determinants of DEBs among female adolescents attending intermediate and secondary schools in Riyadh, using semi-structured interviews and applying Bronfenbrenner's Bioecological Model as a theoretical framework. Female students who reported a high risk of DEBs on EAT-26 (Study Two) were selected to participate in the interviews. This exploratory study identified several determinants of DEBs, including negative cognitions, conscious imitation/copying behaviours, bullying, comparisons, and negative comments. Some students highlighted biological determinants, mainly focusing on puberty, hormonal changes, and fear of chronic diseases. Family-related factors were identified as essential determinants, suggesting that disputes and conflicts between family members, particularly parents, can increase the likelihood of DEBs. Engaging in DEBs can also be caused by seeking parental care and attention. As described in Bronfenbrenner's

Bioecological Model, all depicted determinants originate from the microsystem—the inner circle that involves direct and immediate relationships with family, friends, and objects— and techno-subsystem that emphasises technology and the use of devices.

Most participants indicated that the frequency of DEBs would decline with age due to increased levels of awareness and comprehension, realising the risks and outcomes of engaging in DEBs. Although Studies One and Two both indicated that DEBs increased with age despite growing awareness and understanding of the associated risks, Study Three suggested a perceived decreased risk of DEBs with age.

7.2 INTEGRATION OF MAIN FINDINGS

This section of the discussion integrates the key findings of this thesis and compares them in the context of the existing literature. The main findings are:

- 1) Studies One and Two confirmed the significance of DEBs in Saudi Arabia, with rising prevalence among adolescents, and comparable rates across regions in Saudi Arabia.**
- 2) Studies Two and Three indicated that DEBs risk is not directly related to BMI and weight status, yet it is affected by weight status perception and body dissatisfaction.**
- 3) All three studies demonstrated that age is an important factor; however, the evidence is inconsistent.**

4) Study Three indicated that most determinants contributing to the development of DEBs originate from the microsystem, encompassing the technosubsystem of Bronfenbrenner's Bioecological Model.

Studies One and Two confirmed the significance of DEBs in Saudi Arabia, with rising prevalence among adolescents, and comparable rates across regions in Saudi Arabia.

This thesis makes an original contribution to the knowledge of DEBs, including their prevalence, frequent behaviours, and correlations with key parameters among female adolescents in Saudi Arabia. The findings confirmed that the prevalence of DEBs in young females in Saudi Arabia is comparable to that in other Western countries. Study One indicated a prevalence of EDs/DEBs ranging from 10.2% to 48.1% across regions in Saudi Arabia using EAT-26, and Study Two confirmed a prevalence of almost 30% of DEBs among female school students indicated by scores of 20 or more on the EAT-26.

The literature consistently highlights females to be more concerned about their body weight, exposing them to a higher prevalence of DEBs (Mallick, Ray and Mukhopadhyay, 2014; Neumark-Sztainer *et al.*, 2002; Torstveit, Agedal-Mortensen and Stea, 2015). Nonetheless, findings from Study One highlighted that males also have a significant risk of EDs/DEBs, which were inconsistent with existing literature. The studies in the review that included male participants found that DEBs are prevalent in this group, with significant prevalence rates among both females and males. It was evidenced by the 19.3% reported by AlHazmi and AlJohani (2019), 65.5% reported by Tomar and Antony (2021), and 40% as reported by Loni *et al.* (2022). Males were recruited by Ghafouri *et al.* (2021), but a general figure of

prevalence for both females and males was produced (46%). Meanwhile, it is important to acknowledge that these studies recruited small sample sizes relative to female samples from other studies in the review, indicating that the capacity to generalise research findings is frequently constrained by samples that may not be representative of the actual population of male adolescents. AlHazmi and AlJohani (2019) recruited 171 male adolescents and 171 females and concluded an increased vulnerability of DEBs in females compared to males (38% vs. 19.3%). On the other hand, Loni *et al.* (2022) selected 35 male adolescents versus 90 females, making up only 28% of the sample, and indicated that males had a higher risk of DEBs (40%) compared to female adolescents (33.3%). Ghafouri *et al.* (2021) recruited 72 males versus 399 females but did not explore sex variations in relation to DEB. Tomar and Antony (2021) recruited only males (n=60) and concluded a significant risk among the sample. This clearly indicates that these findings are not conclusive and require further exploration to understand the nature of DEBs among male adolescents in Saudi Arabia. Another possible explanation could be related to publication bias, represented by the selective publication of studies with noteworthy or favourable findings.

Findings from Study Two suggest that prevalence rates in Riyadh have risen to 30%, compared with Al-Subaie (2000), who indicated a prevalence of 15.9% of DEBs among female adolescents in intermediate and secondary schools, which was the only study implemented in Riyadh concerning EDs/DEBs as highlighted in Study One. Comparing our sample to that of Al-Subaie (2000), both studies recruited female adolescents from

intermediate and secondary schools in Riyadh to explore DEBs. In contrast to Al-Subaie (2000), who recruited 1179 female students, our sample size was smaller (n=416). Furthermore, the tool used to investigate DEBs differed; our study used the EAT-26, whereas Al-Subaie (2000) used the EDI-DT.

The literature indicates that DEBs are apparent among both sexes. However, the evidence suggests that DEBs are more prevalent in females, which is not consistent with our findings (Mallick, Ray and Mukhopadhyay, 2014; Neumark-Sztainer *et al.*, 2002; Torstveit, Aagedal-Mortensen and Stea, 2015). Literature from the Middle East and Western countries indicated a higher risk of DEBs among females compared to their male counterparts. In the Middle East region, a review of DEBs revealed a significant proportion of adolescents and adults classified as high risk for EDs, with the highest risk reported among university students in Egypt, including females and males (Females: 75.8%; Males: 69.6%) (Azzeh, Peachey and Loney, 2022).

Cybulski *et al.* (2021) identified that the prevalence of mental health disorders and self-harm among adolescents in the UK significantly increased in both females and males between 2003 and 2018, with females experiencing greater rates of EDs, anxiety, depression and self-harm. In the US, a study on DEBs during adolescence identified a rising prevalence among females and males (Simone *et al.*, 2022). These behaviours ranged from 2.3% to 45.5%, and binge eating prevalence ranged from 6.3% to 23.2%, with young females reporting more DEBs compared to their male counterparts. A study on Australian adults and adolescents explored

the trends in the prevalence of DEBs over 20 years and identified an increase in the prevalence of DEBs (Santana *et al.*, 2023). The prevalence of binge eating increased significantly, while dieting increased dramatically from 1998 to 2008, then remained stable between 2008 and 2016. Females were associated with greater odds of endorsing dieting.

According to region, findings from Study One indicated a rising trend of EDs/DEBs across regions, with the eastern region having the highest overall prevalence, ranging from 29.4% to 65.5%, followed by the northwest region (48.1%). The northern region reported the lowest prevalence (25.4%). The prevalence in the central region (i.e. including the city of Riyadh) ranged from 15.9% to 36.8%. Even though the selected cities varied in terms of population, climate, and size, they all showed a high risk prevalence of EDs and DEBs. Study Two also indicated that regions in Riyadh did not seem to be strong predictors of DEBs, with only two schools exhibiting significant differences—the 40 Intermediate School in the west and the 213 Intermediate School in the north. This suggests that the regions of Riyadh have a comparable prevalence of DEBs, which is comparable to other regions in Saudi Arabia.

It was expected that Riyadh would have the highest risk of DEBs due to urbanisation and Westernisation, considering that Riyadh is experiencing the most significant share of urbanisation, being identified as the largest city on the Arabian Peninsula and the capital of Saudi Arabia. This unexpected finding is in contrast to Takimoto *et al.*'s (2004) findings on young Japanese females that confirmed the role of urbanisation in increasing susceptibility to DEBs in Japan. Their findings suggest that female adolescents living in larger cities have an

increased risk of DEBs compared to those residing in smaller cities due to misconceptions about body image, as females believe that they are overweight despite having a normal BMI. Urbanisation plays a significant role in increasing the incidence of eating pathology by raising concerns about body weight and body image (Gorrell, Trainor and Grange, 2019; Hay and Mitchison, 2021; Tiuganji *et al.*, 2020). These concerns that are indirectly related to urbanisation increase the possibility of DEBs and persistent consumption alertness. Al-Kloub *et al.* (2019) confirmed that adolescents experiencing urbanisation may face increased pressure to conform to Western standards, increasing the risk of DEBs. Comparable trends of DEBs in Saudi Arabia indicated that the whole nation is experiencing urbanisation, including the city of Riyadh. Alshehali, AlHadi and Waller (2021) confirmed that EDs and body image dissatisfaction are significant concerns among Saudi female students, with rates similar to those in Western cultures, implying that ongoing internalisation of Western values is a key factor in this trend.

The observed increase in DEBs rates in Saudi Arabia's regions cannot be clearly explained since there is no definitive rationale for the higher prevalence of DEBs in the Middle East.

The aetiology is not fully understood, but it is hypothesised that the interaction between genetic, cultural, and psychological factors drives individuals to EDs (Azzeh, Peachey and Loney, 2022).

Studies Two and Three indicated that DEBs risk is not directly related to BMI and weight status, yet it is affected by weight status perception and body dissatisfaction.

Although BMI did not predict DEBs, it was significantly correlated with dieting. Findings from Study Two demonstrated that female adolescents classified as overweight or obese were more likely to engage in dieting and food restriction, experiencing a greater preoccupation with thinness compared to their peers with normal or underweight BMI.

Furthermore, findings identified an inverse correlation between BMI and oral control, suggesting that females with lower BMI demonstrated elevated self-control in eating and encountered heightened external pressure to gain weight, in contrast to other female students who are overweight and obese.

Study Two also identified that the frequency of engaging in DEBs, particularly binge eating, induced vomiting and using laxatives, was not predicted by BMI. Exercising was the only behaviour that demonstrated a significant relationship with the BMI category; students categorised as overweight exhibited the highest percentages for exercising two to six times per week (14.7%) and once a day or more (7.8%) over the past six months. Weight loss (i.e. losing nine kg or more in the last six months) exhibited no significant variation among BMI categories. Since the main objective of DEBs is weight loss, the lack of a significant correlation between DEB and BMI indicates that this relationship is rather intricate, suggesting that a DEB directly contributes to weight loss (diet restricting, fasting, consuming laxatives, exercising, induced vomiting) or weight gain (binge eating), as a two-way relationship, rather than being simply associated with BMI. A longitudinal study explored DEBs and BMI trajectory over 15 years among adolescents from Project Eating and Activity

in Teens and Young Adults (EAT) in the US. During a 15-year follow-up period, adolescents who participated in DEBs had higher BMI. It was concluded that engaging in DEBs predicted higher BMI, irrespective of the type of DEB (Yoon *et al.*, 2020).

It is essential to consider the role of shape concerns, negative body image, and a preference for a thin body ideal in increasing the vulnerability of DEBs. Findings from Study Three indicated that participants who felt overweight or fat, despite not being physically overweight, had a strong desire to lose weight. Their BMI ranged from underweight to overweight (14.18 kg/m² to 27.51 kg/m²), yet most of them expressed they were unhappy with their weight or shape.

Participants explained that different actions can aggravate feelings of shame and embarrassment about their bodies, such as trying on clothes or watching other girls. Many adolescents repeated phrases such as “I don’t want to eat anymore”, “I want to be like her”, and “I don’t want this body”. They characterised overthinking as a means of cultivating negative thoughts and cognitions about their weight and distorting confidence levels. They also reported that negative self-talk related to shape/appearance can induce negative body image and severely undermine confidence. Bullying and negative comparisons from parents and school peers can also trigger such feelings. Negative comparisons over body image and weight perceptions may be detrimental, causing DEBs. Comparisons are motivated by feelings of shame and jealousy. The significance of biological factors during this sensitive

period of growth and development was also emphasised by adolescents, as females often struggle to accept changes in their weight and body shape.

The findings were inconsistent with previous literature that suggests that higher BMI is a potential risk factor for DEBs. However, this relationship is complex and affected by perception of weight status, body dissatisfaction and dieting behaviour. Existing literature confirms that the prevalence of DEBs is greater in adolescents with obesity compared to those within the normal weight range (Flament *et al.*, 2015; He, Cai and Fan, 2017; Jebeile *et al.*, 2021; Nagata *et al.*, 2018). High BMI and obesity exacerbate negative emotions, such as body dissatisfaction, depression and low self-esteem, increasing the likelihood of engaging in DEBs (Jebeile *et al.*, 2021). As depicted in Figure 13, Hayes *et al.* (2018) clarified that various individual and environmental factors intricately influence DEBs and obesity. Despite the significant influence of genetic and biological characteristics, a distinct cognitive pattern was reported in individuals with obesity and DEBs. Compared to children with obesity alone, children with DEBs and obesity have a different and deficient cognitive profile. Such deficiency interferes with executive functions and causes cognitive dysregulation, which acts as a precursor to dysfunctional behaviours such as binge eating, poor self-regulation, impulsivity and loss of control (Hayes *et al.*, 2018). Promoting a sedentary environment and the availability of high-calorie foods can increase obesogenic vulnerability.

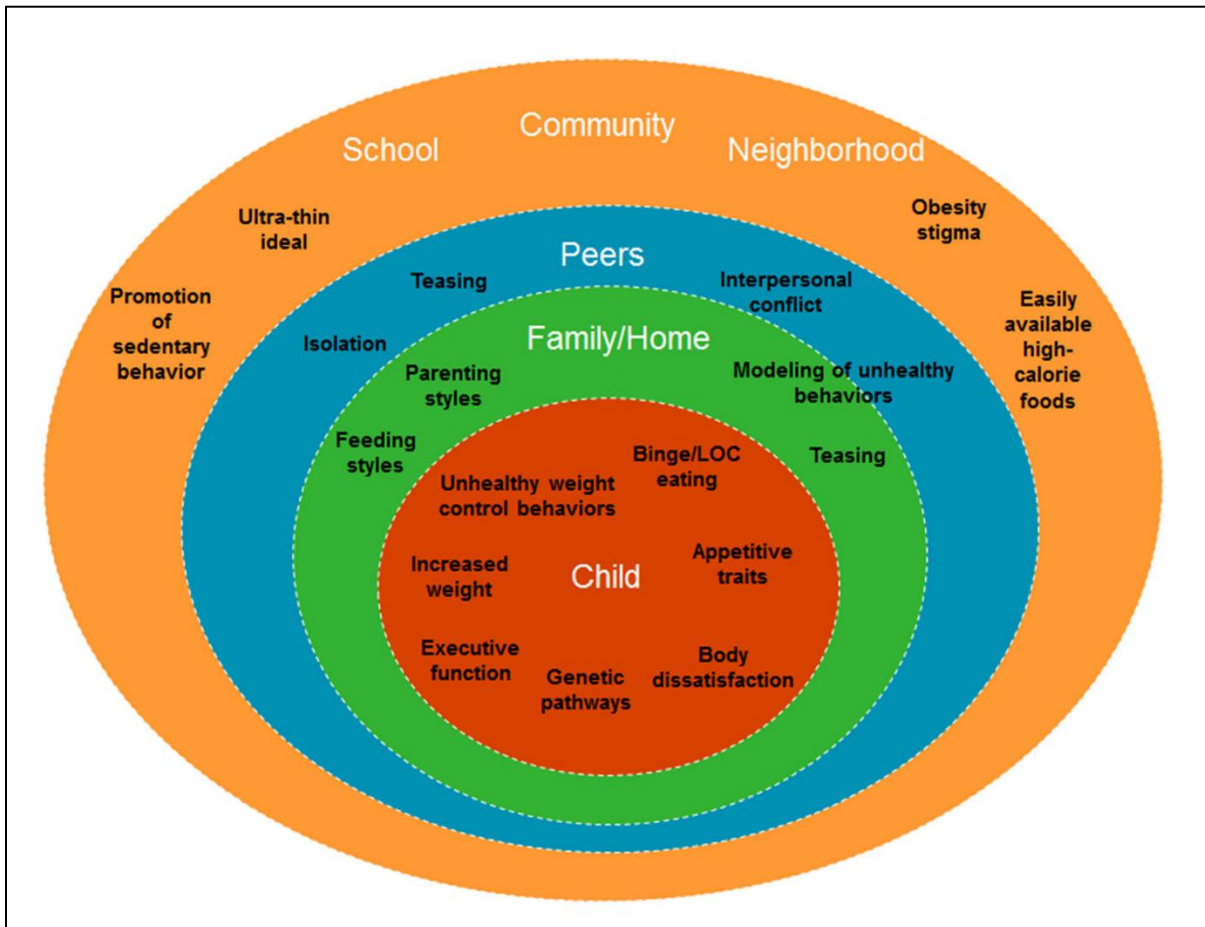
Interpersonal interactions and social characteristics also contribute to DEBs and obesity, promoting weight gain in generations, through a set of factors that are shared and/or

transmitted within populations. Some hereditary factors that parents pass on to their children include genetic predispositions that influence metabolism and appetite, increasing the risk of weight gain and obesity (Carnell *et al.*, 2023). Biological mechanisms, specifically changes in metabolic rates and appetite hormones, can make individuals more vulnerable to gaining weight. Both genetic and environmental factors may have an impact on these changes (Hanson, Weickert and Barber, 2020). Diet and lifestyle are both important factors linked to weight and obesity risk. Parents play a crucial role in shaping their children's diet and lifestyle (Kłosowska *et al.*, 2022; Mahmood *et al.*, 2021). Children's dietary behaviours can be positively impacted by practices like role modelling and moderate restriction, and parents can set an example of healthy eating during family meals and dietary habits. Essentially, the risk of childhood obesity is linked to parental lifestyle factors, including physical activity, diet quality, BMI, and smoking (Lecorguillé *et al.*, 2023).

This challenging contradiction stems from the conflicting messages sent within the environment: it simultaneously fosters a thin body ideal while promoting behaviours that lead to weight gain. This predisposes generations to DEBs and obesity (Bristow *et al.*, 2020; Huang, Peng and Ahn, 2020).

Figure 13 Individual and Environmental Factors Associated with DEBs and Obesity/BMI

Adapted from Hayes, J.F. *et al.* (2018) Disordered eating attitudes and behaviours in youth with overweight and obesity: implications for treatment (*Appendix 20*)



All three studies demonstrated that age is an important factor; however, the evidence is inconsistent.

Findings from this thesis confirmed the significant role of age in the development of DEBs.

In Study Two, female adolescents who are older (16–19 years) were found to have a significantly higher risk of DEBs compared to younger adolescents (12–15 years), suggesting an increased risk of DEBs as adolescents grow older. This pattern was supported by the

findings from Study One, which reported prevalence rates ranging from 10.2% to 42.5% for secondary and intermediate school students and 29.4% to 65.5% for university students.

Findings from Study Three concluded that most adolescent females believed that DEBs would be reduced with age. Participants explained the role of knowledge and understanding with growing older in enhancing emotional and behavioural control, recognising risks, and addressing negative consequences, which will aid in comprehending risks associated with DEBs and limiting such behaviours. This is inconsistent with the findings from Studies One and Two, which indicated that growing older is linked to increased concerns related to weight and more susceptibility to DEBs.

The relationship between age and DEBs in adolescents is not definitively established, as most studies focus on specific age groups rather than the entire adolescent spectrum (Jones *et al.*, 2001; Ward *et al.*, 2019). A recent meta-analysis explored changes in DEBs over ten or more years and identified that the magnitude of risk reductions for practising certain compensatory DEBs was greater, and the risk of engaging in DEBs declined for adolescents over time (Romano *et al.*, 2020). Another systematic review and meta-analysis estimated the global proportion of DEBs in children and adolescents and found that the proportion positively correlated with age, with the prevalence of DEBs elevated with increasing age (López-Gil *et al.*, 2023).

As vulnerability to DEBs increases in adolescence, clinical disorders often persist during adulthood (Micali *et al.*, 2015b; Ruan *et al.*, 2023; Slane *et al.*, 2014). Scientific evidence

suggests that symptoms, particularly behavioural and cognitive symptoms, typically develop in adolescence, explaining the peak incidence and point prevalence of DEBs and EDs before reaching 18 years. The persistent rise in overall disordered scores from late adolescence to early adulthood may be due to shifts in cognitive concerns about weight and body image, as well as age-related increases in self-consciousness (Rankin *et al.*, 2004; Ruan *et al.*, 2023; Slane *et al.*, 2014).

Despite inconsistent findings on the relationship between age and DEBs, it is clear that adolescence is associated with increased susceptibility to DEBs. The findings of the literature are inconclusive; although some research indicated that DEBs persist and increase in adolescence through early adulthood, others confirmed that middle-aged adults may have a higher tendency to DEBs (Hadjigeorgiou *et al.*, 2018; Neumark-Sztainer *et al.*, 2011).

Evidence generally acknowledges that the aetiology of such behaviours is complex, confirming that DEBs can occur at any age and are not confined to adolescence (Hadjigeorgiou *et al.*, 2018).

Study Three indicated that the majority of determinants contributing to the development of DEBs originate from the microsystem, encompassing the techno-subsystem of Bronfenbrenner's Bioecological Model.

Determinants of DEBs identified in Study Three that arise from the microsystem are centred on intrapersonal cognitions and perceptions, including negative cognitions, conscious imitation/copying behaviours, and interpersonal interactions, including bullying,

comparisons, and negative comments. The transition from adolescence to adulthood is characterised by an increased emergence of emotional and behavioural problems, with early adolescence being a pivotal phase for their onset (Neumark-Sztainer *et al.*, 2011; Sekaran *et al.*, 2017). As articulated by Bronfenbrenner (1994), each adolescent is distinctly shaped by the influences inside immediate and external environments, highlighting direct contacts with family, friends, neighbours and the school, which are components of the microsystem.

Determinants and factors identified in the microsystem can be classified into intrapersonal and interpersonal. At the intrapersonal level, negative cognitions, including self-esteem and confidence issues and negative body image, were frequently stated by female adolescents.

Negative cognitions are triggered by negative self-talk and overthinking in relation to weight and shape. Adolescents explained that they perceive their bodies as different or strange when compared to a slim body, feel uncomfortable with their bodies and avoid wearing clothes they like, due to negative body image. Literature confirmed the role of negative emotions, body dissatisfaction, weight concerns, and low self-esteem on the development of DEBs

(Dingemans, Danner and Parks, 2017; Kenny *et al.*, 2021; Özdin *et al.*, 2020). In the Arab world, including Saudi Arabia and the UAE, the risk of DEBs/EDs is significantly correlated with negative emotions (i.e. depression and anxiety) and body dissatisfaction (Alhuwaydi, 2024; Alrahili *et al.*, 2024; Melisse, Beurs and Van Furth, 2020).

Conscious imitation/copying behaviour is another intrapersonal factor highlighted by female adolescents, increasing the risk of DEBs. They expressed that they feel tempted to mimic and

copy the behaviours of others when they observe their bodies, either in real-life or on social media. According to their explanation, they feel overlooked and unnoticed because of their lack of beauty. They would imitate the actions of an attractive girl to get a similar body and become noticeable.

Self-comparisons were also identified by adolescents who experience difficulties comparing themselves to others in terms of their body image and weight perceptions. This is driven by a strong desire to lose weight, associated with feelings of shame and jealousy.

It is important to emphasise that adolescents' susceptibility to these determinants, including negative cognitions, body dissatisfaction, and self-comparisons, can be influenced by specific personality traits, rendering certain adolescents more at risk than others. Adolescence is a critical period for developing personality traits, such as perfectionism, neuroticism, avoidance motivation, and heightened sensitivity to social rewards, which significantly impact eating pathology and the likelihood of developing DEBs (Dufresne *et al.*, 2020; Farstad, McGeown and von Ranson, 2016; Legg and Turner, 2020). Some adolescents have more vulnerability to perfectionism, with 32% to 46% of perfectionistic concerns and neuroticism being inherited (Burcaş and Creţu, 2021). Neuroticism, characterised by anxiety, mood fluctuations, worry, and perfectionism, is a risk factor for DEBs, with those with elevated neuroticism more prone to irrational behaviour and impulsive decision-making (Bien, Wagner and Brandt, 2024; Butcher, Mineka and Hooley, 2017). Impulsivity mediates the relationship between

neuroticism and DEBs, with increased levels of impulsivity often linked to elevated body dissatisfaction in females (Thamotharan, Hubbard and Fields, 2015).

The techno-sub system is a key component of the microsystem, comprising the use of the internet and social media. Participants in Study Three explained that while social media might have advantages, it could also have drawbacks, raising the risk of DEBs. They clarified that they question their weight and appearance because social media constantly highlights slender and toned bodies, leading them to believe they are neither attractive nor beautiful. They also indicated that they were following specific celebrities' activity routines and diets to reach similar physiques. They mentioned cyberbullying as a commonly experienced phenomenon on social media platforms, characterised by posting abusive comments from unidentified or anonymous accounts. They classified it as more harmful than traditional bullying.

Literature confirmed that having social media accounts, particularly on Instagram and Snapchat, is associated with higher DE cognitions and behaviours among adolescents (Wilksch *et al.*, 2020). According to another study, 84% of female adolescents and young adults who interacted with pro-ED online content on social media reported having symptoms similar to those of clinical or subclinical EDs (Fitzsimmons-Craft *et al.*, 2020).

At the interpersonal level, familial and parental factors significantly influence adolescents' DEBs. Considering negative comments and comparisons, adolescents ranked comparisons from family, especially parents, as the most stressful source, followed by siblings and other

family members. They stated that comparing them to slender or thinner females is detrimental, especially when the mother is involved. Some adolescents also mentioned relationships among family members and the home environment as the main factors influencing DEBs. Parental emotional insensitivity and weight teasing within the family are associated with the development of a specific DEB, such as binge eating (Saltzman and Liechty, 2016). Among Middle Eastern females, increased appearance pressures and “fat talk” from mothers and sisters were linked to DEBs (Deek, Kemps and Prichard, 2024). The term “fat talk” is a particular type of negative body talk that pertains to criticisms of one’s physical appearance and has consistently been linked to body dissatisfaction and the development of an ED (Deek, Kemps and Prichard, 2024). Appearance pressures from family members are predictive of body dissatisfaction, which is mediated by appearance comparisons and internalisation of the thin ideal, contributing to the development of DEBs. Friends and peers are also significant interpersonal components predicting the development of DEBs and body dissatisfaction among adolescents (Amaya-Hernández *et al.*, 2017). Participants acknowledged the role of bullying on weight and shape on mental health and school achievement. They clarified that it could and, in some cases, does lead to depression and isolation, increasing the risk of DEBs. Peer comparisons in relation to weight and shape can trigger feelings of body dissatisfaction. Body dissatisfaction can be triggered by various peer interactions, including appearance teasing, conversations about appearance, perceived pressure to be thin, and friends’ modelling dieting behaviour (Webb and Zimmer-Gembeck,

2014). Weight-related teasing increases the likelihood of DEBs, particularly emotional eating, eating in the absence of hunger, and loss-of-control eating episodes, with these relationships mediated by negative affect (Rubin *et al.*, 2021). According to a meta-analysis, participants with an ED were two to three times more likely to have encountered bullying and appearance-related teasing prior to disorder onset compared to healthy controls (Lie, Rø and Bang, 2019).

Although determinants and factors identified in Study Three interviews primarily originated from the microsystem, it is essential to consider the roles of the mesosystem, exosystem, macrosystem, and chronosystem, as they indirectly influence adolescents through the microsystem (Bronfenbrenner, 1977; Bronfenbrenner and Ceci, 1994). This ecological perspective highlights the intricate interactions among several environmental layers that influence adolescent development and behaviours (Delany and Cheung, 2019). The following is a description of the primary characteristics in each system that tend to have the most significant influence on adolescents and susceptibility to DEBs.

As the mesosystem highlights the connection between two or more microsystems, it can be primarily influenced by adolescents' family-peer relationships. Among interviewed participants in Study Three, the importance of family and peers was evident, as they explained how comparisons and negative comments hurt and are harmful when they come from close members. Through adolescence, interrelationships between parenting and peer factors indicated shifts in risky behaviour. Parental care and monitoring predicted an overall

reduction in risky behaviour. They served as a protective factor for adolescents, particularly those who were susceptible to such behaviour. This susceptibility often arose from complex peer interactions, due to being favoured by certain peers while simultaneously disliked by others (Véronneau and Dishion, 2010).

Exosystem, which specifies social contexts when adolescents are not present but are nevertheless influenced by their roles and/or functions, primarily focuses on the role of mass media and its influence on adolescent behaviours. Participants described conscious imitation/copying behaviours on social media, which can also be applied to mass media. Participants intentionally copy certain behaviours (diets, recipes, exercising methods, etc..) viewed on media to reach a similar shape or body physique. Mass media influence is linked to a higher likelihood of body dissatisfaction in adolescents, which is linked to a higher risk of DEBs (Uchôa *et al.*, 2019). Barcaccia and others (2017) confirmed that prolonged screen time could indirectly lead to the development of DEBs due to an increased desire to imitate screen characters.

