# THE PREVALENCE OF OBESITY AND OVERWEIGHT IN 1-18-YEAR-OLD SAUDI CHILDREN

Mohsen A.F. El-Hazmi, PhD, FRCPath; Arjumand S. Warsy, PhD

**Objectives:** The aim of this study was to review the prevalence of overweight and obesity in Saudi children with ages ranging up to 18 years.

**Subjects and Methods:** The study was a cross-sectional national epidemiological household survey, and the study group included 12071 children (boys 6281; girls 6420), with ages ranging from 1-18 years. Their height and weight were measured and body mass index (BMI) was calculated. The study group was classified as obese or overweight, using age- and sex-specific cut-off points for BMI for determining overweight and obesity in children.

**Results:** The overall prevalence of overweight was 10.7% and 12.7% in the boys and girls, respectively, and obesity was 6.0% and 6.74% in the two groups, respectively. The children were grouped according to the province to which they belonged, and prevalence of obesity and overweight were calculated for each province. The highest frequency was in the Eastern Province, while the lowest was in the Southern Province. The children were further grouped into 1-6, 6-12 and 12-18-year-olds and prevalence of obesity and overweight was calculated. In addition, at yearly intervals, the prevalence of obesity and overweight was calculated. Among the boys and girls, the maximum prevalence of obesity was in the 2-3 year-olds. A decrease in prevalence was found in both males and females up to the age group of 8-13 years, and then the prevalence increased again up to the 18 years age.

**Conclusion:** This epidemiological household survey shows the overweight and obesity trends in Saudi children based on the international sex-specific cut-off points for BMI. It also shows a variable prevalence in different age groups until after 13 years, when the prevalence rate increases.

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**Key words:** Body mass index, obesity, overweight.

Obesity is an important nutritional disorder in most of the developed countries, and is assuming an issue of increasing significance in the developing ones.[1] Among children worldwide, the prevalence of obesity is rapidly increasing,[2-24] and is considered as an important underlying factor for development of hyperlipidemias, hypertension, hyper-insulinemia and early atherosclerosis.[25-34] These are all high-risk factors for the development of chronic heart diseases. Generally, obese children grow to be obese adults, and hence it is agreed that childhood obesity should be prevented.[35] This raises the question as to how one defines childhood obesity. In adults, the body mass index (BMI) is widely used as a measure of normal weight (BMI <25 kg/m$^2$), overweight (BMI between 25-<30 kg/m$^2$), and obesity (BMI $\geq$30 kg/m$^2$).[36-37] These cut-off values are measure obesity.[39] In children, the BMI changes substantially with age, and it is shown that at birth the median BMI is around 13 kg/m$^2$, at age of one year it is 17 kg/m2 and decreases to 15.5 kg/m$^2$ at age 6, and then increased to 21 kg/m$^2$ at age 20. Hence, the cut-off point needs to be related to age to define childhood obesity.[39] Many studies have used reference centiles and in most studies, the 85th and 95th centiles of BMI for age and sex have been used as cut-off points to identify overweight and obesity in children.[2-24,34] However, this has been considered unsatisfactory, and hence a workshop organized by the International Obesity Task Force proposed that the adult cut-off points be linked to body mass index centiles for children to provide child cut-off points.[40,41] Cole and coworkers used pooled international data and developed age- and sex-specific cut-off points for BMI for overweight and obesity in children, using data set specific centiles linked to adult cut-off points (i.e., BMI 30 kg/m$^2$), that can be used worldwide.[42]

We applied the cut-off points recommended by Cole et al.[42] to our studies on Saudi children with ages ranging from 1-18 years, and classified the children as normal,

From the Department of Medical Biochemistry, College of Medicine, King Khalid University Hospital and King Saud University, Riyadh, Saudi Arabia.

Address reprint requests and correspondence to Prof. Dr. El-Hazmi: Medical Biochemistry Department & WHO Collaborating Centre for Haemoglobinopathies, Thalassaemias and Enzymopathies, College of Medicine & King Khalid University Hospital, PO Box 2925, Riyadh 11461, Saudi Arabia. E-mail: mohsen@ksu.edu.sa

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overweight and obese. In this paper we present the prevalence of overweight and obese in Saudi children.

