A Comparative Study of Prevalence of Overweight and Obesity in Children in Different Provinces of Saudi Arabia

by Mohsen A. F. El-Hazmi[a] *and* Arjumand S. Warsy[b]

[a] *Department of Medical Biochemistry, College of Medicine & King Khalid University Hospital, King Saud University, Riyadh, Saudi Arabia*

[b] *Department of Biochemistry, College of Science, King Saud University, Riyadh, Saudi Arabia*

Summary

The aim of this study was to determine the prevalence of overweight and obesity in Saudi children from different provinces of the country and in different age groups. A total of 12 701 children (6281 boys and 6420 girls) with ages ranging from 1 to 18 years were enrolled during a household screening programme in different provinces of Saudi Arabia and height and weight were recorded. Body Mass Index (BMI) was calculated and applying age and sex specific cut-off points for BMI the children were grouped into overweight and obese. The overall prevalence of overweight was 10.68 and 12.7 per cent and that of obesity was 5.98 and 6.74 per cent in the boys and girls, respectively. In the different provinces the prevalence of overweight ranged from 8.8 to 27.4 per cent and from 9.3 to 27.6 per cent and obesity ranged from 4.7 to 10.4 per cent and from 4.3 to 13.8 per cent in the boys and girls, respectively. Prevalence of overweight and obesity was also calculated after grouping the children into 17 groups according to age. It is concluded that overweight and obesity occur in all provinces of Saudi Arabia although at a variable prevalence. In general, girls have a higher prevalence of both overweight and obesity compared with boys. Eastern province children have the highest prevalence and the Southern province children have the lowest prevalence of overweight and obesity. When grouped according to age, overweight and obesity tend to increase with age. Suggestions are made to prevent overweight and obesity development in Saudi children.

Introduction

Obesity has been recognized from the Stone Age, as judged from some of the ancient drawings and sculptures. In ancient times female obesity represented fertility and was viewed as a maternal symbol. As far back as the time of Hyppocrates, it was recognized that obesity affects health, and some of the writings of Hyppocrates state 'Sudden death is more common in those who are naturally fat than in the lean'.[1] It is now well recognized that obesity is linked to ill health and may be an underlying cause of diabetic mellitus, hypertension, arteriosclerosis and cardiovascular disease, coronary heart disease and certain types of cancer.[2–11] In addition, it has been clearly shown that increase in weight gain contributes to early mortality.[12–15] The major causes of obesity are both genetic and environmental. Among the environmental factors are included physical inactivity and an unhealthy eating pattern. In addition, it has been suggested that the behavioral parameters (i.e., diet and physical activity), which are major aetiological factors in the development of obesity and an increased risk for chronic diseases, have their roots in childhood.[16,17] Obesity prevalence is high in children in many populations of the world and several studies have shown that there has been a significant increase in this prevalence.[18–38] The special concern is that obese children grow to be obese adults and hence it is necessary to control overweight and obesity in children.[39]

The most frequently used method for measuring overweight and obesity in adults is based on values of Body Mass Index (BMI).[40,41] In children, several studies have used the 85th and 95th centiles of BMI for age and sex as cut-off points to identify overweight and obesity.[41] However, this has been considered unsatisfactory.[42,43] Cole, *et al*,[44] used pooled international data and developed age and sex specific cut-off points for BMI to classify overweight and obese children. We applied these cut-off points to classify Saudi children, with ages ranging from 1 to 18 years, as overweight or obese in different provinces of Saudi Arabia, in an attempt to determine the prevalence in each province and to compare the different provinces of Saudi Arabia.

Correspondence: Prof. Dr Mohsen A. F. El-Hazmi, Medical Biochemistry Department & WHO Collaborating Centre for Haemoglobinopathies, Thalassaemias and Enzymopathies, College of Medicine & King Khalid University Hospital, P.O. Box 2925, Riyadh 11461, Saudi Arabia. Tel. 4670831; Fax 4672575. E-mail <mohsen@ksu.edu.sa>.

Materials and Methods

The study was carried out as part of a National Study for Diabetes Mellitus in five provinces of Saudi Arabia, shown in Fig. 1, from 1994 to 1998. The screening was based on a 'household screening programme' in which the different provinces were divided into sectors. In randomly selected sectors, every 10th house on every 10th street was included in the study. The phone number of the family was obtained from the local health center and the family was first contacted by phone. The purpose of the study was explained and they were invited to join in the study. Ninety-five per cent of the families contacted volunteered to join. An early morning visit was made on a mutually agreed date and essential details of each family member were recorded. Only children and adolescents aged 1–18 years were included in the study.