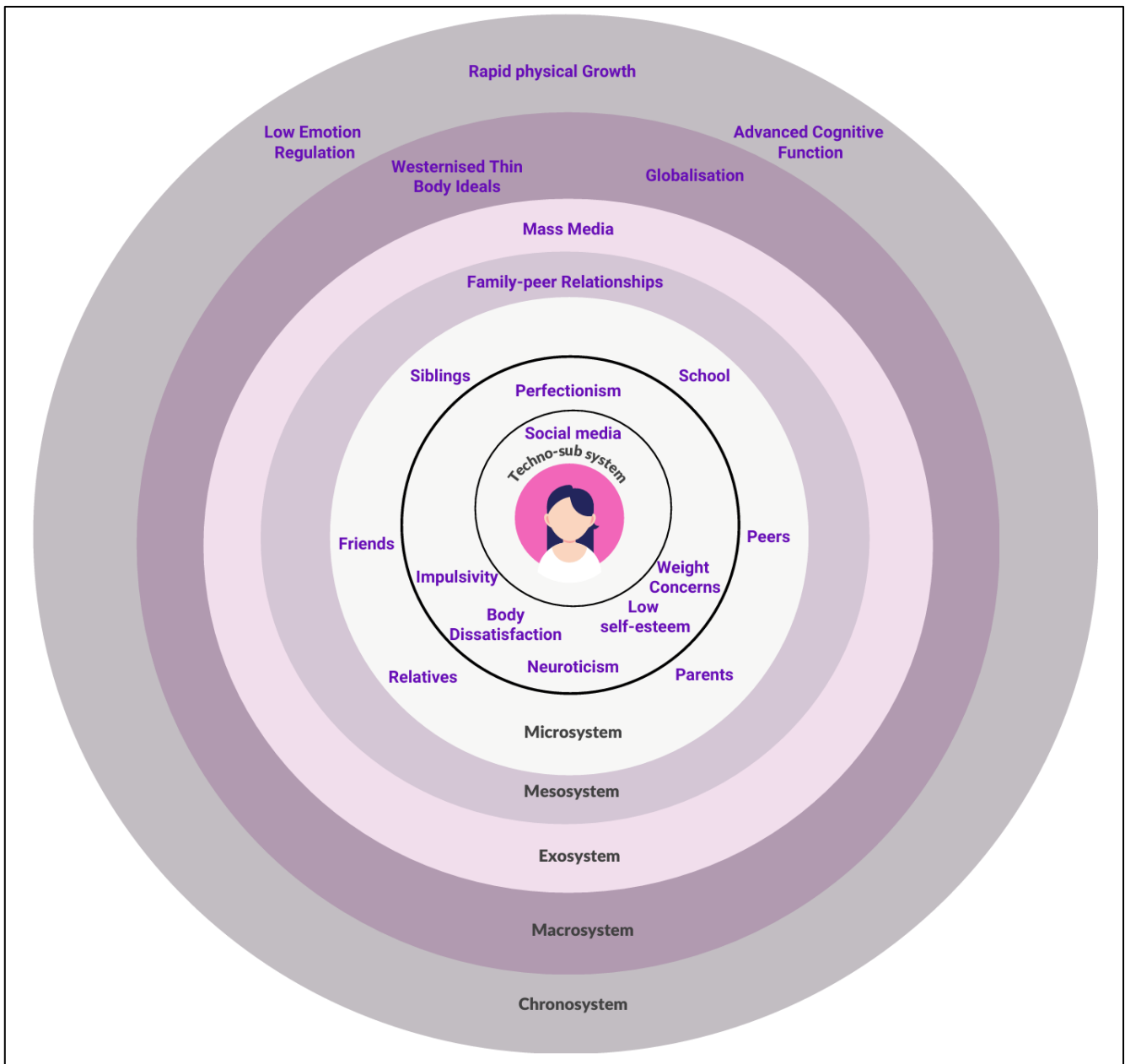
Macrosystem factors include Saudi Arabian cultural and social values surrounding body preference and beauty standards. It was evident that participants viewed the ideal of a slender and thin body as the sole representation of beauty and attractiveness, and any other physique that is not thin as abnormal and unattractive. Globalisation has contributed to the dissemination of Western lifestyles and ideals, which have impacted Saudi Arabian cultural identity (Alsisy and Alsewiket, 2020). This has caused a growing conflict between Western

values and Arabic traditions, shifting the traditional Arabic perception of a plump and attractive body to one favouring a thin body ideal. Consequently, the likelihood of DEBs increases due to elevated body dissatisfaction and negative body image (Latzer, Azaiza and Tzischinsky, 2014).

Chronosystem, emphasising the dimension of time, connects best with adolescents' internal changes, identifying physiological changes that occur with ageing. Participants identified the role of puberty and hormonal shifts in increasing the risk of DEBs, indicating that negative emotions related to body and confidence may be exacerbated by early pubertal timing.

Adolescents may respond to changes in their surroundings differently as they become older and may be better able to predict how those changes will influence them (Andrews, Ahmed and Blakemore, 2021). At the same time, they have a more challenging time controlling their emotions and are more susceptible to mood swings (Stang and Story, 2005). They face difficulty with emotion regulation, especially related to impulse control and goal-directed behaviour (Defayette *et al.*, 2021). Due to their rapid growth and development, adolescents may be particularly susceptible to a range of health concerns as well as psychological difficulties (Patel *et al.*, 2021). The following figure highlights factors more likely to increase vulnerability to DEBs among participants (**Figure 14**).

Figure 14 Adolescent's Vulnerability to DEBs Through Bronfenbrenner's Bioecological Model



7.3 THESIS STRENGTHS AND LIMITATIONS

Throughout this thesis, strengths and limitations were discussed for each study in its corresponding chapter. Therefore, this section highlights general strengths and limitations that require further consideration.

A strength of the research was that his thesis adopted the explanatory sequential mixed-methods research (MMR) to fully understand DEBs among adolescents in Saudi Arabia. The relevance of MMR through the combined application of quantitative and qualitative methodologies provides a more profound understanding of research problems than employing each method independently (Adu *et al.*, 2022).

Although MMR provides a framework integrating quantitative and qualitative methodologies to enhance research understanding, applying it is complex and time-consuming (Tariq and Woodman, 2013). Both methodologies have distinct and different data collection and analysis tools, from recruiting students to presenting findings. This demands the skills and knowledge to undertake a variety of quantitative and qualitative data collection procedures (Cresswell and Plano Clark, 2011; Zoellner and Harris, 2017). The MMR design, starting with the quantitative phase followed by the qualitative phase, represents the most appropriate design for this thesis. Conducting quantitative research first, by recruiting students to report EAT-26 responses, meant that for the subsequent qualitative research, students could be selected based on their scores, to be recruited for the interview, and the interview guide adjusted depending on the EAT-26 findings.

Convenience sampling was employed for selecting schools. This non-probability sampling method is considered a valuable technique for sampling, particularly when large populations generate randomisation difficulties (Etikan, Musa and Alkassim, 2016). It was acknowledged that convenience sampling introduces sampling bias, while random sampling is more

representative of the population (Tyrer and Heyman, 2016). However, random sampling was not feasible due to time constraints and comprehensive Ministry of Education (MOE) regulations for accessing schools and recruiting students. Consequently, convenience sampling was preferred due to time constraints to ensure approved access for a selected number of schools deemed representative of the relevant population. Given the small number of schools it was feasible to recruit.

Data collection, particularly EAT-26 responses, was done during the holy month of Ramadan. From sunrise to sunset, Muslims refrain from eating or drinking, including water or chewing gum. Breaking the fast at the end of each day is recognised as an opportunity for everyone to eat together. Religious fasting and diet restriction interfere with usual eating behaviours, which could trigger DEBs (Akgül, Derman and Kanbur, 2014; Hasan *et al.*, 2021). The effects of fasting on EAT-26 responses can be explained by food-related attentional bias. Hunger during fasting might increase attentional bias towards bingeing high-calorie food, which could lead to more DEBs reports (Placanica, Faunce and Soames Job, 2002). If data collection for surveys were to be repeated, the optimal scenario would involve conducting it during any month when students are regularly consuming food and adhering to their usual dietary patterns.

The role of subjectivity and reflexivity is acknowledged in qualitative components. These reflections stemming from personal experiences might have influenced the qualitative research process and brought potential biases. Realising the researcher's reflexivity due to

earlier challenges, accepting changes in weight and shape, bullying, and negative comments is important. This is regarded as a strength, as it enabled the researcher to better understand the interviewees' experiences by comparing them to her own, which affected the interviewing process and data analysis. Also, the focus on family and school peers' questions might arise from the researcher's appreciation of these particular relationships.

With just the principal researcher conducting the process of transcription and analysis, the process was lengthy. Since the data were collected and transcribed in Arabic, the analysis was conducted in Arabic. Then, qualitative themes were formulated in English, and quotes were translated into English by the principal researcher. This could be viewed as a limitation because other researchers did not review the transcripts due to the language barrier. However, to minimise the risk of losing the intended meaning during translation from Arabic to English, 10% of the transcripts were reviewed by a second researcher, an Arabic speaker, and themes were agreed upon following an independent review by the principal researcher and the second researcher.

7.4 IMPLICATIONS FOR POLICY AND PRACTICE

This thesis examined DEBs among female adolescents in Saudi Arabia. Based on the aspects highlighted in the thesis, these findings indicate that it is imperative to acknowledge that DEBs are a significant concern in Saudi Arabia that must be addressed to limit their progression to clinical EDs. Implications are discussed according to the phases conducted

(systematic review (Study One), quantitative phase (Study Two) and qualitative phase (Study Three)).

The systematic review findings imply the need to address the risk of DEBs in both sexes across the adolescent age range in Saudi Arabia. It is essential to highlight the critical need for this population to access effective DEBs prevention and treatment programmes. Findings suggest that DEBs preventive measures should be planned before and continue through adolescence. Adolescent-focused interventions should be developed for schools and universities to foster nutritious eating practices and an active lifestyle, thereby promoting healthy behaviours and reducing the prevalence of DEBs. As these disorders are more deeply rooted in self-perceptions of weight and body image, applying a holistic approach incorporating physical activity, education on body image and body dissatisfaction management may be required to promote self-esteem and contribute to psychological well-being and healthy behaviours. For example, an interactive programme that covers cultural influences on body image, weight regulation, eating disorders, self-esteem, stress management, healthy eating, and non-dieting was presented to UK female school students in Year 9. It was found that dietary restraints, shape concerns, and dietary concerns were reduced in intervention students compared to control students (Stewart *et al.*, 2001). López-Guimerà *et al.* (2011) applied a school-based EDs prevention programme for Spanish female secondary school students. They received a partial version of the prevention programme (without nutritional education) or the full programme (containing fundamental nutrition

concepts, media literacy, and criticism of aesthetic models of beauty that emphasise extreme thinness). Both the full and partial prevention programmes improved students' eating attitudes and nutrition knowledge while lowering perceived pressure to be thin compared to students who received no programme.

Significant prevalence rates of DEBs across regions in Saudi Arabia indicate that it is considered a public health concern. Therefore, raising awareness and implementing intervention programmes/ health promotion in schools, colleges, and the general public should be the goal of public health professionals and organisations.

The survey findings indicated that older adolescents are more likely to manifest DEBs, highlighting the necessity of creating tailored interventions that offer educational awareness for adolescent students on DEBs to reduce their onset and prevalence in secondary schools.

Abhilasha and Joel (2019) applied a structured education programme on EDs to high school adolescent girls in India and demonstrated that it was a useful instrument for raising adolescents' awareness of EDs, as evidenced by the significant differences between the pre-test and post-test knowledge scores.

Despite significant DEBs prevalence, BMI was not a significant predictor. This implies the need to address the role of body dissatisfaction and the idealisation of thinness in increasing the risk of DEBs. Adolescents can benefit from interventions and programmes that promote healthy weight and positive body image (Rohde, Stice and Marti, 2015).

The interview findings identified specific determinants centred around family, schools, and media. Aspects of the family environment, including family functioning and the nature of the parent-adolescent relationship, may be crucial when designing interventions to promote adolescents' weight status and healthy behaviours. Parents should strive to foster a positive parent-adolescent relationship by balancing adolescents' growing desire for independence with the need for structure and supervision, particularly supervising eating behaviours. Family support and motivation can act as protective factors from engaging in DEBs. Parent education programmes that promote ongoing communication and understanding can be conducted in multiple venues to help reduce conflict and better adapt to the changing dynamics of adolescents. Healthy eating and a positive body image can be the main topics of these parent programmes, which may improve eating habits, confidence level, and body satisfaction of their adolescents. A healthy lifestyle programme (Peer education About Weight Steadiness Club- PAWS) was implemented for middle school students in the US with parental participation. It was concluded that parental participation may enhance the frequency and atmosphere of family mealtimes, as well as foster self-control and social support for the family's dietary behaviours (Muzaffar, Nikolaus and Nickols-Richardson, 2019).

For schools, bullying seems to be the primary problem that requires interventions and prevention strategies. Implementing school programmes that empower adolescent peers to stop bullying and utilising the influence of older peer mentors would foster a school environment that discourages aggressive behaviours and motivates students to ask for help

(Grenz, 2014). Empowering Teen Peers to Prevent Bullying is an effective programme designed by Horne and others (2012) for secondary school students, which offers a guide that teachers or school social workers can adopt. This programme combines four strategies designed specifically for adolescents: connecting with older peer mentors, working in groups, increasing connectedness, and teaching social and emotional skills. All school staff members play a key role in putting whole-school strategies designed to stop bullying into practice. Building students' self-confidence and providing supervision and guidance are considered core preventive measures.

With cyberbullying, it is imperative that schools acknowledge it as a major concern, particularly among intermediate schools, and devote efforts to limit its prevalence. Schools must be responsible for setting strict policies and measures for cyberbullying while providing teaching strategies that promote diversity, appreciation, and empathy. "Media Heroes" is a cyberbullying prevention programme designed for middle school students in Germany. The programme's effectiveness in reducing cyberbullying behaviour was clearly demonstrated in intervention classes compared to control group classes (Wölfer *et al.*, 2014).

Schools should implement programmes that are focused on DEBs prevention. Since faculty and teachers have a unique opportunity to regularly interact with a large number of students and detect changes in them, it is important to have the best possible awareness of DEBs.

Professional programmes that offer formal training and guidance to identify and help students with DEBs increase the ability to detect students at risk and refer them to the appropriate

resources. According to a study on physical education teachers, participating in the “Psychology for Nutrition and Physical Activity programme” enhanced their knowledge of EDs and provided them with educational resources for dealing with such behaviours (Monserrat *et al.*, 2024). Another study on US school faculty and staff applied a professional development DEBs prevention programme and indicated increased ability to detect students at risk and direct them to the appropriate resources (Anderson *et al.*, 2017). Implementing programmes that enable collaborations with students, families, and schools could also be beneficial in reducing risk and adopting healthy behaviours. A systematic review explored parents’ involvement in interventions aiming to prevent body dissatisfaction or EDs in their children. When parents were involved, children’s outcomes were significantly improved in relation to DEBs or body dissatisfaction (Hart *et al.*, 2015).

For the media, rather than focusing on laws and legislation to limit media exposure and reduce the detrimental effects of viewing thin, ideal images, an alternative strategy would be to work on acquiring media literacy. It aims to develop critical thinking and viewing skills to limit susceptibility to negative media impacts and improve health outcomes (Brown and Bobkowski, 2011). Media literacy interventions intended to increase media literacy have been linked with reduced body and weight concerns (McLean, Paxton and Wertheim, 2016).

González *et al.* (2011) administered a media literacy programme to adolescent school students in Spain and concluded that media literacy-based programmes are effective interventions, decreasing the DEBs self-reported scores and internalisation of the ideal body.

7.5 IMPLICATIONS FOR FUTURE WORK

Each study in this thesis presents a novel contribution to the literature on DEBs and adolescents. Nonetheless, further research should be considered to better understand DEBs.

This section offers recommendations for future research, building on this thesis.

The systematic review indicated that the prevalence of DEBs and EDs among male adolescents and young adults is higher than that among females. There is a relative lack of research on males, which necessitates further investigation into the epidemiology of male DEBs and their contributing factors. Exploring the prevalence of DEBs among male adolescent students in intermediate and secondary schools would provide further insights and a deeper understanding of their occurrence among both sexes in Saudi Arabia.

A cross-sectional survey contributes valuable insights when adequately designed. Although it can yield significant findings related to disease prevalence, it is limited in drawing causal inferences (Savitz and Wellenius, 2023). The possibility of causation needs to be further explored using cohort studies to identify and explore primary factors and mediators causing DEBs in this complex bi-directional relationship.

Moreover, regional variances were nonsignificant, indicating no differences across schools concerning DEBs. The size and diversity of school samples were likely insufficient to compare findings across regions or school types, and a larger study would be required to further explore regional variances. Considering additional factors such as school

characteristics and socioeconomic factors, including parental income and education, as well as individual psychological and lifestyle elements, may elucidate differences among schools concerning the prevalence of DEBs.

Assessing the prevalence of DEBs among university students would also contribute to a comprehensive understanding of DEBs patterns in older adolescents and allow comparison of findings between younger school students and older university students.

7.6 FURTHER PLANS FOR DISSEMINATION

Further plans to share the findings of this thesis include:

- 1) Disseminating this thesis by presenting the findings in scientific presentations at King Saud University to share research findings with department members and students.
- 2) Presenting studies in relevant venues across Saudi Arabia, including educational, academic, and professional conferences, to educate the Saudi population about the significance of DEBs among adolescents and young adults.
- 3) Providing resources to guide professionals and individuals who interact with adolescents- such as those in schools or clinics- to monitor adolescents and provide necessary support if a DEB is suspected.

4) Seeking opportunities to participate on a global scale by presenting posters and infographics would educate academics and researchers about the nature of DEBs in the Arab world and the significant risks that adolescents face in Saudi Arabia.

7.7 CONCLUSION

This thesis makes a novel contribution to knowledge by establishing the prevalence of DEBs and specifically related behaviours in Saudi female adolescents and exploring the primary determinants of increasing vulnerability to such behaviours. DEBs are found to be a significant problem in this country, with a high risk of developing such behaviours across adolescents and young adults. Female school adolescents in Riyadh had an increased risk of DEBs, according to their EAT-26 scores. Negative cognitions, conscious imitation/copying behaviours, bullying, comparisons, and negative comments should be acknowledged as significant determinants increasing the risk of DEBs. The role of family, school peers, and media should be recognised and addressed to reduce the risk of DEBs. Teaching adolescents about healthy eating habits, positive body image, and the negative effects of DEBs is imperative. This significant rise in Saudi Arabia should compel researchers, physicians, and dietitians to formulate scientifically grounded standards for assessing and treating these detrimental behaviours. Further investigation is required, exploring other populations in Saudi Arabia to develop a better understanding of the prevalence of DEBs among males and females across the whole age range of adolescence.

APPENDICES

Appendix 1 License to use Figure. 1 Predispositional model- Five theoretical models of the eating disorder–personality (disorder) relationship from Lilenfeld, L. R. *et al.* (2006) Eating disorders and personality: A methodological and empirical review. *Clinical Psychology Review*, 26(3), 299–320. <https://doi.org/10.1016/j.cpr.2005.10.003>.



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Participant Information Sheet

Research Project Title: **Prevalence and Associated Predictors and Determinants of Eating Behaviours Among Female Adolescents in Saudi Arabia- Phase 1 (Quantitative Analysis)**

Dear parents,

Your daughter is invited to participate in this study. Before taking any decision, it is important to understand the study's purposes and the nature of your daughter's participation. Please read the information carefully and discuss it with others if you wish. Please be advised that participation is completely voluntary.

I'm Azzah Alsheweir, a faculty member at the Applied Medical Sciences college at King Saud University and I'm currently working on my PhD research with the School of Health and Related Research (ScHARR) at the University of Sheffield. My research focuses on studying particular eating behaviours among female adolescents.

With adolescence's remarkable growth, nutritional requirements reach their peak. It is essential to meet macronutrients and micronutrients demands, as deficiency may cause irreversible medical conditions. Adolescent females are identified to be more prone to particular eating behaviours compared males or other age groups. Due to a limited number of references concerning eating behaviours in Arabian countries, specifically in Saudi Arabia, the prevalence might be underreported.

In this project, your daughter's weight and height will be measured, then a self-administered questionnaire will be applied. The questionnaire EAT-26 (Eating Attitudes Test-26) includes 26 multiple-choice questions related to eating attitudes and food consumption. Upon your approval, your daughter will join an introductory session to explain the aims and purposes of the study. Then, the nature of participation and the type of data collected will be clearly detailed. At the end of the session, she will be given an informed consent to sign prior to her participation.



It is entirely up to you whether or not you approve your daughter's participation. Kindly, check the attached informed consent, select the suitable answers, sign it and return it with your daughter to school. Your daughter may withdraw at any time without incurring any consequences. No justification is required.

Anthropometric measurements and questionnaires will take place during school time after arrangements with teachers and school administration. Upon your approval, your daughter will have a formal excuse to leave class and join the intended project. The whole process might range from approximately 30-40 min. I will guide students and take measurements, with the presence of a trained assistant.

Data collection will be anonymous, as each student will be assigned a numerical ID number to maintain confidentiality. Anthropometric measurements and questionnaire responses will be entered into a password-protected spreadsheet. Participation in this study may impose minimal risk and potential harm.

Despite the fact that there are no immediate benefits for those participating in the study, it is intended that this effort will promote understanding certain eating behaviours among this highly vulnerable segment of the population.

According to data protection legislation, we are required to inform you that the legal basis we are applying in order to process your personal data is that 'processing is necessary for the performance of a task carried out in the public interest' (Article 6(1)(e)). Further information can be found in the University's Privacy Notice <https://www.sheffield.ac.uk/govern/data-protection/privacy/general>.

As we will be collecting some data that is defined in the legislation as more sensitive (information about health), we also need to let you know that we are applying the following condition in law: that the use of your data is necessary 'for archiving purposes in the public interest, scientific research purposes or statistical purposes' (9(2)(j)).

All the information collected from your daughter is strictly confidential and only members of the research team will have access to any information. Your daughter's identity will not be disclosed in any reports or publications.

Hard copies (questionnaires) will be kept in a non-transparent file and stored in a locked filing cabinet prior to data entry. Following data entry, questionnaires will be shredded and destroyed in confidential waste disposal. Spreadsheets containing all entered data will be stored on the university's secure unidrive (X drive). Data will be kept on the university repository for the standard retention period of 10 years after the study. The study's results will be presented in the report. The findings could be presented at conferences or published in journals. Your daughter's data will not be identifiable in any published results.

Due to the nature of this study, it is quite possible that other researchers will find the information gathered beneficial in resolving research issues. Before sharing your data in any manner, we will formally request your consent for sharing your daughter's data in any way.

The study is carried out by the main researcher, who is a PhD student at the School of Health and Related Research (ScHARR), University of Sheffield, UK.

This study has been ethically approved by the Research Ethics Committee at the University of Sheffield and the Research Ethics Committee at King Saud University in Riyadh. This indicates that both entities will act as data controllers and they are both in charge of safeguarding and appropriately using your information.

If you are unsatisfied with any part of the study and you would like to file a complaint, please email the main researcher [Azzah Alsheweir: aalshuweir@ksu.edu.sa; Mobile: +966555287767] in the first instance. If you wish to raise a complaint, please contact the main supervisor [Dr. Samantha Caton; s.caton@sheffield.ac.uk; Phone: 0114 2224198]. If you feel your complaint has not been handled in a satisfactory way you can contact the Head of the Department of the School of Health and Related Research (ScHARR) [Prof. **Mark Strong**; m.strong@sheffield.ac.uk; Phone: +44 114 222 0812]. If the complaint relates to how your personal data has been handled, please contact The University of Sheffield Data Protection Officer [Luke Thompson; data.protection@sheffield.ac.uk]. Also, you will find information about how to raise a complaint in the University's Privacy Notice: <https://www.sheffield.ac.uk/govern/data-protection/privacy/general>.

If you wish to make a report of a concern or incident relating to potential exploitation, abuse or harm resulting from your involvement in this project, please contact the project's Designated Safeguarding Contact [Dr. Samantha Caton; s.caton@sheffield.ac.uk; Phone: 0114 2224198]. If the concern or incident relates to the Designated Safeguarding Contact, or if you feel a report you have made to this Contact has



not been handled in a satisfactory way, please contact the Head of the Department the School of Health and Related Research (ScHARR) [Prof: **Mark Strong**; m.strong@sheffield.ac.uk; Phone: +44 114 222 0812] and/or the University's Research Ethics & Integrity Manager (Lindsay Unwin; l.v.unwin@sheffield.ac.uk).

In Saudi Arabia, if you are dissatisfied with any aspect of the research and wish to make a complaint, you can contact the Research Ethics at King Saud University [Dr. Taha Inam; dr_tahainam@hotmail.com, irbhuman@ksu.edu.sa].

If you have further inquiries or need more information on the study, please contact:

Main researcher

Azzah Alsheweir; aalshuweir@ksu.edu.sa; Phone: +966555287767.

Main supervisor

Dr. Samantha Caton; s.caton@sheffield.ac.uk; Phone: 0114 2224198

Co- supervisor

Elizabeth C Goyder; e.goyder@sheffield.ac.uk; Phone: 0114 222 0783

Thank you for your daughter's participation..

Appendix 3 Parent Consent Form (Quantitative Phase)



Parental Informed Consent Form

Prevalence and Associated Predictors and Determinants of Eating Behaviours Among Female Adolescents in Saudi Arabia- Phase 1 (Quantitative Analysis)

<i>Please tick the appropriate boxes</i>	Yes	No
Taking Part in the Project		
I have read and understood the project information sheet or the project has been fully explained to me. (If you will answer No to this question please do not proceed with this consent form until you are fully aware of what your participation in the project will mean.)	☐	☐
I have been given the opportunity to ask questions about the project.	☐	☐
I agree on my daughter's participation in the study. I understand that taking part in the project will include measuring my daughter's weight and height. After that, she will be asked to complete a questionnaire on eating attitudes.	☐	☐
I understand that approving my daughter to participate as a volunteer in this research, this does not create a legally binding agreement nor is it intended to create an employment relationship with the University of Sheffield.	☐	☐
I understand that my taking my daughter's participation is voluntary and that she can withdraw from the study at any time; she does not have to give any reasons for withdrawal, and there will be no adverse consequences pertaining to that.	☐	☐
After 1/5/2023, your daughter cannot withdraw because the data will be anonymised and we will not be able to locate specific individuals.	☐	☐
How my daughter's information will be used during and after the project		
I understand that my daughter's personal details such as name, phone number, address and email address etc. will not be revealed to people outside the project.	☐	☐
I understand and agree that my daughter's words may be quoted in publications, reports, web pages, and other research outputs. I understand that my daughter will not be named in these outputs unless I specifically request this.	☐	☐
I understand and agree that other authorised researchers will have access to this data only if they agree to preserve the confidentiality of the information as requested in this form.	☐	☐
I understand and agree that other authorised researchers may use my data in publications, reports, web pages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form.	☐	☐
I give permission for the collected data to be saved and anonymously used through the PhD project and for 10 years after completing all expected published work that I provide to be deposited in the University of Sheffield's repository so it can be used for future research and learning	☐	☐
So that the information you provide can be used legally by the researchers		
I agree to assign the copyright I hold in any materials generated as part of this project to The University of Sheffield.	☐	☐

Name of participant [printed]

Signature

Date



Participant Information Sheet

Research Project Title: **Prevalence and Associated Predictors and Determinants of Eating Behaviours Among Female Adolescents in Saudi Arabia- Phase 1 (Quantitative Analysis)**

This sheet will be explained in the introductory session by the main researcher

Dear student,

You are invited to participate in this study. Before taking any decision, it is important to understand the study's purposes and the nature of your participation. I will read and explain each section. I also reassure you that it is up to you if you want to participate or not.

I'm Azzah Alsheweir, a faculty member at the Applied Medical Sciences college at King Saud University and I'm currently working on my PhD research with the School of Health and Related Research (ScHARR) at the University of Sheffield. My research focuses on studying eating behaviours among girls your age.

I'm sure that you understand that your bodies are going through massive changes and your nutritional requirements reach their peak. It is essential to meet macronutrients and micronutrients demands, as deficiency may cause different medical conditions. In our country, studies exploring teenage girls and eating behaviours are limited. For that, your participation will definitely help in understanding multiple concepts related to nutrition among your age group.

In this project, I will be measuring your weight and height, then I will distribute a self- administered questionnaire. This questionnaire includes 26 multiple-choice questions related to eating attitudes. Read each statement and select the answer that reflects your behaviour. You have already delivered some papers about the study to your parents and you have returned their approval for your participation. You will also get a form to sign if you like to continue with participation.



It is entirely up to you whether or not you want to participate. If you choose to participate, you will get a copy of the information sheet and you will sign the informed consent attached. You may withdraw at any time without any consequences.

Weight and height measurements and questionnaires will take place during school time after arrangements with your teachers and school administration. You will be excused to leave class and join the project. The whole process might range from approximately 30-40 min. I will be guiding you through measurements and questionnaires, with the presence of a trained assistant.