## Subjects and Methods

This study was a part of an extensive national project on various aspects of diabetes mellitus which was conducted in different areas of Saudi Arabia from 1994 to 1998. The screening involved a "household screening program" in which each area was divided into several sectors. Sectors were randomly selected and every tenth house on every tenth road, was included for the study. The family was contacted by phone and invited to join in the study. Only those who volunteered were included. Decline rate was <5%. The families were requested to remain in a fasting state and, on a mutually agreed date, an early morning visit was made. Relevant details were recorded on specially prepared forms. Height was recorded using a measuring tape, with individuals standing and without shoes. Each individual was asked to stand straight next to the wall. The head was kept erect and the height was measured to the nearest 0.1 cm. Weight was recorded on a measuring scale calibrated daily at the beginning of each working day. The weight was recorded by taking two successive readings to the nearest 100 g, when individuals were wearing light clothes and were bare footed.

The height and weight data were used to calculate the quetelet index or the BMI using the formula:

Weight (kg)/height$^2$(m$^2$).

The final study included 12,701 children with ages ranging from 1 to 18 years. There were 6281 boys and 6420 girls. All individuals above the age of 18 years were excluded. By applying the cut off-points for BMI for overweight and obesity by sex, using the standard international definition for child overweight and obesity,[42] their prevalence was calculated in the girls and boys separately. Chi square analysis was applied to determine the statistical significance of the difference in obesity and overweight prevalence in the boys and girls.

## Results

There were 671 overweight and 376 obese boys in the total group, while there were 813 overweight and 433 obese girls. This gave a prevalence of overweight as 10.68% and 12.7% and the prevalence of obesity as 5.99% and 6.74% in the boys and girls, respectively. The children were grouped according to the province to which they belonged and the prevalence of overweight and obesity was calculated in each province. Figure 1 shows the prevalence of overweight and obesity in the different provinces of Saudi Arabia. The total data from all children, irrespective of the province to which the children belonged, were pooled together and the children were grouped into 1-6 years, 6-12 years, 12-18 years and 6-18 years age group and the prevalence of overweight and

FIGURE 1. Prevalence of overweight and obesity in Saudi children from different regions.

obesity were calculated separately in the boys and girls. The results in the different groups are presented in Table 1. A significant increase in the prevalence of overweight was observed in both boys and girls with age. However, obesity was more in the 1-6 years age group and decreased in the 12-18 years age group significantly in both boys and girls. The children were then grouped further into 17 age groups on the basis of yearly age intervals and the prevalence of overweight and obesity was calculated in each age group. The results are presented in Table 2. Prevalence of overweight increased in both boys and girls and the highest prevalence was in the 15-16 years old boys and 17-18 years old girls. Obesity prevalence was highest in the 2-3 years olds, where 16.4% boys and 13.7% girls were obese. The lowest prevalence of obesity was in the 10-11 years old boys and 9-10 years old girls. A slight increase was observed in the prevalence of obesity in both boys and girls beyond this age group.

## Discussion

In the last few decades, an "epidemic" of obesity has been reported in many developed countries of the world.[4] The term "epidemic" of obesity implies that obesity is a characteristic of the populations not only of individuals. A recent paper reviewed the increase in the population prevalence of overweight and obesity in several countries. Finland, New Zealand, the United Kingdom, the United States and Western Samoa showed a large increase in prevalence, whereas some other countries showed only a slight increase.[2]

Several studies have reported prevalence of overweight or/and obesity in school children with ages ranging from 7-14 years, applying the 85th percentile and 95th percentile as cut-off points for overweight and obesity, respectively,

TABLE 1. *Prevalence of obesity and overweight in Saudi children in different age groups.*

| | 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) |

TABLE 2. *Prevalence of overweight and obesity in Saudi children 1-18 years old.**

| | Boys | | | Girls | | |
|---|---|---|---|---|---|---|
| Age group (years) | No. investigated | Overweight (%) | Obese (%) | No. investigated | Overweight (%) | Obese (%) |
| 1-<2 | 25 | 0 (0) | 0 (0) | 21 | 0 (0) | 0 (0) |
| 2-<3 | 73 | 4 (5.5) | 12 (16.4) | 95 | 4 (4.2) | 13 (13.7) |
| 3-<4 | 169 | 6 (3.6) | 19 (11.2) | 146 | 10 (6.8) | 15 (10.3) |
| 4-<5 | 240 | 17 (7.1) | 25 (10.4) | 224 | 13 (5.8) | 22 (9.8) |
| 5-<6 | 323 | 11 (3.4) | 27 (8.4) | 302 | 10 (3.3) | 27 (8.9) |
| 6-<7 | 375 | 17 (4.5) | 31 (8.3) | 370 | 23 (6.2) | 32 (8.6) |
| 7-<8 | 419 | 32 (7.6) | 20 (4.8) | 386 | 32 (8.3) | 29 (7.5) |
| 8-<9 | 466 | 38 (8.2) | 20 (4.3) | 436 | 42 (9.6) | 34 (7.8) |
| 9-<10 | 437 | 41 (9.4) | 22 (5) | 447 | 53 (11.9) | 18 (4) |
| 10-<11 | 508 | 55 (10.8) | 14 (2.8) | 508 | 84 (16.5) | 29 (5.7) |
| 11-<12 | 478 | 49 (10.3) | 26 (5.4) | 408 | 61 (14.9) | 18 (4.4) |
| 12-<13 | 500 | 65 (13) | 22 (4.4) | 494 | 61 (12.3) | 22 (4.4) |
| 13-<14 | 480 | 64 (13.3) | 25 (5.2) | 506 | 67 (13.2) | 25 (4.9) |
| 14-<15 | 457 | 73 (16) | 18 (3.9) | 449 | 71 (15.8) | 32 (7.1) |
| 15-<16 | 410 | 67 (16.3) | 30 (7.3) | 474 | 76 (16) | 33 (7) |
| 16-<17 | 347 | 46 (13.2) | 22 (6.3) | 408 | 66 (16.2) | 32 (7.8) |
| 17-<18 | 572 | 86 (15) | 43 (7.5) | 745 | 140 (18.8) | 52 (7) |

