Validation of the Children's Eating Behaviour Questionnaire (CEBQ) in the population of Saudi preschoolers

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Abstract

The Children's Eating Behaviour Questionnaire (CEBQ) is a multi-dimensional questionnaire filled out by parents to determine the characteristics of eating behaviour of their children and, consequently, children's propensity to become obese. It assesses eating habits that contribute to childhood obesity. It has been successfully validated mainly in countries of Western-type eating habits, but not in Saudi Arabia or anywhere else in the Middle East, where obesity has become a significant health problem. In the current study, the CEBQ factor structure and reliability were assessed in a sample of Saudi preschoolers aged 2-6 years. In addition, the associations between children's BMI z-scores, eating behaviours and parental weight were examined. Parents of 200 Saudi preschool children (100 boys and 100 girls) completed the Arabic version of the CEBQ. BMI of children and parents, and parental educational levels were collected. The BMI of every child was calculated and converted to BMI z-score. Factor analyses on all the CEBQ items were performed and the differences between genders and age groups were examined. Correlations between children's BMI z-scores and eating behaviours were analysed using linear regression, controlling for age, gender, parental educational levels and parental weight. The factor analysis revealed an eight-factor solution similar to the theoretical factor structure, with good internal reliability and acceptable correlations between subscales. Boys scored slightly higher than girls on food responsiveness, whereas no difference between age groups was found. Significant and positive associations between BMI z-scores and "food approach" subscales, food responsiveness, enjoyment of food and emotional overeating were found, while "food avoidant" subscales, satiety responsiveness and slowness in eating, had significant inverse relationships with BMI z-scores. Maternal BMI had strong positive associations with BMI z-scores and food responsiveness, whereas paternal BMI had no effect on BMI z-scores or eating behaviours of children. The current data suggest that the CEBQ is a valid psychometric tool that can be reliably used to assess eating behaviour characteristics in Saudi preschool children. The results derived from this study can be useful in understanding the aetiology of overweight and obesity in pre-school children in regard to their eating behaviours.

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Finally, this thesis is dedicated to the most important people in my life, my mother, my brothers and sisters who have shaped me into the person I am today and for their long-distance emotional support from the first day I arrived in New Zealand until the end of this long journey.

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List of Abbreviation

WHO	World Health Organisation
BMI	Body Mass Index
CDC	The U.S. Centres for Disease Control and Prevention
CEBQ	Children's Eating Behaviour Questionnaire
FR	Food responsiveness
EF	Enjoyment of food
DD	Desire to drink
SR	Satiety responsiveness
SE	Slowness in eating
FF	Food fussiness
EOE	Emotional overeating
EUE	Emotional undereating
KFMC	King Fahad Medical City

Chapter One: A review of the literature

1.1 Introduction

According to the World Health Organisation (WHO, 2010), obesity among children is one of the world's most critical public health issues. It is reported that there are over 40 million children who are overweight and less than five years old; the majority of these live in low and middle-income countries. Obesity among children is an increasing concern, as these children are at risk of developing a number of comorbidities including high blood pressure, heart disease and diabetes (Burton et al., 1985). Many studies have suggested that obese children tend to become obese adults (Serdula et al., 1993; Clarke et al., 1993). As in the majority of developed countries, Saudi Arabia has a very high prevalence of obesity among children and adults. Over the past three decades, Saudi Arabia has witnessed significant changes in lifestyle as a consequence of modernisation. They include physical activity patterns and eating habits which are considered the main reasons for the dramatic increase in the prevalence of obesity among Saudi children and adolescents (Al-Hazzaa, 2007). Al-Dossary et al. (2010) studied obesity in Saudi children and reported that the overall prevalence of overweight was 19.0% and of obesity 23.3%. The lack of a sufficient body of data on obesogenic behavioural traits in Saudi Arabia, especially in children (Abalkhail, 2002) points to an urgent need for studies analysing eating behavioural patterns in Saudi children in order to define the characteristics of consummatory behaviour in this regional population as well as more effectively conceptualise obesity prevention strategies (Skouteris et al., 2011).

1.2 The epidemiology of obesity

In 1997, obesity was formally recognised as a global epidemic by the WHO (Caballero, 2007). Obesity is one of the major emerging health problems worldwide, associated with all ages, affecting physical, psychological and social health. Obesity has a high frequency in both developing and developed countries. Globally, around 2.8 million adults die every year due to being overweight or

obese (WHO, 2013). According to Reilly et al. (2003), obesity can be referred to as a condition that shows the accumulation of excess of body fat which may enhance the risk of morbidity and death of an individual. Park (1995) defined obesity as "an abnormal growth of the adipose tissue because of an enlargement of fat cell size (hypertrophic obesity); or an increase in fat cell number (hyperplasic obesity) or a combination of both". According to National Heart, Lungs & Blood Institute (1998), obesity can be defined as "a complex, multifactorial chronic disease which involves the interaction of both genotype and environment". It involves many factors whether behavioural, social, cultural, physiological, genetic or metabolic. Popkin (1994) and Mo-suwan et al. (1993) point out that, in developing countries, obesity is associated with two extreme and rapid changes in lifestyle patterns, urbanisation and rapid economic development. The developmental mechanism of obesity is not completely understood and it is assumed to be a disorder with many causes. Environmental factors, lifestyle preferences, physical and cultural factors all play a crucial role in the high prevalence of obesity throughout the world. Obesity can be described as a "New World Syndrome" causing an enormous socioeconomic and public health burden in developed, developing and in poor countries of the world.

1.3 Body Mass Index (BMI)

The body mass index (BMI) is an indirect measure of the human body composition based on an individual's height and weight to determine whether a person is underweight, healthy weight, overweight or obese. It is calculated by using the weight in kilograms divided by the square of height in meters (kg/m^2). The WHO developed a classification of BMI of adults according to their weight and height (WHO, 2000). Table 1.1 shows the international classification of adult underweight, overweight and obesity according to BMI.

Table 1.1 The International Classification of adult's weight status according to BMI

Classification	BMI (Kg/m²)	Risk of comorbidity
Underweight	<18.5	Low
Normal weight	18.5-24.9	Average
Overweight	25-29.9	Increased
Obese class I	30- 34.9	Moderate
Obese class II	35-39.9	Severe
Obese class III	≥40	Very severe

The normal BMI range of 18.5 to 24.9 is a suitable measure for adults of age 20 and over only. The usage of BMI is different for children and adolescents. The U.S. Centres for Disease Control and Prevention (CDC) have developed BMI charts for children and adolescents adjusted for age and sex (Kuczmarski et al., 2002). These charts are suitable for children and adolescents aged 2 to 20 years and are used to obtain a percentile ranking, which allows comparison with children of the same gender and age. Table 1.2 shows the weight status category of children based on their BMI and the corresponding percentiles.

Table 1.2 BMI for age - weight status categories. Table adapted from Kuczmarski et al. (2002).

Weight Status Category	**Percentile Range**
Underweight	Less than the 5th percentile
Healthy Weight	5th percentile to less than the 85th percentile
Overweight	85th to less than the 95th percentile
Obese	Equal to or greater than the 95th percentile

Figure 1.1 shows an example of how sample BMIs of a 10-year-old boy should be interpreted using the CDC reference data for age and sex.

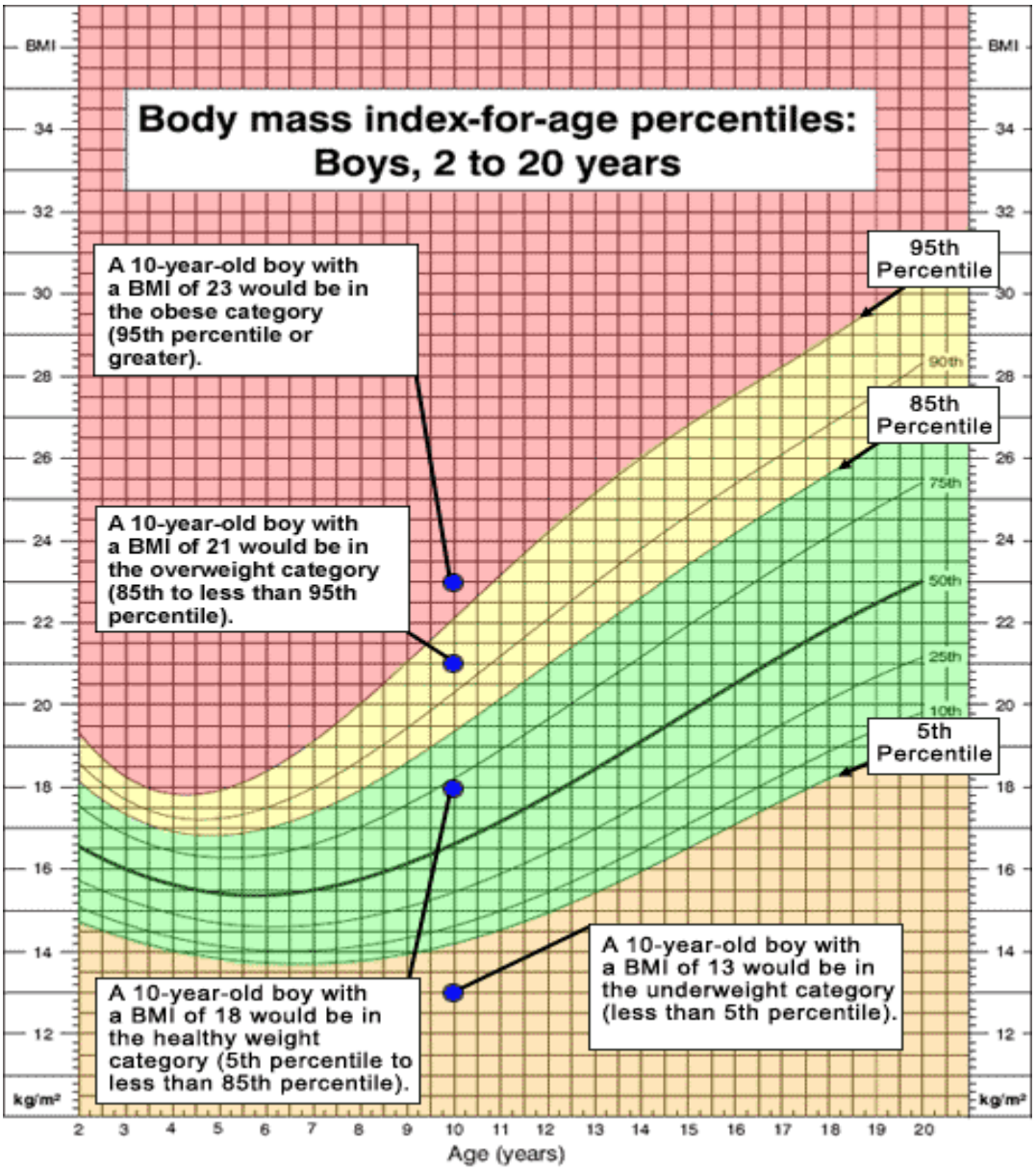

Figure 1.1 CDC BMI-for-age growth chart. Figure adapted from Kuczmarski et al. (2002).

1.4 Causes of obesity

Obesity usually occurs when an individual eats and drinks more calories than are burnt through daily activities; over time this leads the body to store the excess calories as fat. A range of biological, behavioural and environmental factors have been known to influence body weight including:

1.4.1 Unhealthy diet and eating habits

A growing problem related to obesity is a person's diet. The most common cause of obesity is excess energy intake (Aronne, Nelinson, & Lillo, 2009). The overconsumption of food that is high in fat and sugar particularly, is significantly associated with obesity (Jequier, 2002). Many reasons contribute to increase the daily intake and overeating of an individual. For instance, large portion sizes of high-calorie foods served in fast food restaurants which are affordable and easily accessible are partly responsible for the high rate of obesity (Ledikwe, Ello-Martin, & Rolls, 2005). In addition, people with lower incomes and less education levels tend to be overweight or obese. This can be explained in terms of poor people consuming a high-fat diet because it is more affordable than healthy foods (Drewnowski & Specter, 2004).

1.4.2 Physical inactivity

Lack of physical activity is another major factor that contributes to obesity. The balance of daily calories that are consumed and burnt is an important factor related to this disease. Eating too many calories and not doing enough exercise leads to an energy imbalance which causes obesity over time (US Surgeon General, 2001). In the past several decades, physical activity levels have significantly decreased in adults and adolescents (Wright & Aronne. 2012). Modern living and technology such as cars, watching television, playing video games and surfing the internet decrease the need to be physically active (Blair & Leermakers, 2002). The recommended adult physical activity time for moderate-to-vigorous exercise is two and a half hours weekly (Haskell et al., 2007).

Globally, around 31% of the world's population are not physically active (WHO, 2011).