Please be aware that all the information gathered from you is strictly confidential and only members of the research team will have access to any information. Your identity will not be disclosed in any reports or publications. Your personal information will not be included.

I understand that weight measurement can be stressful for some but no one except me and my assistant will be able to read the measurement. You will be asked to stand backward on the weighing scale, and a piece of paper will be attached below the reading (as a shield), so you won't be able to read the measurement.

Data collection will be anonymous, as each one of you will be assigned a numerical ID to maintain confidentiality. Anthropometric measurements and questionnaire responses will be entered into a password-protected spreadsheet.

Hard copies (questionnaires) will be kept in a private and safe place. All entered data will be stored on the secure storage area (X drive). Data will be kept on the university repository for the standard retention period of 10 years after the study. Results will be presented in the report. The findings could be presented at conferences or published in journals. Make sure that your data will not be identifiable in any published results.

If you have a concern, please contact me [Azzah Alsheweir: aalshuweir@ksu.edu.sa; Mobile: +966555287767] in the first instance. If you wish to raise a complaint, please contact the main supervisor [Dr. Samantha Caton; s.caton@sheffield.ac.uk; Phone: 0114 2224198].



If you have further inquiries or need more information on the study, please contact:

Main researcher

Azzah Alsheweir: aalshuweir@ksu.edu.sa; Phone: +966555287767.

Main supervisor

Dr. Samantha Caton; s.caton@sheffield.ac.uk; Phone: 0114 2224198

Co- supervisor

Elizabeth C Goyder; e.goyder@sheffield.ac.uk; Phone: 0114 222 0783

Thank you for your participation..



Student Informed Consent Form

Research Project Title: Prevalence and Associated Predictors and Determinants of Eating Behaviours (DEB) Among Female Adolescents in Saudi Arabia- Phase 1 (Quantitative Analysis)

Name of Principal Investigator: Azzah Ibrahim Alsheweir

Name and address of Institution: College of Applied Medical Sciences at King Saud University in association with the School of Health and Related Research at the University of Sheffield.

Principal Investigator Contact no: 0555287767

Dear student,

I would like to ask this opportunity if you are willing to take part in this questionnaire-based study. Please answer the questions to the best of your knowledge. All information asked in this study questionnaire will be treated confidentially. If you are willing to participate voluntarily in this study, please sign this form.

- ☐ I attended the introductory session and the study was fully explained.
- ☐ I agree to participate in this study by measuring my weight and height, then filling out a questionnaire.
- ☐ I understand that I can withdraw from taking part in this study at any time and that I do not need to explain why I no longer wish to participate.
- ☐ I agree to utilize the information for scientific research purposes.

Signed by:

Participant's Name	
Signature	
Date	



Participant Information Sheet

Research Project Title: **Prevalence and Associated Predictors and Determinants of Eating Behaviours Among Female Adolescents in Saudi Arabia- Phase 2 (Qualitative Analysis)**

Dear parents,

We thank you for your daughter's participation in Phase 1 and we are looking to further explore your daughter's answers on the previously administered questionnaire by inviting her to participate in Phase 2. Before taking any decision, it is important to understand the study's purposes and the nature of your daughter's participation. Please read the information carefully and discuss it with others if you wish. Please be advised that participation is completely voluntary.

Adolescent females are identified to be more prone to certain eating behaviours compared to males and other age groups. Several determinants could trigger the development of these behaviours, including biological, social, parental, and psychosocial factors and we are interested in exploring all these aspects further. In Saudi Arabia, only a few studies have focused on exploring certain factors, such as socioeconomic status, family size, parental education, and occupation.

It is entirely up to you whether or not you approve your daughter's participation. Kindly, check the attached informed consent, select the suitable answers, sign it and return it with your daughter to school. Your daughter may withdraw at any time without incurring any consequences. No justification is required.

The interview will take place during school time after arrangements with teachers and school administration. Upon your approval, your daughter will have a formal excuse to leave class and attend the interview. The approximate time of the interview will be 30 minutes. I will be carrying out all the interviews.

Interviews will be audio recorded using Google drive and recordings will be transferred to the university secure (X drive). Audio recordings will only be used for transcription. Your daughter can withdraw at any time before the recording. Your daughter's name will be removed from the list, to ensure her confidentiality.

The recording will be kept on the University of Sheffield's secure online server in a password-protected folder. The Arabic recordings will be converted into an anonymous transcript by the researcher. This anonymous transcript will be converted into English by me. After the PhD project is finished, the recording will be deleted.

Participation in this study imposes minimal risk and potential harm. Your daughter is not obliged to answer all questions asked. If she feels uncomfortable at any point, the interview will be terminated. If your daughter is distressed as a result of being interviewed, she will be directed to the student advisor's office in the school.

According to data protection legislation, we are required to inform you that the legal basis we are applying in order to process your personal data is that 'processing is necessary for the performance of a task carried out in the public interest' (Article 6(1)(e)). Further information can be found in the University's Privacy Notice <https://www.sheffield.ac.uk/govern/data-protection/privacy/general>.

As we will be collecting some data that is defined in the legislation as more sensitive (information about health), we also need to let you know that we are applying the following condition in law: that the use of your data is necessary 'for archiving purposes in the public interest, scientific research purposes or statistical purposes' (9(2)(j)).

All the information collected from you is strictly confidential unless there is a perceived risk of concern. Confidentiality will be breached if your daughter reveals severe disordered behaviours and the likelihood of potential danger or harm is realised. You will be directly contacted and notified. Your daughter's identity will not be disclosed in any reports or publications. Security will be established for any audio recordings and associated notes.

Only the study team (the student researcher and her supervisors) will have access to the collected data (including personal information and transcripts), and they will process and analyse it in reports. All data will be stored on a secure university drive that only members of the research team at the University of Sheffield will be able to access. When this PhD study is complete, all audio recordings will be destroyed. After ten years have passed and all publications have been completed, anonymous transcripts will be deleted. The study's results will be presented in the report. The findings could be presented at conferences or published in journals. Your daughter will not be identifiable in any published results.



Due to the nature of this study, it is quite possible that other researchers will find the information gathered beneficial in resolving research issues. Before sharing your data in any manner, we will formally request your consent for sharing your daughter's data in any way.

This study has been ethically approved by the Research Ethics Committee at the University of Sheffield and the Research Ethics Committee at King Saud University in Riyadh. This indicates that both entities will act as data controllers and they are both in charge of safeguarding and appropriately using your information.

If you are unsatisfied with any part of the study and you would like to file a complaint, please email the main researcher [Azzah Alsheweir: aalshuweir@ksu.edu.sa; Mobile: +966555287767] in the first instance. If you wish to raise a complaint, please contact the main supervisor [Dr. Samantha Caton; s.caton@sheffield.ac.uk; Phone: 0114 2224198]. If you feel your complaint has not been handled in a satisfactory way you can contact the Head of the Department of the School of Health and Related Research (ScHARR) [Prof: **Mark Strong**; m.strong@sheffield.ac.uk; Phone: +44 114 222 0812]. If the complaint relates to how your personal data has been handled, please contact The University of Sheffield Data Protection Officer [Luke Thompson; data.protection@sheffield.ac.uk]. Also, you will find information about how to raise a complaint in the University's Privacy Notice: <https://www.sheffield.ac.uk/govern/data-protection/privacy/general>.

If you wish to make a report of a concern or incident relating to potential exploitation, abuse or harm resulting from your involvement in this project, please contact the project's Designated Safeguarding Contact [Dr. Samantha Caton; s.caton@sheffield.ac.uk; Phone: 0114 2224198]. If the concern or incident relates to the Designated Safeguarding Contact, or if you feel a report you have made to this Contact has not been handled in a satisfactory way, please contact the Head of the Department the School of Health and Related Research (ScHARR) [Prof: **Mark Strong**; m.strong@sheffield.ac.uk; Phone: +44 114 222 0812] and/or the University's Research Ethics & Integrity Manager (Lindsay Unwin; l.v.unwin@sheffield.ac.uk).

In Saudi Arabia, if you are dissatisfied with any aspect of the research and wish to make a complaint, you can contact the Research Ethics at King Saud University [Dr. Taha Inam; dr_tahainam@hotmail.com, irbhuman@ksu.edu.sa).

If you have further inquiries or need more information on the study, please contact:



Main researcher

Azzah Alsheweir: aalshuweir@ksu.edu.sa; Phone: +966555287767.

Main supervisor

Dr. Samantha Caton; s.caton@sheffield.ac.uk; Phone: 0114 2224198

Co- supervisor

Elizabeth C Goyder; e.goyder@sheffield.ac.uk; Phone: 0114 222 0783

Thank you for your daughter's participation..

Appendix 7 Parent Consent Form (Qualitative Phase)



Parental Informed Consent Form

Prevalence and Associated Predictors and Determinants of Eating Behaviours Among Female Adolescents in Saudi Arabia- Phase 2 (Qualitative Analysis)

<i>Please tick the appropriate boxes</i>	Yes	No
Taking Part in the Project		
I have read and understood the project information sheet or the project has been fully explained to me. (If you will answer No to this question please do not proceed with this consent form until you are fully aware of what your participation in the project will mean.)	☐	☐
I have been given the opportunity to ask questions about the project.	☐	☐
I agree with my daughter's participation in this project. I understand that taking part in the project will include my daughter's participation in an interview. This interview will be audio-recorded and recordings will be transcribed anonymously. <u>All information is considered confidential unless there is a perceived cause of concern</u>	☐	☐
I understand that approving my daughter to participate as a volunteer in this research, this does not create a legally binding agreement nor is it intended to create an employment relationship with the University of Sheffield.	☐	☐
I understand that my taking my daughter's participation is voluntary and that she can withdraw from the study at any time; she does not have to give any reasons for withdrawal, and there will be no adverse consequences pertaining to that.	☐	☐
After 30/11/2023, your daughter cannot withdraw because the data will be anonymised and we will not be able to locate specific individuals.	☐	☐
How my daughter's information will be used during and after the project		
I understand that my daughter's personal details such as name, phone number, address and email address etc. will not be revealed to people outside the project.	☐	☐
I understand and agree that my daughter's words may be quoted in publications, reports, web pages, and other research outputs. I understand that my daughter will not be named in these outputs unless I specifically request this.	☐	☐
I understand and agree that other authorised researchers will have access to this data only if they agree to preserve the confidentiality of the information as requested in this form.	☐	☐
I understand and agree that other authorised researchers may use my data in publications, reports, web pages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form.	☐	☐
I give permission for the collected data to be saved and anonymously used through the PhD project and for 10 years after completing all expected published work that I provide to be deposited in the University of Sheffield's repository so it can be used for future research and learning	☐	☐
So that the information you provide can be used legally by the researchers		
I agree to assign the copyright I hold in any materials generated as part of this project to The University of Sheffield.	☐	☐

Name of participant [printed]

Signature

Date



Participant Information Sheet

Research Project Title: **Prevalence and Associated Predictors and Determinants of Eating Behaviours Among Female Adolescents in Saudi Arabia- Phase 2 (Qualitative Analysis)**

This sheet will be explained to each candidate separately by the main researcher

Dear student,

We thank you for your participation in Phase 1 and we would like to further explore your answers on the questionnaires by inviting you to participate in Phase 2. Before taking any decision, it is important to understand the study's purposes and the nature of your participation. I will read and explain each section. I also reassure you that it is up to you if you want to participate or not.

Girls your age are identified to be vulnerable to certain eating behaviours compared to males and other age groups. Many factors can trigger the development of these behaviours, including biological, social, parental, and psychosocial factors and we are aiming to explore these factors even more. Your participation will definitely help in understanding multiple concepts related to nutrition among your age group.

In this study, I will be interviewing you and we will discuss your eating behaviours and food consumption. You have already delivered some papers about the study to your parents and you have returned their approval for your participation. You will also get a form to sign if you like to continue with participation.

It is entirely up to you whether or not you want to participate. If you choose to participate, you will get a copy of the information sheet and you will sign the informed consent attached. You may withdraw at any time without any consequences.

The interview will take place during school time after arrangements with your teachers and school administration. You will have a formal excuse to leave class and attend the interview. The approximate time of the interview will be 30 minutes. I will run the interview.



The interview will be audio recorded using Google drive and will only be used for transcription. You can withdraw at any time before the recording. Your name will be removed from the list, to ensure your confidentiality. The recording will be kept on the University of Sheffield's secure online server in a password-protected folder. The Arabic recordings will be converted into an anonymous transcript by the researcher. This anonymous transcript will be converted into English by me (the main researcher). After the PhD project is finished, the recording will be deleted.

I understand that talking about your eating habits and attitudes and sharing your experiences can make you uncomfortable but I confirm that all mentioned is confidential and will only be used for research means. You are not required to answer a question if you do not wish to. We can also take a break if you prefer. If you are upset after the interview, I can direct you to the student advisor's office if you want.

Please be aware that all the information gathered from you is strictly confidential unless a recognised reason for concern exists. If that occurs, confidentiality will be breached. Your identity will not be disclosed in any reports or publications. Your personal information will not be included. Security will be established for any audio recordings and associated notes.

Only the study team (the student researcher and her supervisors) will have access to the collected data (including personal information and transcripts), and they will process and analyse it in reports. All data will be stored on a secure university drive that only members of the research team at the University of Sheffield will be able to access. When this PhD study is complete, all audio recordings will be destroyed. After ten years have passed and all publications have been completed, anonymous transcripts will be deleted. The study's results will be presented in the report. The findings could be presented at conferences or published in journals. You will not be identifiable in any published results.

This study has been ethically approved by the Research Ethics Committee at the University of Sheffield and the Research Ethics Committee at King Saud University in Riyadh. This indicates that both entities will act as data controllers and they are both in charge of safeguarding and appropriately using your information.

If you are unsatisfied with any part of the study and you would like to file a complaint, please email the main researcher [Azzah Alsheweir: aalshuweir@ksu.edu.sa; Mobile: +966555287767] in the first instance. If you wish to raise a complaint, please contact the main supervisor [Dr. Samantha Caton; s.caton@sheffield.ac.uk; Phone: 0114 2224198].



If you have further inquiries or need more information on the study, please contact:

Main researcher

Azzah Alsheweir: aalshuweir@ksu.edu.sa; Phone: +966555287767.

Main supervisor

Dr. Samantha Caton; s.caton@sheffield.ac.uk; Phone: 0114 2224198

Co- supervisor

Elizabeth C Goyder; e.goyder@sheffield.ac.uk; Phone: 0114 222 0783

Thank you for your participation..



Student Informed Consent Form

Research Project Title: Prevalence and Associated Predictors and Determinants of Eating Behaviours (DEB) Among Female Adolescents in Saudi Arabia- Phase 2 (Qualitative Analysis)

Name of Principal Investigator: Azzah Ibrahim Alsheweir

Name and address of Institution: College of Applied Medical Sciences at King Saud University in association with the School of Health and Related Research at the University of Sheffield.

Principal Investigator Contact no: 0555287767

Dear student,

I would like to ask this opportunity if you are willing to take part in this study. You will be interviewed and asked about your eating attitudes and food consumption. All information mentioned and recorded in the interview will be treated confidentially. If you are willing to participate voluntarily in this study, please sign this form.

- ☐ I have understood the purposes of the study and the participant information sheet was fully explained.
- ☐ I agree to participate in the study's interview and share my thoughts and experiences related to eating behaviours
- ☐ I understand that I can withdraw from taking part in this study at any time and that I do not need to explain why I no longer wish to participate.
- ☐ I agree to allow the researchers to audiotape my voice as in the interview for research purposes.
- ☐ I agree to utilize the information for scientific research purposes.

Signed by:

Participant's Name	
Signature	
Date	

Appendix 10 EAT-26 Questionnaire

Eating Attitudes Test (EAT-26)[©]

Instructions: This is a screening measure to help you determine whether you might have an eating disorder that needs professional attention. This screening measure is not designed to make a diagnosis of an eating disorder or take the place of a professional consultation. Please fill out the below form as accurately, honestly and completely as possible. There are no right or wrong answers. All of your responses are confidential.

Part A: Complete the following questions:

1) Birth Date	Month:	Day:	Year:	2) Gender:	Male	Female
3) Height	Feet :	Inches:			☐	☐
4) Current Weight (lbs.):	5) Highest Weight (excluding pregnancy):					
6) Lowest Adult Weight:	7) Ideal Weight:					

Part B: Check a response for each of the following statements:	Always	Usually	Often	Some times	Rarely	Never
1. Am terrified about being overweight.	☐	☐	☐	☐	☐	☐
2. Avoid eating when I am hungry.	☐	☐	☐	☐	☐	☐
3. Find myself preoccupied with food.	☐	☐	☐	☐	☐	☐
4. Have gone on eating binges where I feel that I may not be able to stop.	☐	☐	☐	☐	☐	☐
5. Cut my food into small pieces.	☐	☐	☐	☐	☐	☐
6. Aware of the calorie content of foods that I eat.	☐	☐	☐	☐	☐	☐
7. Particularly avoid food with a high carbohydrate content (i.e. bread, rice, potatoes, etc.)	☐	☐	☐	☐	☐	☐
8. Feel that others would prefer if I ate more.	☐	☐	☐	☐	☐	☐
9. Vomit after I have eaten.	☐	☐	☐	☐	☐	☐
10. Feel extremely guilty after eating.	☐	☐	☐	☐	☐	☐
11. Am preoccupied with a desire to be thinner.	☐	☐	☐	☐	☐	☐
12. Think about burning up calories when I exercise.	☐	☐	☐	☐	☐	☐
13. Other people think that I am too thin.	☐	☐	☐	☐	☐	☐
14. Am preoccupied with the thought of having fat on my body.	☐	☐	☐	☐	☐	☐
15. Take longer than others to eat my meals.	☐	☐	☐	☐	☐	☐
16. Avoid foods with sugar in them.	☐	☐	☐	☐	☐	☐
17. Eat diet foods.	☐	☐	☐	☐	☐	☐
18. Feel that food controls my life.	☐	☐	☐	☐	☐	☐
19. Display self-control around food.	☐	☐	☐	☐	☐	☐
20. Feel that others pressure me to eat.	☐	☐	☐	☐	☐	☐
21. Give too much time and thought to food.	☐	☐	☐	☐	☐	☐
22. Feel uncomfortable after eating sweets.	☐	☐	☐	☐	☐	☐
23. Engage in dieting behavior.	☐	☐	☐	☐	☐	☐
24. Like my stomach to be empty.	☐	☐	☐	☐	☐	☐
25. Have the impulse to vomit after meals.	☐	☐	☐	☐	☐	☐
26. Enjoy trying new rich foods.	☐	☐	☐	☐	☐	☐

Part C: Behavioral Questions: In the past 6 months have you:		Never	Once a month or less	2-3 times a month	Once a week	2-6 times a week	Once a day or more
A	Gone on eating binges where you feel that you may not be able to stop? *	☐	☐	☐	☐	☐	☐
B	Ever made yourself sick (vomited) to control your weight or shape?	☐	☐	☐	☐	☐	☐
C	Ever used laxatives, diet pills or diuretics (water pills) to control your weight or shape?	☐	☐	☐	☐	☐	☐
D	Exercised more than 60 minutes a day to lose or to control your weight?	☐	☐	☐	☐	☐	☐
E	Lost 20 pounds or more in the past 6 months	Yes ☐		No ☐			

* Defined as eating much more than most people would under the same circumstances and feeling that eating is out of control

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اختبار السلوكيات الغذائية

EAT-26

التعليمات: هذا الاستبيان لمساعدتك على تحديد ما إذا كان لديك اضطراب في الأكل يحتاج إلى تدخل طبي. الرجاء العلم أن هذا الاستبيان غير مصمم لتشخيص اضطراب الأكل ولا يحل محل الاستشارات الطبية من قبل أطباء أو أخصائيين تغذية. يرجى تعبئة النموذج أدناه بأكبر قدر ممكن من الدقة والمصادقية.

وجب التنبيه أنه لا توجد إجابات صحيحة أو خاطئة, كما أن جميع الإجابات تعتبر سرية.

الجزء الأول: الرجاء الإجابة عن الأسئلة التالية						
تاريخ الميلاد / الشهر:		اليوم:		السنة:		
الجنس /		ذكر ☐		أنثى ☐		
الطول /		سم				
الوزن /		كجم				
الجزء الثاني: اختر إجابة تعكس سلوكك الغذائي لكل من العبارات التالية						
أبدا	نادرا	أحيانا	غالبا	عادة	دائما	
						(1) أنا أرتعب من أن يكون وزني زائداً
						(2) أتجنب تناول الطعام حين أكون جائعة
						(3) أجد نفسي منشغلة بالطعام
						(4) سبق أن مررت بنوبات من الإفراط في الأكل حيث أشعر أنني عاجزة عن التوقف
						(5) أشعر بالحاجة إلى تقطيع طعامي إلى أجزاء صغيرة
						(6) أنا على علم بما تحتويه الأطعمة التي أأكلها من سرعات حرارية
						(7) أتجنب الأطعمة الغنية بالنشويات خصوصاً (مثل الخبز والأرز والبطاطا...)
						(8) أشعر بأن الآخرين يفضلون لو أنني أأكلت أكثر
						(9) أنا أتقيأ بعد أن أتناول الطعام
						(10) أشعر بذنب شديد بعد الأكل
						(11) أنا منشغلة برغبتي في أن أكون نحيفة
						(12) أفكر في حرق السعرات الحرارية حين أمارس الرياضة البدنية
						(13) يظن الآخرون أنني نحيفة جداً
						(14) أنا منهكة في التفكير في تكديس السممة بجسمي
						(15) أستغرق وقتاً أطول من غيري لتناول وجباتي
						(16) أتجنب الأطعمة التي تحتوي على السكر
						(17) أتناول الأطعمة الخاصة بالحمية الغذائية
						(18) أشعر بأن الطعام يتحكم بحياتي ويسلوكي
						(19) استطيت أن أتحكم بالطعام الذي أتناوله
						(20) أشعر بأن الآخرين يضعطون عليّ لكي أأكل
						(21) أكرس نسبة كبيرة من الوقت والتفكير للطعام
						(22) أشعر بعدم الارتياح بعد تناول الحلويات
						(23) أتبع حمية غذائية معينة
						(24) أحب أن تكون معدتي فارغة

						25) لديّ نزعة إلى التقيؤ بعد تناول الوجبات
						26) أستمع بتجربة الأطعمة الغنية بالعناصر المغذية

الجزء الثالث: الأسئلة السلوكية خلال الأشهر الستة الماضية، هل قمت بما يلي:	أبدا	مرة في الشهر أو أقل	مرتين إلى ثلاث مرات في الشهر	مرة في الأسبوع	مرتين إلى 6 مرات في الأسبوع	مرة في اليوم أو أكثر
أ هل مررت بفترات حيث تأكل بنهم وشراسة و تشعر أنك لا تستطيع التوقف؟						
ب هل سبق لك أن تعمدت التقيؤ لضبط وزنك أو تعديل شكلك؟						
ت هل سبق لك استخدام المليينات أو أدوية خاصة بالحمية أو مدرات للبول (الحيوب المائية) لضبط وزنك أو تعديل شكلك؟						
ث مارست الرياضة لأكثر من 60 دقيقة في اليوم لفقد الوزن أو ضبطه؟						
ج هل فقدت 9 كجم أو أكثر خلال الأشهر الستة الماضية؟	☐ نعم	☐ لا				

شكرا لوقتكم

الباحث الرئيسي: عزه الشويعر

تمت ترجمة الاستبيان من النسخة الأصلية والمتوفرة باللغة الإنجليزية على الموقع الرسمي

[/https://www.eat-26.com](https://www.eat-26.com)

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The EAT-26 has been reproduced with permission. Garner et al. (1982). The Eating Attitudes Test: Psychometric features and clinical correlates. *Psychological Medicine*, 12, 871-878

Appendix 12 Semi-structured Interview Guide

Interview Guide

First of all, I want to thank you for agreeing to participate in this interview. Then, I want to indicate that we are interested in understanding teenage girls' eating behaviours and the reasons why they engage in such behaviours.

It is important to understand that the whole interview and discussed aspects will be private and confidential, used for research means only, and will not be disclosed to anyone under any condition.

- As a teenager, can you describe typical teenage girls eating patterns/ habits or behaviours?

Prompts: What about you, can you explain your eating pattern on a typical day?

- How do girls your age feel about their weight and shape? (BMI and shape)

Prompts: How about your weight and body shape?

- We know that particular disordered behaviours are common among teenage girls your age. Can you give your opinion on that? (disordered behaviours)

Examples: dieting and food restriction, bingeing, induced vomiting, consuming laxatives, intensive exercising

Prompts: This (...) behaviour is practiced by teenagers, do you think it is common in your age group? Do you or your friends ever discuss that? How far do you agree with that?

Prompts: What about you, have you ever practiced this (...) behaviour?

- Why do you think girls your age engage in such behaviours? (predictors and determinants)

Prompts: How does getting older affect the intensity of these behaviours?

- Have you ever experienced any of the causes you described?
- Can you think of other causes that might lead to these behaviours?

Thank you for your participation

Appendix 13 Ethical Approval from the University of Sheffield



Downloaded: 21/06/2023
Approved: 20/03/2023

Azzah Alsheweir
Registration number: 210204902
School of Health and Related Research
Programme: none

Dear Azzah

PROJECT TITLE: Prevalence and Associated Predictors and Determinants of Disordered Eating Behaviours (DEB) Among Female Adolescents in Saudi Arabia
APPLICATION: Reference Number 050493

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 20/03/2023 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 050493 (form submission date: 20/03/2023); (expected project end date: 31/01/2025).
- Participant information sheet 1117282 version 8 (13/02/2023).
- Participant information sheet 1117384 version 5 (09/03/2023).
- Participant information sheet 1118707 version 1 (09/03/2023).
- Participant information sheet 1118708 version 1 (09/03/2023).
- Participant information sheet 1118709 version 1 (09/03/2023).
- Participant information sheet 1118710 version 1 (09/03/2023).
- Participant consent form 1117283 version 8 (13/02/2023).
- Participant consent form 1117385 version 4 (14/02/2023).

If during the course of the project you need to [deviate significantly from the above-approved documentation](#) please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

Anju Keetharuth
Ethics Administrator
School of Health and Related Research

Please note the following responsibilities of the researcher in delivering the research project:

- The project must abide by the University's Research Ethics Policy: <https://www.sheffield.ac.uk/research-services/ethics-integrity/policy>
- The project must abide by the University's Good Research & Innovation Practices Policy: https://www.sheffield.ac.uk/polopoly_fs/1.671066!/file/GRIPPpolicy.pdf
- The researcher must inform their supervisor (in the case of a student) or Ethics Administrator (in the case of a member of staff) of any significant changes to the project or the approved documentation.
- The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.

Appendix 14 Ethical Approval from King Saud University

Kingdom of Saudi Arabia King Saud University (034) P.O. Box 7805 Riyadh 11472 Tel: +966 11 467 00 11 Fax: +966 11 467 19 92 http://medicalcity.ksu.edu.sa	المملكة العربية السعودية جامعة الملك سعود (٣٤) ص.ب. الرياض ٧٨٠٥ ١١٤٧٢ هاتف: +٩٦٦ ١١ ٤٦٧ ٠٠ ١١ فاكس: +٩٦٦ ١١ ٤٦٧ ١٩٩٢	جامعة الملك سعود King Saud University المدينة الطبية الجامعة
Institutional Review Board		
09 February 2023 G (18 Rajab 1444 H) Ref. No. 23/0105/IRB		
To:	Ms. Azzah Ibrahim Alsheweir PhD student School of Health & Related Research/ University of Sheffield Teacher Assistant with Master's degree, Community Health Department College of Applied Medical Sciences King Saud University Email: aalshuweir@ksu.edu.sa; Aalsheweir@sheffield.ac.uk <i>Principal Investigator</i>	
Cc:	Dr. Samantha Caton: s.caton@sheffield.ac.uk Prof. Elizabeth Goyder <i>Co-Investigators</i>	
Subject:	IRB Approval of Research Project No. E-23-7551	
Study Title:	"Prevalence and Associated Predictors and Determinants of Disordered Eating Behaviours (DEB) Among Female Adolescents in Saudi Arabia".	
Type of Review:	Expedite	
Date of Approval:	01 February 2023	
Date of Expiry:	01 February 2024	

Dear **Ms. Azzah Ibrahim Alsheweir**,

I am pleased to inform you that your above-mentioned research project submitted to the IRB was reviewed and approved on 01 February 2023 (10 Rajab 1444). You are now granted permission to conduct this study as approved by the IRB.

As principal investigator, you are required to abide by the rules and regulations of the Kingdom of Saudi Arabia and the research policies and procedures of the KSU IRB. If you make any changes to the protocol during the period of this approval, you must submit a revised protocol for IRB approval prior to implementing the changes. This approval is only for one (1) year and shall remain valid until the expiry date noted above assuming timely and acceptable responses from the IRB's periodic requests for surveillance and monitoring information. To renew approval, please submit your request at least **30 days before the expiry date**. Failure to receive approval for continuation before the expiration date will result in automatic suspension of the approval of this protocol on the expiration date. Personal identifying data should only be collected when necessary for research. Secondary disclosure of personal identifiable data is not allowed. Data should be stored securely so that a few authorized users are permitted access to the database.