Essential details, i.e., age and sex, were recorded on specially designed forms. Height was recorded using a tape measure, with the subject standing straight next to the wall, without shoes. The head was kept erect and height was measured to the nearest 0.1 cm. Weight was recorded on a measuring scale which was calibrated at the beginning of each working day. The weight was recorded by taking two successive readings to the nearest 100 g, when the individual was wearing light clothes and was bare footed.

The Quelelet index or the BMI was calculated using the formula:

$$\text{BMI} = \frac{\text{weight}\,(\text{kg})}{\text{height}^2\,(\text{m})}$$

Results

The final study group included 12 701 children (6281 boys and 6420 girls) with ages ranging from 1 to 18 years. The number of children from each province is shown in Fig. 1. Using the cut-off points proposed for each age group by Cole, *et al.*[44] (Table 1) the

TABLE 1
International cut-off points[a] *for BMI for overweight and obesity by sex between 2 and 18 years*

Age (years)	BMI (kg/m^2)			
	Overweight		Obese	
	Boys	Girls	Boys	Girls
2	18.4	18.0	20.1	20.1
3	17.9	17	19.6	19.4
4	17.8	17.3	19.3	19.1
5	17.4	17.1	19.3	19.2
6	17.6	17.3	19.8	19.7
7	17.9	17.8	20.6	20.5
8	18.4	18.3	21.8	21.6
9	19.1	19.1	22.8	22.8
10	19.8	19.9	24.0	24.1
11	20.0	20.7	25.1	20.4
12	21.2	21.7	26.0	26.7
13	21.9	22.6	26.8	27.8
14	22.8	23.3	27.8	26.6
15	23.3	23.9	28.3	29.1
16	23.9	24.4	28.9	29.4
17	24.5	24.7	29.4	29.7
18	25.0	25.0	30.0	30.0

[a] Adapted from reference 44.

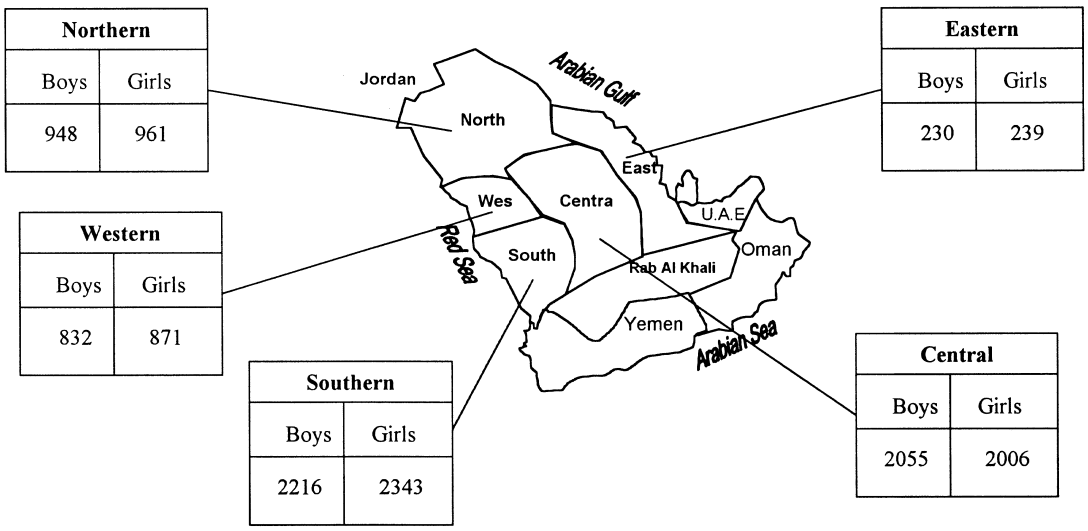

FIG. 1. Sketch map of Saudi Arabia showing the number of boys and girls screened during this study.

number of overweight and obese boys and girls were counted.

The overall prevalence of overweight and obesity in the total Saudi children is presented in Table 2. The number of overweight girls was greater than the number of overweight boys and the difference in prevalence was statistically significant.

The prevalence values of overweight and obesity in the boys and girls in different provinces are presented in Table 3. In each province overweight was significantly more prevalent in girls compared to boys ($p < 0.05$), except in the western province where there were more overweight boys than girls ($p > 0.05$) and in the eastern province where the prevalence was almost equal ($p > 0.05$). Similarly, obesity prevalence was more in the girls compared to boys, except in the southern province where the prevalence was almost equal. However, the difference in the prevalence of obesity was not different statistically between the provinces.