1.4.3 Environment

The surrounding environment has a significant effect on people's eating habits. In fact, the environment doesn't prop up healthy lifestyle habits but rather encourages obesity for many reasons. For example, the widespread distribution of fast food restaurants plays a significant role in increasing the risk of obesity (Currie, DellaVigna, Moretti, & Pathania, 2009). These unhealthy foods seem to have cheaper prices, and by a little extra outlay, food portions can be boosted in size. Thus people absorb too many calories which means that they gain weight over time if they do not balance it with physical activity. Furthermore, food advertising and marketing by food companies are both linked to increased obesity among adults and children. A study of advertising during Saturday morning children's programming reported that 71% of these commercials were about food products and 80% were ads for foods with low nutritional value (Coon & Tucker, 2002). Likewise, research has reported that there is a positive association between children's TV viewing and their requests for and the consumption of advertised foods, and parents are willing to buy the foods children request (Patrick & Nicklas, 2005). In addition to factors related to the environment, the lack of recreational facilities such as sidewalks, trails, parks and affordable gyms does not help people to engage in physical activity. A study on neighbourhood differences in physical activity found that the prevalence of overweight residents in areas of high walkability was 25% less than overweight residents in areas of low walkability (Saelens, Sallis, Black, & Chen, 2003).

1.4.4 Parental influences and genetics

The interplay between genetics and the environment can lead to obesity similar to many other medical diseases (Poirier et al., 2006). Obesity tends to run in families where they share the same food and physical activities. Research has shown that parents strongly influence the shape of their child's eating habits including food

availabilities and accessibilities, child's attitudes toward food and the assessment of child's satiety (Patrick & Nicklas, 2005). Also, genes seem to increase the risk of obesity with the interaction of environmental factors such as unhealthy food and lack of physical activity (Qi & Cho, 2008). Studies have shown that the chances of being overweight or obese are higher if one or both parents are overweight or obese (Rice, Perusse, Bouchard, & Rao, 1999; Kolata, 2007). In addition, there are some genetic conditions that can lead to obesity, such as Prader-Willi syndrome, MOMO syndrome, Cohen syndrome and Bardet-Biedl syndrome (Gunay-Aygun, Cassidy, & Nicholls, 1997). However, the chance of being obese or overweight decreased when families adopted healthier food choices and increased physical activity (Qi & Cho, 2008).

1.4.5 Other various causes of obesity

There are many additional factors that may lead to obesity. Certain illnesses may contribute to obesity or weight gain including Cushing's syndrome, polycystic ovarian syndrome, hypothyroidism and night eating syndrome (Rosen, Bosaeus, TöIli, Lindstedt, & Bengtsson, 1993). For example, hypothyroidism is a hormone condition in which the thyroid gland fails to produce enough thyroid hormones; as a consequence, metabolism slows down causing weight gain (Jassam et al., 2011). Furthermore, many medicines may also contribute to obesity; these include certain anticonvulsants, antidepressants, insulin, hormones and some corticosteroids. Some of these drugs' side effects contribute to slow down metabolism or increase appetite causing the body to gain weight (Cheskin et al., 1999). In addition, emotional factors such as boredom, sadness, anger, depression or stress may also play a role in obesity. These psychological factors can be due to relationship pressures, study or job and may over time lead to overeating and weight gain (Dallman, 2010). Sleep deprivation is another factor related to increasing risk of obesity. Generally, children and adults who sleep fewer hours tend to gain weight more than those who get enough sleep. People may take in more calories when they are awake for a longer time because they have more opportunities to eat. In addition the balance of key hormones that regulate appetite

may be disrupted because of the lack of sleep; thus people feel hungrier than when they are well-rested (Patel & Hu, 2008).

1.5 Complications of obesity

Obesity is a serious disease that can lead to many other medical complications among various age groups such as high blood pressure (hypertension), type 2 diabetes, certain types of cancers, sleep disorders, asthma, stroke and depression, and it has been associated with shortened life expectancy (Malnick & Knobler, 2006). Figure 1.2 summarises the psychological and physical complications of obesity in children.

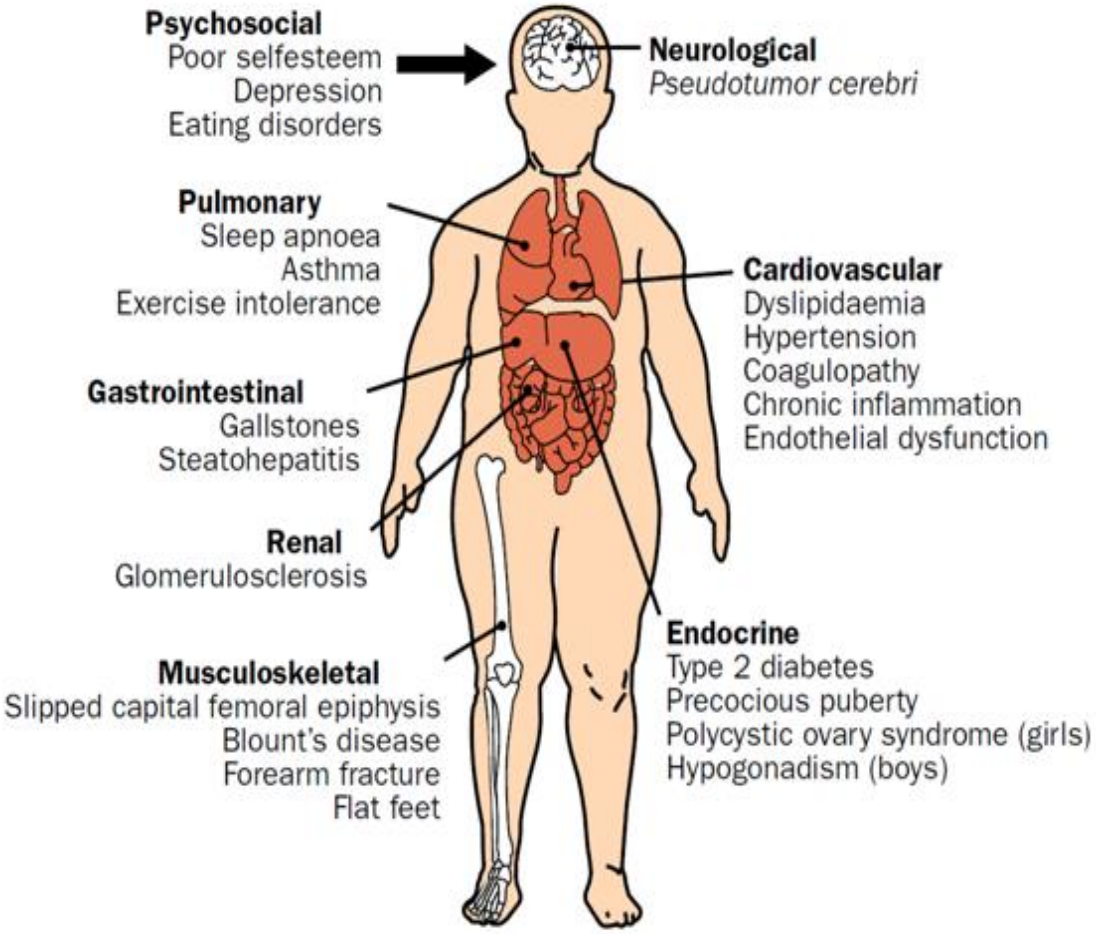

Figure 1.2 The psychological and physical complications of obesity in children. Figure taken from Ebbeling, Pawlak, & Ludwig (2002).

1.6 Prevalence of obesity worldwide

1.6.1 Prevalence of adult obesity worldwide

According to WHO (2013), obesity has almost doubled since 1980 and reported that in the year 2008 there were more than 1.4 billion adults of age 20 years and older who were overweight; of these, around 200 million men and nearly 300 million women were obese (WHO, 2013). This means that at that time, over 10% of the world's adults aged 20+ were obese and around 35% (34% men and 35% women) were overweight. It is estimated that by 2015, around 2.3 billion of the world's adults will be overweight and at least 700 million people will be obese (WHO, 2013). The highest rate of this epidemic among adults is in the Pacific Islands and the lowest is in Asia. In Europe and North America the prevalence of obesity is generally high, while there are variable rates in Africa and Middle East. Table 1.3 presents the distribution of overweight among adults by country.

Table 1.3 Distribution of overweight (BMI ≥ 25) among adults (age ≥ 20) by country. Table adapted from WHO (2008).

Country	BMI ≥ 25 (age-standardised estimate)		
	Male	Female	Both sexes
Afghanistan	10.0 [1.8-27.2]	13.6 [2.0-34.8]	11.8 [3.5-25.1]
Albania	60.5 [45.1-72.6]	48.2 [31.0-63.1]	54.2 [42.8-64.3]
Algeria	41.8 [31.5-53.0]	51.8 [40.8-62.0]	48.2 [40.3-55.7]
Andorra	65.9 [47.4-79.7]	51.9 [28.5-71.4]	58.9 [44.5-71.2]
Angola	20.4 [4.4-42.6]	30.7 [8.1-57.4]	25.8 [11.0-43.1]
Argentina	66.8 [58.3-74.5]	61.1 [51.2-70.1]	64.2 [57.7-70.1]
Armenia	49.2 [40.2-57.3]	60.9 [53.9-67.5]	55.1 [49.6-60.3]
Australia	66.5 [62.6-70.3]	56.2 [51.3-60.9]	61.3 [58.1-64.3]
Austria	56.9 [40.5-69.9]	42.1 [23.5-58.7]	49.6 [37.7-60.5]
Azerbaijan	52.0 [44.5-59.0]	61.9 [55.3-67.8]	57.4 [52.3-62.2]
Bahamas	66.0 [46.6-80.1]	72.1 [54.0-85.5]	69.2 [56.9-79.5]
Bahrain	70.2 [61.3-77.4]	70.5 [61.6-78.4]	70.6 [64.5-76.0]
Bangladesh	7.6 [2.8-15.7]	7.8 [5.1-11.5]	7.7 [4.8-12.0]
Belarus	56.7 [34.0-75.0]	55.6 [30.1-75.6]	57.4 [40.5-71.2]
Belgium	59.8 [49.8-68.2]	43.1 [30.0-54.4]	51.5 [43.4-58.8]
Belize	65.4 [57.7-71.6]	76.6 [71.0-81.6]	71.0 [66.1-75.2]
Benin	20.4 [14.9-26.3]	31.7 [25.7-38.1]	26.1 [22.0-30.6]

Country	BMI ≥ 25 (age-standardised estimate)		
	Male	Female	Both sexes
Bhutan	24.5 [12.5-37.7]	24.4 [10.7-39.1]	24.4 [15.0-34.5]
Bolivia	40.4 [25.1-56.7]	58.9 [52.3-64.4]	50.0 [41.9-58.4]
Brazil	53.5 [47.1-59.9]	52.0 [46.4-57.2]	52.8 [48.5-56.9]
Bulgaria	61.2 [52.6-68.3]	47.1 [36.8-56.3]	54.3 [47.6-60.3]
Burkina Faso	11.9 [4.5-23.6]	14.2 [8.0-22.2]	13.0 [8.0-19.8]
Cambodia	11.4 [7.7-16.0]	13.8 [10.1-18.2]	12.7 [9.9-15.9]
Cameroon	32.6 [22.3-43.2]	42.3 [33.4-51.5]	37.5 [30.7-44.3]
Canada	65.7 [62.2-69.1]	55.2 [50.0-60.2]	60.5 [57.2-63.5]
Chad	14.6 [6.4-25.7]	16.9 [9.8-25.4]	15.7 [9.9-22.6]
Chile	64.2 [56.4-70.3]	65.7 [58.0-72.8]	64.9 [59.4-69.9]
China	25.1 [20.8-29.5]	24.9 [19.2-30.3]	25.0 [21.4-28.5]
Colombia	44.9 [38.6-51.5]	53.8 [48.4-58.7]	49.6 [45.4-53.7]
Cook Islands	91.0 [87.8-93.7]	90.2 [86.1-93.6]	90.6 [88.0-92.9]
Costa Rica	60.3 [51.1-68.3]	58.8 [50.4-66.7]	59.6 [53.4-65.4]
Cote d'Ivoire	21.8 [10.3-35.3]	32.3 [20.8-44.1]	26.9 [18.6-35.7]
Croatia	61.6 [49.2-72.1]	44.6 [30.1-57.9]	53.2 [43.8-61.9]
Cuba	47.5 [35.6-59.9]	57.9 [46.1-68.1]	52.8 [44.4-60.9]
Cyprus	64.6 [55.9-72.7]	47.6 [37.2-57.7]	55.9 [48.9-62.4]
Czech Republic	72.3 [67.3-77.0]	53.1 [46.3-59.6]	61.7 [57.3-65.7]
Denmark	54.6 [42.7-64.5]	42.1 [26.9-56.2]	48.4 [38.8-57.2]
Djibouti	30.2 [10.1-53.0]	37.4 [13.2-62.5]	33.9 [17.9-50.9]
Dominica	41.4 [34.0-49.7]	71.2 [64.5-76.9]	56.7 [51.8-61.8]
Dominican Republic	49.6 [36.3-62.9]	61.1 [49.0-71.2]	55.4 [46.7-63.9]
Ecuador	51.8 [35.8-66.8]	60.2 [50.2-68.3]	56.0 [46.6-64.8]
Egypt	62.4 [53.5-69.5]	76.9 [74.1-79.6]	69.8 [65.2-73.6]
El Salvador	59.1 [44.4-71.0]	65.6 [59.9-71.1]	62.5 [55.0-68.9]
Ethiopia	7.1 [3.3-12.9]	9.0 [5.4-13.9]	8.0 [5.3-11.7]
Fiji	60.1 [49.7-68.4]	72.9 [65.0-79.6]	66.6 [60.0-72.1]
Finland	59.6 [53.5-65.1]	46.2 [39.1-53.3]	53.0 [48.3-57.6]
France	52.0 [46.1-57.5]	40.0 [32.6-47.6]	45.9 [41.1-50.8]
Germany	62.8 [56.7-68.3]	46.6 [39.0-53.6]	60.5 [55.9-64.8]
Ghana	24.2 [18.8-29.6]	36.7 [32.2-42.0]	30.4 [26.9-34.2]
Greece	56.6 [47.1-65.4]	41.3 [30.3-51.8]	49.1 [41.7-56.0]
Grenada	49.0 [26.6-68.9]	62.2 [40.3-78.9]	56.0 [41.3-69.5]
Hungary	65.8 [53.9-76.1]	49.4 [32.1-64.5]	57.7 [47.1-67.2]
Iceland	63.6 [51.6-73.9]	49.1 [31.8-64.0]	56.4 [46.3-65.3]
India	10.0 [7.4-13.2]	12.5 [9.3-16.3]	11.2 [9.1-13.7]
Indonesia	16.1 [11.0-21.9]	25.3 [18.2-32.6]	20.7 [16.2-25.4]
Iran	48.8 [43.6-54.2]	61.0 [56.8-64.9]	55.0 [51.6-58.3]
Iraq	62.2 [55.1-68.3]	68.2 [60.9-74.8]	62.3 [57.1-67.0]
Ireland	67.1 [63.0-70.9]	54.8 [48.4-60.5]	60.9 [57.1-64.5]