We wish you success in your research and request you to keep the IRB informed about the progress of the study on a regular basis by submitting a **Study Progress Report annually** and a **Final Report** when **the study has been completed**. Please quote the project number and project title above in any further correspondence related to this study.

Thank you!
Sincerely yours,

Prof. Ahmad A. Abdulmomen
Chairman IRB Sub-Committee
Health Sciences Colleges Research on Human Subjects
King Saud University – College of Medicine
Email: atürk@ksu.edu.sa



/tinam



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Appendix16 Supplementary Materials.1 Databases Search Strategy: Ovid MedLine, APA PsycInfo, Scopus, Web of Science, Proquest via ASSIA.

MEDLINE via Ovid

#	Query	Results from 6 February 2023
1	(adolescent* or teen* or teenager* or youth*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	2,288,433
2	(eating disorder or disordered eating or feeding disorder or appetite disorder or anorexia nervosa or bulimia nervosa or binge eating or disturbed eating or weight control or purging).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	43,525
3	Saudi Arabia.mp. or Saudi Arabia/	27,874
4	1 and 2 and 3	14

APA PsycInfo

#	Query	Results from 6 February 2023
1	(adolescent* or teen* or teenager* or youth*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	551,981
2	(eating disorder or disordered eating or feeding disorder or appetite disorder or anorexia nervosa or bulimia nervosa or binge eating or disturbed eating or weight control or purging).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	40,856
3	Saudi Arabia.mp.	2,652
4	1 and 2 and 3	1

Scopus

adolescent OR teen* OR teenager* OR youth* AND eating AND disorder OR disordered AND eating OR feeding AND disorder OR appetite AND disorder OR anorexia AND nervosa OR bulimia AND nervosa OR binge AND eating OR disturbed AND eating OR weight AND control OR purging AND saudi AND arabia*

Web of Science

((ALL= (adolescent* or teen* or teenager* or youth*)) AND ALL=(eating disorder or disordered eating or feeding disorder or appetite disorder or anorexia nervosa or bulimia nervosa or binge eating or disturbed eating or weight control or purg-ing)) AND ALL=(Saudi Arabia)

ProQuest via ASSIA

(adolescent* or teen* or teenager* or youth*) AND (eating disorder or disordered eating or feeding disorder or appetite disorder or anorexia nervosa or bulimia nervosa or binge eating or disturbed eating or weight control or purging) AND (Saudi Arabia)

Appendix 17 JBI Quality Assessment Tool for the Quality Appraisal of the Selected Records

No.	Authors & Year	JBI quality assessment criteria's								Quality Assessment Score
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	
#1	AlHazmi & AlJohani (2019)	N	Y	Y	Y	NA	NA	Y	Y	5
#2	Albrahim et al (2019)	Y	Y	Y	Y	NA	NA	Y	Y	6
#3	Alwosaifer et al (2018)	Y	Y	Y	Y	NA	NA	Y	Y	6
#4	Tomar & Antony (2021)	Y	Y	Y	Y	NA	NA	Y	Y	6
#5	Al-Qahtani & Al-Harbi (2020)	Y	Y	Y	Y	NA	NA	Y	Y	6
#6	Al-Subaie (2000)	Y	U	Y	Y	NA	NA	Y	Y	5
#7	Almuhlaifi et al (2018)	N	Y	Y	Y	NA	NA	Y	Y	5
#8	Alsubaie et al (2019)	N	Y	Y	Y	NA	NA	Y	Y	5
#9	Fatima & Ahmed (2018)	Y	Y	Y	Y	NA	NA	Y	Y	6
#10	Ghafouri et al (2021)	Y	Y	Y	Y	NA	NA	Y	Y	6
#11	Allihaibi (2015)	N	Y	Y	U	NA	NA	Y	Y	4
#12	Fallatah et al (2015)	Y	Y	Y	Y	NA	NA	Y	Y	6
#13	Loni et al (2022)	Y	Y	Y	Y	NA	NA	Y	Y	6
#14	ElShikieri (2022)	Y	Y	Y	Y	NA	NA	Y	Y	6
	Note: Y - Yes, N - No, U - Unclear, NA-Not applicable Q1= Were the criteria for inclusion in the sample clearly defined? Q2= Were the study subjects and the setting described in detail? Q3= Was the exposure measured in a valid and reliable way? Q4= Were objective, standard criteria used for measurement of the condition? Q5= Were confounding factors identified? Q6= Were strategies to deal with confounding factors stated? Q7= Were the outcomes measured in a valid and reliable way? Q8= Was appropriate statistical analysis used?									

Sample Size for Frequency in a Population

Population size(for finite population correction factor or fpc)(N): 1000000
 Hypothesized % frequency of outcome factor in the population (p): 16%+/-5
 Confidence limits as % of 100(absolute +/- %)(d): 5%
 Design effect (for cluster surveys- $DEFF$): 1

Sample Size(n) for Various Confidence Levels

ConfidenceLevel(%)	Sample Size
95%	207
80%	89
90%	146
97%	254
99%	357
99.9%	582
99.99%	814

Equation

Sample size $n = [DEFF * Np(1-p)] / [(d^2 / Z^2_{1-\alpha/2} * (N-1) + p*(1-p)]$

Results from OpenEpi, Version 3, open source calculator--SSPropor

Appendix 19 Additional Records Identified from the Updated Systematic Review Search in Selected Databases (Medline via Ovid, Psych Info, Scopus, Web of Science, and ProQuest via ASSIA)

No.	Author (Year)	City/Area	Study Design	Setting	Sample Size	Sex Distribution (F/M)	Age Group (Mean Age±SD)	Screening Tool	Disorder Screened	Prevalence (N and/or %)
1	Alhuwaydi (2024a)	Aljouf/north ern	Cross-sectional	public places, such as shopping centres, mosques, and parks	384	(190/194)	10–19 (15.23±2.80)	BES	BED	moderate BED (n=43, 11.2%) Severe BED (n=32, 8.3%)
2	Alhuwaydi et al. (2024b)	Aljouf/north ern	Cross-sectional	public locations, including shopping complexes, parks, etc	400	(400/0)	10–19 (15.47±2.83)	BES	BED	moderate BED (n=22, 5.5%) Severe BED (n=25, 6.2%)
3	Almutairi et al. (2023)	Jeddah/west	Cross-sectional	Public schools	502	(502/0)	13–18 (NR)	EAT-26	EDs	EAT-26 ≥20 (n =269 , 53.6%)
4	Alrahili et al. (2024)	different regions in Saudi Arabia	Cross-sectional	Social media	379	(277/102)	10–18 (15.53±2.3)	Patient Health Questionnaire Eating Disorders Scale	EDs	BED (14.8%) Bulimia nervosa (8.7%) Prevalence of EDs: (n=8, 53.3%) among 10-year-old participants, (n=8, 15.4%) among 17-year-old participants
5	Makki et al. (2024)	Riyadh/Central	Cross-sectional	Public schools	347	(347/0)	13–18 (14.16 ± 1.25)	EAT-26	DEBs	EAT-26 ≥20 (n =113, 32.6%)

NR: Not Reported, BES: Binge Eating Scale, BED: Binge Eating Disorder, EAT-26: Eating Attitudes Test, EDs: Eating Disorders, DEB: Disordered Eating Behaviours

Appendix 20 License to use Figure 1- Individual and environmental correlates of disordered eating and obesity from Hayes et al. (2018) Disordered eating attitudes and behaviours in youth with overweight and obesity: implications for treatment. Current obesity reports, 7, pp.235-246.

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REFERENCES

- A.Amer, S. *et al.* (2022) Assessment of Fast and Junk Food Consumption and Addiction Among Saudi Population. National Descriptive Study 2020.. Current Research in Nutrition and Food Science Journal. <https://doi.org/10.12944/crnfsj.10.1.02>.
- Abdollahi, P. and Mann, T. (2001) Eating disorder symptoms and body image concerns in Iran: Comparisons between Iranian women in Iran and in America. International journal of eating disorders, 30(3), pp.259-268.
- Adolphus, K. *et al.* (2016) The effects of breakfast and breakfast composition on cognition in children and adolescents: a systematic review. Advances in Nutrition, 7(3), pp.590S-612S.
- Alvarenga, M.D.S., Scagliusi, F.B. and Philippi, S.T. (2006) Effects of multiprofessional treatment on clinical symptoms, food intake, eating patterns, eating attitudes and body image of Brazilian Bulimic patients. Anorexia nervosa and bulimia nervosa: new research; Nova Science Publishers: New York, NY, USA.
- Abebe, D.S. *et al.* (2012) Binge eating, purging and non-purging compensatory behaviours decrease from adolescence to adulthood: A population-based, longitudinal study. BMC Public Health, 12, pp.1-10.
- Abhilasha, K. and Joel, F.I. (2019) A pre-experimental study to evaluate the effectiveness of structured teaching programme on knowledge regarding eating disorders among adolescent girls in selected high schools at Mukerian, Punjab. Asian Journal of Multidimensional Research (AJMR), 8(8), pp.10-17.
- Abou-Saleh, M.T., Younis, Y. and Karim, L. (1998) Anorexia nervosa in an Arab culture. International Journal of Eating Disorders, 23(2), pp.207-212.
- Absah, I. *et al.* (2017) Rumination syndrome: pathophysiology, diagnosis, and treatment. Neurogastroenterology & Motility, 29. <https://doi.org/10.1111/nmo.12954>.
- Adesina, A.F. *et al.* (2012) Weight status of adolescents in secondary schools in Port Harcourt using Body Mass Index (BMI). Italian journal of paediatrics, 38(1), pp.1-7.
- Adu, J. *et al.* (2022) A discussion of some controversies in mixed methods research for emerging researchers. Methodological Innovations, 15(3), pp.321-330.
- Afifi-Soweid, R. A., Najem Kteily, M. B. and Shediach-Rizkallah, M. C. (2002) Preoccupation with weight and disordered eating behaviours of entering students at a university in Lebanon. International Journal of Eating Disorders, 32, 52-7.
- Ahrén, J.C. *et al.* (2013) We are family—parents, siblings, and eating disorders in a prospective total-population study of 250,000 Swedish males and females. International Journal of Eating Disorders, 46(7), pp.693-700.
- Akgül, S., Derman, O. and Kanbur, N.Ö. (2014) Fasting during Ramadan: A religious factor as a possible trigger or exacerbator for eating disorders in adolescents. International Journal of Eating Disorders, 47(8), pp.905-910.
- Al Ani, M.F., Al Subhi, L.K. and Bose, S. (2016) Consumption of fruits and vegetables among adolescents: a multi-national comparison of eleven countries in the Eastern Mediterranean Region. British Journal of Nutrition, 115(6), pp.1092–1099.
- Al Otaibi, H.H. (2017) Sugar sweetened beverages consumption behaviour and knowledge among university students in Saudi Arabia. Age (Mean, sd), 21, pp.4-61.
- Al Sabbah, H. *et al.* (2009) Body weight dissatisfaction and communication with parents among adolescents in 24 countries: international cross-sectional survey. BMC public health, 9, pp.1-10.
- Al Sabbah, H. *et al.* (2010) Weight control behaviours among overweight, normal weight and underweight adolescents in Palestine: findings from the national study of Palestinian

- schoolchildren (HBSC-WBG2004). *International Journal of Eating Disorders*, 43(4), pp.326-336.
- Al-Adawi, S. *et al.* (2002) A survey of anorexia nervosa using the Arabic version of the EAT-26 and “gold standard” interviews among Omani adolescents. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 7(4), pp.304-311.
- Aladel, A. *et al.* (2023) Effect of Weight Self-Stigma on Quality of Life and Dietary Habits among Adult Students in Riyadh, Saudi Arabia. *Healthcare* 2023, 11, 1754. <https://doi.org/10.3390/healthcare11121754>
- Albert, D., Chein, J. and Steinberg, L. (2013) Peer Influences on Adolescent Decision Making. *Current Directions in Psychological Science*, [online] 22(2), pp.114–120. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4276317/>.
- Albrahim, T. *et al.* (2019) The spectrum of disordered eating attitudes among female university students: A cross-sectional study. *Current Research in Nutrition and Food Science Journal*, 7(3), pp.698-707.
- Albrecht, N. and Iyengar, B. (2021) Paediatric Obesity: An Economic Perspective. *Frontiers in Public Health*, 8. <https://doi.org/10.3389/fpubh.2020.619647>.
- AlBuhairan, F.S. *et al.* (2015) Time for an adolescent health surveillance system in Saudi Arabia: findings from “Jeeluna”. *Journal of Adolescent Health*, 57(3), pp.263-269.
- Alfhaid, F.M. *et al.* (2021) Eating disorders among Majmaah University Students, Saudi Arabia. *Med. Sci.*, 25, 3007–3016.
- Al-hajoj, S. (2012) Tuberculosis in Saudi Arabia. *Understanding Tuberculosis-Global Experiences and Innovative Approaches to the Diagnosis*. IntechOpen. <https://doi.org/10.5772/30369>.
- Alharbi, A.M.M. (2024) An Overview of Saudi Arabia's Education System and Contextual Factors Shaping the Adoption of E-Textbooks. *International Journal for Cross-Disciplinary Subjects in Education (IJCDSE)*, 14.
- Alhazmi, A.H. and Al Johani, A. (2019) Prevalence and associated factors of eating disorders among students in Taiba University, Saudi Arabia: a cross-sectional study. *Malaysian Journal of Public Health Medicine*, 19(1), pp.172-176.
- Al-Hazzaa, H. and Albawardi, N. (2021) Obesity, Lifestyle Behaviours, and Dietary Habits of Saudi Adolescents Living in Riyadh (ATLS-2 Project): Revisited after a Ten-Year Period. *Life*, 11. <https://doi.org/10.3390/life11101078>.
- Al-Hazzaa, H.M. *et al.* (2011) Physical activity, sedentary behaviours and dietary habits among Saudi adolescents relative to age, gender and region. *International Journal of Behavioural Nutrition and Physical Activity*, 8, pp.1-14.
- Al-Hazzaa, H.M. *et al.* (2020) Anthropometric, Familial- and Lifestyle-Related Characteristics of School Children Skipping Breakfast in Jeddah, Saudi Arabia. *Nutrients* 12, no. 12: 3668. <https://doi.org/10.3390/nu12123668>.
- Alhefnawi, M. *et al.* (2023) Population modelling and housing demand prediction for the Saudi 2030 Vision: a case study of Riyadh City. *International Journal of Housing Markets and Analysis*. <https://doi.org/10.1108/ijhma-05-2023-0062>.
- Alhojailan, M.I. (2012) Thematic analysis: a critical review of its process and evaluation. In WEI International European academic conference proceedings, Zagreb, Croatia.
- Alhumidan, S. (2021) Geological Risk Hazardous of Riyadh City, Saudi Arabia resulting to Climate Change and Fast Population Growth. In AGU Fall Meeting Abstracts (Vol. 2021, pp. A45I-1958).
- Alhuwaydi, A.M. (2024) A cross-sectional evaluation of binge-eating behaviour and its correlation with anxiety disorders among adolescents in Northern Saudi Arabia: implications for future generations. *Frontiers in Psychiatry*, 15, p.1384218.

- Alhuwaydi, A.M. *et al.* (2024) Assessment of binge eating behaviour, body shape concerns, and Associated Factors among female adolescents of Northern Saudi Arabia: a cross-sectional study. *Nutrients*, 16(18), p.3082.
- Alimoradi, Z. *et al.* (2019) Weight-related stigma and psychological distress: A systematic review and meta-analysis.. *Clinical nutrition*.
<https://doi.org/10.1016/j.clnu.2019.10.016>.
- Al-Jawaldeh, A., Taktouk, M., and Nasreddine, L. (2020) Food Consumption Patterns and Nutrient Intakes of Children and Adolescents in the Eastern Mediterranean Region: A Call for Policy Action. *Nutrients*, 12. <https://doi.org/10.3390/nu12113345>.
- Aljefree, N.M., Shatwan, I.M. and Almoraie, N.M. (2022) Impact of the intake of snacks and lifestyle behaviours on obesity among university students living in Jeddah, Saudi Arabia. In *Healthcare* (Vol. 10, No. 2, p. 400). MDPI.
- Al-Khusaibi, M. (2019) Arab traditional foods: Preparation, processing and nutrition. *Traditional Foods: History, Preparation, Processing and Safety*, pp.9-35.
- Al-Kibsi, G. *et al.* (2015) Saudi Arabia beyond oil: The investment and productivity transformation. McKinsey Global Institute. Available online:
<https://www.mckinsey.com> (accessed on 24 March 2024).
- Al-Kloub, M.I. *et al.* (2019) Disordered eating in Jordanian adolescents. *International Journal of Nursing Practice*, 25 (1), p.e12694. <https://doi.org/10.1111/ijn.12694>.
- Allemang, B., Sitter, K. and Dimitropoulos, G. (2021) Pragmatism as a paradigm for patient-oriented research. *Health Expectations : An International Journal of Public Participation in Health Care and Health Policy*, 25, pp. 38 - 47.
<https://doi.org/10.1111/hex.13384>.
- Allen, K.L. *et al.* (2014) Maternal and family factors and child eating pathology: risk and protective relationships. *Journal of eating disorders*, 2(1), pp.1-14.
- Allen, M. S. and Robson, D. A. (2020) Personality and body dissatisfaction: An updated systematic review with meta-analysis. *Body Image*, 33, 77–89.
<https://doi.org/10.1016/j.bodyim.2020.02.001>
- Allihaibi, M.M. (2015) Disordered eating attitudes among secondary schoolgirls in Al-Iskan sector, Makkah Al-Mukarramah, Saudi Arabia. *Int J Med Sci Public Health*, 4(7), p.939.
- Almatar, K.M. (2022) Transit-oriented development in Saudi Arabia: Riyadh as a case study. *Sustainability*, 14(23), p.16129.
- Al-Mendalawi, M.D. and Asghar, A.H. (2010) Frequency and antimicrobial susceptibility of Gram-negative bacteria isolated from 2 hospitals in Makkah, Saudi Arabia. *Saudi Med J*, 31(3), p.338.
- Almuhlaifi, M. *et al.* (2018) Relationship between early menarche, obesity, and disordered eating behaviors: a school-based cross-sectional survey in Northern Saudi Arabia. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, pp.743-751.
- Almutairi, R. *et al.* (2023) Eating disorders among adolescent female students in Jeddah, Saudi Arabia. *The Malaysian journal of medical sciences: MJMS*, 30(1), p.185.
- Al-Nakeeb, Y. *et al.* (2012) Obesity, physical activity and sedentary behavior amongst British and Saudi youth: A cross-cultural study. *International journal of environmental research and public health*, 9(4), pp.1490-1506.
- Alnasser, A. and Musallat, N. (2022) Food sustainability knowledge among Saudis: Towards the goals of Saudi Vision 2030. *Sustainability*, 14, 11398.
- Al-Qahtani, A.M. and Al-Harbi, L.M. (2020) Prevalence and risk factors of disordered eating attitudes and behaviours among high-school girls in Al-Madinah City, Saudi Arabia. *Current Nutrition & Food Science*, 16(5), pp.709-717.

- Alrahili, N. *et al.* (2024) Prevalence of Eating Disorders and Comorbidity With Depression Among Adolescents in Saudi Arabia: A Cross-Sectional Study. *Cureus*, 16(2).
- Alrayes, A. *et al.* (2018) Association between Breakfast Intake and Short-Term Memory, Performance and Mood among Saudi Female Adolescents. *The North African Journal of Food and Nutrition Research*. <https://doi.org/10.51745/najfnr.2.4.75-80>.
- Al-Rethaiaa, A.S., Fahmy, A.E.A. and Al-Shwaiyat, N.M. (2010) Obesity and eating habits among college students in Saudi Arabia: a cross sectional study. *Nutrition journal*, 9, pp.1-10.
- Alshabanat, Z. *et al.* (2021) Quantifying Food Loss and Waste in Saudi Arabia. Sustainability. <https://doi.org/10.3390/su13169444>.
- AlShebali, M., AlHadi, A. and Waller, G. (2021) The impact of ongoing westernisation on eating disorders and body image dissatisfaction in a sample of undergraduate Saudi women. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 26, pp.1835-1844.
- Alsheweir, A. *et al.* (2023) Prevalence of eating disorders and disordered eating behaviours amongst adolescents and young adults in Saudi Arabia: A systematic review. *Nutrients*, 15(21), p.4643.
- Alsheweir, A. *et al.* (2024) Determinants of Disordered Eating Behaviours (DEBs) among Adolescent Female School Students in Riyadh, Saudi Arabia: A Qualitative Study. *Nutrients*, 16(13), p.2119.
- Alsheweir, A., Goyder, E. and Caton, S.J. (2024) The prevalence of disordered eating behaviours (DEBs) among adolescent female school students in Riyadh, Saudi Arabia: A cross-sectional study. *Nutrients*, 16(2), p.281.
- Al-sheyab, N., Gharaibeh, T. and Kheirallah, K. (2018) Relationship between Peer Pressure and Risk of Eating Disorders among Adolescents in Jordan. *Journal of Obesity*, 2018(1), p.7309878. <https://doi.org/10.1155/2018/7309878>.
- Alsisy, A.G. and Alsewiket, A. A. (2020) Perspectives of Academic Staff and Graduate Students on the Effects of Globalisation on Cultural Identity in Saudi Arabia: A case Study. 36-1, 36, *مجلة كلية التربية (أسيوط)*.
- Al-Subaie, A. *et al.* (1996) Validity of the Arabic version of the Eating Attitude Test. *International Journal of Eating Disorders*, 20(3), pp.321-324.
- Al-Subaie, A. S. (2000) Some correlates of dieting behaviour in Saudi schoolgirls. *International Journal of Eating Disorders*, 28(2), pp.242-246.
- Alsubaie, S. *et al.* (2020) Prevalence of Eating Disorders and Obsessive-Compulsive Disorder among Adolescent Schoolgirls: Abha City Southern Saudi Arabia. *EC Psychol Psych*, 9, pp.1-10. <https://api.semanticscholar.org/CorpusID:213843839>
- AlTamimi, J. *et al.* (2022) Breakfast Skipping among a Multi-Ethnic Population of Young Men and Relationship with Sociodemographic Determinants and Weight Status. *International Journal of Environmental Research and Public Health*, 19. <https://doi.org/10.3390/ijerph19052903>.
- Althayidi, J.N.M. *et al.* (2018) Underweight Adolescents in Northern Saudi Arabia-A Community-Based Study. *The Egyptian Journal of Hospital Medicine*, 71(7), pp.3641-3647.
- Althubaiti, A. (2016) Information bias in health research: definition, pitfalls, and adjustment methods. *Journal of multidisciplinary healthcare*, pp.211-217.
- Alvarenga, MS., Scagliusi, FB. and Philippi, ST. (2006) Effects of multiprofessional treatment on clinical symptoms, food intake, eating patterns, eating attitudes and body image of Brazilian bulimic patients. In *Anorexia Nervosa and Bulimia Nervosa: New Research*. Swain PI, Ed. New York, Nova Publishers, p.105–143.

- Alvarenga, MS., Scagliusi, FB. and Philippi, ST. (2012) Comparison of eating attitudes among university students from the five Brazilian regions. *Ciencia & saude coletiva*, 17 2, pp. 435-44. <https://doi.org/10.1590/S1413-81232012000200016>.
- Alwosaifer, A.M. *et al.* (2018) Eating disorders and associated risk factors among Imam Abdulrahman bin Faisal university preparatory year female students in Kingdom of Saudi Arabia. *Saudi medical journal*, 39(9), p.910.
- Amaya-Hernández, A. *et al.* (2017) Peer influence in preadolescents and adolescents: A predictor of body dissatisfaction and disordered eating behaviours. *Revista mexicana de trastornos alimentarios*, 8(1), pp.31-39.
- American Dietetic Association (2006) Position of the American Dietetic Association: Nutrition intervention in the treatment of anorexia nervosa, bulimia nervosa, and other eating disorders. *Journal of the American Dietetic Association*, 106(12), pp.2073-2082.
- American Psychiatric Association (2000) *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed.; Text Revision (DSM-IV-TR); American Psychiatric Association Publishing: Washington, DC, USA.
- American Psychiatric Association (2013) *Diagnostic and Statistical Manual of Mental Disorders*. Fifth Edition (DSM-5). American Psychiatric Association: Arlington, VA, USA
- American Psychiatric Association (2018) *APA Dictionary of Psychology*. Dictionary. apa. Org. Available online: <https://dictionary.apa.org/self-schema> (accessed on 12 January 2024).
- Anderluh, M. B. *et al.* (2009) Lifetime course of eating disorders: Design and validity testing of a new strategy to define the eating disorders phenotype. *Psychological Medicine*, 39(1), 105–114. <https://doi.org/10.1017/S0033291708003292>
- Anderluh, M.B. *et al.* (2003) Childhood obsessive-compulsive personality traits in adult women with eating disorders: defining a broader eating disorder phenotype. *American Journal of Psychiatry*, 160(2), pp.242-247.
- Anderson, C.N. *et al.* (2017) An exploratory evaluation of the feasibility, acceptability, and efficacy of the mental fitness disordered eating program in schools. *Eating Disorders*, 25(3), pp.230-245.
- Anderson, L. *et al.* (2013) Investigating complexity in systematic reviews of interventions by using a spectrum of methods. *Journal of clinical epidemiology*, 66 11, pp. 1223-9. <https://doi.org/10.1016/j.jclinepi.2013.06.014>.
- Andrews, J.L., Ahmed, S.P. and Blakemore, S.J. (2021) Navigating the social environment in adolescence: The role of social brain development. *Biological Psychiatry*, 89(2), pp.109-118.
- Ang, R.P. (2015) Adolescent cyberbullying: A review of characteristics, prevention and intervention strategies. *Aggression and violent behaviour*, 25, pp.35-42.
- Ardeshirlarijani, E. *et al.* (2019) The link between breakfast skipping and overweight/obesity in children and adolescents: a meta-analysis of observational studies. *Journal of Diabetes & Metabolic Disorders*, 18, pp. 657 - 664. <https://doi.org/10.1007/s40200-019-00446-7>.
- Armour, C. *et al.* (2016) Assessing childhood maltreatment and mental health correlates of disordered eating profiles in a nationally representative sample of English females. *Social Psychiatry and Psychiatric Epidemiology*, 51, pp.383-393.
- Askew, A. J. *et al.* (2020) Not all body image constructs are created equal: Predicting eating disorder outcomes from preoccupation, dissatisfaction, and overvaluation. *The International journal of eating disorders*, 53(6), 954–963. <https://doi.org/10.1002/eat.23277>

- Aspers, P. and Corte, U. (2019) What is qualitative in qualitative research. *Qualitative sociology*, 42, pp.139-160.
- Attouche, N. *et al.* (2021) Factors associated with the risk of developing eating disorders among medical students in Casablanca, Morocco. *The Pan African medical journal*, 39, pp.270-270.
- Austin, S.B. (2000) Prevention research in eating disorders: theory and new directions. *Psychological medicine*, 30(6), pp.1249-1262.
- Azrimaidaliza, A., Famelia, W. and Nur, N. (2022) Peer Influences and Its Association with The Risk of Eating Disorders Among Adolescents. *Jurnal Kesehatan Masyarakat Andalas*. <https://doi.org/10.24893/jkma.v16i1.1047>.
- Azzeh, M., Peachey, G. and Loney, T. (2022) Prevalence of High-Risk Disordered Eating Amongst Adolescents and Young Adults in the Middle East: A Scoping Review. *International Journal of Environmental Research and Public Health*, 19. <https://doi.org/10.3390/ijerph19095234>.
- Azzopardi, P.S. *et al.* (2019) Progress in adolescent health and wellbeing: tracking 12 headline indicators for 195 countries and territories, 1990–2016. *The Lancet*, 393(10176), pp.1101-1118.
- Backes, E.P. and Bonnie, R.J. (2019) The promise of adolescence: Realising opportunity for all youth.
- Bacon, L. and Bacon, L. (2010) *Health at every size: The surprising truth about your weight*. BenBella Books, Inc.
- Badaly, D. (2013) Peer similarity and influence for weight-related outcomes in adolescence: A meta-analytic review. *Clinical psychology review*, 33(8), pp.1218-1236.
- Bahn, S. and Weatherill, P. (2013) Qualitative social research: a risky business when it comes to collecting ‘sensitive’ data. *Qualitative research*, 13(1), pp.19-35.
- Bair, C.E. *et al.* (2012) Does the Internet function like magazines? An exploration of image-focused media, eating pathology, and body dissatisfaction. *Eating behaviours*, 13(4), pp.398-401.
- Baranne, M. and Falissard, B. (2018) Global burden of mental disorders among children aged 5–14 years. *Child and Adolescent Psychiatry and Mental Health*, 12. <https://doi.org/10.1186/s13034-018-0225-4>.
- Barcaccia, B. *et al.* (2017) Dysfunctional eating behaviours, anxiety, and depression in Italian boys and girls: the role of mass media. *Brazilian Journal of Psychiatry*, 40, pp. 72-77. <https://doi.org/10.1590/1516-4446-2016-2200>.
- Barnawi, M. *et al.* (2023) Prevalence and Determinants of Depression, Anxiety, and Stress Among Secondary School Students. *Cureus*, 15. <https://doi.org/10.7759/cureus.44182>.
- Barnhart, W.R., Braden, A.L. and Price, E. (2021) Emotion regulation difficulties interact with negative, not positive, emotional eating to strengthen relationships with disordered eating: An exploratory study. *Appetite*, 158, p.105038.
- Bartholdy, S. *et al.* (2017) Identifying disordered eating behaviours in adolescents: how do parent and adolescent reports differ by sex and age?. *European child & adolescent psychiatry*, 26, pp.691-701.
- Bates, E. *et al.* (2023) Examination of promotive and protective effects on early adolescent prosocial behaviour through a bioecological lens. *Frontiers in Psychology*, 14. <https://doi.org/10.3389/fpsyg.2023.1280346>.
- Belay, M. *et al.* (2022) Overnutrition and Associated Factors Among High School Adolescents in Mid COVID-19 Pandemic in Ethiopia: Neglected Public Health Concern. *Adolescent Health, Medicine and Therapeutics*, [online] 13, pp.1–14. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8784252/>