In each province, the children were grouped according to age in 17 groups and the prevalence of overweight and obesity in the boys and girls are presented in Tables 4 and 5, respectively. In each province overweight and obesity patterns differed in different age groups.

Discussion

Overweight and obesity are considered as an 'epidemic' in many countries of the world, including developed and developing countries.[35] It is reported that the BMI shows a complex pattern of distribution that varies with sex, age, socioeconomic circumstances, race, geography, and over time.[46] The epidemiological transition seen in the developing countries as a result of urbanization, migration, new eating habits, and recent affluence are considered as some of the factors playing a role in the development of obesity and overweight.[46] Prevalence of obesity varies greatly in different populations of the world. In China prevalence of obesity is 2.2 and 1.9 per cent in 0–7-year-old boys and girls,[27] while in American Indians the prevalence rates reach values above 20 per cent.[31] Comparing the results in Saudi children with those of other populations,[25–38] places Saudi Arabia in an intermediate position for both overweight and obesity. It has a prevalence of overweight less than that found in children from Germany, America, Canada, American-Indian, north western Spain and Britain, but has values higher than those in the Netherlands, Italy, and China. Obesity prevalence in Saudi children is lower than that in children from Germany, America, South Africa, Italy, Britain and American-Indian, but is higher than that in

TABLE 2
Prevalence (%) of obesity and overweight in total Saudi children

Boys[a]					Girls[a]				
No. investigated	Overweight		Obese		No. investigated	Overweight		Obese	
	No.	(%)	No.	(%)		No.	(%)	No.	(%)
6281	671	(10.68)	376	(5.98)	6420	813	(12.7)	433	(6.74)

[a] Significance of the difference in the prevalence between boys and girls: Overweight; $\chi^2 = 19.189$, $p < 0.0001$; (ii) Obesity, $\chi^2 = 2.935$, $p > 0.05$.

TABLE 3
Prevalence of overweight and obesity in Saudi children from different provinces

Provinces	Boys				Girls				Significance[a]			
	Overweight		Obese		Overweight		Obese		Overweight		Obese	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	χ^2	p	χ^2	p
Central	199	(9.7)	131	(6.4)	250	(12.5)	148	(7.4)	9.839	0.0017	1.444	0.229
Eastern	63	(27.4)	24	(10.4)	66	(27.6)	33	(13.8)	0.0029	0.956	0.250	0.616
Northern	114	(12.0)	66	(7.0)	158	(16.4)	77	(8.0)	7.259	0.007	0.615	0.40
Western	100	(12.0)	51	(6.1)	81	(9.3)	73	(10.2)	3.03	0.081	2.878	0.090
Southern	195	(8.8)	104	(4.7)	258	(11.0)	102	(4.3)	5.981	0.0145	0.231	0.630

[a] Significance of the difference in the prevalence in boys and girls.

TABLE 4
Prevalence of overweight in boys and girls of different age groups in different provinces of Saudi Arabia

Age (years)	Overweight boys (%)					Overweight girls (%)				
	CP	EP	NP	WP	SP	CP	EP	NP	WP	SP
1–2	–	–	–	–	–	–	–	–	–	–
2–3	2.6	–	–	16.7	8.3	7.4	–	–	–	–
3–4	2.5	–	13.3	–	4.7	9.1	–	–	6.3	5.1
4–5	9.7	23.6	–	3.3	1.7	9.2	11.1	8.0	2.2	1.7
5–6	1.8	25.0	6.7	2.0	1.9	3.2	14.3	7.7	2.2	1.1
6–7	4.0	12.5	5.3	2.3	4.7	4.4	20.0	16.2	–	5.3
7–8	6.4	36.8	6.9	9.1	5.2	11.0	26.1	7.9	7.1	4.0
8–9	7.1	35.0	17.6	3.7	4.7	6.4	33.3	17.0	8.2	8.0
9–10	6.0	42.1	14.6	13.8	5.6	12.5	41.2	10.8	8.6	9.0
10–11	8.7	29.4	13.2	22.4	6.0	13.9	46.2	14.5	13.8	16.2
11–12	10.2	41.2	3.6	14.7	8.6	13.9	33.3	8.1	12.7	18.5
12–13	11.1	26.3	15.2	16.4	10.9	11.1	15.4	15.8	7.5	13.1
13–14	14.3	35.7	14.1	16.0	9.0	14.4	23.1	19.6	12.5	8.3
14–15	16.8	20.0	17.1	11.8	15.7	15.5	40.0	16.9	8.9	15.7
15–16	19.1	15.4	16.9	17.2	13.6	22.5	16.7	18.3	14.5	10.3
16–17	15.4	14.3	7.6	20.0	12.8	16.4	14.3	24.7	12.7	12.8
17–18	16.4	22.7	13.1	11.1	16.0	19.8	29.0	23.1	14.7	16.4

CP = central province; EP = eastern province; NP = northern province; WP = western province; SP = southern province.