Country	BMI ≥ 25 (age-standardised estimate)		
	Male	Female	Both sexes
Israel	62.4 [56.9-67.8]	59.4 [53.4-65.6]	60.9 [56.7-65.0]
Italy	58.3 [51.8-63.6]	40.1 [32.7-47.3]	49.2 [44.2-53.8]
Jamaica	40.7 [34.6-47.2]	70.6 [65.1-75.3]	56.2 [52.1-60.2]
Japan	28.9 [25.0-32.9]	15.9 [12.0-20.0]	22.4 [19.6-25.4]
Jordan	66.5 [61.7-71.0]	71.2 [68.3-73.8]	68.8 [66.0-71.4]
Kenya	15.2 [4.6-31.7]	25.5 [18.7-32.7]	20.5 [14.0-29.0]
Kiribati	78.4 [72.9-83.3]	82.5 [76.8-87.3]	80.5 [76.6-84.1]
Kuwait	78.1 [74.1-81.9]	81.3 [77.3-84.8]	78.8 [75.9-81.5]
Laos	11.6 [4.9-21.7]	17.8 [10.0-27.0]	14.8 [9.3-21.5]
Latvia	59.4 [46.6-70.7]	47.8 [33.5-61.2]	53.6 [44.2-62.5]
Lebanon	67.0 [62.8-70.9]	58.7 [53.6-63.8]	62.8 [59.5-66.0]
Libya	60.4 [54.7-65.5]	71.0 [66.0-75.6]	65.4 [61.6-68.9]
Madagascar	12.6 [6.9-20.2]	8.8 [6.0-12.1]	10.6 [7.5-14.6]
Malawi	16.7 [12.1-22.0]	24.3 [18.7-30.2]	20.6 [16.9-24.8]
Malaysia	42.4 [36.5-48.8]	47.0 [39.6-54.1]	44.6 [39.8-49.5]
Mexico	67.8 [62.9-71.9]	70.3 [65.3-74.9]	69.1 [65.6-72.3]
Micronesia	71.4 [63.2-78.7]	82.5 [75.7-88.0]	76.8 [71.6-81.6]
Morocco	43.1 [32.5-54.3]	53.6 [44.9-60.9]	48.5 [41.7-55.2]
Namibia	23.3 [15.5-31.6]	44.7 [36.7-52.0]	34.6 [28.8-40.2]
Nauru	93.5 [91.0-95.3]	92.3 [89.2-94.9]	92.8 [90.9-94.6]
Nepal	9.8 [2.8-22.0]	8.9 [5.3-14.1]	9.3 [5.2-15.4]
Netherlands	52.4 [46.0-57.9]	43.2 [35.3-50.7]	47.8 [43.0-52.6]
New Zealand	67.8 [63.7-71.9]	60.6 [54.2-66.3]	64.1 [60.3-67.7]
Niger	11.0 [7.2-16.1]	16.6 [11.0-23.3]	13.7 [10.2-17.6]
Nigeria	26.2 [15.5-37.1]	29.3 [23.5-34.9]	26.8 [21.1-32.7]
Norway	62.3 [55.5-68.0]	47.6 [38.6-56.0]	55.0 [49.2-60.3]
Oman	57.8 [47.8-66.1]	57.2 [46.0-66.1]	57.5 [50.1-63.8]
Pakistan	20.0 [10.3-31.8]	28.8 [16.1-43.2]	24.3 [16.4-33.4]
Palau	81.9 [69.6-90.6]	81.7 [68.2-91.6]	81.8 [73.0-88.8]
Paraguay	50.9 [26.6-72.3]	50.2 [21.8-73.5]	50.5 [32.0-66.9]
Peru	43.3 [36.9-50.0]	52.2 [46.4-57.5]	47.9 [43.5-52.2]
Philippines	24.5 [17.1-32.2]	29.1 [20.0-38.1]	26.9 [20.9-32.9]
Poland	61.6 [55.9-66.6]	49.6 [43.1-56.0]	55.7 [51.5-59.8]
Portugal	59.7 [51.4-66.5]	50.8 [42.3-58.5]	55.3 [49.5-60.5]
Romania	51.7 [38.3-63.3]	45.4 [31.4-57.5]	48.6 [39.1-57.1]
Qatar	73.1 [68.8-77.3]	71.3 [65.4-76.6]	72.1 [68.5-75.5]
Russian Federation	55.8 [50.9-60.7]	62.8 [58.4-66.9]	57.8 [54.4-61.0]
Samoa	82.6 [77.1-87.3]	88.9 [84.6-92.5]	85.6 [82.1-88.7]
Saudi Arabia	70.2 [66.0-74.6]	73.2 [68.9-76.7]	71.3 [68.3-74.2]
Senegal	18.0 [6.4-34.2]	37.0 [28.1-46.4]	27.7 [20.2-36.7]
Serbia	65.3 [60.2-69.7]	46.2 [39.2-52.6]	55.9 [51.5-60.0]

Country	BMI ≥ 25 (age-standardised estimate)		
	Male	Female	Both sexes
Singapore	32.3 [26.5-38.0]	23.7 [17.5-29.9]	28.1 [23.8-32.4]
Somalia	18.9 [4.9-38.8]	24.0 [5.7-48.2]	21.5 [8.8-36.9]
South Africa	62.0 [56.1-66.6]	73.6 [69.5-77.1]	68.0 [64.6-71.0]
Spain	65.1 [60.2-69.8]	50.9 [44.6-57.0]	58.2 [54.2-62.0]
Sri Lanka	16.5 [11.7-22.5]	26.5 [18.8-34.1]	21.7 [17.0-26.5]
Sudan	21.6 [5.9-42.0]	28.2 [7.5-53.1]	25.0 [10.8-40.8]
Sweden	57.3 [49.6-64.1]	42.5 [33.6-50.9]	50.0 [44.2-55.4]
Switzerland	55.0 [43.6-64.0]	34.1 [21.3-46.5]	44.3 [36.0-52.0]
Syria	63.4 [55.0-70.3]	69.3 [61.6-76.1]	66.4 [60.8-71.4]
Tajikistan	33.7 [12.1-56.8]	33.9 [17.7-49.9]	33.8 [20.4-47.7]
Thailand	25.8 [21.3-30.5]	36.4 [30.9-42.3]	31.4 [27.8-35.3]
Tonga	85.8 [81.6-89.3]	90.6 [86.7-93.9]	88.1 [85.2-90.6]
Tunisia	47.5 [34.9-59.0]	64.2 [54.0-73.1]	55.9 [47.7-63.5]
Turkey	61.4 [57.6-64.7]	65.8 [62.1-69.4]	63.6 [61.0-66.1]
Ukraine	49.8 [26.2-70.9]	53.2 [38.6-65.0]	51.8 [38.1-64.1]
United Arab Emirates	71.3 [64.2-77.5]	73.9 [66.8-80.2]	72.0 [66.6-76.8]
United Kingdom	65.6 [62.1-68.9]	57.5 [52.8-61.8]	61.5 [58.6-64.3]
United States of America	72.5 [69.8-75.3]	66.3 [62.6-70.0]	69.4 [67.1-71.8]
Uruguay	59.0 [50.9-66.6]	55.4 [46.1-63.9]	57.3 [51.3-63.0]
Viet Nam	9.4 [5.8-14.2]	10.8 [6.4-16.9]	10.1 [7.1-13.9]
Yemen	40.2 [18.7-62.7]	51.0 [27.0-72.5]	45.7 [29.8-61.1]
Zambia	9.1 [4.2-16.4]	26.0 [19.5-32.4]	17.8 [13.5-22.7
Zimbabwe	17.6 [10.5-25.6]	40.3 [32.3-48.6]	29.4 [24.0-35.3]

1.6.2 Prevalence of childhood obesity worldwide

The prevalence of childhood obesity has increased significantly over the past 3 decades. In 2010, the estimated number of overweight preschool children (under age 5) was over 42 million. Around 35 million of these children lived in developing countries (WHO, 2010). There is strong evidence that overweight and obesity are now increasingly prevalent in low- and middle-income countries particularly in urban settings (Kelishadi, 2007). During the period from the 1970s to the end of the 1990s, the proportions of overweight or obesity among school-age children doubled or tripled in many large countries in most regions, such as Canada, the US, Brazil, Chile, Australia, Japan , Finland, Germany, Greece, Spain and the UK (Wang & Lobstein, 2006). Obesity does not seem to be a public

health issue in preschool-age children in Asia and sub-Saharan Africa. However, the levels are higher in some countries in North America, Latin America, Central/Eastern Europe, North Africa, the Middle East, Central/Eastern Europe (Kelishadi, 2007). Globally, the prevalence of childhood overweight and obesity grew from 4.2% in 1990 to 6.7% in 2010, and it is expected to reach 9.1% by 2020 (De Onis, Blössner, & Borghi, 2010). Table 1.4 shows the prevalence of overweight and obesity in preschool children aged 0–5 years, by United Nations (UN) regions for the period 1990 to 2020.

Table 1.4 Prevalence of overweight and obesity in children aged 0–5 years, by United Nations (UN) regions: 1990–2020. Table retrieved from De Onis, Blössner, & Borghi (2010).

UN regions and subregions	Overweight and obese (%)						
	1990	1995	2000	2005	2010	2015	2020
Africa	4	4.7	5.7	6.9	8.5	10.4	12.7
Eastern	3.9	4.4	5.1	5.8	6.7	7.6	8.7
Middle	2.5	3.4	4.7	6.4	8.7	11.7	15.5
Northern	6.1	8	10.3	13.3	17	21.4	26.6
Southern	10.2	9.5	8.8	8.2	7.6	7	6.5
Western	2.2	2.9	3.8	4.9	6.4	8.3	10.6
Asia	3.2	3.4	3.7	4.2	4.9	5.7	6.8
Eastern	4.8	4.9	5	5.1	5.2	5.3	5.4
South central	2.3	2.6	2.9	3.2	3.5	3.9	4.3
Southeastern	2.1	2.6	3.1	3.8	4.6	5.6	6.7
Western	3	4.5	6.8	10.1	14.7	21	29.1
Latin America and Caribbean	6.8	6.8	6.8	6.9	6.9	7	7.2
Caribbean	4.6	5.1	5.6	6.2	6.9	7.6	8.3
Central America	4.8	5.3	5.9	6.5	7.2	8	8.8
South America	8	7.7	7.4	7.1	6.8	6.5	6.3
Oceania	2.9	3.1	3.2	3.3	3.5	3.6	3.8
Developing countries	3.7	4	4.5	5.2	6.1	7.2	8.6
Developed countries	7.9	8.8	9.7	10.6	11.7	12.9	14.1
Global	4.2	4.6	5.1	5.8	6.7	7.8	9.1

1.7 Prevalence of obesity in Saudi Arabia

1.7.1 Prevalence of obesity in Saudi adults

The Middle East region has the second highest mean BMI after North America (Musaiger et al., 2011). The rapid socioeconomic development in Saudi Arabia is now considered one of the fastest worldwide. Consequently, rapid changes in eating habits, lifestyle and physical inactivity have led to a rise in the prevalence of overweight and obesity in Saudi Arabia. Much research has been carried out to determine the prevalence of overweight and obesity in Saudi Arabia; it shows that obesity has reached an alarming level among the population. According to Forbes (2007), Saudi Arabia ranked 29 on a list of countries with the greatest percentage of overweight people with a proportion of 68.3% of its population being overweight. Table 1.5 shows the top 30 countries of overweight people.

Table 1.5 The top 30 countries of overweight people. Table adapted from Forbes (2007).