- Belbasis, L. and Bellou, V. (2018) Introduction to Epidemiological Studies.. Methods in molecular biology, 1793, pp. 1-6. https://doi.org/10.1007/978-1-4939-7868-7_1.
- Berg, K. (2016) Eating Disorder Examination (EDE)/(EDE-Q). , pp. 1-4. https://doi.org/10.1007/978-981-287-087-2_101-1.
- Berge, J.M. *et al.* (2013) Parent conversations about healthful eating and weight: associations with adolescent disordered eating behaviours. JAMA Pediatrics, 167(8), pp.746-753.
- Bergen, N. and Labonté, R. (2020) “Everything is perfect, and we have no problems”: detecting and limiting social desirability bias in qualitative research. Qualitative health research, 30(5), pp.783-792.
- Berger, R. (2015) Now I see it, now I don't: Researcher's position and reflexivity in qualitative research. Qualitative Research, 15(2), 219–234. doi:10.1177/1468794112468475.
- Bhardwaj, P. (2019) Types of sampling in research. Journal of the Practice of Cardiovascular Sciences, 5, pp. 157 - 163. https://doi.org/10.4103/jpcs.jpcs_62_19.
- Bhutta, Z. *et al.* (2017) Severe childhood malnutrition. Nature Reviews Disease Primers, 3. <https://doi.org/10.1038/nrdp.2017.67>.
- Bibi, H., Khan, S. and Shabir, M. (2022) A Critique Of Research Paradigms And Their Implications For Qualitative, Quantitative And Mixed Research Methods. Webology, 19(2).
- Bibiloni, M.D.M., Pons, A. and Tur, J.A. (2013) Prevalence of overweight and obesity in adolescents: a systematic review. International Scholarly Research Notices, 2013(1), p.392747.
- Bien, K., Wagner, J. and Brandt, N.D. (2024) Who tends to be a perfectionistic adolescent? Distinguishing perfectionism from excellencism and investigating the links with the Big Five and self-esteem. British Journal of Psychology.
- Bishop, F. (2015) Using mixed methods research designs in health psychology: an illustrated discussion from a pragmatist perspective.. British journal of health psychology, 20 1, pp. 5-20 <https://doi.org/10.1111/bjhp.12122>.
- Bittar, C. and Soares, A. (2020) Media and eating behaviour in adolescence. Cadernos Brasileiros de Terapia Ocupacional, 28, pp.291-308.
- Blakemore, S.-J. and Choudhury, S. (2006) Brain development during puberty: state of the science. Developmental Science, 9(1), pp.11–14.
- Bollen, E. and Wojciechowski, F. L. (2004) Anorexia nervosa subtypes and the big five personality factors. European Eating Disorders Review, 12(2), 117–121. <https://doi.org/10.1002/erv.551>
- Bottino, S. *et al.* (2015) Cyberbullying and adolescent mental health: systematic review. Cadernos De Saude Publica, 31, pp. 463-475. <https://doi.org/10.1590/0102-311X00036114>.
- Bould, H. *et al.* (2017a) Eating disorders in children and young people. British Medical Journal, 359. <https://doi.org/10.1136/bmj.j5245>.
- Bould, H. *et al.* (2017b) Assessment of child or young person with a possible eating disorder. BMJ, 359.
- Bould, H. *et al.* (2018) Do disordered eating behaviours in girls vary by school characteristics? A UK cohort study. European child & adolescent psychiatry, 27(11), pp.1473-1481.
- Bourne, L. *et al.* (2020) Avoidant/restrictive food intake disorder: A systematic scoping review of the current literature. Psychiatry Research, 288. <https://doi.org/10.1016/j.psychres.2020.112961>.
- Bozzola, E. *et al.* (2022) The Use of Social Media in Children and Adolescents: Scoping Review on the Potential Risks. International Journal of Environmental Research and Public Health, 19. <https://doi.org/10.3390/ijerph19169960>.

- Braun, V. and Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), pp.77-101.
- Brener, N. *et al.* (2003) Reliability and validity of self-reported height and weight among high school students.. *The Journal of adolescent health : official publication of the Society for Adolescent Medicine*, 32 4, pp. 281-7 . [https://doi.org/10.1016/S1054-139X\(02\)00708-5](https://doi.org/10.1016/S1054-139X(02)00708-5).
- Brener, N.D. (2024) Overview and methods for the Youth Risk Behaviour Surveillance System—United States, 2023. *MMWR supplements*, 73.
- Bristow, C. *et al.* (2020) Anti-obesity public health messages and risk factors for disordered eating: a systematic review.. *Health promotion international*. <https://doi.org/10.1093/heapro/daaa018>.
- Brixval, C.S. *et al.* (2012) Overweight, body image and bullying—an epidemiological study of 11-to 15-years olds. *The European Journal of Public Health*, 22(1), pp.126-130.
- Bronfenbrenner, U. (1977) Toward an experimental ecology of human development. *American psychologist*, 32(7), p.513.
- Bronfenbrenner, U. (1979) *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.
- Bronfenbrenner, U. (1986) Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology*, 22(6), 723–742. <https://doi.org/10.1037/0012-1649.22.6.723>
- Bronfenbrenner, U. (1994) Ecological models of human development. *International encyclopedia of education*, 3(2), pp.37-43.
- Bronfenbrenner, U. and Ceci, S. J. (1994) Nature-reconceptualized in developmental perspective: A bioecological model. *Psychological Review*, 101(4), 568–586. <https://doi.org/10.1037/0033-295X.101.4.568>
- Brown, J.D. and Bobkowski, P.S. (2011) Older and newer media: Patterns of use and effects on adolescents' health and well-being. *Journal of research on Adolescence*, 21(1), pp.95-113.
- Brown, S.L., Schiraldi, G.R. and Wroblewski, P.P. (2009) Association of eating behaviours and obesity with psychosocial and familial influences. *American Journal of Health Education*, 40(2), pp.80-89.
- Brown, T.A. *et al.* (2020) A 30-year longitudinal study of body weight, dieting, and eating pathology across women and men from late adolescence to later midlife. *Journal of Abnormal Psychology*, 129(4), p.376.
- Bruce, K. R. and Steiger, H. (2005) Treatment implications of Axis-II comorbidity in eating disorders. *Eating Disorders*, 13(1), 93–108. <https://doi.org/10.1080/10640260590893700>.
- Bryla, K.Y. (2003) Disordered Eating among Female Adolescents: Prevalence, Risk Factors, and Consequences. *Health Educator*, 35(2), pp.25-29.
- Budd, G. (2007) Disordered eating: Young women's search for control and connection. *Journal of Child and Adolescent Psychiatric Nursing*, 20(2), pp.96-106.
- Bujang, M.A. *et al.* (2024) Sample size determination for conducting a pilot study to assess reliability of a questionnaire. *Restorative Dentistry & Endodontics*, 49(1).
- Burcaş, S. and Creţu, R.Z. (2021) Perfectionism and Neuroticism: Evidence for a common genetic and environmental aetiology. *Journal of Personality*, 89(4), pp.819-830.
- Burns, T. and Gottschalk, F. (2019) *Educating 21st Century Children: Emotional Well-being in the Digital Age*, Educational Research and Innovation, OECD Publishing, Paris, <https://doi.org/10.1787/b7f33425-en>.
- Busetto, L., Wick, W. and Gumbinger, C. (2020) How to use and assess qualitative research methods. *Neurological Research and practice*, 2, pp.1-10.

- Butcher, J.N., Mineka, S. and Hooley, J.M. (2017) *Abnormal Psychology*. (15 ed.) Pearson.
- Butrus, N. and Witenberg, R. T. (2014) The relationships between five-factor model personality traits and personality disorder features in an Australian non-clinical sample. *Journal of Psychopathology and Behavioural Assessment*, 37(1), 12–26. <https://doi.org/10.1007/s10862-014-9445-y>
- Byrne, S.E., Basten, C.J. and McAloon, J. (2024) The development of disordered eating in male adolescents: A systematic review of prospective longitudinal studies. *Adolescent Research Review*, 9(2), pp.227-252.
- Cai, W. (2014) Nutritional challenges for children in societies in transition. *Current Opinion in Clinical Nutrition & Metabolic Care*, 17(3), pp.278-284.
- Cala, V. and Soriano, E. (2014) Health Education from an Ecological Perspective. Adaptation of the Bronfenbrenner Model from an Experience with Adolescents. *Procedia - Social and Behavioural Sciences*, 132, pp. 49-57. <https://doi.org/10.1016/J.SBSPRO.2014.04.277>.
- Calzo, J. *et al.* (2012) The development of associations among body mass index, body dissatisfaction, and weight and shape concern in adolescent boys and girls.. *The Journal of adolescent health : official publication of the Society for Adolescent Medicine*, 51 5, pp. 517-23 . <https://doi.org/10.1016/j.jadohealth.2012.02.021>.
- Campbell, S. *et al.* (2020) Purposive sampling: complex or simple? Research case examples. *Journal of Research in Nursing*, 25, pp. 652 - 661. <https://doi.org/10.1177/1744987120927206>.
- Cance, J., Loukas, A. and Talley, A. (2015) The differential associations of internalizing symptoms and family and school relationships with disordered eating attitudes among early adolescents. *Journal of Social and Personal Relationships*, 32, pp. 41 - 56. <https://doi.org/10.1177/0265407514523551>.
- Carnell, S. *et al.* (2023) Biobehavioural susceptibility for obesity in childhood: behavioural, genetic and neuroimaging studies of appetite. *Physiology & behaviour*, 271, p.114313.
- Cassin, S.E. and von Ranson, K.M. (2005) Personality and eating disorders: a decade in review. *Clinical psychology review*, 25(7), pp.895-916.
- Centre for Disease Control and Prevention and the National Centre for Health Statistics (2022) CDC Extended BMI-for-age Growth Charts. <https://www.cdc.gov/growthcharts/Extended-BMI-Charts.html>
- Charles Shapu, R. *et al.* (2020) Systematic review: Effect of health education intervention on improving knowledge, attitudes and practices of adolescents on malnutrition. *Nutrients*, 12(8), p.2426.
- Charmaz, K. (2015) Grounded theory. *Qualitative psychology: A practical guide to research methods*, 3, pp.53-84.
- Chaves, E., Jeffrey, D.T. and Williams, D.R. (2023) Disordered eating and eating disorders in pediatric obesity: assessment and next steps. *International journal of environmental research and public health*, 20(17), p.6638.
- Chen, H., Ye, Y. and Guo, J. (2020) Impact of weight stigma on preadolescents' and adolescents' disordered eating behaviours: Testing two mediation models. *Social Behaviour and Personality*, 48, pp. 1-15. <https://doi.org/10.2224/sbp.9392>.
- Chenail, R.J. (2011) Interviewing the investigator: Strategies for addressing instrumentation and researcher bias concerns in qualitative research. *Qualitative report*, 16(1), pp.255-262.
- Cheng, C. *et al.* (2023) Cyberbullying and eating disorder symptoms in US early adolescents. *International Journal of Eating Disorders*, 56(12), pp.2336-2342. <https://doi.org/10.1002/eat.24034>.

- Chiasson, M. (2014) Influence of Menarche on Body Weight. A Systematic Review and Meta-Analysis. <https://doi.org/10.20381/RUOR-6497>.
- Chng, S.C. and Fassnacht, D.B. (2016) Parental comments: Relationship with gender, body dissatisfaction, and disordered eating in Asian young adults. *Body Image*, 16, pp.93-99.
- Christian, P. and Smith, E. (2018) Adolescent Undernutrition: Global Burden, Physiology, and Nutritional Risks. *Annals of Nutrition and Metabolism*, 72, pp. 316 - 328. <https://doi.org/10.1159/000488865>.
- Chung, A. *et al.* (2021) Adolescent peer influence on eating behaviours via social media: scoping review. *Journal of medical Internet research*, 23(6), p.e19697.
- Clarke, V. and Braun, V. (2017) Thematic analysis. *The Journal of Positive Psychology*, 12(3), pp.297-298.
- Coakley, K. (2022) Disordered Eating Among University Students is Common and Associated With Clinical Eating Disorder Symptoms. *Current Developments in Nutrition*, 6, pp. 353 - 353. <https://doi.org/10.1093/cdn/nzac054.008>.
- Collison, K.S. *et al.* (2010) Sugar-sweetened carbonated beverage consumption correlates with BMI, waist circumference, and poor dietary choices in school children. *BMC Public Health*, 10(1), pp.1-13.
- Colton, P. *et al.* (2004) Disturbed eating behaviour and eating disorders in preteen and early teenage girls with type 1 diabetes: a case-controlled study. *Diabetes care*, 27(7), pp.1654-1659.
- Cooper, M.J., Rose, K.S. and Turner, H. (2006) The specific content of core beliefs and schema in adolescent girls high and low in eating disorder symptoms. *Eating behaviours*, 7(1), pp.27-35.
- Cooper, Z. and Fairburn, C. (1987) The eating disorder examination: A semi-structured interview for the assessment of the specific psychopathology of eating disorders. *International journal of eating disorders*, 6(1), pp.1-8.
- Costa, C. *et al.* (2008) Determinants of Eating Disorders Symptomatology in Portuguese Adolescents. *Archives of Paediatrics & Adolescent Medicine*, 162(12), p.1126-1132.
- Cresswell, J. W. (2009) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (3rd ed.). Los Angeles: Sage
- Cresswell, J.W. and Plano Clark, V.L. (2011) *Designing and conducting mixed methods research*.
- Creswell, J.W. and Poth, C.N. (2016) *Qualitative inquiry and research design: Choosing among five approaches*. Sage Publications.
- Cronbach, L.J. (1951) Coefficient alpha and the internal structure of tests. *psychometrika*, 16(3), pp.297-334.
- Crone, E.A. and Dahl, R.E. (2012) Understanding adolescence as a period of social-affective engagement and goal flexibility. *Nature Reviews Neuroscience*, 13(9), 636-650.
- Cruickshank, M. *et al.* (2023) Nutritional status and its determinants among adolescents with HIV on anti-retroviral treatment in low-and middle-income countries: a systematic review and meta-analysis.
- Cruz-Sáez, S. *et al.* (2018) The effect of body dissatisfaction on disordered eating: The mediating role of self-esteem and negative affect in male and female adolescents. *Journal of health psychology*, 25(8), pp.1098-1108.
- Cunha, M. (2007) Modelling Peer Group Dieting Behaviour. *Int. J. Humanit. Soc. Sci*, 1, pp.232-236.
- Curtin, S. *et al.* (2018) Recent Increases in Injury Mortality Among Children and Adolescents Aged 10-19 Years in the United States: 1999-2016.. *National vital statistics reports*:

- from the Centres for Disease Control and Prevention, National Centre for Health Statistics, National Vital Statistics System, 67 4, pp. 1-16.
- Cybulski, L. *et al.* (2021) Temporal trends in annual incidence rates for psychiatric disorders and self-harm among children and adolescents in the UK, 2003–2018. *BMC Psychiatry*, 21. <https://doi.org/10.1186/s12888-021-03235-w>.
- D'Souza, C.M., Forman, S.F. and Austin, S.B. (2005) Follow-up evaluation of a high school eating disorders screening program: knowledge, awareness and self-referral. *Journal of Adolescent Health*, 36(3), pp.208-213.
- Dahill, L.M. *et al.* (2023) Associations between Parents' Body Weight/Shape Comments and Disordered Eating Amongst Adolescents over Time—A Longitudinal Study. *Nutrients*, 15.
- Dahl, R. (2003) Beyond Raging Hormones: The Tinderbox in the Teenage Brain Beyond Raging Hormones: The Tinderbox in the Teenage Brain. From *Cerebrum: The Dana Forum On Brain Science*, [online] 5(3), pp.7–22. Available at: <https://www.ccoso.org/sites/default/files/import/beyond-raging-hormones.pdf>
- Dakanalis, A. *et al.* (2023) The Association of Emotional Eating with Overweight/Obesity, Depression, Anxiety/Stress, and Dietary Patterns: A Review of the Current Clinical Evidence. *Nutrients*, 15. <https://doi.org/10.3390/nu15051173>.
- Daly, A.N., O'Sullivan, E.J. and Kearney, J.M. (2022) Considerations for health and food choice in adolescents. *Proceedings of the Nutrition Society*, 81(1), pp.75-86.
- Damstetter, E. and Vashi, N. (2015) Body Image and Body Image Dissatisfaction. , pp. 83-93. https://doi.org/10.1007/978-3-319-17867-7_5.
- Dardas, L. A. (2021) Depression and suicide among Arab adolescents: 7 messages from research in Jordan. *Journal of Psychiatric and Mental Health Nursing*. <https://doi.org/10.1111/jpm.12802>.
- Das, J.K. *et al.* (2017) Nutrition in adolescents: physiology, metabolism, and nutritional needs. *Annals of the New York Academy of Sciences*, 1393(1), pp.21-33.
- Davis, R. *et al.* (2014) Theories of behaviour and behaviour change across the social and behavioural sciences: a scoping review. *Health Psychology Review*, 9, pp. 323-344. <https://doi.org/10.1080/17437199.2014.941722>.
- Day, S. *et al.* (2021a). The Impact of Teasing and Bullying Victimization on Disordered Eating and Body Image Disturbance Among Adolescents: A Systematic Review. *Trauma, Violence, & Abuse*, 23(3), 985-1006. <https://doi.org/10.1177/1524838020985534>
- Day, S. *et al.* (2021b) Associations of weight-or shape-related bullying with diverse disordered eating behaviours in adolescents. *International journal of eating disorders*, 54(9), pp.1641-1651.
- De Clercq, B. and De Fruyt, F. (2012) A five-factor model framework for understanding childhood personality disorder antecedents. *Journal of Personality*, 80(6), 1533–1563. <https://doi.org/10.1111/j.1467-6494.2012.00778.x>
- Dean, A.G., Sullivan, K.M., Soe, M.M. (2013) OpenEpi: Open Source Epidemiologic Statistics for Public Health, Version 2.3.1. Available online: <https://www.OpenEpi.com/> (accessed on 20 October 2022).
- Deek, M.R., Kemps, E. and Prichard, I. (2024) My mother, sisters, and I: Investigating the role of female family members in body dissatisfaction and disordered eating behaviours among young Middle-Eastern women. *Body Image*, 48, p.101682.
- Defayette, A.B. *et al.* (2021) Adolescent depressed mood and difficulties with emotion regulation: Concurrent trajectories of change. *Journal of adolescence*, 91, pp.1-14.

- DeJonckheere, M. and Vaughn, L. (2019) Semistructured interviewing in primary care research: a balance of relationship and rigour. *Family Medicine and Community Health*, 7. <https://doi.org/10.1136/fmch-2018-000057>.
- Delany, D.E. and Cheung, C.S. (2019) Culture and Adolescent Development. *The Encyclopedia of Child and Adolescent Development*, pp.1-12.
- Denny, E. and Weckesser, A. (2022) How to do qualitative research?. *Bjog*, 129, pp. 1166 - 1167. <https://doi.org/10.1111/1471-0528.17150>.
- Derenne, J.L. and Beresin, E.V. (2006) Body image, media, and eating disorders. *Academic psychiatry*, 30, pp.257-261.
- Diaz-Marsa, M., Carrasco, J. L. And Saiz, J. (2000) study of temperament and personality in anorexia nervosa and bulimia nervosa. *Journal of Personality Disorders*, 14, 352–359.
- Dimmelmeier, A. and Dow, S. (2021) Paradigms and Research Programmes. *Research Methods in the Social Sciences: An A-Z of key concepts*. <https://doi.org/10.1093/hepl/9780198850298.003.0049>
- Dingemans, A., Danner, U. and Parks, M. (2017) Emotion Regulation in Binge Eating Disorder: A Review. *Nutrients*, 9. <https://doi.org/10.3390/nu9111274>.
- Dion, J. *et al.* (2014) Development and aetiology of body dissatisfaction in adolescent boys and girls. *International journal of adolescence and youth*, 20(2), pp.151-166.
- Doba, K. *et al.* (2018) Self-differentiation and eating disorders in early and middle adolescence: A cross-sectional path analysis. *Eating behaviours*, 29, pp.75-82.
- Dodgson, J.E. (2019) Reflexivity in qualitative research. *Journal of human lactation*, 35(2), pp.220-222.
- Dubovi, A. S., Li, Y. And Martin, J. L. (2016) Breaking the silence: Disordered eating and big five traits in college men. *American Journal of Men's Health*, 10(6), NP118–NP126. <https://doi.org/10.1177/1557988315590654>
- Dufresne, L. *et al.* (2020) Personality traits in adolescents with eating disorder: A meta-analytic review.. *The International journal of eating disorders*. <https://doi.org/10.1002/eat.23183>.
- Dunn, C. *et al.* (2022) Factors Associated With Disordered Eating Behaviour Among Adolescent Girls: Screening and Education. *Journal of Primary Care & Community Health*, 13. <https://doi.org/10.1177/21501319211062673>.
- Eapen, V., Mabrouk, A.A. and Bin-Othman, S. (2006) Disordered eating attitudes and symptomatology among adolescent girls in the United Arab Emirates. *Eating behaviours*, 7(1), pp.53-60.
- Eggert, J., Levendosky, A. and Klump, K. (2007) Relationships among attachment styles, personality characteristics, and disordered eating. *International Journal of Eating Disorders*, 40(2), 149–155. <https://doi.org/10.1002/eat.20351>
- Eiber, R., Mirabel-Sarron, C. and Urdapilleta, I. (2005) Cognitions in eating disorders and their assessment. *L'encéphale*, 31(6 Pt 1), pp.643-652.
- Einstein, N. (2006) A simple map showing the major cities in Saudi Arabia. [online] Wikimedia Commons Contributors 2022. Available at: https://commons.wikimedia.org/wiki/File:Saudi_Arabia_map.png.
- El Shikieri, A.B. (2022) The prevalence and nutritional status of adolescent Saudi girls with disordered eating. *Journal of nutritional science*, 11, p.e71.
- Elal, G., Sabol, E. and Slade, P. (2004) Abnormal eating attitudes and sexual abuse experiences in Turkish university women. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 9(3), pp.170–178. <https://doi.org/10.1007/bf03325063>.

- El-Bagoury, L., Hassan, A. and AbouSeif, H. (2017) Eating attitudes and barriers to healthy eating and physical activity among a sample of university students in Egypt. *Journal of Egyptian Public Health Association*, 92(1), pp.29-35.
- Elgin, J. and Pritchard, M. (2006) Gender differences in disordered eating and its correlates. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 11(3), pp.e96–e101. doi:<https://doi.org/10.1007/bf03327565>.
- Eliashevich, S., Araukho, D. and Drapkina, O. (2023) Eating behaviour: disorders and how to assess them. *Cardiovascular Therapy and Prevention*. <https://doi.org/10.15829/1728-8800-2023-3663>.
- El-Radhi, A.S. (2015) Appropriate care for children with eating disorders and obesity. *British Journal of Nursing*, 24(10), pp.518-522.
- Emery, R.L. *et al.* (2021) Childhood maltreatment and disordered eating attitudes and behaviours in adult men and women: Findings from project EAT. *Appetite*, 163, p.105224.
- Engelsen, B.K. and Laberg, J.C. (2001) A comparison of three questionnaires (EAT-12, EDI, and EDE-Q) for assessment of eating problems in healthy female adolescents. *Nordic Journal of Psychiatry*, 55(2), pp.129-135.
- Epi Info™ (2022) Division of Health Informatics & Surveillance (DHIS), Centre for Surveillance, Epidemiology & Laboratory Services (CSELS). Available online: <https://www.cdc.gov/csels/dhis/index.html> (accessed on 20 October 2022).
- Eriksson, M., Ghazinour, M. and Hammarström, A. (2018) Different uses of Bronfenbrenner's ecological theory in public mental health research: what is their value for guiding public mental health policy and practice?. *Social Theory & Health*, 16(4), pp.414-433.
- Escrivá, D. *et al.* (2021) Relationship of Overweight and Obesity with Body Self-Image Dissatisfaction in Urban Mediterranean Adolescents. *International Journal of Environmental Research and Public Health*, 18. <https://doi.org/10.3390/ijerph18157770>.
- Etikan, I., Musa, S. and Alkassim, R. (2016) Comparison of Convenience Sampling and Purposive Sampling. *American Journal of Theoretical and Applied Statistics*, 5, pp. 1. <https://doi.org/10.11648/J.AJTAS.20160501.11>.
- Fairburn, C.G. (2008) *Cognitive behaviour therapy and eating disorders*. Guilford Press: New York, NY, USA.
- Fairclough, S. (2021) Adolescents' digital screen time as a concern for health and well-being? Device type and context matter. *Acta Paediatrica*, 110. <https://doi.org/10.1111/apa.15843>.
- Fairweather-Schmidt, A. and Wade, T. (2015) Changes in genetic and environmental influences on disordered eating between early and late adolescence: a longitudinal twin study. *Psychological Medicine*, 45, pp. 3249 - 3258. <https://doi.org/10.1017/S0033291715001257>.
- Fallatah, A., Al-Hemairy, M. and Al-Ghamidi, H. (2015) Eating disorders among female adolescents in Jeddah. *C COOP*, 138, pp.138-147.
- Fan, Y. *et al.* (2010) Associations between body mass index, weight control concerns and behaviours, and eating disorder symptoms among non-clinical Chinese adolescents. *BMC Public Health*, 10, pp.1-12.
- Farello, G. *et al.* (2019) Review of the Literature on Current Changes in the Timing of Pubertal Development and the Incomplete Forms of Early Puberty. *Frontiers in Paediatrics*, 7. <https://doi.org/10.3389/fped.2019.00147>.
- Farstad, S. M., McGeown, L. M. and von Ranson, K. M. (2016) Eating disorders and personality, 2004–2016: A systematic review and meta-analysis. *Clinical Psychology Review*, 46, 91–105. <https://doi.org/10.1016/j.cpr.2016.04.005>

- Fath Al Alim, M.A., Noon, H.A. and Abdelghani, A. (2012) Eating disorders symptoms among a university students: an exploratory study. *Sudan Med J*, 48(3), pp.186-193.
- Fatima, W. and Ahmad, L.M. (2018) Prevalence of disordered eating attitudes among adolescent girls in Arar City, Kingdom of Saudi Arabia. *Health Psychology Research*, 6(1), p. 7444.
- Feilzer, M. (2010) Doing Mixed Methods Research Pragmatically: Implications for the Re-discovery of Pragmatism as a Research Paradigm. *Journal of Mixed Methods Research*, 4, pp. 16 - 6. <https://doi.org/10.1177/1558689809349691>.
- Fennig, S. *et al.* (2008) Self-criticism is a key predictor of eating disorder dimensions among inpatient adolescent females. *International Journal of Eating Disorders*, 41(8), pp.762-765.
- Fernández-Aranda, F., Granero, R. and Jiménez-Murcia, S. (2023) Eating Disorders and Addictive Behaviours: Implications for Human Health. *Nutrients*, 15. <https://doi.org/10.3390/nu15173718>.
- Ferreiro, F., Seoane, G. and Senra, C. (2012) Gender-related risk and protective factors for depressive symptoms and disordered eating in adolescence: A 4-year longitudinal study. *Journal of youth and adolescence*, 41, pp.607-622.
- Ferreiro, F., Seoane, G. and Senra, C. (2014) Toward understanding the role of body dissatisfaction in the gender differences in depressive symptoms and disordered eating: A longitudinal study during adolescence. *Journal of adolescence*, 37(1), pp.73-84.
- Field, A.E. *et al.* (2001) Peer, parent, and media influences on the development of weight concerns and frequent dieting among preadolescent and adolescent girls and boys. *Pediatrics*, 107(1), pp.54-60.
- Fields, V. *et al.* (2021) Pica, Autism, and Other Disabilities. *Pediatrics*, 147. <https://doi.org/10.1542/peds.2020-0462>.
- First, M. *et al.* (2021) An organization- and category-level comparison of diagnostic requirements for mental disorders in ICD-11 and DSM-5. *World Psychiatry*, 20. <https://doi.org/10.1002/wps.20825>.
- Fischer, L. K. *et al.* (2017) Neuroticism and clinical course of weight restoration in a meal-based, rapid-weight gain, inpatient-partial hospitalization program for eating disorders. *Eating Disorders*, 25(1), 52–64. <https://doi.org/10.1080/10640266.2016.1241056>
- Fitzsimmons-Craft, E.E. *et al.* (2020) Adolescents and young adults engaged with pro-eating disorder social media: eating disorder and comorbid psychopathology, health care utilization, treatment barriers, and opinions on harnessing technology for treatment. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 25, pp.1681-1692.
- Flament, M. *et al.* (2015) Weight Status and DSM-5 Diagnoses of Eating Disorders in Adolescents From the Community.. *Journal of the American Academy of Child and Adolescent Psychiatry*, 54 5, pp. 403-411.e2. <https://doi.org/10.1016/j.jaac.2015.01.020>.
- Fossey, E. *et al.* (2002) Understanding and evaluating qualitative research. *Australian & New Zealand journal of psychiatry*, 36(6), pp.717-732.
- Francisco, R. *et al.* (2015) Body dissatisfaction and disordered eating among Portuguese and Spanish adolescents: The role of individual characteristics and internalisation of sociocultural ideals. *Journal of Adolescence*, 41, pp.7-16.
- Frank, G. (2016) The Perfect Storm- A Bio-Psycho-Social Risk Model for Developing and Maintaining Eating Disorders. *Frontiers in Behavioural Neuroscience*, 10. <https://doi.org/10.3389/fnbeh.2016.00044>.

