Prevalence of obesity and overweight among Saudi adolescents in Eastern Saudi Arabia

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ABSTRACT

Objective: To determine the prevalence of obesity and overweight among Saudi adolescents, using the 2 most widely used international references.

Methods: A cross-sectional study conducted towards the end of 2001 on a random sample of third grade intermediate and all 3 grades of secondary school Saudi students of both genders in Al-Khobar area, Eastern Saudi Arabia. The body mass index (BMI) was calculated. The American National Health and Nutrition Examination Survey (NHANES) growth charts, which have been adopted by the World Health Organization (WHO), were used. Student with a BMI of <85th and >95th percentile for age and genders, were defined as overweight and <95th percentile defined as obese. The International Obesity Taskforce (IOTF) age-sex-specific BMI cut-offs reference for defining overweight and obesity was used for comparison.

Results: The sample was 1766 students, comprising 675 males and 1091 females. The mean age was 16.4 $\pm$ 1.7 years. The prevalence of obesity was higher in male than female students (19.3% versus 11.8%) while a higher proportion of female students than males were overweight (17.2% versus 10.2%). No significant difference was found between the 2 references used to determine the prevalence of obesity and overweight.

Conclusion: The high prevalence of overweight and obesity recorded in this study call for prevention programs based on dietary and physical education in schools.

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Ten percent of the world's school-aged children are estimated to be overweight or obese.[1] Childhood and adolescent obesity have been linked to higher all-cause mortality in adulthood, as well as childhood hyperlipidemia, glucose intolerance, cholelithiasis and hypertension.[2,3] Endocrine and pulmonary problems, as well as orthopedic, gastroenterological, and neurological difficulties are more common in obese children.[4-6] Longitudinal change in the body mass index (BMI) is accompanied by same direction change in blood pressure.[7] In addition to the physical health consequences, both immediate and long-term obesity has psychosocial effects and substantial economic costs.[8-10] In Saudi Arabia, obesity is a common health problem among all age groups.[11-16] Few studies were carried out to measure the prevalence of overweight and obesity in children and adolescents in Saudi Arabia in the past 15 years. The overweight and obesity were reported in male students to range from 11.7-17.6%, and 9.5-20.5%, while overweight in girls was 20.5% and obesity 11.3%.[17-20] The specific objectives of this study were 1) to determine the prevalence of obesity and overweight among adolescents of both genders in Al-Khobar area, Saudi Arabia, using the 2 most widely used international references and 2) to compare between the findings of the 2 references used for each age and gender.

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Methods. This cross-sectional study was conducted on third grade intermediate and all 3 grades of secondary school Saudi male and female students in Al-Khobar area. Multistage stratified self-weighting sampling design was adopted. All schools were divided into males and females, then into government and private and further classification was made based on intermediate and secondary levels. Stratified random sampling with proportional allocation based on total number of male and female students and their distribution according to grade, was applied. This resulted in selecting 11 male and 13 female schools in all educational levels. At first stage, a systematic random sampling procedure was used to select schools. In the final stage, classes were selected at each level using simple random sampling design. All students in selected classes were included in the study. The final sample of schools consisted of: a) 4 government and 3 private intermediate schools, and 2 government and 2 private secondary schools for boys; b) 5 government and 3 private intermediate schools, and 3 government and 2 private secondary schools for girls. The sample size was calculated, using an appropriate formula,[21] to get the 1450 students. Taking in consideration, a possible response rate of 75%, (drown from the pilot study), this resulted on a suggested sample size of 1811 Saudi students, comprising 707 males and 1104 females. Three male physicians and 3 females medical staff (a pharmacist and 2 nurses) participated in the data collection for boys and girls schools. Weight and height were measured using digital physician weighing scale model SECA 708 (Vogel and Halke, Hamburg, Germany) and a height measuring rod model SECA 220 attached to the digital scale. The scales were previously checked for reliability. Practical demonstrations were conducted to ensure accuracy of measurements. Weight was measured in kilograms (kg) with students barefooted and wearing their usual school light clothes. Weight was recorded to the nearest 100 gm. Height was measured in centimeters (cm) to the nearest 0.5 cm. The BMI, defined as the weight in kilograms divided by the square of the height in meters, was calculated. The BMI growth charts percentile for age and gender, of the American National Health and Nutrition Examination Survey (NHANES), which has been adopted by World Health Organization (WHO) as the international anthropometrical reference, were used.[22] A student whose BMI falls between the 85th and 95th percentile for age and gender is defined as overweight and students whose BMI was greater than or equal to the 95th percentile defined as obese. Another reference for comparison using the International Obesity Task Force (IOTF) age-sex-specific BMI cut-offs that correspond to a BMI of 25 and 30 at age 18 for defining overweight and obesity, in children and adolescents aged 2–18 years (obtained by averaging data from Brazil, Great Britain, Hong Kong, Netherlands, Singapore, and United States) was also used.[23]