Rank	Country	%
1.	Nauru	94.5
2.	Micronesia, Federated States of	91.1
3.	Cook Islands	90.9
4.	Tonga	90.8
5.	Niue	81.7
6.	Samoa	80.4
7.	Palau	78.4
8.	Kuwait	74.2
9.	United States	74.1
10.	Kiribati	73.6
11.	Dominica	71.0
12.	Barbados	69.7
13.	Argentina	69.4
14.	Egypt	69.4
15.	Malta	68.7
16.	Greece	68.5
17.	New Zealand	68.4
18.	United Arab Emirates	68.3
19.	Mexico	68.1
20.	Trinidad and Tobago	67.9
21.	Australia	67.4
22.	Belarus	66.8
23.	Chile	65.3
24.	Venezuela (Bolivarian Republic of)	65.2
25.	Seychelles	64.6
26.	Bahrain	64.1
27.	Andorra	63.8
28.	United Kingdom	63.8
29.	Saudi Arabia	63.5
30.	Monaco	62.4

Al-Hamdan et al. (2005) published nationally representative estimates of overweight and obesity among adults aged 15-64 years in Saudi Arabia. Of over 2244 men, around 37.9% were overweight and 28.9% obese; and of 2345 females, 27.6% were overweight and around 43.3% were obese (Table 1.6).

Table 1.6 Estimate of overweight and obesity among adults in Saudi Arabia. Table taken from Al-Hamdan et al. (2005).

Age group	Sample size	% overweight only ($25 \leq BMI < 30$)	% obese ($BMI \geq 30$)	% overweight or obese
15-64	Male = 2244	Male = 37.9	Male = 28.3	66.2
	Female = 2345	Female = 27.6	Female = 43.3	71.4

Al-Nozha et al. (2005) studied the prevalence of obesity in both genders aged 30-70 years in rural and urban areas of Saudi Arabia. They found that the group of 40-49 years had the highest obesity rate of 30.3% in males and 50.2% in females. They also reported that the eastern and central regions of Saudi Arabia had the greatest prevalence of obesity at 42.2% and 40% respectively while the southern region had the lowest rate at 29.2%. In addition, the percentage of obese people living in urban areas was 39.7%, whereas the rate was lower for obese people living in rural areas at 27% (Table 1.7).

Table 1.7 Prevalence of normal weight, overweight and obese for demographic factors of gender, age, residence and regions in Saudi Arabia. Table adapted from Al-Nozha et al. (2005).

Factors	N	Not overweight nor obese ≤25 kg/m²	Overweight 25.1 – 29.9 kg/m²	Obese ≥ 30 kg/m²	*p*-value
Gender/age (years)					
Male					<0.0001
30-39	2136	33.2	41.6	25.2	
40 – 49	2170	25.7	44.0	30.3	
50 – 59	1962	29.7	42.5	27.8	
60 – 70	1947	36.3	41.6	22.1	
Total	**8215**	**31.1**	**42.4**	**26.4**	
Female					<0.0001
30 – 39	3775	28.1	31.7	40.2	
40 – 49	2717	18.7	31.1	50.2	
50 – 59	1522	22.3	31.8	45.9	
60 – 70	994	27.0	34.0	39.0	
Total	**9008**	**24.2**	**31.8**	**44.0**	
Residence					<0.0001
Urban	11723	23.4	36.9	39.7	
Rural	5500	36.1	36.9	27.0	
Region					<0.0001
Central	3995	23.6	36.4	40.0	
Northern	1536	26.2	36.8	37.0	
Southern	3590	31.8	38.3	29.9	
Western	5462	30.6	36.7	32.7	
Eastern	2640	21.9	35.9	42.2	
Total	**17223**	**27.5**	**36.9**	**35.6**	

1.7.2 Prevalence of obesity in Saudi children

Many studies have been conducted to assess the magnitude and burden of overweight and obesity among Saudi Arabian children. The perceived causes for the increased rate of obesity in preschool and school-age children in Saudi Arabia may be due to increased dietary intake, reduced physical activity, food at school, changing family structure, cultural influence, changing dietary habits, changing lifestyle, or increased sedentary activity. Al-Hazzaa (2006) pointed that lifestyle transformation is one of the main factors for the increase in the prevalence of obesity among Saudi children. El-Hazmi et al. (2002) studied the prevalence of obesity and overweight in Saudi children and showed that 10% were obese and 4.58% overweight for boys in a group aged 1-6 years. They also found that 9.80%

were obese and 4.70% were overweight for girls in the same age group. In addition, the highest rate of overweight and obesity in their study was in a group aged 12-18 years. In boys, 5.78% were obese and 14.50% were overweight, whereas girls were 6.87% and 15.64%, respectively (Table 1.8).

Table 1.8 Prevalence of obesity and overweight in Saudi children in different age groups. Table retrieved from El-Hazmi et al. (2002).

	Boys			Girls		
Age (years)	No. investigated	Overweight (%)	Obese (%)	No. investigated	Overweight (%)	Obese (%)
1-6	830	38 (4.58)	83 (10)	788	37 (4.70)	77 (9.80)
6-12	2683	232 (8.65)	133 (4.96)	2555	295 (11.54)	160 (6.26)
12-18	2766	401 (14.50)	160 (5.78)	3076	481 (15.64)	196 (6.87)
6-18	5449	633 (11.62)	293 (5.38)	5631	776 (13.78)	356 (6.32)
Total	6279	671 (10.68)	376 (5.99)	6419	813 (12.7)	433 (6.74)

Al-Dossary et al. (2010) studied obesity in Saudi children and reported that the overall prevalence of overweight was 19.0% and obesity 23.3%. They also found that the proportion of children aged 2 to 4 years in Saudi Arabia who were overweight and obese was 18.1% and 19.2%, respectively. There was a slight rise in the prevalence of obesity and overweight in the 5 to 9 years age group in which 18.3% of children were overweight and 21.1% obese. Furthermore, the prevalence of obesity and overweight in the 10 to 13 years, and the 14 to 18 years groups were higher and quite similar. In the 10 to 13 years group, 28% were obese and 20.2% overweight, while 27% were obese and 20% overweight in the 14 to 18 years group (Table 1.9).

Table 1.9 Distribution of body mass index (BMI) categories by sex, age and nationality. Table taken from Al-Dossary et al. (2010).

Categories	Normal weight (BMI < 85%)		Overweight (BMI 85%–95%)		Obese (BMI > 95%)		Total		*P*-value
	No.	%	No.	%	No.	%	No.	% In category	
Sex									
Male	2185	55.6	708	18.0	1040	26.4*	3933	55.7	*$P < 0.05$
Female	1886	60.4	633	20.3	604	19.3	3123	44.3	
Age (years)									
2–4	1164	62.7	337	18.1	356	19.2	1857	26.3	*$P < 0.05$
5–9	1346	60.6	406	18.3	469	21.1	2221	31.5	
10–13	709	51.8	276	20.2	384	28.0*	1369	19.4	
14–18	852	53.0	322	20.0	435	27.0*	1609	22.8	
Nationality									
Saudi	3222	57.5	1048	18.7	1329	23.7	5599	79.4	NS
Non-Saudi	849	58.3	293	20.1	315	21.6	1457	20.6	
Total	4071	57.7	1341	19.0	1644	23.3	7056	100.0	

Al-Hazzaa (2007) conducted two cross-sectional studies in 1988 and 2005 to examine the body fatness and prevalence of obesity among Saudi primary schoolboys 6 to 14 years of age. He reported that there were significant increases in body weight, body height, biacromial and bi-iliac widths, triceps skinfolds, subscapular skinfolds, S/T ratio, BMI and body fat percentage. Figure 1.3 shows the increase in BMI among Saudi primary aged schoolboys between 1988 and 2005.

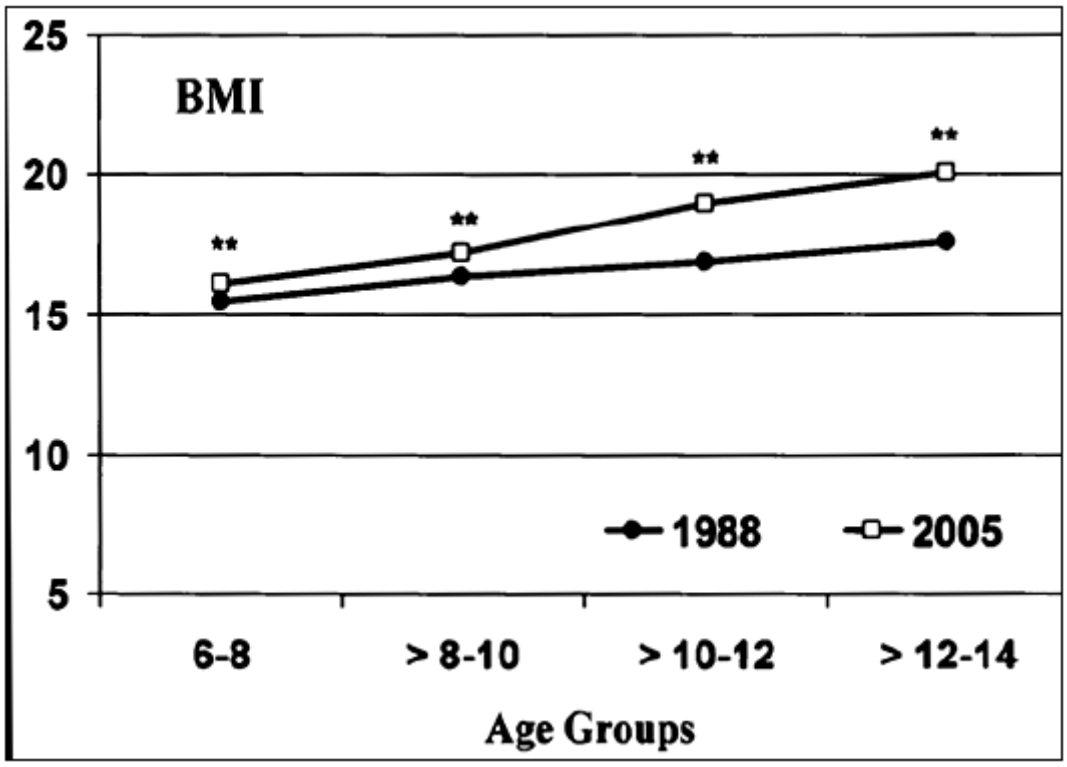

Figure 1.3 The body mass index (BMI) of Saudi primary aged schoolboys by age groups in 1988 and 2005. Figure adapted from Al-Hazzaa (2007).

1.8 The Children's Eating Behaviour Questionnaire

Eating is one of the fundamental behaviours that allows the organism to acquire energy and hence maintain its core physiological functions. However, excessive consumption is one of the most critical factors underlying obesity. Foods that have mostly contributed to the problem are those high in sugar and fat. Importantly, children's eating behaviour patterns develop as early as during infancy and at the pre-school age, and they serve as the basis for consumption characteristics later on during adulthood (Centre for Community Child Health, 2006).

Specific behavioural traits have been associated with obesity in children. For instance, low satiety responsiveness, emotional overeating, and eating too fast (Schachter, 1968; Barkeling, Ekman, & Rössner, 1992). Already in the preschool period, individual differences in eating behaviours are prominent and they stem from heritability, parental food preferences, taste, smell, food availability/quality

practices and child's adiposity (Birch et al., 1998). Furthermore, one of the strongest risk factors for developing obesity among children is elevated weight of parents (Whitaker et al., 1997).

It is crucial to define eating traits early that promote overconsumption and obesity in order to identify at-risk families and to conceptualise appropriate interventions directed at parents. This is usually done using questionnaires which are completed by parents; these forms describe the eating behaviour of their children, and relate it to the probability of obesity; the questionnaires need to be standardised for the population of interest, and their validity and usability have to be assessed for each country they are used in.

The cross-sectional questionnaires can be used as a foundation for investigating eating habits contributing to the aetiology of this "epidemic" among the human population. In the epidemiological studies, questionnaires are important tools used as the main source of information to identify and describe health problems such as obesity in a community. The validity of data obtained from questionnaires can also be used to compare the eating behaviours across age, gender, and other ethnic groups. Hence, further biological research, plans and programs can be designed to prevent and control the disease and promote public health based on the approach adopted from these studies (Spence, Carson, Casey, & Boule, 2011).

One of the most comprehensive instruments is termed the Children's Eating Behaviour Questionnaire (CEBQ); this survey was produced and verified in Britain (Wardle et al., 2001; Carnell and Wardle, 2007); it is applicable to preschool children. The CEBQ is a questionnaire filled out by parents to determine the eating behaviour of their children, and the children's propensity to becoming obese. The CEBQ is a comprehensive assessment tool which relies on 35 specific questions, which were formulated based on interviews with parents about the way their children eat, as well as on published research. The items cover four dimensions indicating "food approach" (enjoyment of food, food responsiveness, emotional overeating, and desire to drink) and four dimensions measuring "food avoidant" (satiety responsiveness, slowness in eating, emotional under eating, and food fussiness) (Wardle et al., 2001).

The two sub-scales, food responsiveness (FR) and enjoyment of food (EF) assess eating in response to environmental food cues. These behaviours have been found to become clearer as children get older (Wardle et al., 2001; Carnell and Wardle, 2007). The desire to drink (DD) scale detects increased desire for children to drink frequently, especially sugar-sweetened drinks (Sweetman, Wardle, & Cooke, 2008). Satiety responsiveness (SR) means how able a child is at controlling the amount of food that is eaten to regulate its energy intake (Wardle et al., 2001; Carnell and Wardle, 2007). High scores on the slowness in eating (SE) subscale reflect a reduction in eating rate as a result of low interest and enjoyment of food (Barkeling, Ekman, & Rössner, 1992; Lindgren et al., 2000). Food fussiness (FF) is related to a rejection of a substantial amount of new and familiar foods, leading to an inadequate variety of foods (Dovey, Staples, Gibson, & Halford, 2008). Finally, the emotional overeating (EOE) and emotional undereating (EUE) scales refer to an increase or a decrease in eating under negative emotions, such as anger and anxiety (Braet and Van Strien, 1997).