- Franklin, J. *et al.* (2006) Obesity and risk of low self-esteem: a statewide survey of Australian children. *Pediatrics*, 118(6), pp.2481-2487.
- Foreich, F.V. *et al.* (2016) Dimensions of control and their relation to disordered eating behaviours and obsessive-compulsive symptoms. *Journal of eating disorders*, 4, pp.1-9.
- Gade, H. *et al.* (2014) Psychological correlates to dysfunctional eating patterns among morbidly obese patients accepted for bariatric surgery. *Obesity Facts*, 7(2), 111–119. <https://doi.org/10.1159/000362257>
- Gao, H. *et al.* (2019) The Mediating Effect of Body Dissatisfaction in Association between Obesity and Dietary Behaviour Changes for Weight Loss in Chinese Children.. *Bio-medical and environmental sciences: BES*, 32 9, pp. 639-646. <https://doi.org/10.3967/bes2019.083>.
- Gardner, R.M. *et al.* (2000) Predictors of eating disorder scores in children ages 6 through 14: A longitudinal study. *Journal of psychosomatic research*, 49(3), pp.199-205.
- Garner, D.M. (1991) Eating disorder Inventory-2; Professional Manual. Psychological assessment resources. 39–48.
- Garner, D.M. and Garfinkel, P.E. (1979) 'The Eating Attitudes Test: an index of the symptoms of anorexia nervosa', *Psychological Medicine*, 9(2), pp. 273–279. doi:10.1017/S0033291700030762.
- Garner, D.M. and Garfinkel, P.E. (1980) Socio-cultural factors in the development of anorexia nervosa. *Psychological medicine*, 10(4), pp.647-656.
- Garner, D.M. *et al.* (1982) The eating attitudes test: psychometric features and clinical correlates. *Psychological medicine*, 12(4), pp.871-878.
- Garner, D.M., Olmstead, M.P. and Polivy, J. (1983) Development and validation of a multidimensional eating disorder inventory for anorexia nervosa and bulimia. *International journal of eating disorders*, 2(2), pp.15-34.
- Garrusi, B., Baneshi, M.R. and Pakgohar, M. (2016) Eating disorders among Iranian male adolescents. *Iranian Journal of Psychiatry and Behavioural Sciences*, 10(4), p.e5352.
- Gavin, L. *et al.* (2009) Sexual and reproductive health of persons aged 10–24 years—United States, 2002–2007. *MMWR surveill Summ*, 58(6), pp.1-58.
- General Authority for Statistics (2021) Population Estimates in the Midyear of 2021. Available online: <https://www.stats.gov.sa/sites/default/files/POP%20SEM2021E.pdf> (accessed on 5 September 2023).
- General Authority for Statistics (2022) <https://portal.saudicensus.sa/portal>.
- Gentzler, A. *et al.* (2023) Which social media platforms matter and for whom? Examining moderators of links between adolescents' social media use and depressive symptoms.. *Journal of adolescence*. <https://doi.org/10.1002/jad.12243>.
- Ghaderi, A. and Scott, B. (2000) The big five and eating disorders: A prospective study in the general population. *European Journal of Personality*, 14, 311–323.
- Ghafouri, K.J. *et al.* (2021) Eating disorders amongst adolescents in Makkah: Effects of stress and smoking. *Med. Sci*, 25, pp.767-775.
- Giallonardo, V. (2019) ICD-11 sessions within the 18th World Congress of Psychiatry. *World Psychiatry*, 18(1), p.115.
- Giletta, M. *et al.* (2021) A meta-analysis of longitudinal peer influence effects in childhood and adolescence. *Psychological Bulletin*, 147(7), pp.719–747.
- Gilmartin, T. *et al.* (2022) One size does not fit all: Exploring how the five-factor model facets predict disordered eating behaviours among adolescent and young adult males and females. *British Journal of Psychology*, 00, 1–27. <https://doi.org/10.1111/bjop.12601>
- Gilmartin, T., Gurvich, C. and Sharp, G. (2022) The relationship between disordered eating behaviour and the five factor model personality dimensions: A systematic review.

- Journal of Clinical Psychology, 78, pp. 1657-1670.
<https://doi.org/10.1002/jclp.23337>.
- Gleaves, D.H. *et al.* (2014) Measuring eating disorder attitudes and behaviours: a reliability generalisation study. *Journal of Eating Disorders*, 2(1), pp.1-12.
- González, M. *et al.* (2011) Disordered eating prevention programme in schools: A 30-Month Follow-up. *European Eating Disorders Review*, 19(4), pp.349-356.
- Gorrell, S., Trainor, C. and Grange, L. (2019) The impact of urbanisation on risk for eating disorders. *Current Opinion in Psychiatry*, 32, pp. 242–247.
<https://doi.org/10.1097/YCO.0000000000000497>.
- Gough, B. (2017) Reflexivity in qualitative psychological research. *The Journal of Positive Psychology*, 12, pp. 311 - 312. <https://doi.org/10.1080/17439760.2016.1262615>.
- Gowers, S.G. and Shore, A. (2001) Development of weight and shape concerns in the aetiology of eating disorders. *The British Journal of Psychiatry*, 179(3), pp.236-242.
- Graber, J. A. (2013) Pubertal timing and the development of psychopathology in adolescence and beyond. *Hormones and Behaviour*, 64, 262–269.
- Graber, J.A., Tyrka, A.R. and Brooks-Gunn, J. (2003) How similar are correlates of different subclinical eating problems and bulimia nervosa?. *Journal of Child Psychology and Psychiatry*, 44(2), pp.262-273.
- Grenz, S. (2014) Empowering Teen Peers to Prevent Bullying: The Bully Busters Program for High School. *School Social Work Journal*, 39(1), p.93.
- Griffith, D. (2013) Establishing Qualitative Geographic Sample Size in the Presence of Spatial Autocorrelation. *Annals of the Association of American Geographers*, 103, pp. 1107 - 1122. <https://doi.org/10.1080/00045608.2013.776884>.
- Grilo, C.M. and Juarascio, A. (2023) Binge-eating disorder interventions: review, current status, and implications. *Current obesity reports*, 12(3), pp.406-416.
- Guetterman, T. (2020) Qualitative, Quantitative, and Mixed Methods Research Sampling Strategies. *Education*. <https://doi.org/10.1093/obo/9780199756810-0241>.
- Gupta, D. and Ankur, A. (2023) Pica and The Iron Deficiency Anaemia: A Case Series. *International Journal of Advanced Research*. <https://doi.org/10.21474/ijar01/16179>.
- Gupta, S. *et al.* (2018) Systematic Review of the Literature: Best Practices.. *Academic radiology*, 25 11, pp. 1481-1490 . <https://doi.org/10.1016/j.acra.2018.04.025>.
- Habbab, R. and Bhutta, Z. (2020) Prevalence and social determinants of overweight and obesity in adolescents in Saudi Arabia: A systematic review. *Clinical Obesity*, 10.
<https://doi.org/10.1111/cob.12400>.
- Hadjigeorgiou, C. *et al.* (2018) Disordered eating in three different age groups in Cyprus: a comparative cross-sectional study. *public health*, 162, pp.104-110.
- Hafsa, R. (2014) Coping strategies for stress used by adolescent girls.
- Haines, J. *et al.* (2011) Screening high school students for eating disorders: validity of brief behavioural and attitudinal measures. *Journal of School Health*, 81(9), pp.530-535.
- Haines, J. *et al.* (2016) Family functioning and quality of parent-adolescent relationship: cross-sectional associations with adolescent weight-related behaviours and weight status. *The International Journal of Behavioural Nutrition and Physical Activity*, 13.
<https://doi.org/10.1186/s12966-016-0393-7>.
- Hamm, M. *et al.* (2015) Prevalence and Effect of Cyberbullying on Children and Young People: A Scoping Review of Social Media Studies.. *JAMA Paediatrics*, 169 8, pp. 770-7.
<https://doi.org/10.1001/jamapediatrics.2015.0944>.
- Hampshire, C., Mahoney, B. and Davis, S. (2022) Parenting Styles and Disordered Eating Among Youths: A Rapid Scoping Review. *Frontiers in Psychology*, 12.
<https://doi.org/10.3389/fpsyg.2021.802567>.

- Hanachi, M. *et al.* (2019) Micronutrients deficiencies in 374 severely malnourished anorexia nervosa inpatients. *Nutrients*, 11(4), p.792.
- Hand, W. *et al.* (2017) The Identity Threat of Weight Stigma in Adolescents. *Western Journal of Nursing Research*, 39, pp. 1007 - 991. <https://doi.org/10.1177/0193945917704201>.
- Hanson, P., Weickert, M.O. and Barber, T.M. (2020) Obesity: novel and unusual predisposing factors. *Therapeutic Advances in Endocrinology and Metabolism*, 11, p.2042018820922018.
- Harden, K.P. *et al.* (2014) Descriptive review: hormonal influences on risk for eating disorder symptoms during puberty and adolescence. *International Journal of Eating Disorders*, 47(7), pp.718-726.
- Harden, K.P., Mendle, J. and Kretsch, N. (2012) Environmental and genetic pathways between early pubertal timing and dieting in adolescence: distinguishing between objective and subjective timing. *Psychological Medicine*, 42(1), pp.183-193.
- Harrell, M.C. and Bradely, M.A. (2009) Data Collection Methods: Semi-Structured Interviews and Focus Groups. RAND Corporation.
- Harris, S.M. (2015) Black American female eating dysfunctions and body image: A bioecological perspective. *Negro Educational Review*, 66(1-4), pp.27-54.
- Harrison, A.N. *et al.* (2020) Disordered eating behaviours and attitudes among adolescents in a middle-income country. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 25, pp.1727-1737.
- Harrison, K. (2000) The body electric: Thin-ideal media and eating disorders in adolescents. *Journal of Communication*, 50(3), pp.119-143.
- Hart, L.M. *et al.* (2015) Parents and prevention: A systematic review of interventions involving parents that aim to prevent body dissatisfaction or eating disorders. *International Journal of Eating Disorders*, 48(2), pp.157-169.
- Hartmann, A.S. and Hilbert, A. (2013) Child and adolescent obesity, psychosocial consequences and treatment strategies. *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz*, 56(4), pp.532-538.
- Hasan, F. *et al.* (2021) A qualitative exploration of motivations for fasting and the impact of Ramadan on eating behaviours and body image among young adult Muslim women in the United Kingdom. *Eating behaviours*, 42, p.101545.
- Hasan, M.N. (2016) Positivism: to what extent does it aid our understanding of the contemporary social world?. *Quality & Quantity*, 50(1), pp.317-325.
- Hausenblas, H.A. *et al.* (2013) Media effects of experimental presentation of the ideal physique on eating disorder symptoms: A meta-analysis of laboratory studies. *Clinical Psychology Review*, 33(1), pp.168-181. *Health J* 2014;20:39–45. doi:10.26719/2014.20.1.39.
- Haworth-Hoepfner, S. (2000) The critical shapes of body image: The role of culture and family in the production of eating disorders. *Journal of marriage and family*, 62(1), pp.212-227.
- Hay, P. and Mitchison, D. (2021) Urbanization and eating disorders: a scoping review of studies from 2019 to 2020. *Current opinion in psychiatry*, 34(3), pp.287-292. <https://doi.org/10.1097/YCO.0000000000000681>.
- Hayes, J.F. *et al.* (2018) Disordered eating attitudes and behaviours in youth with overweight and obesity: implications for treatment. *Current obesity reports*, 7, pp.235-246.
- He, J., Cai, Z. and Fan, X. (2017) Prevalence of binge and loss of control eating among children and adolescents with overweight and obesity: An exploratory meta-analysis. *International Journal of Eating Disorders*, 50, pp. 91–103. <https://doi.org/10.1002/eat.22661>.

- Healy, M. and Perry, C. (2000) Comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm. *Qualitative market research: An international journal*, 3(3), pp.118-126.
- Hellmann, F. *et al.* (2014) 50th anniversary of the Declaration of Helsinki: the double standard was introduced. *Archives of medical research*, 45 7, pp. 600-1. <https://doi.org/10.1016/j.arcmed.2014.10.005>.
- Herman-Giddens, M.E. *et al.* (2012) Secondary sexual characteristics in boys: Data from the paediatric research in office settings network. *Paediatrics*, 130(5), 1058-1068.
- Hernandez, R. *et al.* (2018) Psychological Well-Being and Physical Health: Associations, Mechanisms, and Future Directions. *Emotion Review*, 10, pp. 18-29. <https://doi.org/10.1177/1754073917697824>.
- Herpertz-Dahlmann, B. (2015) Adolescent eating disorders: update on definitions, symptomatology, epidemiology, and comorbidity. *Child and Adolescent Psychiatric Clinics*, 24(1), pp.177-196.
- Higgins, J.P.T. *et al.* (2024) *Cochrane Handbook for Systematic Reviews of Interventions*, version 6.5 (updated August 2024); Cochrane: London, UK.
- Hijji, T.M., Saleheen, H. and AlBuhairan, F.S. (2021) Underweight, body image, and weight loss measures among adolescents in Saudi Arabia: is it a fad or is there more going on?. *International Journal of Paediatrics and Adolescent Medicine*, 8(1), pp.18-24.
- Hill, A. (2006) Symposium on 'Nutrition and health in children and adolescents' Session 3: Eating behaviour and early indicators of metabolic syndrome Motivation for eating behaviour in adolescent girls: the body beautiful. *Proceedings of the Nutrition Society*, 65, pp. 376 - 384. <https://doi.org/10.1079/PNS2006513>.
- Hoare, P. and Cosgrove, L. (1998) Eating habits, body-esteem and self-esteem in Scottish children and adolescents. *Journal of psychosomatic research*, 45(5), pp.425-431.
- Hochgraf, A.K. and Ruggiero, C.F. (2021) Children's Eating Behaviour in Context: Family Systems and Broader Ecological Influences. *Families, Food, and Parenting: Integrating Research, Practice and Policy*, pp.173-185.
- Holtom-Viesel, A. and Allan, S. (2014) A systematic review of the literature on family functioning across all eating disorder diagnoses in comparison to control families. *Clinical psychology review*, 34(1), pp.29-43.
- Hong, S.C. *et al.* (2015) Prevalence of distorted body image in young Koreans and its association with age, sex, body weight status, and disordered eating behaviours. *Neuropsychiatric Disease and Treatment*, pp.1043-1049.
- Horesh, A. *et al.* (2021) Adolescent and Childhood Obesity and Excess Morbidity and Mortality in Young Adulthood—a Systematic Review. *Current Obesity Reports*, 10, pp. 301-310. <https://doi.org/10.1007/s13679-021-00439-9>.
- Horne, A.M. *et al.* (2012) Empower teen peers to prevent bullying: The Bully Busters program for high school. Research Press.
- Hoste, R.R., Labuschagne, Z. and Le Grange, D. (2012) Adolescent bulimia nervosa. *Current psychiatry reports*, 14, pp.391-397.
- Howitt, D. and Cramer, D. (2020) *Research methods in psychology*. Pearson.
- Hoyland, A., Dye, L. and Lawton, C.L. (2009) A systematic review of the effect of breakfast on the cognitive performance of children and adolescents. *Nutrition research reviews*, 22(2), pp.220-243.
- Huang, Q., Peng, W. and Ahn, S. (2020) When media become the mirror: a meta-analysis on media and body image. *Media Psychology*, 24, pp. 437 - 489. <https://doi.org/10.1080/15213269.2020.1737545>.
- Huo, J. *et al.* (2022) Screen Time and Its Association with Vegetables, Fruits, Snacks and Sugary Sweetened Beverages Intake among Chinese Preschool Children in Changsha,

- Hunan Province: A Cross-Sectional Study. *Nutrients*, 14.
<https://doi.org/10.3390/nu14194086>.
- Hutchinson, D. and Rapee, R. (2007) Do friends share similar body image and eating problems? The role of social networks and peer influences in early adolescence.. *Behaviour research and therapy*, 45 7, pp. 1557-77.
<https://doi.org/10.1016/J.BRAT.2006.11.007>.
- Iliadis, C. *et al.* (2020) Anorexia nervosa: A literature review. *Progress in Health Sciences*, 10(2), pp.74-79.
- Indu, P. and Vidhukumar, K. (2020) Research designs-an overview., 32.
<https://doi.org/10.30834/kjp.32.1.2019.179>.
- Insani, H., Kustiyah, L. and Dwiriani, C. (2022) Breakfast Habits of Adolescents in Bandung. *Journal of Applied Food and Nutrition*.
<https://doi.org/10.17509/jafn.v1i1.34321>.
- Jacobi, C. *et al.* (2004) Coming to terms with risk factors for eating disorders: application of risk terminology and suggestions for a general taxonomy. *Psychological bulletin*, 130(1), p.19.
- Jahrami, H. *et al.* (2019) The relationship between risk of eating disorders, age, gender and body mass index in medical students: a meta-regression. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 24, pp.169-177.
- Jalali-Farahani, S. *et al.* (2015) Disordered eating and its association with overweight and health-related quality of life among adolescents in selected high schools of Tehran. *Child Psychiatry & Human Development*, 46, pp.485-492.
- Jamshed, S. (2014) Qualitative research method-interviewing and observation. *Journal of basic and clinical pharmacy*, 5(4), p.87.
- Javdani, S. *et al.* (2023) Mixed methods in community psychology: A values-forward synthesis. *American journal of community psychology*, 72(3-4), pp.355-365.
- Jawed, A., Harrison, A. and Dimitriou, D. (2020) The Presentation of Eating Disorders in Saudi Arabia. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.586706>.
- Jayawardene, W., Lohrmann, D. and Youssef Agha, A. (2014) Discrepant body mass index: behaviours associated with height and weight misreporting among US adolescents from the National Youth Physical Activity and Nutrition Study. *Childhood obesity*, 10 3, pp. 225-33. <https://doi.org/10.1089/chi.2014.0002>.
- Jebeile, H. *et al.* (2021) Eating disorder risk in adolescents with obesity. *Obesity Reviews*, 22. <https://doi.org/10.1111/obr.13173>.
- Jimenez, A.L. *et al.* (2024) Adolescent Development. In: Tasman, A., et al. *Tasman's Psychiatry*. Springer, Cham. https://doi.org/10.1007/978-3-030-51366-5_106.
- Johnson, G.M. and Pupilampu, K.P. (2008) Internet use during childhood and the ecological techno-subsystem. *Canadian Journal of Learning and Technology*, 34(1), p.n1.
- Johnson, R.B. and Onwuegbuzie, A.J. (2004) Mixed methods research: A research paradigm whose time has come. *Educational researcher*, 33(7), pp.14-26.
- Johnson, R.B., Onwuegbuzie, A.J. and Turner, L.A. (2007) Toward a definition of mixed methods research. *Journal of mixed methods research*, 1(2), pp.112-133.
- Johnstone, A. and Stephen, S. (2020) Energy balance: impact of physiology and psychology on food choice and eating behaviour. , pp. 143-158. <https://doi.org/10.1016/b978-0-12-818460-8.00008-3>.
- Jones, J.M. *et al.* (2001) Disordered eating attitudes and behaviours in teenaged girls: a school-based study. *Cmaj*, 165(5), pp.547-552.
- Jung, J. and Forbes, G.B. (2006) Multidimensional assessment of body dissatisfaction and disordered eating in Korean and US college women: A comparative study. *Sex Roles*, 55, pp.39-50.

- Kagan, S. and Melrose, C. (2003) The SCOFF questionnaire was less sensitive but more specific than the ESP for detecting eating disorders. *Evidence-Based Nursing*, 6(4), pp.118-118.
- Kahale, L. *et al.* (2021a) PRISMA flow diagrams for living systematic reviews: a methodological survey and a proposal.. *F1000Research*, 10, pp. 192 .
<https://doi.org/10.12688/F1000RESEARCH.51723.1>.
- Kahale, L. *et al.* (2021b) Tailored PRISMA 2020 flow diagrams for living systematic reviews: a methodological survey and a proposal. *F1000Research*, 10.
<https://doi.org/10.12688/f1000research.51723.3>.
- Kallio, H. *et al.* (2016) Systematic methodological review: developing a framework for a qualitative semi-structured interview guide. *Journal of advanced nursing*, 72(12), pp.2954-2965.
- Kärkkäinen, U. *et al.* (2018) Do Disordered Eating Behaviours Have Long-term Health-related Consequences?. *European Eating Disorders Review*, 26, pp. 22–28.
<https://doi.org/10.1002/erv.2568>.
- Karlsson, S. *et al.* (2021) Patients' experiences and perceptions of recovering from anorexia nervosa while having contact with psychiatric care: a literature review and narrative synthesis of qualitative studies. *Issues in mental health nursing*, 42(8), pp.709-719.
- Katz, B. (2014) Gender and disordered eating of adolescents in Israel. *Isr. J. Psychiatry Relat. Sci*, 51, pp.137-144.
- Kaushik, D., Garg, M. and Mishra, A. (2023) Exploring Developmental Pathways: An In-depth Analysis of Bronfenbrenner's Bioecological Model. *International Journal For Multidisciplinary Research*. <https://doi.org/10.36948/ijfmr.2023.v05i06.9154>.
- Kawa, I. *et al.* (2021) Endocrine disrupting chemical Bisphenol A and its potential effects on female health.. *Diabetes & metabolic syndrome*, 15 3, pp. 803-811 .
<https://doi.org/10.1016/j.dsx.2021.03.031>.
- Keel, P.K. and Klump, K.L. (2003) Are eating disorders culture-bound syndromes? Implications for conceptualizing their etiology. *Psychological bulletin*, 129(5), p.747.
- Keller, C. and Siegrist, M. (2015) Does personality influence eating styles and food choices? Direct and indirect effects. *Appetite*, 84, 128–138. <https://doi.org/10.1016/j.appet.2014.10.003>
- Kendler, K.S. (2008) Explanatory models for psychiatric illness. *American Journal of Psychiatry* 165 (6): 695–702.
- Kenny, B. *et al.* (2021) Depression and eating disorders in early adolescence: A network analysis approach.. *The International journal of eating disorders*.
<https://doi.org/10.1002/eat.23627>.
- Keong, Y., Husin, M. and Kamarudin, S. (2023) Understanding Research Paradigms: A Scientific Guide. *Journal of Contemporary Issues in Business and Government*, 27, 2021.
- Keski-Rahkonen, A. and Silén, Y. (2019) Incidence and Prevalence of Eating Disorders Among Children and Adolescents. *Eating Disorders and Obesity in Children and Adolescents*. <https://doi.org/10.1016/B978-0-323-54852-6.00009-4>.
- Kesmodel, U. (2018) Cross-sectional studies – what are they good for?. *Acta Obstetricia et Gynecologica Scandinavica*, 97, pp. 388 - 393. <https://doi.org/10.1111/aogs.13331>.
- Khalaf, A. *et al.* (2015) “Prevalence and association of female weight status and dietary habits with sociodemographic factors: a cross-sectional study in Saudi Arabia,” *Public Health Nutrition*. Cambridge University Press, 18(5), pp. 784–796. doi: 10.1017/S1368980014001797.
- Kimber, M. *et al.* (2017) Consequences of child emotional abuse, emotional neglect and exposure to intimate partner violence for eating disorders: a systematic critical review. *BMC psychology*, 5, pp.1-18.

- Kinasz, K. *et al.* (2016) Does Sex Matter in the Clinical Presentation of Eating Disorders in Youth?. *The Journal of adolescent health : official publication of the Society for Adolescent Medicine*, 58 4, pp. 410-416. <https://doi.org/10.1016/j.jadohealth.2015.11.005>.
- Kinnear, A. *et al.* (2023) Functions of disordered eating behaviours: a qualitative analysis of the lived experience and clinician perspectives. *Journal of Eating Disorders*, 11(1), p.141
- Klosowska, J. *et al.* (2022) Emotion regulation moderates the associations of food parenting and adolescent emotional eating. *Journal of Nutrition Education and Behaviour*, 54(9), pp.808-817.
- Klump, K.L. (2013) Puberty as a critical risk period for eating disorders: A review of human and animal studies. *Hormones and behaviour*, 64(2), pp.399-410.
- Knight, J. *et al.* (2020) Pre-Pubertal Internalizing Symptoms and Timing of Puberty Onset in Girls.. *American journal of epidemiology*. <https://doi.org/10.1093/aje/kwaa223>.
- Kotler, L.A. *et al.* (2001) Longitudinal relationships between childhood, adolescent, and adult eating disorders. *Journal of the American Academy of Child & Adolescent Psychiatry*, 40(12), pp.1434-1440.
- Kouris-Blazos, A. (2020) Disordered eating and eating disorders. In *Food and Nutrition* (pp. 565-575). Routledge.
- Krauss, S., Dapp, L. and Orth, U. (2023) The Link Between Low Self-Esteem and Eating Disorders: A Meta-Analysis of Longitudinal Studies. *Clinical Psychological Science*, 11, pp. 1141 - 1158. <https://doi.org/10.1177/21677026221144255>.
- Krauss, S.E. (2005) Research paradigms and meaning making: A primer. *The qualitative report*, 10(4), pp.758-770.
- Kruger, L.J. *et al.* (2019) Individual interviews or focus groups? Interview format and women's self-disclosure. *International Journal of Social Research Methodology*, 22(3), pp.245-255.
- Krupinski, E.A. (2019) Writing Systematic Reviews of the Literature—It Really Is a Systematic Process!. *Journal of digital imaging*, 32, pp.199-200.
- Kuckartz, U. and Rädiker, S. (2019) Setting Up a Project and Importing Data. *Analyzing Qualitative Data with MAXQDA*. https://doi.org/10.1007/978-3-030-15671-8_3.
- Kuipers, G.S. *et al.* (2016) Attachment insecurity, mentalization and their relation to symptoms in eating disorder patients. *Attachment & Human Development*, 18(3), pp.250-272.
- Kumari, V. (2020) Emotional abuse and neglect: time to focus on prevention and mental health consequences. *The British Journal of Psychiatry*, 217, pp. 597 - 599. <https://doi.org/10.1192/bjp.2020.154>.
- Kutbi H. A. (2021) Nutrient intake and gender differences among Saudi children. *Journal of Nutritional Science*, 10, e99. <https://doi.org/10.1017/jns.2021.95>
- Lähteenmäki, S. *et al.* (2014) Prevalence and correlates of eating disorders among young adults in Finland. *Nordic Journal of Psychiatry*, 68(3), pp.196-203.
- Lancet, T. (2017) Better understanding of youth mental health. *Lancet (London, England)*, 389(10080), p.1670.
- Langdon-Daly, J. and Serpell, L. (2017) Protective factors against disordered eating in family systems: a systematic review of research. *Journal of eating disorders*, 5, pp.1-15.
- Lange, S. *et al.* (2021) Percentage of Adolescents Meeting Federal Fruit and Vegetable Intake Recommendations — Youth Risk Behaviour Surveillance System, United States, 2017. *Morbidity and Mortality Weekly Report*, 70, pp. 69 - 74. <https://doi.org/10.15585/mmwr.mm7003a1>.