A pilot study was conducted in a male secondary school in Dhahran city, Saudi Arabia to test the organizational procedures such as time taken for height and weight measurements. There was a good cooperation between schools' authorities and fieldworkers. The investigator supervised the fieldwork.

The data obtained were entered into a personal computer and the "Statistical Products and Service Solutions" (SPSS) version 11 was used for analysis. A P-value of <0.05 was taken as statistically significant. All the necessary approvals of the relevant authorities were obtained before the conduction of the study. Written permission and cooperation was soughed from all schools, teachers and students who participated in the study. Health education, both verbally and using educational materials was provided to both teachers and students.

Results. The final total number of students included in the study was 1766, comprising 675 males and 1091 females. The overall response rate was 97.5% of the study sample, and that was composed of approximately 95.5% of male and 98.8% of female samples. Approximately three-quarter of them belong to government schools. The mean age was 16.4 ± 1.7 years. There was no significant difference in the mean age between males and females. The prevalence of overweight among male adolescents was 10.2% and obesity was 19.3% according to NHANES/WHO BMI age-specific percentile, and 14.1% and 16.7% according to the international cut-off points of BMI (**Table 1**). On the other hand, the prevalence of overweight among female was 17.2% and obesity was 11.8% according to NHANES/WHO BMI age-specific percentile, and 20.2% and 10.9% according to the international cut-off points of BMI (**Table 2**).

Discussion. The BMI, expressed as body weight in kilograms divided by the square of height in meters (kg/m^2) is the standard method for obesity assessment in adults, and its use in children provides a consistent measure across age groups. Participants at a workshop on childhood and adolescent's obesity, convened by the International Task Force on Obesity, agreed that BMI provides a reasonable index of adiposity.[24, 25]

The BMI has a high specificity (correctly classifying those not obese) and variable sensitivity (proportion of subjects truly at risk of being overweight or obese) as an indicator of overweight

Table 1 - Prevalence of obesity and overweight among Saudi male student according to NHANES/WHO BMI age-specific percentile and the international cut-off points of BMI.

Age (years)	N	NHANES/WHO BMI age-specific percentile		International cut-off points of BMI (kg/m²)		*p* value	
		Overweight >85th - <95th	Obesity ≥95th	Overweight ≥25 - 30	Obesity ≥30	Overweight	Obesity
		n (%)	n (%)	n (%)	n (%)		
19	98	11 (11.2)	19 (19.4)	15 (15.3)	19 (19.4)	0.3996	-
18	112	7 (6.3)	24 (21.4)	10 (9)	23 (20.5)	0.4491	0.8697
17	148	23 (15.7)	26 (17.6)	29 (19.6)	22 (14.9)	0.3594	0.5282
16	136	9 (6.6)	22 (16.2)	13 (9.5)	19 (14)	0.3737	0.6111
15	139	13 (9.4)	27 (19.4)	19 (13.7)	21 (15.1)	0.2595	0.341
14	42	6 (14.3)	12 (28.6)	9 (21.4)	9 (21.5)	0.3927	0.4497
Total	**675**	**69 (10.2)**	**130 (19.3)**	**95 (14.1)**	**113 (16.7)**	**0.0303**	**0.2285**

NHANES - The American National Health and Nutrition Examination Survey
WHO - World Health Organization, BMI - body mass index.