The CEBQ has been successfully validated in many populations across the world, mainly in countries of Western-type eating habits, including the United Kingdom (Wardle et al., 2001; Carnell and Wardle, 2007; Ashcroft et al., 2007; Webber et al., 2008), the Netherlands (Sleddens, Kremers, & Thijs, 2008; Jansen et al., 2012), Portugal (Viana, Sinde, & Saxton, 2008), Canada (Spence, Carson, Casey, & Boule, 2011), and Sweden (Svensson et al., 2011). China (Cao et al., 2012) and Chile (Santos et al., 2011) are the few non-Western countries in which the CEBQ has been validated.

1.9 Research Objectives

In consideration of the growing obesity rates in Saudi Arabia and the lack of validation of the CEBQ in any Middle Eastern country, the current cross-sectional project assessed the factor structure of the CEBQ in Saudi preschool children aged 2-6 years. It was also aimed to elucidate the association between children's eating behaviour and age, gender and relative weight, as well as their parents' BMI. Additionally, the study investigated the distribution of obesity among Saudi preschool children and their parents, and assessed the influence of the parents' weight on children's weight.

Chapter Two: Methodology

2.1 Research Permits

This study was reviewed and approved by the Human Research Ethics Committee of The University of Waikato, New Zealand. It was also accepted by the Institutional Review Board of King Fahad Medical City, Ministry of Health, Riyadh, Saudi Arabia. In addition, the approval of the Ministry of Higher Education, Saudi Arabia was granted before the beginning of the research.

2.2 Measures

The original English version of the CEBQ was translated into Arabic and approved by an authorised translator. The CEBQ consists of 35 items and covers eight factors of eating styles. Parents were asked to rate their child's eating behaviour on a five-point Likert scale (never, rarely, sometimes, often, always; 1–5). The CEBQ was distributed together with a request letter and extra questions about the child's birth date, gender, chronic diseases, current weight and height, and both parents' weight, height, and educational levels (primary school, high school, college/university) were recorded on the case sheet (Appendix A). The survey contains a participant information sheet that explains in detail their right to withdraw from the study (Appendix B).

2.3 Body Mass Index

Body mass index (BMI) was calculated as BMI = Weight (in kg) / Height^2 (in metres) for parents and children. Each parent's weight category was classified using the international cut-off points (WHO, 2000) as: "normal weight" (BMI < 25), "overweight" (BMI 25-29.9) and "obese" (BMI ≥ 30).

The CDC reference data adjusted for age and sex (Kuczmarski et al., 2002) was used to classify weight status category of children based on their BMI as: "Underweight" (less than the 5th percentile), "normal weight" (5th percentile to

less than the 85th percentile), “overweight” (85th to less than the 95th percentile) and “obese” (equal to or greater than the 95th percentile). For analysis purposes the CDC reference data was also used to convert each child's BMI to a standardised z-score. Epi Info 7 software was used to calculate BMI z-score.

2.4 Overview of procedure

The research took place at King Fahad Medical City (KFMC) in Riyadh, the capital and the largest city (pop. > 5.5 million) of Saudi Arabia. KFMC is one of the largest health care facilities in the country and consists of four main hospitals, a paediatric hospital, a general hospital, a maternity hospital and a rehabilitation hospital. It is funded by the government of Saudi Arabia to provide treatment for citizens from all over the country. This study was set in a public medical city in order to easily reach a large number of participants of diverse backgrounds. Only healthy children, or children under acute care, were allowed to participate. With the help of Clinical Nutrition Department staff at KFMC to assist and describe the researcher's purpose to the participants, the questionnaire was distributed only to KFMC visitors and staff with Saudi nationality. Participants were contacted in the waiting rooms, clinics, kindergarten and wards. A total of 400 questionnaires were handed out with envelopes, and parents of preschool children aged 2-6 years old were asked to complete them either at home or in the hospital, put them in the envelope, seal it and then return it to the department. Only the researcher had the right to open the envelope. The collection of questionnaires for this research, which was carried out from February 2013 to May 2013, produced a total of 238 participants (59.5% response rate). Children with asthma (N = 18) and diabetes (N = 4), as well as children with missing information or missing parental weight and height (N = 16), were excluded from the study.

This resulted in a sample of 200 children, 100 boys and 100 girls, aged 2-6 years old from 175 families. Each family had only one or two children within the specified age group. The mean age of the children in the study was 4.1 years. The children were subdivided into four groups: 2 years (N = 56), 3 years (N = 40), 4 years (N = 35) and 5-6 years (N = 69). The questionnaire was completed by the

father for 10.9% of the children, the mother for 82.9% and in 6.2% of the cases both parents filled it out.

Parental education levels were divided into 3 groups; only 4% of the fathers and 4.5% of the mothers were not educated, or had a primary education. The majority of the whole sample had a college/university education: 65.1% of the fathers and 66.9% of the mothers. The remaining 30.9% of the fathers and 28.6% of the mothers had a high school education level.

Similar to the Swedish version of CEBQ (Svensson et al., 2011), children were put into two groups depending on various parental weight categories to assess the influence of the parents' weight on their children's weight and eating behaviours: those with a minimum of one obese parent or two overweight parents versus children with two normal weight parents or one normal weight and one overweight parent. Table 2.1 presents the demographic and anthropometric characteristics of the whole sample.

Table 2.1 Demographic and anthropometric characteristics of survey respondents (N=200).

	N	%
Children's weight categories		
Normal	144	72
Overweight	19	9.5
Obese	37	18.5
Children's gender		
Boys	100	50
Girls	100	50
Children's age groups		
2 years	56	28
3 years	40	20
4 years	35	17.5
5-6 years	69	34.5
Parental weight categories		
Father		
Normal	31	17.7
Overweight	84	48
Obese	60	34.3
Mother		
Normal	48	27.5
Overweight	67	38.2
Obese	60	34.3
Father and mother combined weight groups		
2 overweight or at least 1 obese parent	144	72
2 normal weight or one normal weight and one overweight parent	56	28
Parental education		
Father		
Primary school	7	4
High school	54	30.9
College/University	114	65.1
Mother		
Primary school	8	4.5
High school	50	28.6
College/University	117	66.9
Completed the questionnaire		
Father	19	10.9
Mother	145	82.9
Both parents	11	6.2

2.5 Statistical analysis

In order to verify the underlying structure of the Saudi version of the questionnaire and determine whether it was similar to the original CEBQ (Wardle et al., 2001), a Principal Components Analysis (PCA) with direct oblimin rotation was performed on all thirty-five CEBQ items. In accordance with Svensson et al. (2011), factor loadings 0.4 was set as the threshold loading for factor analysis. Internal reliability coefficients (Cronbach's alpha) and (average) inter-item correlations were estimated for each factor identified from the evaluation of the CEBQ. Cronbach's alpha is a good measure of internal consistency, and acceptable values are normally above 0.70 (Nunnally, 1978). However, Cronbach's alpha values near 0.60 can still be acceptable (Hair et al., 2006). In terms of inter-item correlations, the recommended average inter-item correlation should fall in the range of 0.15-0.50 (Briggs & Cheek, 1986). Mean scores were computed for each factor and the correlations between the eight sub-scales of the CEBQ were determined by Pearson's correlations. Cohen's guidelines (Cohen, 1988) were used to interpret the strength of correlation between factors. (i.e. correlation between 0.5 and 1.0 is described as a "strong" effect size, between 0.3 and 0.5 as "moderate", and between 0.1 and 0.3 as "weak"). Eight sub-scales of the CEBQ were compared based on gender and parental combined weight groups using independent t-test, and based on age group using one-way analysis of variance (ANOVA). An hierarchical multiple linear regression analysis was carried out to examine the association between children's BMI z-scores as a continuous dependent variable and each eating behaviour subscale, controlling for age, gender, parental educational levels and parental combined weight groups. Finally, Pearson's correlation was tested between the CEBQ scales and maternal BMI, paternal BMI and children's BMI z-scores. All statistical analyses were carried out using SPSS Statistics 18.0.

Chapter Three: Results

3.1 Prevalence of obesity

3.1.1 Prevalence of obesity and overweight among parents

This cross-sectional study confirms that there is a very high proportion of obesity among adults in Saudi Arabia. Across 175 families, the obesity rate of the fathers was 34.3% and 48% were overweight, while only 17.7% were of normal weight. The mean BMI for fathers was 29.0 (SD 4.9, range 16.9 - 49.6) (Figure 3.1).

The prevalence of obesity among the mothers was, in fact, very similar to that of fathers. Around 34.3% of mothers were categorised as being obese, 38.2 % were overweight and 27.5% were normal of weight. The mean BMI for mothers was 28.2 (SD 5.1, range 17.1 - 44.6) (Figure 3.2).

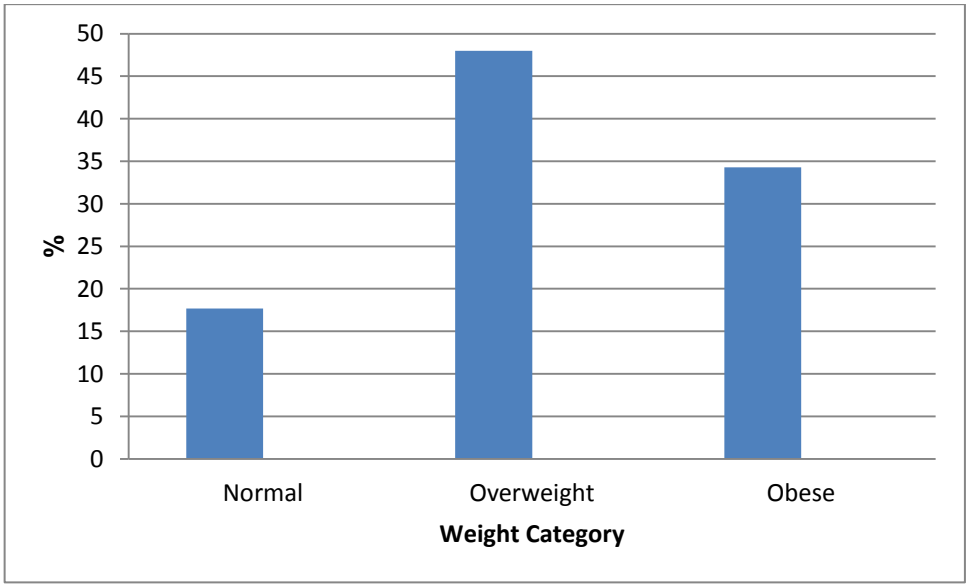

Figure 3.1 Prevalence of obesity (%) by category of the father's weight in the population sample.

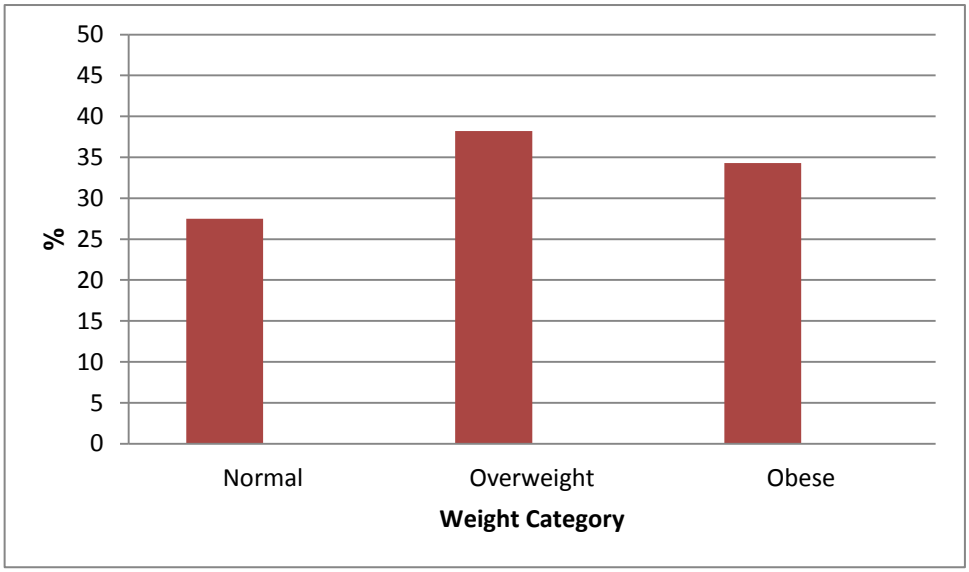

Figure 3.2 Prevalence of obesity (%) by category of the mother's weight in the population sample.

3.1.2 Prevalence of obesity and overweight among preschool children

In the whole sample of 200 preschool children aged 2-6 years, 72% of children were of normal weight, 18.5% were overweight and 9.5% obese (Figure 3.3). Among boys, 74% were normal, 6% overweight and 20% obese boys, while among girls 70% were normal, 13% overweight and 17% obese (Table 3.1).