- Larson, N. *et al.* (2021) Body dissatisfaction and disordered eating are prevalent problems among US young people from diverse socioeconomic backgrounds: Findings from the EAT 2010–2018 study. *Eating Behaviours*, 42, p.101535.
- Lassi, Z.S. *et al.* (2017a) Systematic review on evidence-based adolescent nutrition interventions. *Annals of the New York Academy of Sciences*, 1393(1), pp.34-50. <https://doi.org/10.1111/nyas.13335>.
- Lassi, Z.S. *et al.* (2017b) Review of nutrition guidelines relevant for adolescents in low- and middle-income countries. *Annals of the New York Academy of Sciences*, 1393(1), pp.51–60.
- Latzer, Y., Azaiza, F. and Tzischinsky, O. (2014) Not just a western girls' problem: eating attitudes among Israeli-Arab adolescent boys and girls. *International Journal of Adolescence and Youth*, 19(3), 382-394. doi:10.1080/02673843.2012.747973.
- Le Grange, D. *et al.* (2010) Academy for eating disorders position paper: The role of the family in eating disorders. *International Journal of Eating Disorders*, 43(1), p.1.
- Le Grange, D. *et al.* (2012) Eating disorder not otherwise specified presentation in the US population. *International Journal of Eating Disorders*, 45(5), pp.711-718.
- Lecorguillé, M. *et al.* (2023) Impact of parental lifestyle patterns in the preconception and pregnancy periods on childhood obesity. *Frontiers in Nutrition*, 10, p.1166981.
- Leenstra, T. *et al.* (2005) Prevalence and severity of malnutrition and age at menarche; cross-sectional studies in adolescent schoolgirls in western Kenya. *European journal of clinical nutrition*, 59, 41-48.
- Leffler, J.M., Riebel, J. and Hughes, H.M. (2015) A review of child and adolescent diagnostic interviews for clinical practitioners. *Assessment*, 22(6), pp.690-703.
- Legg, N. and Turner, B. (2020) Personality correlates of eating pathology severity and subtypes in The National Comorbidity Survey Adolescent Supplement.. *Journal of clinical psychology*. <https://doi.org/10.1002/jclp.23021>.
- Lesthaeghe, R. (2020) The second demographic transition, 1986–2020: sub-replacement fertility and rising cohabitation—a global update. *Genus*, 76, pp.1-38.
- Leti, M.M. *et al.* (2020) Eating Disorders in Children and Adolescents. An Updated Review on Screening Methods.
- Leung, A. and Hon, K. (2019) Pica: A common condition that is commonly missed - An update review. *Current paediatric reviews*. <https://doi.org/10.2174/1573396315666190313163530>.
- Li, K. *et al.* (2016) Assessment of adolescent weight status: Similarities and differences between CDC, IOTF, and WHO references. *Preventive medicine*, 87, pp.151-154. <https://doi.org/10.1016/j.ypmed.2016.02.035>
- Lie, S.Ø., Rø, Ø. and Bang, L. (2019) Is bullying and teasing associated with eating disorders? A systematic review and meta-analysis. *International journal of eating disorders*, 52(5), pp.497-514.
- Lilenfeld, L. R. *et al.* (2006) Eating disorders and personality: A methodological and empirical review. *Clinical Psychology Review*, 26(3), 299–320. <https://doi.org/10.1016/j.cpr.2005.10.003>.
- Lindstedt, K. *et al.* (2018) 'A life put on hold: adolescents' experiences of having an eating disorder in relation to social contexts outside the family', *Journal of Multidisciplinary Healthcare*, 11, pp. 425–437. doi: 10.2147/JMDH.S168133.
- Lochmiller, C. (2021) Conducting Thematic Analysis with Qualitative Data. The Qualitative Report. <https://doi.org/10.46743/2160-3715/2021.5008>.
- Loni, S.B. *et al.* (2022) Prevalence of Eating Disorders among Students of Health Science Colleges in Majamaah University, Saudi Arabia. *Pakistan Journal of Medical & Health Sciences*, 16(02), pp.886-886.

- Lopes, K. G. *et al.* (2022) Adiposity Metabolic Consequences for Adolescent Bone Health. *Nutrients*, 14(16), 3260. <https://doi.org/10.3390/nu14163260>.
- López-Gil, J.F. *et al.* (2023) Global Proportion of Disordered Eating in Children and Adolescents: A Systematic Review and Meta-analysis. *JAMA Pediatrics*, 177(4), pp.363-372.
- López-Guimerà, G. *et al.* (2011) Impact of a school-based disordered eating prevention program in adolescent girls: general and specific effects depending on adherence to the interactive activities. *The Spanish Journal of Psychology*, 14(1), pp.293-303.
- Luce, K.H. and Crowther, J.H. (1999) The reliability of the eating disorder examination—Self-report questionnaire version (EDE-Q). *International Journal of Eating Disorders*, 25(3), pp.349-351.
- Luck, A.J. *et al.* (2002) The SCOFF questionnaire and clinical interview for eating disorders in general practice: comparative study. *Bmj*, 325(7367), pp.755-756.
- Lynch, W.C. *et al.* (2007) Ethnic differences in BMI, weight concerns, and eating behaviors: Comparison of Native American, White, and Hispanic adolescents. *Body Image*, 4(2), pp.179-190.
- Ma, X. *et al.* (2020) Skipping breakfast is associated with overweight and obesity: A systematic review and meta-analysis. *Obesity Research & Clinical Practice*, 14(1), pp.1–8.
- Mahmood, L. *et al.* (2021) The influence of parental dietary behaviours and practices on children's eating habits. *Nutrients*, 13(4), p.1138.
- Major, B., Eliezer, D. and Rieck, H. (2012) The Psychological Weight of Weight Stigma. *Social Psychological and Personality Science*, 3, pp. 651 - 658. <https://doi.org/10.1177/1948550611434400>.
- Majumdar, A. (2022) Thematic analysis in qualitative research. In *Research anthology on innovative research methodologies and utilization across multiple disciplines* (pp. 604-622). IGI Global.
- Makansi, N. *et al.* (2018) Fruit and vegetable intake among Emirati adolescents: a mixed methods study.. *Eastern Mediterranean health journal = La revue de sante de la Mediterranee orientale = al-Majallah al-sihhiyah li-sharq al-mutawassit*, 24 7, pp. 653-663 . <https://doi.org/10.26719/2018.24.7.653>.
- Makino, M., Tsuboi, K. and Dennerstein, L. (2004) Prevalence of eating disorders: a comparison of Western and non-Western countries. *Medscape general medicine*, 6(3), p.49.
- Makki, J. *et al.* (2024) Depressive, Anxiety, and Stress Symptoms Among Schoolgirls With Disordered Eating Behaviours. *Cureus*, 16(1).
- Mallick, N., Ray, S. and Mukhopadhyay, S. (2014) Eating Behaviours and Body Weight Concerns among Adolescent Girls. *Advances in Public Health*, 2014, 257396. <https://doi.org/10.1155/2014/257396>.
- Mancuso, S.G. *et al.* (2015) Classification of eating disorders: comparison of relative prevalence rates using DSM-IV and DSM-5 criteria. *The British Journal of Psychiatry*, 206(6), pp.519-520.
- Maor, N.R. *et al.* (2006) Eating attitudes among adolescents. *IMAJ-RAMAT GAN-*, 8(9), p.627.
- Marinov, D., Najdenova, D. and Dimitrova, T. (2020) Assessment of the eating behaviour of adolescent girls from Varna, Bulgaria. *European Journal of Public Health*. <https://doi.org/10.1093/eurpub/ckaa166.929>.
- Martin, M.C. and Kennedy, P.F. (1993) Advertising and social comparison: Consequences for female preadolescents and adolescents. *Psychology & Marketing*, 10(6), pp.513-530.
- Martínez, M. *et al.* (2021) Rumination Syndrome in Children and Adolescents: A Mini Review. *Frontiers in Paediatrics*, 9. <https://doi.org/10.3389/fped.2021.709326>.

- McCabe, M. *et al.* (2019) Development and testing of a model for risk and protective factors for eating disorders and higher weight among emerging adults: A study protocol. *Body image*, 31, pp. 139-149. <https://doi.org/10.1016/j.bodyim.2019.10.001>.
- McCuen-Wurst, C., Ruggieri, M. and Allison, K.C. (2018) Disordered eating and obesity: associations between binge-eating disorder, night-eating syndrome, and weight-related comorbidities. *Annals of the New York Academy of Sciences*, 1411(1), pp.96-105.
- McDow, K.B. *et al.* (2019) Attempts to lose weight among adolescents aged 16–19 in the United States, 2013–2016.
- McLean, S.A., Paxton, S.J. and Wertheim, E.H. (2016) The role of media literacy in body dissatisfaction and disordered eating: A systematic review. *Body image*, 19, pp.9-23.
- McNamara, N. *et al.* (2022) The link between family identification, loneliness, and symptom severity in people with eating disorders. *Journal of Community & Applied Social Psychology*. <https://doi.org/10.1002/casp.2606>.
- Melisse, B., De Beurs, E. and Van Furth, E. (2020) Eating disorders in the Arab world: a literature review. *Journal of Eating Disorders*, 8. <https://doi.org/10.1186/s40337-020-00336-x>.
- Memon, A.A. *et al.* (2012) Eating disorders in medical students of Karachi, Pakistan-a cross-sectional study. *BMC research notes*, 5, pp.1-7.
- Mertens, D. (2010) Transformative Mixed Methods Research. *Qualitative Inquiry*, 16, pp. 469 - 474. <https://doi.org/10.1177/1077800410364612>.
- Micali, N. *et al.* (2013) The incidence of eating disorders in the UK in 2000–2009: findings from the General Practice Research Database. *BMJ open*, 3(5), p.e002646.
- Micali, N. *et al.* (2014) Frequency and patterns of eating disorder symptoms in early adolescence. *Journal of Adolescent Health*, 54(5), pp.574-581.
- Micali, N. *et al.* (2015a) Adolescent eating disorder behaviours and cognitions: gender-specific effects of child, maternal and family risk factors. *The British Journal of Psychiatry*, 207(4), pp.320-327.
- Micali, N. *et al.* (2015b) Adolescent eating disorders predict psychiatric, high-risk behaviours and weight outcomes in young adulthood. *Journal of the American Academy of Child & Adolescent Psychiatry*, 54(8), pp.652-659.
- Miller, M.N. and Pumariega, A.J. (2001) Culture and eating disorders: A historical and cross-cultural review. *Psychiatry: Interpersonal and biological processes*, 64(2), pp.93-110.
- Mintzker, Y., Blum, D. and Adler, L. (2022) Replacing PICO in non-interventional studies. *BMJ evidence-based medicine*.
- Mitchell, A. (2018) A Review of Mixed Methods, Pragmatism and Abduction Techniques. *The Electronic Journal of Business Research Methods*, 16, pp. 103.
- Mitchison, D. and Mond, J. (2015) Epidemiology of eating disorders, eating disordered behaviour, and body image disturbance in males: a narrative review. *Journal of eating disorders*, 3, pp.1-9.
- Mizia, S. *et al.* (2021) Evaluation of Eating Habits and Their Impact on Health among Adolescents and Young Adults: A Cross-Sectional Study. *International Journal of Environmental Research and Public Health*, 18. <https://doi.org/10.3390/ijerph18083996>.
- Mogashoa, T. (2014) Applicability of constructivist theory in qualitative educational research. *American International Journal of Contemporary Research*, 4(7), pp.51-59.
- Mohajan, D. and Mohajan, H. (2023) Body Mass Index (BMI) is a Popular Anthropometric Tool to Measure Obesity Among Adults. *Journal of Innovations in Medical Research*. <https://doi.org/10.56397/jimr/2023.04.06>.
- Mohajan, H. (2020) Quantitative Research: A Successful Investigation in Natural and Social Sciences. *Journal of Economic Development, Environment and People*. <https://doi.org/10.26458/jedep.v9i4.679>.

- Mohammadi, M.R. *et al.* (2020) Prevalence, correlates and comorbidities of feeding and eating disorders in a nationally representative sample of Iranian children and adolescents. *International Journal of Eating Disorders*, 53(3), pp.349-361.
- Monserat, M. *et al.* (2024) Teachers' knowledge and experiences after the implementation of an eating disorder prevention program in the physical education classroom. *Education Sciences*, 14(5), p.467.
- Montani, J., Schutz, Y. and Dulloo, A. (2015) Dieting and weight cycling as risk factors for cardiometabolic diseases: who is really at risk?. *Obesity Reviews*, 16. <https://doi.org/10.1111/obr.12251>.
- Monzani, A. *et al.* (2019) A Systematic Review of the Association of Skipping Breakfast with Weight and Cardiometabolic Risk Factors in Children and Adolescents. What Should We Better Investigate in the Future?. *Nutrients*, 11. <https://doi.org/10.3390/nu11020387>.
- Moola, S.Z.C.E.K.R.E. *et al.* (2017) Systematic reviews of etiology and risk. Joanna Briggs Institute reviewer's manual, 5, pp.217-69.
- Moore, C.G. *et al.* (2011) Recommendations for planning pilot studies in clinical and translational research. *Clinical and translational science*, 4(5), pp.332-337.
- Moradi, M. *et al.* (2020) Association between overweight/obesity with depression, anxiety, low self-esteem, and body dissatisfaction in children and adolescents: a systematic review and meta-analysis of observational studies. *Critical Reviews in Food Science and Nutrition*, 62, pp. 555 - 570. <https://doi.org/10.1080/10408398.2020.1823813>.
- Morgan, J.F., Reid, F. and Lacey, J.H. (1999) The SCOFF questionnaire: assessment of a new screening tool for eating disorders. *Bmj*, 319(7223), pp.1467-1468.
- Morgan, R.L. *et al.* (2018) Identifying the PECO: a framework for formulating good questions to explore the association of environmental and other exposures with health outcomes. *Environment international*, 121(Pt 1), p.1027.
- Moriarty, J. (2011) Qualitative methods overview. (SSCR Methods Reviews). National Institute for Health Research School for Social Care. http://eprints.lse.ac.uk/41199/1/SSCR_Methods_Review_1-1.pdf
- Moses-Payne, M. *et al.* (2021) I know better! Emerging metacognition allows adolescents to ignore false advice.. *Developmental science*. <https://doi.org/10.1111/desc.13101>.
- Moskowitz, L. and Weiselberg, E. (2017) Anorexia nervosa/atypical anorexia nervosa. *Current problems in pediatric and adolescent health care*, 47(4), pp.70-84.
- Mousa, T.Y. *et al.* (2010) Eating disturbances among adolescent schoolgirls in Jordan. *Appetite*, 54(1), pp.196-201.
- Mueller, A. and Segal, D. (2015) Structured versus Semistructured versus Unstructured Interviews. , pp. 1-7. <https://doi.org/10.1002/9781118625392.WBEC069>.
- Mumena, W. *et al.* (2022) Fast-Food Consumption, Dietary Quality, and Dietary Intake of Adolescents in Saudi Arabia. *International Journal of Environmental Research and Public Health*, 19. <https://doi.org/10.3390/ijerph192215083>.
- Munafo, M. *et al.* (2016) Collider scope: when selection bias can substantially influence observed associations. *International Journal of Epidemiology*, 47, pp. 226-235. <https://doi.org/10.1093/ije/dyx206>.
- Munn, Z. *et al.* (2018) Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Medical Research Methodology*, 18. <https://doi.org/10.1186/s12874-018-0611-x>.
- Musaiger, A.O. (2011) Food consumption patterns in the Eastern Mediterranean Region.
- Musaiger, A.O. (2014) Body size preferences among young women in five Arab countries: a cross-cultural study. *International Journal of Adolescent Medicine and Health*, 26(3), pp.417-421.

- Musaiger, A.O. and Al-Mannai, M. (2014) Association between exposure to media and body weight concern among female university students in five Arab countries: a preliminary cross-cultural study. *Journal of biosocial science*, 46(2), pp.240-247.
- Musaiger, A.O. *et al.* (2013) Risk of disordered eating attitudes among adolescents in seven Arab countries by gender and obesity: A cross-cultural study. *Appetite*, 60, pp.162-167.
- Musaiger, A.O. *et al.* (2016) Disordered eating attitudes among university students in Kuwait: the role of gender and obesity. *International Journal of Preventive Medicine*, 7(1), p.67.
- Muzaffar, H., Nikolaus, C. and Nickols-Richardson, S. (2019) Parental Participation in a Healthy Lifestyle Program for Middle Schoolers Improves Their Family Meal Patterns and Social Support and Self-Regulation for Healthy Eating (P16-041-19). *Current Developments in Nutrition*, 3, pp.nzz050-P16.
- Mwita, M.K. (2022) Factors to consider when using qualitative interviews in data collection. *Soc Sci Humanit Educ J (SHE Journal)*, 3(3), pp.313-323.
- Nagata, J. *et al.* (2018) Prevalence and Correlates of Disordered Eating Behaviours Among Young Adults with Overweight or Obesity. *Journal of General Internal Medicine*, 33, pp. 1337-1343. <https://doi.org/10.1007/s11606-018-4465-z>.
- Nagata, J. *et al.* (2020) Gender Norms and Weight Control Behaviours in U.S. Adolescents: A Prospective Cohort Study (1994–2002). *The Journal of Adolescent Health*, 66, pp. S34 - S41. <https://doi.org/10.1016/j.jadohealth.2019.08.020>.
- Naguib, R. *et al.* (2020) Study of bodyweight and eating attitude among female university members in the Kingdom of Saudi Arabia: A comparison between different methods of weight assessment. *Journal of Family Medicine and Primary Care*, 9(4), pp.2071-2078.
- NCD Risk Factor Collaboration (2017) Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. *Lancet* (London, England), 390, 2627-2642.
- Neumark-Sztainer, D. *et al.* (2002) Weight-related concerns and behaviours among overweight and nonoverweight adolescents: implications for preventing weight-related disorders. *Archives of Paediatrics & Adolescent Medicine*, 156(2), pp.171-178.
- Neumark-Sztainer, D. *et al.* (2004) Are family meal patterns associated with disordered eating behaviours among adolescents?. *Journal of Adolescent Health*, 35(5), pp.350-359.
- Neumark-Sztainer, D. *et al.* (2006) Obesity, disordered eating, and eating disorders in a longitudinal study of adolescents: how do dieters fare 5 years later?. *Journal of the American Dietetic Association*, 106(4), pp.559-568.
- Neumark-Sztainer, D. *et al.* (2009) Five-year longitudinal predictive factors for disordered eating in a population-based sample of overweight adolescents: Implications for prevention and treatment. *International Journal of Eating Disorders*, 42(7), pp.664-672.
- Neumark-Sztainer, D. *et al.* (2011) Dieting and disordered eating behaviours from adolescence to young adulthood: findings from a 10-year longitudinal study. *Journal of the American Dietetic Association*, 111(7), pp.1004-1011.
- Nevonen, L. and Broberg, A.G. (2000) The emergence of eating disorders: An exploratory study. *European Eating Disorders Review*, 8(4), pp.279-292.
- Nicholls, D. and Viner, R. (2005) Eating disorders and weight problems. *BMJ: British Medical Journal*, 330, pp. 950-953. <https://doi.org/10.1136/BMJ.330.7497.950>.
- Nishizawa, Y. *et al.* (2003) Perception of self-physique and eating behaviour of high school students in Japan. *Psychiatry and Clinical Neurosciences*, 57(2), pp.189-196.

- Nitsch, A. *et al.* (2021) Medical complications of bulimia nervosa. *Cleveland Clinic Journal of Medicine*, 88(6), pp.333-343.
- Noble, H. and Smith, J. (2013) Qualitative data analysis: a practical example. *Evidence-Based Nursing*, 17, pp. 2 - 3. <https://doi.org/10.1136/eb-2013-101603>.
- Noma, S.I. *et al.* (2006) Comparison between the SCOFF questionnaire and the Eating Attitudes Test in patients with eating disorders. *International Journal of Psychiatry in Clinical Practice*, 10(1), pp.27-32.
- Obilor, E. and Isaac (2023) Convenience and Purposive Sampling Techniques: Are they the Same?
- O’Cathain, A., Murphy, E. and Nicholl, J. (2007) Why, and how, mixed methods research is undertaken in health services research in England: a mixed methods study. *BMC Health Serv Res*;7: 85–85. *of the Academy of Nutrition and Dietetics*, 117(5), pp.683-697.
- Ocker, L.B. *et al.* (2007) Psychometric properties of the eating attitudes test. *Measurement in physical education and exercise science*, 11(1), pp.25-48.
- O’Connor, A. *et al.* (2014) Conducting Systematic Reviews of Intervention Questions I: Writing the Review Protocol, Formulating the Question and Searching the Literature. *Zoonoses and Public Health*, 61. <https://doi.org/10.1111/zph.12125>.
- Omidvar, S. *et al.* (2016) Weight-related concerns and diet behaviours among urban young females: A cross-sectional study. *Journal of Family Medicine and Primary Care*, 5, pp. 326-330. <https://doi.org/10.4103/2249-4863.192324>.
- Osra, O. A. and Jones, P. (2017) Processes of Urban Transformation: Exploring the Nexus Between the Built Environment and Islamic Identity in Saudi Arabia (between 1938 and 1990). *New Arch-international Journal of Contemporary Architecture*, 4, 17-31.
- Özdin, S. *et al.* (2020) The effect of cognitive symptoms in binge eating disorder on depression and self-esteem: a cross-sectional study. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 26, pp. 1483 - 1489. <https://doi.org/10.1007/s40519-020-00966-9>.
- Page, M.J. *et al.* (2021) The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *bmj*, 372.
- Palmeira, L., Pinto-Gouveia, J. and Cunha, M. (2016) The role of weight self-stigma on the quality of life of women with overweight and obesity: A multi-group comparison between binge eaters and non-binge eaters. *Appetite*, 105, pp. 782-789. <https://doi.org/10.1016/j.appet.2016.07.015>.
- Pandis, N. (2014) Cross-sectional studies. *American journal of orthodontics and dentofacial orthopedics: official publication of the American Association of Orthodontists, its constituent societies, and the American Board of Orthodontics*, 146 1, pp. 127-9. <https://doi.org/10.1016/j.ajodo.2014.05.005>.
- Park, Y., Konge, L. and Artino, A. (2019) The Positivism Paradigm of Research. *Academic Medicine*, 95, pp. 690 - 694. <https://doi.org/10.1097/ACM.0000000000003093>.
- Parker, M.N. *et al.* (2023) Practical Considerations for Using the Eating Disorder Examination Interview with Adolescents. *Adolescent Health, Medicine and Therapeutics*, pp.63-85.
- Patel, P.K. *et al.* (2021) Adolescent neurodevelopment and vulnerability to psychosis. *Biological Psychiatry*, 89(2), pp.184-193.
- Pereira, R.F. and Alvarenga, M. (2007) Disordered eating: identifying, treating, preventing, and differentiating it from eating disorders. *Diabetes Spectrum*, 20(3), pp.141-148.
- Perris, F. (2020) ICD-11 sessions at the 19th World Congress of Psychiatry. *World Psychiatry*, 19(2), p.263.

- Peterson, K. and Fuller, R. (2019) Anorexia nervosa in adolescents: An overview. *Nursing* 2023, 49(10), pp.24-30.
- Pike, K.M. and Dunne, P.E. (2015) The rise of eating disorders in Asia: a review. *Journal of eating disorders*, 3, pp.1-14.
- Piwoz, E., Sundberg, S. and Rooke, J. (2012) Promoting healthy growth: what are the priorities for research and action?. *Advances in Nutrition*, 3(2), pp.234-241.
- Placanica, J.L., Faunce, G.J. and Soames Job, R.F. (2002) The effect of fasting on attentional biases for food and body shape/weight words in high and low eating disorder inventory scorers. *International Journal of Eating Disorders*, 32(1), pp.79-90.
- Podar, I. and Allik, J. (2009) A cross-cultural comparison of the eating disorder inventory. *International Journal of Eating Disorders*, 42(4), pp.346-355.
- Posluszny, H., Quick, V. and Worobey, J. (2021) Disordered eating in college women: Associations with the mother–daughter relationship and family weight-related conversations. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, pp.1-9.
- Puhl, R. *et al.* (2017) Experiences of weight teasing in adolescence and weight-related outcomes in adulthood: A 15-year longitudinal study. *Preventive medicine*, 100, pp. 173-179. <https://doi.org/10.1016/j.ypmed.2017.04.023>.
- Quadflieg, N. *et al.* (2023) Comparing ICD-11 and DSM-5 eating disorder diagnoses with the Munich eating and feeding disorder questionnaire (ED-Quest). *The International journal of eating disorders*. <https://doi.org/10.1002/eat.24010>.
- Ragelienė, T. and Grønhøj, A. (2020) The influence of peers' and siblings' on children's and adolescents' healthy eating behaviour. A systematic literature review. *Appetite*, 148, p.104592.
- Rahman, A. *et al.* (2019) Mental health services for youth in the Eastern Mediterranean Region: challenges and opportunities (Editorial). *Eastern Mediterranean health journal = La revue de sante de la Mediterranee orientale = al-Majallah al-sihhiyah li-sharq al-mutawassit*, 25 2, pp. 80-81 . <https://doi.org/10.26719/2019.25.2.80>.
- Rankin, J.L. *et al.* (2004) Adolescent self-consciousness: Longitudinal age changes and gender differences in two cohorts. *Journal of Research on Adolescence*, 14(1), pp.1-21.
- Rauof, M. *et al.* (2015) Prevalence of eating disorders among adolescents in the Northwest of Iran. *Iranian Red Crescent Medical Journal*, 17(10), p.e19331.
- Rethlefsen, M. and Page, M. (2021) PRISMA 2020 and PRISMA-S: common questions on tracking records and the flow diagram. *Journal of the Medical Library Association: JMLA*, 110, pp. 253 - 257. <https://doi.org/10.5195/jmla.2022.1449>.
- Rethlefsen, M. *et al.* (2021) PRISMA-S: an extension to the PRISMA statement for reporting literature searches in systematic reviews. *Systematic reviews*, 10, pp.1-19.
- Richter, M. *et al.* (2019) Revised Reference Values for the Intake of Protein. *Annals of Nutrition & Metabolism*, [online] 74(3), pp.242–250. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6492513/>.
- Ricotti, R. *et al.* (2021) Breakfast Skipping, Weight, Cardiometabolic Risk, and Nutrition Quality in Children and Adolescents: A Systematic Review of Randomized Controlled and Intervention Longitudinal Trials. *Nutrients*, 13. <https://doi.org/10.3390/nu13103331>.
- Ridderikhof, M. and Hollmann, M. (2020) In reply: PICO questions in systematic reviews. *Emergency Medicine Journal*, 37, pp. 386 - 386. <https://doi.org/10.1136/emered-2020-209587>.
- Rikani, A.A. *et al.* (2013) A critique of the literature on etiology of eating disorders. *Annals of neurosciences*, 20(4), p.157.

- Rippin, H.L. *et al.* (2019) Child and adolescent nutrient intakes from current national dietary surveys of European populations. *Nutrition research reviews*, 32(1), pp.38-69.
- Rodgers, R. and Chabrol, H. (2009) Parental attitudes, body image disturbance and disordered eating amongst adolescents and young adults: A review. *European Eating Disorders Review: The Professional Journal of the Eating Disorders Association*, 17(2), pp.137-151.
- Rodgers, R.F. *et al.* (2020) A biopsychosocial model of social media use and body image concerns, disordered eating, and muscle-building behaviours among adolescent girls and boys. *Journal of youth and adolescence*, 49, pp.399-409.
- Rodgers, R.F., Faure, K. and Chabrol, H. (2009) Gender differences in parental influences on adolescent body dissatisfaction and disordered eating. *Sex Roles*, 61, pp.837-849.
- Rodgers, R.F., O'Flynn, J.L. and McLean, S.A. (2019) Media and eating disorders. *The International Encyclopedia of Media Literacy*, pp.1-10.
- Rodriguez, A. *et al.* (2022) Fitness, Food, and Biomarkers: Characterizing Body Composition in 19,634 Early Adolescents. *Nutrients*, 14. <https://doi.org/10.3390/nu14071369>.
- Rodriguez-Martinez, A. *et al.* (2020) Height and body-mass index trajectories of school-aged children and adolescents from 1985 to 2019 in 200 countries and territories: a pooled analysis of 2181 population-based studies with 65 million participants. *The Lancet*, 396(10261), pp.1511-1524.
- Rogol, A.D., Roemmich, J.N. and Clark, P.A. (2002) Growth at puberty. *Journal of Adolescent Health*, [online] 31(6), pp.192–200. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S1054139X02004858>
- Rohde, P., Stice, E. and Marti, C.N. (2015) Development and predictive effects of eating disorder risk factors during adolescence: Implications for prevention efforts. *International Journal of Eating Disorders*, 48(2), pp.187-198.
- Romano, K. *et al.* (2020) Changes in disordered eating behaviours over 10 or more years: A meta-analysis.. *The International journal of eating disorders*. <https://doi.org/10.1002/eat.23288>.
- Rome, E.S. *et al.* (2003) Children and adolescents with eating disorders: the state of the art. *Paediatrics*, 111(1), pp.e98-e108.
- Rosa, E. M. and Tudge, J. R. H. (2013) Urie Bronfenbrenner's theory of human development: Its evolution from ecology to bioecology. *Journal of Family Theory and Review*, 5(6), 243–258. DOI:10.1111/jftr.12022
- Rosenblum, G.D. and Lewis, M. (1999) The relations among body image, physical attractiveness, and body mass in adolescence. *Child development*, 70(1), pp.50-64.
- Rosi, A. *et al.* (2019) Dietary habits of adolescents living in North America, Europe or Oceania: A review on fruit, vegetable and legume consumption, sodium intake, and adherence to the Mediterranean Diet.. *Nutrition, metabolism, and cardiovascular diseases : NMCD*, 29 6, pp. 544-560. <https://doi.org/10.1016/J.NUMECD.2019.03.003>.
- Ruan, Q. *et al.* (2023) The interplay of self-acceptance, social comparison and attributional style in adolescent mental health: cross-sectional study. *BJPsych Open*, 9. <https://doi.org/10.1192/bjo.2023.594>.
- Rubin, A.G. *et al.* (2021) Associations between weight-based teasing and disordered eating behaviours among youth. *Eating behaviours*, 41, p.101504.
- Ruppar, T. (2020) Meta-analysis: How to quantify and explain heterogeneity?. *European Journal of Cardiovascular Nursing*, 19, pp. 646 - 652. <https://doi.org/10.1177/1474515120944014>.
- Russell G. (1979) Bulimia nervosa: an ominous variant of anorexia nervosa. *Psychol Med* 1979; 9(3): 429-4.