TABLE 5
Prevalence of obesity in boys and girls of different age groups in different provinces of Saudi Arabia

Age (years)	Obese boys (%)					Obese girls (%)				
	CP	EP	NP	WP	SP	CP	EP	NP	WP	SP
1–2	–	–	–	–	–	–				
2–3	17.9	–	12.5	16.7	16.7	14.8		25.0	21.1	
3–4	10.1	33.5	6.7	15.4	9.3	11.7	25.0	16.7	12.5	2.6
4–5	8.8	35.3	9.5	6.6	8.6	10.3	22.2	8.0	9.3	8.3
5–6	7.9	18.8	16.7	9.1	4.6	9.6	14.3	7.7	15.6	4.3
6–7	6.7	25.0	7.9	9.3	7.8	7.8	25.0	13.5	6.1	6.7
7–8	4.0	10.5	17.2	–	3.9	3.4	34.8	13.2	7.1	5.3
8–9	3.5	–	7.8	1.9	5.3	7.6	23.9	10.6	6.1	5.6
9–10	5.2	5.3	8.3	–	5.6	2.6	5.9	8.1	5.7	3.5
10–11	4.0	–	3.9	–	2.5	4.2	7.7	14.5	3.1	4.1
11–12	6.1	5.9	1.2	8.8	5.6	6.9	6.7	7.0	–	2.65
12–13	3.7	5.3	3.3	1.6	6.7	5.6	–	5.3	6.0	2.85
13–14	7.5	7.1	3.8	4.0	4.2	7.6	15.4	3.6	5.4	3.1
14–15	5.9	10.0	4.8	3.9	1.7	7.3	–	5.6	14.3	5.75
15–16	6.4	15.4	9.6	14.1	2.9	9.4	–	3.2	12.9	5.14
16–17	7.7	–	5.1	12.5	4.2	10.3	14.3	12.3	5.5	4.05
17–18	9.2	–	13.1	8.6	3.8	7.6	6.5	7.4	13.7	3.72

CP = central province; EP = eastern province; NP = northern province; WP = western province; SP = southern province.

China and is almost the same as in north-western Spain.[18–38]

Within the Saudi children, the girls have a higher prevalence of both overweight and obesity, although the former is significantly higher but not the latter. In a study on adult Saudis, it was shown that overweight and obesity prevalence is significantly high among the Saudis, where Saudi males have a significantly higher prevalence of overweight, while the Saudi females have more obesity.[45]

Inter-provincial differences are significant in Saudi Arabia. The highest prevalence of both obesity and

overweight are in the boys and girls from the eastern province and the lowest prevalence is in the boys from the southern province. Girls from the western province have lowest prevalence of overweight, while girls from southern province have the lowest prevalence of obesity. Such differences in different regions of the same country have been reported in other studies and may be a result of different eating habits, different degrees of physical activities, and different types of food. In addition, genetics play an important role in influencing the prevalence of overweight and obesity. Genetically the Saudi people in the south are slim and small, while the people in the northern and central Saudi Arabia are well built, taller and stronger. To some extent climate may also influence the build of these people. Another recent trend is the use of 'fast foods'. In the large cities, such as Riyadh, Jeddah, and Dammam, 'fast foods' are much more easily available and popular among children and hence may be one of the causes of the higher prevalence of overweight and obesity in the big cities. In the southern provinces, the epidemiological transition seen in other provinces is much slower and the population still relies largely on traditions and traditional foods and this may influence the prevalence of obesity in this region.

It has been well documented that obese children are at an increased risk of obesity as adults[39] and hence it is suggested that successful prevention of obesity during childhood may reduce the risk of adult obesity, which in turn will reduce the risk of several other chronic non-communicable diseases, particularly heart diseases. It is therefore necessary to increase awareness about overweight and obesity in Saudi Arabia. Alterations in lifestyle are required to provide increased physical activity both at home and school. Time spent on the computer must be decreased, while outdoor activities must be encouraged. In addition, unhealthy eating patterns must be changed. This includes a certain restriction on the intake of fast foods. These are rich in fat and carbohydrates and hence play an important role in increasing weight. Good habits about healthy living developed during young age stay throughout life, and play an important role in influencing health later in life.

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