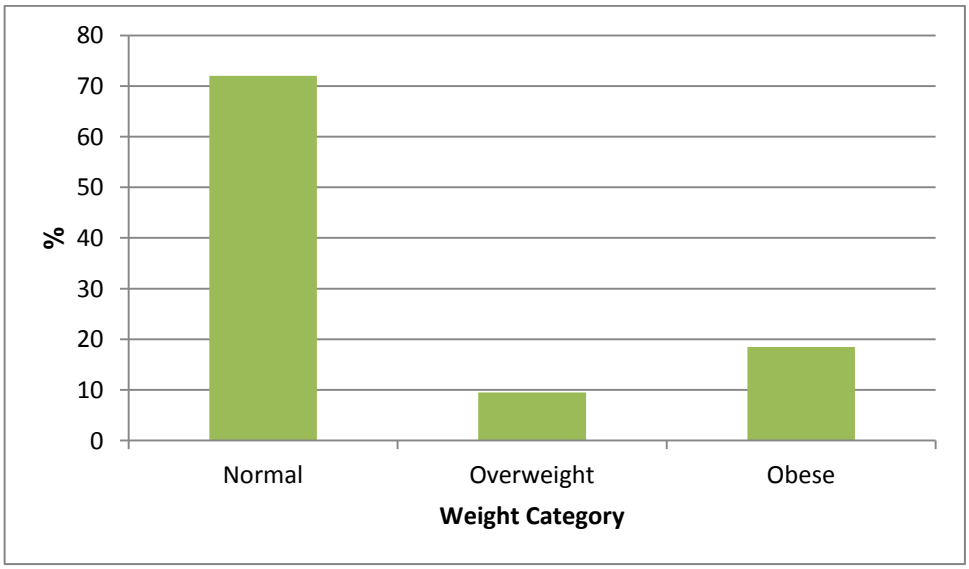

Figure 3.3 Prevalence of obesity (%) by category of the preschool children's weight in the population sample.

Table 3.1 Prevalence of obesity and overweight (%) in Saudi preschool children in the population sample grouped by gender.

Gender	Normal %	Overweight %	Obese %
Boys	74	6	20
Girls	70	13	17
Total	72	9.5	18.5

Twenty-eight percent of children in the 2 year age group were obese or overweight; this percentage increased to 32% for the 3 year age group, reaching a peak of 40% at age 4 and finally declining to 26% for the 5-6 year category. Figure 3.4 displays the prevalence of overweight and obesity over the four groups of preschool children aged 2-6 years.

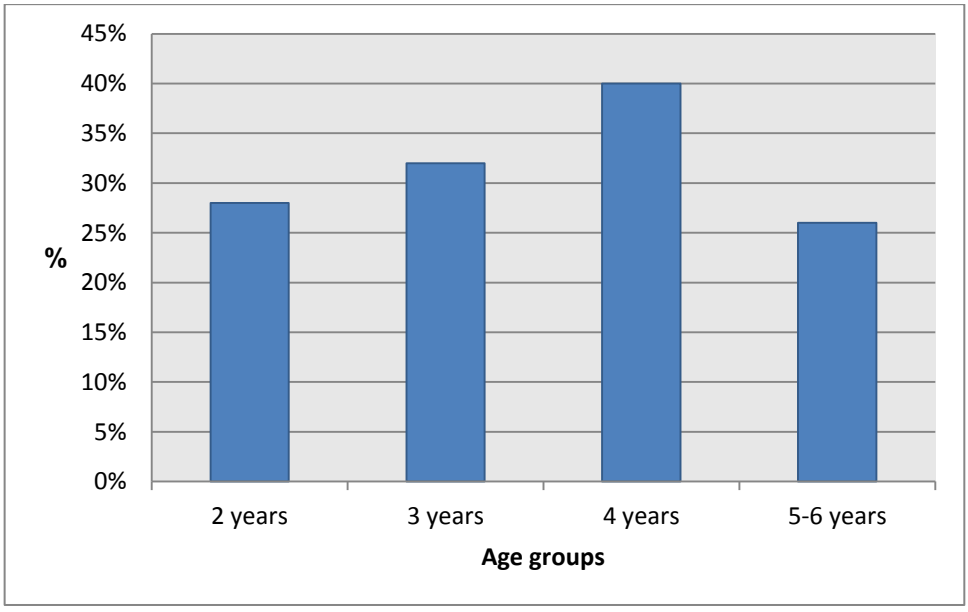

Figure 3.4 Prevalence of obesity and overweight (%) in preschool children in the population sample subdivided into four categories of age.

Based on the parents' combined weight, 72% (N=144) of the preschool children had 2 overweight parents, or at least one obese parent, while only 28% (N=56) of the children had 2 normal weight parents or one normal weight and one overweight parent.

In comparing normal weight preschool children with overweight and obese children based on their parents' combined weight, Figure 3.5 illustrates that 46% of normal children had at least one obese parent, 20% had two overweight parents and 34% had two normal weight parents or one normal weight and one overweight parent. For obese and overweight children there was a large percentage of 78.5% with at least one obese parent, 12.5% had 2 overweight parents and only 9% had 2 normal weight parents or one normal weight and one overweight parent.

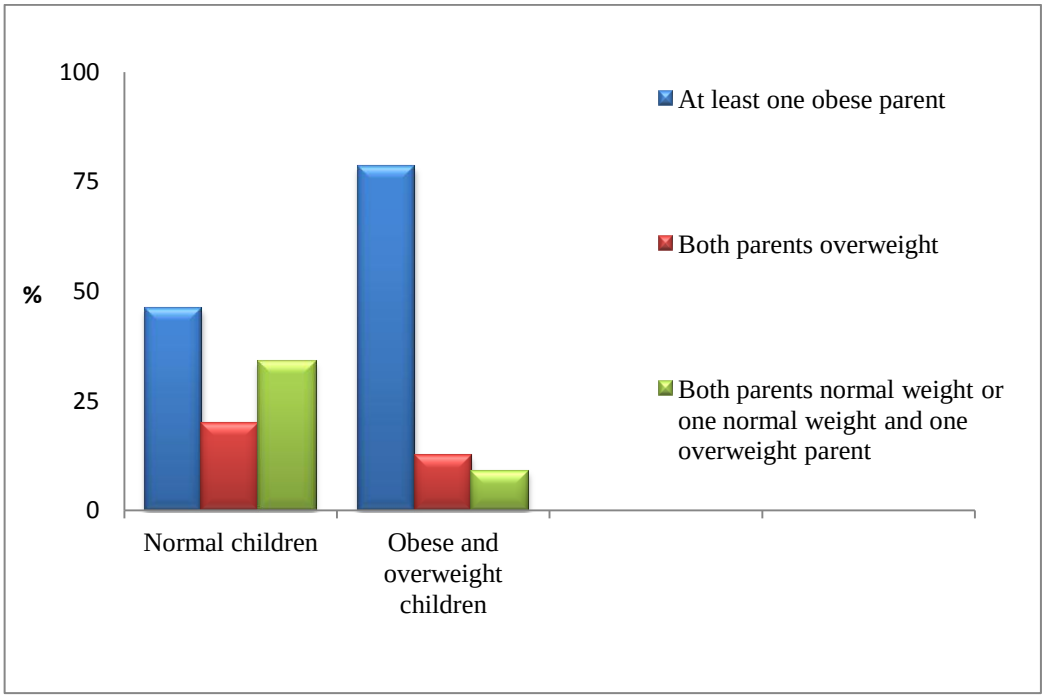

Figure 3.5 The body weight status of parents of children belonging to normal-weight vs. overweight and obese groups.

3.2 Factor analysis

The factor analysis revealed an eight-factor solution (EF, SE, EUE, DD, SR, FF, EOE, FR) and confirmed the original eight-factor structure. Each of the eight scales had one factor with an eigenvalue of more than one. The eight factors accounted for 60.17% of the total variance. Items loaded onto each factor ranged from 2 to 6 items (Table 3.2).

Most of the scale items loaded as expected but a few items warrant attention. Four items did not load as expected compared to the original study. Firstly, the item "My child eats more when anxious" did not load onto the expected factor EOE, but on EUE. Secondly, the item "My child decides that s/he doesn't like a food, even without tasting it", which loaded onto FF in the original study, now loaded onto the SR. Another item that did not load as expected was "My child eats more when s/he has nothing else to do". This item loaded onto the FR not onto the EOE. The item "My child is always asking for food" loaded onto the EF factor, and not onto its original factor FR.

Only three items loaded onto two factors. First of all, the item "My child enjoys a wide variety of foods" loaded most highly onto the FF factor (0.53) which it originally belonged, but was also loaded onto the EF factor (0.43). The item "My child is difficult to please with meals" originally belonging to the FF scale loaded onto FF and also FR, with the similar loading of 0.49 and 0.48 respectively. The item "My child eats less when s/he is tired" loaded onto the EUE scale on theoretical grounds (0.53) but also loaded onto the FR scale (0.42).

The three items "My child has a big appetite", "My child looks forward for mealtimes" and "Even if my child is full up, s/he finds room to eat his/her favourite food" loaded less than 0.4 and thus, were omitted to optimise the analysis (Svensson et al., 2011).

Table 3.2 Factor loadings on Direct Oblimin Rotation of Principal Components Analysis.

Scale name and items	Loading
Enjoyment of food EF (Factor 1; 23.05% variance)	
My child loves food	0.63
My child eats more when s/he is happy	0.51
My child is interested in food	0.42
My child is always asking for food	0.41
My child enjoys a wide variety of foods	0.43
Slowness in eating SE (Factor 2; 10.52% variance)	
My child finishes his/her meal quickly	0.81
My child eats slowly	0.7
My child takes more than 30 minutes to finish a meal	0.68
My child eats more and more slowly during the course of a meal	0.66
Emotional under-eating EUE (Factor 3; 6.79% variance)	
My child eats more when s/he is happy	0.43
My child eats less when upset	0.73
My child eats less when angry	0.69
My child eats less when s/he is tired	0.53
My child eats more when anxious	0.52
Desire to drink DD (Factor 4; 5.10% variance)	
If given the chance, my child would always be having a drink	0.91
If given the chance, my child would drink continuously throughout the day	0.9
My child is always asking for a drink	0.78
Satiety responsiveness SR (Factor 5; 4.27% variance)	
My child gets full before his/her meal is finished	0.79
My child gets full up easily	0.75
My child leaves food on his/her plate at the end of a meal	0.66
My child cannot eat a meal if s/he has had a snack just before	0.54
My child decides that s/he doesn't like a food, even without tasting it	0.43
Food fussiness FF (Factor 6; 3.89% variance)	
My child enjoys tasting new foods	0.76
My child is interested in tasting food s/he hasn't tasted before	0.72
My child enjoys a wide variety of foods	0.53
My child is difficult to please with meals	0.49
My child refuses new foods at first	0.43

Table 3.2 (Continued).

Scale name and items	Loading
Emotional overeating EOE (Factor 7; 3.43% variance)	
My child eats more when worried	0.76
My child eats more when annoyed	0.75
Food responsiveness FR (Factor 8; 3.12% variance)	
My child eats less when s/he is tired	0.42
My child is difficult to please with meals	0.48
If given the chance, my child would always have food in his/her mouth	0.65
Given the choice, my child would eat most of the time	0.52
My child eats more when s/he has nothing else to do	0.51
If allowed to, my child would eat too much	0.44

3.3 Internal reliability

The CEBQ subscales showed good internal reliability with Cronbach's alpha ranging between 0·62 and 0·80. In addition, all the average inter-item correlations of the scales are considered "good" ranging from 0.25 to 0.57 (Briggs & Cheek, 1986). Table 3.3 presents the results of internal reliability coefficients (Cronbach's alpha) and (average) inter-item correlations for the eight scales of the instrument.

A few items were omitted in order to improve reliability of the scales. For instance, the omission of item "My child finishes his/her meal quickly" from factor SE increased the Cronbach's alpha from 0.17 to 0.71. Cronbach's alpha of factor FF increased from 0.01 to 0.68 after "My child refuses new foods at first" and "My child is difficult to please with meals" were excluded. The items "My child eats less when s/he is tired" and "My child is difficult to please with meals" when excluded from factor FR improved the Cronbach's alpha from 0.52 to 0.76. Whenever omission of an item leads to improvement in the internal consistency of a scale, it means that the omitted items do not measure the same construct as the rest of other items in the scale, and thus had to be excluded in order to improve the internal consistency of the scale (Santos, 1999).

Table 3.3 Factor reliability of the CEBQ (N=200).

CEBQ scales	Cronbach's alpha	Average inter-item correlation
Enjoyment of food EF	0.76	0.4
Slowness in eating SE	0.71	0.45
Emotional under-eating EUE	0.62	0.25
Desire to drink DD	0.8	0.57
Satiety responsiveness SR	0.7	0.33
Food fussiness FF	0.68	0.41
Emotional overeating EOE	0.69	0.55
Food responsiveness FR	0.76	0.45

3.4 Correlations between scales

The correlations between scales (Table 3.4) suggest that the "food approach" subscales (EOE, FR, EF, DD) and the two "food avoidant" subscales (SR, SE) tend to be negatively inter-correlated, which is similar to previous work (Wardle et al., 2001; Sleddens et al., 2008; Svensson et al., 2011). In addition, moderate and positive correlations were found between the "food approach" subscales (EOE, FR, EF and DD), while "food avoidant" subscale EUE had weak positive correlations with all "food avoidant" and "food approach" subscales. The "food avoidant" subscale FF tends to have positive inter-correlations with "food approach" subscales and negative correlations with "food avoidant" subscales. Relatively, the highest correlation between any sub-scale was between FF and EF (r = 0.55).