- Sadowska, J. *et al.* (2020) BMI, body perception, and approach to eating and diet in adolescent girls. *SAGE Open*, 10(4), p.2158244020962816.
- Sahlan, R.N. *et al.* (2021) Eating disorder symptoms among adolescent boys and girls in Iran. *International Journal of Eating Disorders*, 54(1), pp.19-23.
- Said, M. A. and Alibrahim, M.S. (2022) 'Physical activity, sedentary behaviours, and breakfast eating as factors influencing BMI in Saudi students, aged 10 to 15 years', *Annals of Medicine*, 54(1), pp. 1459–1472. doi: 10.1080/07853890.2022.2077429.
- Salam, A. A. and Rashid, M. F. A. (2022) Adolescent Health in Saudi Arabia: Policy Dimensions. *Adolescent Mental Health in The Middle East and North Africa*. Springer.
- Salam, R. *et al.* (2016) Interventions to Improve Adolescent Nutrition: A Systematic Review and Meta-Analysis. *The Journal of Adolescent Health*, 59, pp.S29-S39. <https://doi.org/10.1016/j.jadohealth.2016.06.022>.
- Salazar, L. (2021) Cyberbullying victimisation as a predictor of cyberbullying perpetration, body image dissatisfaction, healthy eating and dieting behaviours, and life satisfaction. *Journal of Interpersonal Violence*, 36(1-2), pp.354-380.
- Saltzman, J.A. and Liechty, J.M. (2016) Family correlates of childhood binge eating: A systematic review. *Eating behaviours*, 22, pp.62-71.
- Sanchez-Cerezo, J. *et al.* (2022) What do we know about the epidemiology of avoidant/restrictive food intake disorder in children and adolescents? A systematic review of the literature.. *European eating disorders review: the journal of the Eating Disorders Association*. <https://doi.org/10.1002/erv.2964>.
- Sanders, L. *et al.* (2021) Effects of Whole Grain Intake, Compared with Refined Grain, on Appetite and Energy Intake: A Systematic Review and Meta-Analysis. *Advances in Nutrition*, 12, pp. 1177 - 1195. <https://doi.org/10.1093/advances/nmaa178>.
- Sanlier, N. *et al.* (2016) Does the rise in eating disorders lead to increasing risk of orthorexia nervosa? Correlations with gender, education, and body mass index. *Ecology of food and nutrition*, 55(3), pp.266-278.
- Sanlier, N., Yabanci, N. and Alyakut, Ö. (2008) An evaluation of eating disorders among a group of Turkish university students. *Appetite*, 51(3), pp.641-645.
- Santana, D.D. *et al.* (2023) Twenty-year associations between disordered eating behaviours and sociodemographic features in a multiple cross-sectional sample. *Psychological Medicine*, 53(11), pp.5012-5021.
- Santos, M., Richards, C.S. and Bleckley, M.K. (2007) Comorbidity between depression and disordered eating in adolescents. *Eating behaviours*, 8(4), pp.440-449.
- Savitz, D.A. and Wellenius, G.A. (2023) Can cross-sectional studies contribute to causal inference? It depends. *American journal of epidemiology*, 192(4), pp.514-516.
- Sawicka-Gutaj, N. *et al.* (2022) Publication ethics of human studies in the light of the Declaration of Helsinki – a mini-review. *Journal of Medical Science*. <https://doi.org/10.20883/medical.e700>.
- Sawyer, S.M. *et al.* (2018) The age of adolescence. *The Lancet Child & Adolescent Health*, 2(3), pp.223-228.
- Schønning, V. *et al.* (2020) Social Media Use and Mental Health and Well-Being Among Adolescents – A Scoping Review. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.01949>.
- Schulte, T. *et al.* (2019) Effects of age, sex, and puberty on neural efficiency of cognitive and motor control in adolescents. *Brain Imaging and Behaviour*, 14, pp. 1089 - 1107. <https://doi.org/10.1007/s11682-019-00075-x>.
- Scotland, J. (2012) Exploring the philosophical underpinnings of research: Relating ontology and epistemology to the methodology and methods of the scientific, interpretive, and critical research paradigms. *English language teaching*, 5(9), pp.9-16.

- Seepersad, R. (2012) The relation between eating disorders and self esteem in adolescents in Trinidad. *Journal of the Department of Behavioural Sciences*, 2(1), pp.102-127.
- Sekaran, V.C. *et al.* (2017) Role of micro-and mesosystems in shaping an adolescent. *Journal of Nepal Paediatric Society*, 37(2), pp.178-183.
- Shahatah, M.A. *et al.* (2021) The relationship between body weight and dietary habits with respect to the timing of puberty among Saudi children and adolescents. *Annals of African Medicine*, 20(3), pp.193-197.
- Sharma, S. *et al.* (2013) Maturation of the Adolescent Brain. *Neuropsychiatric Disease and Treatment*, [online] 9(9), pp.449–461. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3621648/>.
- Sharpe, H. (2018) The relative importance of dissatisfaction, overvaluation and preoccupation with weight and shape for predicting onset of disordered eating behaviours and depressive symptoms over 15 years. *International Journal of Eating Disorders*, 51, pp. 1168–1175. <https://doi.org/10.1002/eat.22936>.
- Shehzad, J. (2021) Saudi Arabia Education Report2021. Knight Frank Research Reports. Saudi Arabia Education Report - 2021 | Knight Frank Research
- Shin, K., You, S. and Kim, E. (2017) Sociocultural pressure, internalisation, BMI, exercise, and body dissatisfaction in Korean female college students. *Journal of Health Psychology*, 22(13), pp.1712-1720.
- Sigel, E. (2005) Eating Disorders. American Academy of Paediatrics eBooks, [online] pp.547–572. doi:<https://doi.org/10.1542/9781581104103-eating>.
- Signal, D.M. and Hofman, P.L. (2022) Type 1 diabetes youth with disordered eating: Is there a disproportionate impact on ethnic minorities and indigenous peoples?. *Journal of Paediatrics and Child Health*, 58(4), pp.562-565.
- Simone, M. *et al.* (2022) Ethnic/racial and gender differences in disordered eating behaviour prevalence trajectories among women and men from adolescence into adulthood. *Social Science & Medicine*, 294, p.114720.
- Slane, J.D. *et al.* (2014) Developmental trajectories of disordered eating from early adolescence to young adulthood: A longitudinal study. *International Journal of Eating Disorders*, 47(7), pp.793-801.
- Slater, A. *et al.* (2012) Just one click: A content analysis of advertisements on teen websites. *Journal of Adolescent Health*, 50(4), pp.339-345.
- Smink, F.R., Van Hoeken, D. and Hoek, H.W. (2012) Epidemiology of eating disorders: incidence, prevalence and mortality rates. *Current psychiatry reports*, 14(4), pp.406-414.
- Smith, B. (2016) Narrative analysis. *Analysing qualitative data in psychology*, 2, pp.202-221.
- Smith, K.J. *et al.* (2017) Skipping breakfast among Australian children and adolescents; findings from the 2011-12 National Nutrition and Physical Activity Survey. *Australian and New Zealand Journal of Public Health*, 41(6), pp.572–578.
- Smith, L. (2020) Selection Mechanisms and Their Consequences: Understanding and Addressing Selection Bias. *Current Epidemiology Reports*, 7, pp. 179 - 189. <https://doi.org/10.1007/s40471-020-00241-6>.
- Smolak, L. and Levine, M.P. (2015) *The Wiley Handbook of Eating Disorders*; John Wiley & Sons, Ltd.: West Sussex, NJ, USA; Volume 1, pp. 1–10
- Solmi, F. *et al.* (2014) Prevalence and correlates of disordered eating in a general population sample: the South East London Community Health (SELCoH) study. *Social psychiatry and psychiatric epidemiology*, 49, pp.1335-1346.
- Solmi, M. *et al.* (2020) Risk factors for eating disorders: an umbrella review of published meta-analyses. *Brazilian Journal of Psychiatry*, 43, pp.314-323.

- Spear, B.A. (2002) Adolescent growth and development. *Journal of the Academy of Nutrition and Dietetics*, p.S23.
- Spector, P. (2019) Do Not Cross Me: Optimising the Use of Cross-Sectional Designs. *Journal of Business and Psychology*, 34, pp. 125-137. <https://doi.org/10.1007/S10869-018-09613-8>.
- Stabouli, S. *et al.* (2021) Obesity and eating disorders in children and adolescents: the bidirectional link. *Nutrients*, 13(12), p.4321.
- Stang, J. and Story, M. (2005) Chapter 1 Adolescent Growth and Development. [online] p.1. Available at: <https://demoiselle2femme.org/wp-content/uploads/Adolescent-Growth-and-Development.pdf>
- Stang, J.S. and Stotmeister, B. (2017) Nutrition in adolescence. In *Nutrition guide for physicians and related healthcare professionals* (pp. 29-39). Cham: Springer International Publishing.
- Steinberg, L. and Monahan, K. C. (2007) Age differences in resistance to peer influence. *Developmental Psychology*, 43, 1531–1543.
- Stewart, D.A. *et al.* (2001) Modification of eating attitudes and behaviour in adolescent girls: A controlled study. *International Journal of Eating Disorders*, 29(2), pp.107-118.
- Stice, E. (2016) Interactive and mediational etiologic models of eating disorder onset: Evidence from prospective studies. *Annual Review of Clinical Psychology*, 12(1), pp.359-381.
- Stice, E. *et al.* (2009) An 8-year longitudinal study of the natural history of threshold, subthreshold, and partial eating disorders from a community sample of adolescents. *Journal of abnormal psychology*, 118(3), p.587.
- Stoop, T., Scholten, L. and Besselink, M. (2020) Author response to: Comment on: Systematic review of functional outcome and quality of life after total pancreatectomy. *British Journal of Surgery*, 107. <https://doi.org/10.1002/bjs.11536>.
- Stover, P. *et al.* (2023) Neurobiology of eating behaviour, nutrition, and health. *Journal of Internal Medicine*, 294, pp. 582 - 604. <https://doi.org/10.1111/joim.13699>.
- Strauss, A. and Corbin, J. (1998) Basics of qualitative research techniques.
- Strober, M. (1991) Family-genetic studies of eating disorders. *Journal of Clinical Psychiatry*, 52, 9 – 12.
- Sturgeon, S. (2006) Promoting mental health as an essential aspect of health promotion. *Health promotion international*, 21(suppl_1), pp.36-41.
- Suarez-Albor, C., Galletta, M. and Gómez-Bustamante, E. (2022) Factors associated with eating disorders in adolescents: a systematic review. *Acta Bio Medica: Atenei Parmensis*, 93. <https://doi.org/10.23750/abm.v93i3.13140>.
- Sutter, C. C. *et al.* (2023) School and electronic bullying among adolescents: Direct and indirect relationships with sadness, sleep, and suicide ideation. *Journal of Adolescence*, 95, 82–96. <https://doi.org/10.1002/jad.12101>
- Swami, V. (2015) Cultural influences on body size ideals. *European Psychologist*.
- Sweeting, H. *et al.* (2015) Prevalence of eating disorders in males: a review of rates reported in academic research and UK mass media. *International journal of men's health*, 14(2), pp.10-3149.
- Szweda, S. and Thorne, P. (2002) The prevalence of eating disorders in female health care students. *Occupational Medicine*, 52(3), pp.113-119.
- Tabassum, K. and Shaiba, H. (2018) An Effective Perspective towards Riyadh Smart City. *Proceedings of the 3rd International Conference on Smart City Applications*. <https://doi.org/10.1145/3286606.3286800>.

- Taha, A.A.A.E.A., Abu-Zaid, H.A. and Desouky, D.E.S. (2018) Eating disorders among female students of Taif University, Saudi Arabia. *Archives of Iranian medicine*, 21(3), pp.111-117.
- Takimoto, H. *et al.* (2004) Thinness among young Japanese women. *American journal of public health*, 94(9), pp.1592-1595.
- Tan, E.J. *et al.* (2023) The association between eating disorders and mental health: an umbrella review. *Journal of eating disorders*, 11(1), p.51.
- Tariq, S. and Woodman, J. (2013) 'Using mixed methods in health research', *JRSM Short Reports*, 4(6). doi: 10.1177/2042533313479197.
- Tasca, G. A. *et al.* (2009) Personality dimensions among women with an eating disorder: Towards reconceptualizing DSM. *European Eating Disorders Review*, 17(4), 281–289. <https://doi.org/10.1002/erv.938>
- Tate, R. *et al.* (2023) Pilot Testing as a Strategy to Develop Interview and Questionnaire Skills for Scholar Practitioners. *Impacting Education: Journal on Transforming Professional Practice*. <https://doi.org/10.5195/ie.2023.333>.
- Teddlie, C. and Tashakkori, A. (2011) Mixed methods research. *The Sage handbook of qualitative research*, 4(1), pp.285-300.
- Telhaj, V. (2019) Mental Health of Adolescents and Youth. *Journal of Cultural and Religious Studies*, 2328-2177.
- Tenny, S., Brannan, J.M. and Brannan, G.D. (2017) Qualitative study.
- Thamotharan, S., Hubbard, M. and Fields, S. (2015) Delay discounting, but not disinhibition or inattention, partially mediates the effects of neuroticism on disordered eating in adolescents. *Eating behaviours*, 18, pp.91-96.
- Thanh, N.C. and Thanh, T.T. (2015) The interconnection between interpretivist paradigm and qualitative methods in education. *American journal of educational science*, 1(2), pp.24-27.
- Thomas, F.B. (2022) The role of purposive sampling technique as a tool for informal choices in a social Sciences in research methods. *Just Agriculture*, 2(5), pp.1-8.
- Thompson, A., Poyrazli, S. and Miller, E. (2020) Western Media and Body Image Dissatisfaction in Young Women in Developing Nations. *Eurasian journal of educational research*, 90, pp.45-66.
- Tiggemann, M. and Miller, J. (2010) The Internet and adolescent girls' weight satisfaction and drive for thinness. *Sex roles*, 63(1), pp.79-90.
- Timans, R., Wouters, P. and Heilbron, J. (2019) Mixed methods research: what it is and what it could be. *Theory and Society*, 48, pp. 193 - 216.
- Tiuganji, N. *et al.* (2020) Eating Behaviour (Duration, Content, and Timing) Among Workers Living under Different Levels of Urbanization. *Nutrients*, 12. <https://doi.org/10.3390/nu12020375>.
- Tocco, M.A. and Mohiuddin, S.S. (2022) Trauma & Disordered Eating in Adolescents: A Review. *Adolescent Psychiatry*, 12(2), pp.67-78.
- Tomar, R. and Antony, V.C. (2021) Assessment of eating disorder and obesity among youth in Saudi Arabia. *Med. Sci*, 25, pp.2660-2669.
- Toni, G. *et al.* (2017) Eating disorders and disordered eating symptoms in adolescents with type 1 diabetes. *Nutrients*, 9(8), p.906.
- Torstveit, M.K., Aagedal-Mortensen, K. and Stea, T.H. (2015) More than half of high school students report disordered eating: a cross sectional study among Norwegian boys and girls. *PloS one*, 10(3), p.e0122681.
- Torstveit, M.K., Rosenvinge, J.H. and Sundgot-Borgen, J. (2008) Prevalence of eating disorders and the predictive power of risk models in female elite athletes: a controlled study. *Scandinavian journal of medicine & science in sports*, 18(1), pp.108-118.

- Tripathi, S. and Gehlot, S. (2018) Nutritional Adequacy in Teenage. *International Journal of Health Sciences and Research*, 8, pp. 290-301.
- Trompeter, N. *et al.* (2018) Fear of negative evaluation and weight/shape concerns among adolescents: The moderating effects of gender and weight status. *Journal of youth and adolescence*, 47, pp.1398-1408.
- Trull, T. J. and Widiger, T. A. (2013) Dimensional models of personality: The five-factor model and the DSM-5. *Dialogues in Clinical Neuroscience*, 15(2), 135–146. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/24174888>
- Tsai, M.R. *et al.* (2011) Survey on eating disorders related thoughts, behaviours and dietary intake in female junior high school students in Taiwan. *Asia Pacific Journal of Clinical Nutrition*, 20(2), pp.196-205.
- Tsitsika, A.K. *et al.* (2014) Bullying behaviours in children and adolescents: “An ongoing story”. *Frontiers in public health*, 2, p.7.
- Tu, W. *et al.* (2015) Associations between menarche-related genetic variants and pubertal growth in male and female adolescents.. *The Journal of adolescent health : official publication of the Society for Adolescent Medicine*, 56 1, pp. 66-72. <https://doi.org/10.1016/j.jadohealth.2014.07.020>.
- Tudge, J.R.H. *et al.* (2009) Uses and misuses of Bronfenbrenner’s bioecological theory of human development. *Journal of Family Theory & Review* 1: 198–210.
- Tyrer, S. and Heyman, B. (2016) Sampling in epidemiological research: issues, hazards and pitfalls. *BJPsych Bulletin*, 40, pp. 57 - 60. <https://doi.org/10.1192/pb.bp.114.050203>.
- U.S. Department of Agriculture and U.S. Department of Health and Human Services (2020) *Dietary Guidelines for Americans, 2020-2025. 9th Edition.* December 2020. Available at [DietaryGuidelines.gov](https://www.dietaryguidelines.gov).
- Uchôa, F. *et al.* (2019) Influence of the Mass Media and Body Dissatisfaction on the Risk in Adolescents of Developing Eating Disorders. *International Journal of Environmental Research and Public Health*, 16(9), p.1508. <https://doi.org/10.3390/ijerph16091508>.
- Ung, E.K. (2003) Eating disorders in Singapore: a review. *Annals of the Academy of Medicine, Singapore*, 32(1), pp.19-24.
- Uniacke, B., Attia, E. Walsh, B.T. (2023) Feeding and Eating Disorders. In: Tasman, A., *et al.* *Tasman’s Psychiatry*. Springer, Cham. https://doi.org/10.1007/978-3-030-42825-9_79-1
- UNICEF MENA Fact Sheet (2019). Available at: https://www.unicef.org/mena/media/4541/file/FactSheet_MENA.PDF.pdf
- UNICEF (2022) Adolescents overview - UNICEF DATA. [online] UNICEF DATA. Available at: <https://data.unicef.org/topic/adolescents/overview/>.
- UNICEF (2024) Adolescent mental health statistics. [online] Available at: https://data.unicef.org/topic/child-health/mental-health/#_edn1.
- UNICEF MENARO *et al.* (2024) Integration of mental health and psychosocial support in primary health care for children, adolescents, pregnant women and new mothers in the Middle East and North Africa Region. *Saudi Arabia Country Report 2024*. <https://www.unicef.org/gulf/media/2151/file>
- van Eeden, A.E., van Hoeken, D. and Hoek, H.W. (2021) Incidence, prevalence and mortality of anorexia nervosa and bulimia nervosa. *Current opinion in psychiatry*, 34(6), pp.515-524.
- van Hoeken, D., Burns, J.K. and Hoek, H.W. (2016) Epidemiology of eating disorders in Africa. *Current Opinion in Psychiatry*, 29(6), pp.372-377.
- van Sluijs, E.M. *et al.* (2021) Physical activity behaviours in adolescence: current evidence and opportunities for intervention. *The Lancet*, 398(10298), pp.429-442.

- Vannucci, A. *et al.* (2020) Social media use and risky behaviours in adolescents: A meta-analysis. *Journal of Adolescence*, 79, pp.258-274.
- Vardar, E. and Erzen, M. (2011) The prevalence of eating disorders (EDs) and comorbid psychiatric disorders in adolescents: a two-stage community-based study. *Turkish journal of psychiatry*, 22(4).
- Vasileiou, K. *et al.* (2018) Characterising and justifying sample size sufficiency in interview-based studies: systematic analysis of qualitative health research over a 15-year period. *BMC medical research methodology*, 18, pp.1-18.
- Vélez-Agosto, N.M. *et al.* (2017) Bronfenbrenner's bioecological theory revision: Moving culture from the macro into the micro. *Perspectives on psychological science*, 12(5), pp.900-910.
- Verma, P. and Prasad, J. (2021) Stunting, wasting and underweight as indicators of under-nutrition in under five children from developing Countries: A systematic review.. *Diabetes & metabolic syndrome*, 15 5, pp. 102243 .
<https://doi.org/10.1016/j.dsx.2021.102243>.
- Véronneau, M.H. and Dishion, T.J. (2010) Predicting change in early adolescent problem behaviour in the middle school years: A mesosystemic perspective on parenting and peer experiences. *Journal of abnormal child psychology*, 38, pp.1125-1137.
- Vincente-Benito, I. and Ramírez-Durán, M.D.V. (2023) Influence of social media use on body image and well-being among adolescents and Young adults: a systematic review. *Journal of psychosocial nursing and mental health services*, 61(12), pp.11-18.
- Virgili, G. *et al.* (2016) Outcome measures in trials: the systematic reviewer's point of view. *Internal and Emergency Medicine*, 11, pp. 265-267.
<https://doi.org/10.1007/s11739-015-1356-8>.
- Vu-Ngoc, H. *et al.* (2018) Quality of flow diagram in systematic review and/or meta-analysis. *PLoS ONE*, 13. <https://doi.org/10.1371/journal.pone.0195955>.
- Wade, T. (2016) Eating Attitudes Test. In: Wade, T. (eds) *Encyclopedia of Feeding and Eating Disorders*. Springer, Singapore. https://doi.org/10.1007/978-981-287-087-2_215-1
- Wang, X. and Cheng, Z. (2020) Cross-Sectional Studies: Strengths, Weaknesses, and Recommendations.. *Chest*, 158 1S, pp. S65-S71. <https://doi.org/10.1016/j.chest.2020.03.012>.
- Wang, Y. *et al.* (2020) Longitudinal bidirectional relations between body dissatisfaction and depressive symptoms among Black adolescents: A cross-lagged panel analysis. *PLoS ONE*, 15. <https://doi.org/10.1371/journal.pone.0228585>.
- Ward, Z.J. *et al.* (2019) Estimation of eating disorders prevalence by age and associations with mortality in a simulated nationally representative US cohort. *JAMA network open*, 2(10), pp.e1912925-e1912925.
- Waseem, F. and Leena. M. A. (2018) Prevalence of disordered eating attitudes among adolescent girls in Arar City, Kingdom of Saudi Arabia. *Health Psychology Research*, volume 6:7444.
- Watson, R. (2015) Quantitative research.. *Nursing standard (Royal College of Nursing (Great Britain) : 1987)*, 29 31, pp. 44-8 . <https://doi.org/10.7748/ns.29.31.44.e8681>.
- Weaver, L. and Liebman, R. (2011) Assessment of anorexia nervosa in children and adolescents. *Current psychiatry reports*, 13(2), pp.93-98.
- Webb, H.J. and Zimmer-Gembeck, M.J. (2014) The role of friends and peers in adolescent body dissatisfaction: A review and critique of 15 years of research. *Journal of Research on Adolescence*, 24(4), pp.564-590.
- Wedig, M.M. and Nock, M.K. (2010) The functional assessment of maladaptive behaviours: A preliminary evaluation of binge eating and purging among women. *Psychiatry research*, 178(3), pp.518-524.

- Widiger, T. A. (2011) Integrating normal and abnormal personality structure: A proposal for DSM-V. *Journal of Personality Disorders*, 25(3), 338–363.
<https://doi.org/10.1521/pedi.2011.25.3.338>
- Widiger, T. A. and Costa, P. T., Jr. (2012) Integrating normal and abnormal personality structure: The five-factor model. *Journal of Personality*, 80(6), 1471–1506.
<https://doi.org/10.1111/j.1467-6494.2012.00776.x>
- Widiger, T.A. and Mullins-Sweatt, S.N. (2009) Five-factor model of personality disorder: A proposal for DSM-V. *Annual Review of Clinical Psychology*, 5(1), pp.197-220.
- Widodo, D. and Renyoet, B. (2023) Literature Study: Decreased Productivity in Adolescents Due to Undernutrition. *PROMOTOR*. <https://doi.org/10.32832/pro.v6i5.361>.
- Wiles, J., Bondi, J. and Wiles, M. T. (2006) *The essential middle school* (4th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- Wilfley, D.E. *et al.* (2007) Classification of eating disorders: Toward DSM-V. *International Journal of Eating Disorders*, 40(S3), pp.S123-S129.
- Wilksch, S.M. *et al.* (2020) The relationship between social media use and disordered eating in young adolescents. *International Journal of Eating Disorders*, 53(1), pp.96-106.
- Williams, Y. (2022) Understanding Adolescent Behaviour and Victimization of Special Populations Through Bronfenbrenner's Bioecological Theory. In *Victimology: A Comprehensive Approach to Forensic, Psychosocial and Legal Perspectives* (pp. 401-416). Cham: Springer International Publishing.
- Wölfer, R. *et al.* (2014) Prevention 2.0: Targeting cyberbullying@ school. *Prevention Science*, 15, pp.879-887.
- Wong, C.A., Merchant, R.M. and Moreno, M.A. (2014) Using social media to engage adolescents and young adults with their health. In *Healthcare* (Vol. 2, No. 4, pp. 220-224). Elsevier.
- World Health Organisation (2019) ICD-11. [online] Who.int. Available at: <https://icd.who.int/en>.
- Wrottesley, S. *et al.* (2022) Nutritional status of school-age children and adolescents in low- and middle-income countries across seven global regions: a synthesis of scoping reviews. *Public Health Nutrition*, 26, pp. 63 - 95.
<https://doi.org/10.1017/S1368980022000350>.
- Yager, J. *et al.* (2005) Guideline Watch: Practice Guideline for the Treatment of Patients With Eating Disorders, 2nd Edition. *FOCUS*, 3(4), pp.546–551.
- Yang, S.J., Choi, Y. and Lee, H.Y. (2001) Eating attitude, ego-identity, and self-esteem among the urban high school girls. *Journal of Korean Neuropsychiatric Association*, pp.477-486.
- Yeh, H.W. *et al.* (2009) The risk of eating disorders among female undergraduates in Taiwan. *Archives of Psychiatric Nursing*, 23(6), pp.430-440.
- Yiend, J. *et al.* (2014) Negative self-beliefs in eating disorders: A cognitive-bias-modification study. *Clinical Psychological Science*, 2(6), pp.756-766.
- Yoon, C. *et al.* (2020) Disordered Eating Behaviours and 15-year Trajectories in Body Mass Index: Findings From Project Eating and Activity in Teens and Young Adults (EAT). *The Journal of Adolescent Health*, 66(2), pp.181-188: official publication of the Society for Adolescent Medicine.
<https://doi.org/10.1016/j.jadohealth.2019.08.012>.
- Yu, Z. and Tan, M. (2016) Disordered eating behaviours and food addiction among nutrition major college students. *Nutrients*, 8(11), p.673.
- Yu, Z. *et al.* (2018) Sex differences in disordered eating and food addiction among college students. *Appetite*, 129, pp.12-18.

- Zehr, J.L. *et al.* (2007) An association of early puberty with disordered eating and anxiety in a population of undergraduate women and men. *Hormones and behaviour*, 52(4), pp.427-435.
- Zhang, Z. *et al.* (2020) Development of Disordered Eating Behaviours and Comorbid Depressive Symptoms in Adolescence: Neural and Psychopathological Predictors. *Biological Psychiatry*, 90, pp. 853-862. <https://doi.org/10.1016/j.biopsych.2020.06.003>.
- Zoellner, J. and Harris, J.E. (2017) Mixed-methods research in nutrition and dietetics. *Journal of the Academy of Nutrition and Dietetics*, 117(5), pp.683-697.