*Using the cut-off points recommended by Cole et al.[42]

with rates generally ranging from 6%-30%.[2-18] De Vito et al.[5] studied 11-19-year-old school children in Italy and showed that 8.4% were obese, with a higher rate in males (9.8%) compared to females (6.5%). Overweight was almost 21.4% with no gender difference.

Comparing the prevalence in different provinces, differences were seen in the prevalence of overweight and obesity in different provinces of Saudi Arabia. The highest prevalence of overweight and obesity was encountered in the Eastern Province, while the lowest prevalence rates were in the Southern Province. Interestingly, inter-provincial differences were frequently encountered in Saudi Arabia. These may be a consequence of different environmental or genetic factors. A comparative study of the prevalence of overweight and obesity in different regions of Saudi Arabia has been published elsewhere.[44]

This study on Saudis shows a steady increase in overweight with age. The prevalence of overweight in Saudi children is considerably lower than in Germany, America, Canada, North Western Spain, and the American Indians,[6,8,10,13,22], however, it is significantly higher than the prevalence reported in Italy[5] and the Netherlands and almost the same in 1-6 year-old children as in 0-7 years age group from China.[12] These significant variations in the prevalence rates in the different population groups in different countries may be due to both environmental and genetic factors. The type of diet, extent of physical activity and climatic conditions, all play a role in influencing overweight and obesity prevalence. In most countries, lower socioeconomic groups have a significantly lower prevalence compared to the middle or high socioeconomic groups,[16] as well as environmental and other factors[18,20,21] seem to play a considerable influencing role. In addition, genetic contribution is considerable, since obesity is a multifactorial complex genetic disorder. During the last three decades Saudi Arabia has seen several changing trends in the nutritional habits and activities of children, and this may be the cause of considerably high prevalence of both overweight and obesity.

Interestingly, most studies report an increase in the prevalence of obesity and overweight over the last 10-20 years.[3,7,13,14,18,35] In Northwestern Spain over the last 10 years, overweight has increased from 9.8% to 19.7%.[13] In Sweden, a 2-4 times increase has been observed from 1971 to 1995 in the prevalence of overweight in 18-year-old males, and obesity prevalence has increased 35 times from 0.9% to 32.% in the same time span.[14] A similar trend was reported in Cremona (Italy) when it was shown that overall prevalence increased from 6.1% to 13.6% over an eight year period from 1990-1998.[19] In a study on preschool children in the US, the prevalence increased from 5.8% during the early 1970s to 10% during the period 1988-1994 in 4-5-year-old girls.[3] In Germany, the results were similar with both boys and girls showing a significant increase both in the prevalence of obesity and overweight.[10]

In Saudi Arabia, not much information is available on the prevalence of overweight and obesity in children. In one study on 6-18 year-old boys in different provinces of Saudi Arabia, the prevalence of overweight and obesity were reported as 11.7% and 15.8%, respectively.[15] The prevalence of overweight in the present study similar to that study by Al-Nuaim five years earlier, however, obesity prevalence is significantly lower. This may be either due to differences in the methods used for assessing obesity or to a real decrease in obesity in the males over the past five years. Further studies are required at

different time periods to assess whether or not overweight and obesity prevalence is changing in Saudi children. In conclusion, this study has applied international cutoff points for BMI for determining overweight and obesity in the 1-18-years old Saudi boys and girls and has shown overweight and obesity prevalence with age in Saudi children.

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