Table 3.4 Pearson's correlations between the CEBQ sub-scales (N=200).

	EOE	FR	EF	DD	SR	SE	EUE	FF
EOE	-							
FR	**.42****	-						
EF	**.43****	**.51****	-					
DD	0.131	.25**	.26**	-				
SR	-.21**	-.35**	-.35**	-0.033	-			
SE	-0.11	-0.05	-.30**	.19**	**.41****	-		
EUE	0.115	0.08	.27**	.14*	**.17***	**.16***	-	
FF	.25**	.37**	.55**	.21**	**-.14***	**-.14***	**.16***	-

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Bold area upper-left corner: inter-correlations between 'food approach' subscales.

Bold area bottom right corner: inter-correlations 'food avoidant' subscales.

3.5 Age, gender and combined parental weight differences

The result showed that the effect of age on eating behaviours is not significant. Likewise, gender has no significant effect on eating behaviours except on FR. Boys scored higher than girls on FR (mean 2.2 (SD 1.1) versus 1.9 (SD 0.9), P = 0.04). Table 3.5 presents the gender and age differences in eating behaviour. The differences in children's eating behaviour by parental combined weight groups are illustrated in Table 3.6; FR was also the only factor that significantly differed between the parental combined weight groups. The group of at least one obese parent or two overweight parents scored higher than the group of two normal weight parents or one normal weight and one overweight parent on FR (mean 2.1 (SD 1.0) versus 1.8 (SD 0.8), P = 0.02).

Table 3.5 Gender and age differences in eating behaviour, eight-factor solution (N=200).

	Gender			Age				
	Boys (N = 100)	Girls (N = 100)		2 years (N = 56)	3 years (N = 40)	4 years (N = 35)	5-6 years (N = 69)	
	Mean (SD)	Mean (SD)	P a)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	P b)
Emotional overeating EOE	1.8 (0.9)	1.7 (0.8)	0.86	1.7 (0.8)	1.7 (0.8)	1.7 (0.9)	1.8 (0.8)	0.69
Food responsiveness FR	**2.2 (1.1)**	**1.9 (0.9)**	**0.04***	2.0 (1.0)	2.0 (0.9)	1.9 (0.9)	2.2 (1.1)	0.52
Enjoyment of food EF	3 (0.7)	2.9 (0.9)	0.23	2.9 (0.9)	2.8 (0.7)	2.7 (0.7)	3.1 (0.9)	0.21
Desire to drink DD	3.4 (1.0)	3.2 (1.1)	0.15	3.3 (1.0)	3.5 (1.1)	3.3 (1.1)	3.3 (1.1)	0.85
Satiety responsiveness SR	3.7 (0.8)	3.7 (0.7)	0.86	3.7 (0.7)	3.6 (0.7)	4 (0.9)	3.6 (0.8)	0.11
Slowness in eating SE	3.3 (1.1)	3.3 (1.1)	0.95	3.2 (1.0)	3.3 (1.0)	3.4 (1.1)	3.3 (1.1)	0.82
Emotional under-eating EUE	3.5 (0.9)	3.5 (0.8)	0.81	3.4 (0.9)	3.3 (0.9)	3.4 (0.8)	3.7 (0.9)	0.11
Food fussiness FF	2.7 (1.0)	2.5 (0.9)	0.09	2.8 (1.0)	2.5 (0.9)	2.4 (1.1)	2.7 (0.9)	0.26

a) P-value from t-test

b) P-value from one-way ANOVA

* P-value < 0.05

Table 3.6 The differences in children's eating behaviour by parental combined weight groups.

	Group 1 a) (N = 56)	Group 2 b) (N = 144)	P-value c)
	Mean (SD)	Mean (SD)	
Emotional overeating EOE	1.7 (0.8)	1.8 (0.8)	0.55
Food responsiveness FR	**1.8 (0.8)**	**2.1 (1.0)**	**0.02***
Enjoyment of food EF	2.9 (0.8)	3.0 (0.8)	0.43
Desire to drink DD	3.3 (1.1)	3.3 (1.1)	0.88
Satiety responsiveness SR	3.7 (0.7)	3.7 (0.8)	0.65
Slowness in eating SE	3.3 (1.1)	3.3 (1.1)	0.89
Emotional under-eating EUE	3.5 (0.8)	3.5 (0.9)	0.98
Food fussiness FF	2.5 (0.9)	2.6 (1.0)	0.35

a) Group 1: two normal weight parents or one normal weight and one overweight parent
b) Group 2: at least one obese parent or two overweight parents
c) P-value from t-test
* P-value < 0.05

3.6 Correlations between BMI z-scores and eating behaviours

No significant associations were found between children's BMI z-scores and eating behaviour subscales, when controlled for gender, age, parental combined weight groups and parental educational levels in regression analyses. In addition, children's BMI z-scores showed a linear increase with the "food approach" subscales of the CEBQ (β 0.017 to 0.114), and a decrease with "food avoidant" subscales (β -0.071 to -0.103) except for EUE which had a linear increase with BMI z-scores. Control variables such as child's gender, age, parental combined weight, maternal and paternal education levels, and paternal and maternal BMI, constrained into the models prior to adding each of the CEBQ scales, revealed standardised β coefficients (p-values) of 0.052 (p = 0.446), 0.023 (p = 0.729), 0.187 (p = 0.054), -0.011 (p = 0.887), -0.087 (p = 0.230), -0.088 (p = 0.247) and 0.220 (p = 0.009) respectively. Only maternal BMI significantly contributed to the model. The result of the regression analysis to model the subscales of the CEBQ is presented in Table 3.7.

Table 3.7 Hierarchical linear regression analyses for BMI z-scores on CEBQ subscales and some parental factors (N = 200).

Eating behaviours	Mean	Standard error (SD)	Standardised β	95% CI for Standardised β		P-value
				lower bound	upper bound	
"Food Approach"						
EOE	1.75	.058	.017	-.168	.213	.818
FR	2.05	.070	.114	-.062	.303	.193
EF	2.93	.059	.101	-.124	.376	.320
DD	3.34	.076	.050	-.090	.187	.492
"Food Avoidant"						
SR	3.70	.056	-.080	-.314	.105	.326
SE	3.31	.076	-.103	-.253	.054	.201
EUE	3.49	.061	.017	-.154	.196	.814
FF	2.64	.068	-.071	-.248	.095	.379

Significant positive correlations were identified between children's BMI z-scores and the "food approach" factors EOE ($r = 0.16$, $p = 0.02$), FR ($r = 0.23$, $p = 0.001$) and EF ($r = 0.24$, $p = 0.001$). On the contrary, children's BMI z-scores had a linear decrease with "food avoidant" subscales SR ($r = -0.17$, $p = 0.016$) and SE ($r = -0.16$, $p = 0.019$). The correlation between children's BMI z-scores and maternal BMI was positive and significant ($r = 0.31$, $p = 0.009$) and FR ($r = 0.15$, $p = 0.03$), while paternal BMI did not show any significant correlation with children's BMI z-scores or any of the CEBQ subscales. Table 3.8 presents the correlations between CEBQ subscales and children's BMI z-scores, maternal BMI and paternal BMI.

Table 3.8 Correlations between CEBQ scales and maternal BMI, paternal BMI and BMI Z-scores.

	BMI Z-scores		Maternal BMI		Paternal BMI	
	R	P-value	R	P-value	R	P-value
BMI Z-scores	-	-	**0.31****	**0.009**	0.03	0.62
Emotional overeating EOE	**0.16***	**0.02**	0.08	0.24	0.01	0.99
Food responsiveness FR	**0.23****	**0.001**	**0.15***	**0.03**	0.04	0.52
Enjoyment of food EF	**0.24****	**0.001**	0.08	0.27	0.03	0.64
Desire to drink DD	0.11	0.16	0.09	0.22	-0.08	0.23
Satiety responsiveness SR	**-0.17***	**0.016**	0.08	0.28	-0.05	0.47
Slowness in eating SE	**-0.16***	**0.019**	-0.02	0.74	-0.05	0.45
Emotional under-eating EUE	0.04	0.58	0.02	0.76	-0.03	0.68
Food fussiness FF	0.09	0.21	0.08	0.62	0.03	0.67

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Chapter Four: Discussion & Future Research

4.1 The importance of this study

This study is the first attempt to date to apply the Children's Eating Behaviour Questionnaire (CEBQ) instrument in samples of Saudi preschool children. It shows that the Saudi version of the CEBQ has good psychometric attributes with regard to factor structure, internal reliability and correlation between subscales, which is similar to validation studies in other geographic locations (Wardle et al., 2001; Sleddens, Kremers, & Thijs, 2008; Viana, Sinde, & Saxton, 2008; Svensson et al., 2011).

Most studies targeting eating behaviours and obesity are carried out in school-aged children and adolescents; however, the weight problems may have occurred earlier in life. Furthermore, young children go through many parent-enforced transitions in their every-day diet which points to the formation of children's eating habits being started by the end of the preschool period and becoming more stable (i.e., closer to the "adult diet") from that time on (Jansen et al., 2012). Conducting a study on eating behaviours, and defining children's and parents' eating habits and attitudes is important for designing interventions that promote healthy eating habits and a healthy weight as well as for understanding the behavioural dynamics of parents-versus-children consumption profiles.

The CEBQ is an important instrument in the exposure assessment of eating behaviours among children. The results derived from this study can be useful in understanding the aetiology of overweight and obesity in pre-school children in regard to their eating styles. In addition, differences across age, gender and other ethnic groups, as well as association with parental weight, can be used to recognise the eating habits contributing to the "epidemic" among children. Thus, based on these findings, proper programs and further biological studies can be done in the future to prevent obesity in early stages of life and thus promote the overall health of the Saudi population.

4.2 Prevalence of obesity among parents and children

In this study, the prevalence of overweight (18.5%) and obesity (9.5%) among Saudi preschool children perhaps resulted from the high prevalence of parental obesity. Across 175 families, it was found that 34.3% of fathers and 34.3% of mothers were obese while the overweight rates were 48% and 38.2% respectively for fathers and mothers. This study further shows that 91% of the overweight and obese children had at least one obese parent or two overweight parents, in contrast to 66% of healthy weight children that had at least one obese parent or two overweight parents. It is well known that obesity of the parents increases the risk of their children becoming obese (Whitaker et al., 1997). Obesity in children may partly be from the parents' genes, or because of sharing the same environment where parental eating habits powerfully shape children's eating behaviours. The results suggest that children's and parents' body weight are associated and the chance of the children becoming obese are higher when their parents are obese or overweight.

Garn et al. (1975) have reported previously that children whose parents are obese are four times more likely to develop obesity than children whose parents are lean. Also, Locard et al. (1992) demonstrated that parental obesity increased the risk of childhood obesity threefold when one parent was overweight. Similarly, Whitaker and colleagues (1997) reported a two- to three-fold increase in the obesity of children at all ages due to parental obesity.

4.3 Factor structure and internal reliability

This study revealed an eight-factor structure which conformed to the original UK structure (Wardle et al., 2001) and explained 60.17% of the variance. Although the original CEBQ had 35 items, only 31 items are presented (Table 3.2). The four missing items – “My child enjoys eating”, “My child looks forward to mealtimes”, “My child has a big appetite” and “Even if my child is full up s/he finds room to eat his/her favourite food” – had a loading below 0.4 and were excluded from the study. Furthermore, a few items did not load onto the expected original factors and were removed in the statistical analyses to improve the

internal reliability of the scales. The final eight-factor structure of the Saudi version of CEBQ was comparable with the original UK study and recent validation studies (Wardle et al., 2001; Sleddens, Kremers, & Thijs, 2008; Viana, Sinde, & Saxton, 2008; Svensson et al., 2011).

In comparison with previous studies into the factor structure, the Dutch study (Sleddens, Kremers, & Thijs, 2008) and the Swedish study (Svensson et al., 2011) revealed a seven-factor solution; in addition to the original subscales (EF, DD, SR, SE, EUE, FF), they combined the two "food approach" subscales FR and EOE into one factor called "overeating" to increase the internal consistency coefficient. On the other hand, the factor analysis of the Chinese study (Cao et al., 2012) also revealed a seven factor solution (SE, EUE, FF, DD, EOE), with the subscale FR split into two FR1 and FR2, but the two factors EF and SR could not be detected in their sample.

The CEBQ subscales showed good internal reliability with Cronbach's alpha ranging between 0·62 and 0·80. In comparison to previous studies, Cronbach's alpha ranged between 0·72 and 0·91 in the original UK study (Wardle et al., 2001), 0·70 and 0·89 in the Portuguese study (Viana, Sinde, & Saxton, 2008), 0.76 and 0.92 in the Canadian study (Spence, Carson, Casey, & Boule, 2011), 0.75 and 0.91 in the Dutch study (Sleddens, Kremers, & Thijs, 2008), 0.57 and 0.89 in the Chilean study (Santos et al., 2011), 0.52 and 0.80 in the Chinese study (Cao et al., 2012), and 0.71 and 0.90 in the Swedish study (Svensson et al., 2011). The final model of the factor structure and internal reliability in this study were very similar to the original CEBQ, which confirms the suitability of using the questionnaire for further analyses.

4.4 Age and gender differences in eating behaviours

No age effects were observed within the cohort for the Saudi version of the CEBQ. This result is similar to the findings of the Dutch version of CEBQ (Sleddens, Kremers, & Thijs, 2008), but in contrast to the original and other validation studies (Wardle et al., 2001; Ashcroft et al., 2007; Svensson et al., 2011). The disparity between the result of this study and that of the original and

other validation studies may have been caused by the variation in ages between their samples and the samples in this study. They had children as young as one year old (Svensson et al., 2011) and children over the age of seven (Wardle et al., 2001; Ashcroft et al., 2007), unlike this study where the children's age ranges from two to six.

In terms of gender, a significant difference between boys and girls in eating behaviour was only found in FR. The FR factor indicates a higher interest in food (e.g. "If allowed to, my child would eat too much" and "Given the choice, my child would eat most of the time"). Boys scored higher than girls (mean 2.2 (SD 1.1) versus 1.9 (SD 0.9), P = 0.04). This is in line with the outcome of the Chinese version of CEBQ (Cao et al., 2012), which suggests that boys seem to be more interested in food than girls. Similarly, Llewellyn et al. (2011) have developed and used the Baby Eating Behaviour Questionnaire and reported that female infants were slightly less responsive to food than male infants.

4.5 Association between children's BMI z-scores and eating behaviours

Cross-sectional associations between children's BMI z-scores and eating behaviours showed positive and strong associations between childhood obesity with "food approach" scales FR and EF, which is consistent with the majority of previous studies on associations between children's BMI z-scores and eating behaviours (Carnell & Wardle, 2007; Viana, Sinde, & Saxton, 2008; Sleddens, Kremers, & Thijs, 2008; Santos et al., 2011). Those studies suggested that children with a greater BMI are highly responsive to environmental food cues.

It was interesting to note that "food avoidant" scales SR and SE had significant negative associations with children's BMI z-scores, similar to earlier reports (Carnell and Wardle, 2007; Viana, Sinde, & Saxton, 2008; Sleddens, Kremers, & Thijs, 2008; Santos et al., 2011). EUE and FF were observed to have the weakest associations with children's BMI z-scores in previous studies (Viana, Sinde, & Saxton, 2008; Sleddens, Kremers, & Thijs, 2008; Santos et al., 2011). Indeed, the result confirms this finding as children's BMI z-scores showed no association

with these "food avoidant" scales. Viana et al. (2008) suggested that eating behaviours EUE and FF are not as strongly related to child weight. Similarly in this study, EOE was found to have positive and significant association with children's BMI z-scores. Other studies whose findings support this include Braet & Strien (1997), Viana, Sinde, & Saxton (2008) and Santos et al. (2011). However, the result contradicts the assertion made by some authors (Ashcroft et al., 2007; Sleddens, Kremers, & Thijs, 2008; Strien & Oosterveld, 2008; Jansen et al., 2012) who suggested that EOE onset occurs later in life, and that it seems to be a quite abnormal type of eating behaviour in young children. Finally, the "food avoidant" scale DD had no association with adiposity which replicated the result from previous research (Santos et al., 2011).

4.6 Associations between parental BMI, children's BMI z-scores and eating behaviours

An interesting finding is that maternal BMI had positive and highly significant correlations with children's BMI z-scores ($r = 0.31$, $p = 0.009$) and with "food approach" subscale FR ($r = 0.15$, $p = 0.03$), while results showed that the effect of paternal BMI on children's BMI z-scores and children's eating behaviours were not significant. This outcome reflects a stronger influence of maternal weight status on obesity in children than paternal weight status. This can be explained by the fact that women oftentimes act as children's principal caregiver within a family (includes providing meals) and/or that there is an epigenetic link between a child's propensity to gain weight and maternal adiposity during pregnancy (unknown in this case).

Several observational studies found that maternal obesity is a significant factor in the development of childhood obesity. Strauss & Knight (1999) studied the home environment influences on the development of obesity in children in a large sample of 2913 normal weight children aged between 0 and 8 years who were followed over 6 years. They found that maternal obesity was the most significant factor in the development of childhood obesity. Similarly, Santos et al. (2009) used the Child Feeding Questionnaire in a sample of preschool Chilean

population. They reported that there was a high correlation between the mother's BMI and the children's BMI z-scores which was reflected in the maternal influence on the child's weight. The mother's influence on the body weight and food preferences of the offspring can, at least in theory, stem from both creating the "environmental pressure" (i.e., providing the child with preselected food items containing particular amounts of macronutrients and fitting a certain set of flavour characteristics) as well as from the epigenetic pressure.

Furthermore, children with at least one obese parent or two overweight parents scored slightly higher than children with normal weight parents or one normal weight and one overweight parent on FR. This supports the findings of Wardle et al. (2001) who reported that preschool children of obese parents are more food-responsive to food cues than children from lean parents. The FR indicates a child's tendency to eat if given the chance. When children are more responsive to food cues, it increases the risk of overeating when the food supplies are high.

4.7 Limitations of the study

There are a few limitations of the present study that should be mentioned. As in any questionnaire study, body weights and heights were parentally reported, though, on several occasions medical personnel were asked to help measure the height and weight of children. It is possible that some of the participants may have under- or overestimated their BMI. Secondly, data collection took place at the KFMC which serves primarily Riyadh and the central province of Saudi Arabia. Follow up studies incorporating a larger sample size and a comparison between provinces would be of interest. Finally, the response rate was comparatively low (59.5%) and more than 65% of parents had university education level. It may mean that people with higher levels of education are more likely to participate in the study.

4.8 Future research

Future research should explore the difference in eating behaviours between Saudi preschool children and school-aged children. Some of the eating behaviours might develop and change over time as children get older. For instance, enjoyment of food could increase and food fussiness decrease when a child has more access to food, while speed of eating will increase as a child becomes older (Ashcroft et al., 2007). Conducting this study in a larger sample size of children would allow more comparisons between age groups and genders regarding eating behaviours and obesity. A sufficiently large sample size is important for the quality of the results and statistical tests. The findings in regards to eating behaviours and proportions of obesity among children will be more efficient and accurate if the height and weight of participants' children are measured directly. This can be done in primary schools and kindergartens rather than hospitals where the possibilities of finding children who are not suitable for the study are higher. An effort should be made to do this research in more than one province in Saudi Arabia as it is a large country and people from different regions might have different eating behaviours. This will confirm whether the results apply to the whole population of Saudi Arabia or not. Finally, since this study shows a high significant correlation between maternal and children's obesity, it would be interesting to focus on the association between maternal feeding practices and the child's eating behaviours.

4.9 Conclusion

This study is the first to validate the CEBQ in the Saudi Arabian context and assess children's eating behaviour in Saudi preschool children aged 2 to 6 years. Factor analysis revealed an eight-factor solution which confirmed the theoretical factor structure. There was no difference in eating behaviours between age groups 2 to 6 years, whereas boys scored slightly higher than girls on “food approach” subscale FR. The results confirm the positive associations between children's obesity and “food approach” subscales FR, EF and EOE, and the negative associations between children's obesity and the “food avoidant” subscales SR and SE, all of which were found in previous studies. Surprisingly, maternal BMI had positive and highly significant correlations with children’s BMI z-scores while the effect of paternal BMI on children's obesity was not significant. In conclusion, the findings of this present study support the use of the Children's Eating Behaviours Questionnaire (CEBQ) as a psychometric tool for assessing eating behaviours in Saudi preschool children.

Appendices

Appendix A: The Children's Eating Behaviour Questionnaire

Parents of children aged 2-6 years are invited to participate in this study. Please fill in this questionnaire about your child's eating behaviour. All the fields are required including parents' information. It should take around 20 minutes to complete this questionnaire; we really appreciate your time to help us in this study. Parents having two children aged 2-6 years old should pick up one questionnaire per child. Unfortunately, families having more than 2 children within the specified age group cannot participate.

1. **Information about the parents:**

Father: Height: _____cm. Weight: _____ Kg.

Education level: ☐Primary school ☐High school ☐College/University

Mother: Height: _____cm. Weight: _____ Kg.

Education level: ☐Primary school ☐High school ☐College/university

Who is filling in this questionnaire?

☐Father ☐Mother ☐Both

2. **Information about your child:**

What is your child's gender?
☐Boy ☐Girl

Height: _____cm. Weight: _____ Kg.

What is your child's date of birth?
__/__/20__

Does your child have any chronic diseases?
☐Yes ☐No
If yes, please name them: _____.

3. The Children's Eating Behaviour Questionnaire (CEBQ)

Please read the following statements and tick the boxes most appropriate to your child's eating behaviour.

	Never	Rarely	Some-times	Often	Always
My child loves food	☐	☐	☐	☐	☐
My child eats more when worried	☐	☐	☐	☐	☐
My child has a big appetite	☐	☐	☐	☐	☐
My child finishes his/her meal quickly	☐	☐	☐	☐	☐
My child is interested in food	☐	☐	☐	☐	☐
My child is always asking for a drink	☐	☐	☐	☐	☐
My child refuses new foods at first	☐	☐	☐	☐	☐
My child eats slowly	☐	☐	☐	☐	☐
My child eats less when angry	☐	☐	☐	☐	☐
My child enjoys tasting new foods	☐	☐	☐	☐	☐
My child eats less when s/he is tired	☐	☐	☐	☐	☐
My child is always asking for food	☐	☐	☐	☐	☐
My child eats more when annoyed	☐	☐	☐	☐	☐
If allowed to, my child would eat too much	☐	☐	☐	☐	☐
My child eats more when anxious	☐	☐	☐	☐	☐
My child enjoys a wide variety of foods	☐	☐	☐	☐	☐
My child leaves food on his/her plate at the end of a meal	☐	☐	☐	☐	☐
My child takes more than 30 minutes to finish a meal	☐	☐	☐	☐	☐

	Never	Rarely	Some-times	Often	Always
Given the choice, my child would eat most of the time	☐	☐	☐	☐	☐
My child looks forward to mealtimes	☐	☐	☐	☐	☐
My child gets full before his/her meal is finished	☐	☐	☐	☐	☐
My child enjoys eating	☐	☐	☐	☐	☐
My child eats more when s/he is happy	☐	☐	☐	☐	☐
My child is difficult to please with meals	☐	☐	☐	☐	☐
My child eats less when upset	☐	☐	☐	☐	☐
My child gets full up easily	☐	☐	☐	☐	☐
My child eats more when s/he has nothing else to do	☐	☐	☐	☐	☐
Even if my child is full up s/he finds room to eat his/her favourite food	☐	☐	☐	☐	☐
If given the chance, my child would drink continuously throughout the day	☐	☐	☐	☐	☐
My child cannot eat a meal if s/he has had a snack just before	☐	☐	☐	☐	☐
If given the chance, my child would always be having a drink	☐	☐	☐	☐	☐
My child is interested in tasting food s/he hasn't tasted before	☐	☐	☐	☐	☐
My child decides that s/he doesn't like a food, even without tasting it	☐	☐	☐	☐	☐
If given the chance, my child would always have food in his/her mouth	☐	☐	☐	☐	☐
My child eats more and more slowly during the course of a meal	☐	☐	☐	☐	☐

Appendix B: Participant Information Sheet

Participant Information Sheet

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Project Title

OBESITY AND EATING BEHAVIOUR AMONG PRESCHOOL CHILDREN IN SAUDI ARABIA

Purpose

This research is conducted as partial requirement for a Master degree in the Biological Sciences at Waikato University, New Zealand.

What is this research project about?

'The purpose of the research is to investigate and to know the distribution of obesity among Saudi preschool children. It is also to study the distribution of eating behaviour patterns among the children. It has been suggested that eating behaviour patterns among children is related to the development of obesity. In this study we will also study the relationship between eating behaviour and children's age, gender and parental weight and height'.

What will you have to do and how long will it take?

The researcher invites you to complete a survey questionnaire at your home. The survey should take no longer than 20 minutes to complete. After completing the survey, you are asked to either mail it (if hard copy in the envelope supplied) or email (if electronic copy)

back to the researcher. Your participation is voluntary and you are free to decline to participate, or to not answer any question that you do not wish to.

What will happen to the information collected?

The information collected will be used by the researcher to write a research thesis for a Master degree in the Biological Sciences at Waikato University, New Zealand. It is possible that journal articles and conference presentations may be the outcome of the research. Only the researcher and supervisor will see the data you provide in the survey. The researcher will keep a copy of the completed survey questionnaire but will treat it with the strictest confidentiality. No participants who complete surveys will be named in the publications and personal information is not required in this study such as names, identifications and contact numbers. Any personal information that may be given through returning the surveys e.g. email addresses, will not be kept.

Declaration to participants

If you take part in the study, you have the right to:

- *Ask any further questions about the study that occurs to you during your participation.*
- *Be given access to a summary of findings from the study when it is concluded.*

Who's responsible?

If you have any questions or concerns about the project, either now or in the future, please feel free to contact either:

Researcher: Ali Alhamad

Email: ahma6@students.waikato.ac.nz

Supervisor: Dr Pawel Olszewski

Email: pawel@waikato.ac.nz

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