Table 2 - Prevalence of obesity and overweight among Saudi female student according to NHANES/WHO BMI age-specific percentile and the international cut-off points of BMI.

Age (years)	N	NHANES/WHO BMI age-specific percentile		International cut-off points of BMI (kg/m²)		*p* value	
		Overweight >85th - <95th	Obesity ≥95th	Overweight ≥25 - 30	Obesity ≥30	Overweight	Obesity
		n (%)	n (%)	n (%)	n (%)		
19	45	5 (11.1)	7 (15.6)	8 (17.8)	9 (20)	0.3683	0.5813
18	152	27 (17.8)	12 (7.9)	34 (30.9)	13 (8.6)	0.3161	0.8346
17	213	29 (13.6)	19 (8.9)	38 (18.3)	18 (8)	0.231	0.8634
16	260	51 (19.6)	32 (12.3)	54 (20.8)	32 (12.3)	0.7431	-
15	232	34 (14.7)	37 (15.9)	42 (18.1)	29 (12.5)	0.3156	0.287
14	189	43 (22.7)	24 (12.7)	46 (24.3)	21 (11.1)	0.716	0.6337
Total	**1091**	**195 (17.2)**	**134 (11.8)**	**229 (20.2)**	**124 (10.9)**	**0.0658**	**0.5073**

NHANES - The American National Health and Nutrition Examination Survey
WHO - World Health Organization, BMI - body mass index.

and obesity based on analyses of several ethnically diverse samples.[26] It provides a reasonable index of adiposity among children and adolescents for routine clinical and public health purposes.[24,27] Interpretation should be made cautiously when comparing BMI values across different age groups or predicting a specific individual's total body fat (TBF) or percentage of body fat (PBF). In addition, we should be cautious when comparing a BMI across groups using different criteria or cut-off points for any reported prevalence of obesity and overweight. Differences between studies, between countries and at different times should also be kept in mind when evaluating different data.[24,27]

The prevalence of obesity was higher in male than female adolescents (19.3% versus 11.8%) on contrary, a higher proportion of female adolescents than males were overweight (17.2% versus 10.2%) as shown in **Table 1 & 2**. When combining both overweight and obesity, as a reflection of weight problems, prevalence in the 2 genders was almost the same (29.5% in males versus 29% in females). The high prevalence of overweight and obesity recorded in this study is consistent with the National Survey of the prevalence of overweight and obesity in Saudi population aged 15-20 years (a prevalence of 12% and 7% for males; 15% and 9% for females respectively).[28] In this study, the prevalence is lower than that reported by Gabrah et al[29] among students of both genders (with a mean age of 15.3 years) in Jeddah. The higher prevalence of obesity than overweight in male was similar to that recorded by Al-Rukban among Saudi male students (age 12-20 years) in Riyadh, applying the BMI gender and age-specific percentile, where obesity was 20.5% and overweight was 13.8%.[20] The high prevalence of obesity in males is probably due to the recent trend of male youths eating in fast food chain, rich in saturated fats, reduced physical activities and more time spent in sedentary activities (such as watching television or playing computer and video games).[30,31] Our data were almost comparable to a near by country (Bahrain) in male aged 12-17, while it was less than that recorded in female (24% overweight and 18% obese).[32]

On the other hand, when the prevalence of adolescents with BMI <85th percentile in the present study compared with United States adolescents aged 12-19 years, it was almost the same (30%).[33] The author found no significant difference in the results of the present study between the 2 references used to determine the prevalence of obesity and overweight (NHANES/WHO and the IOTF) as shown in **Tables 1 and 2**. Therefore, either reference may be used as a screening tool to assess overweight and obesity in Saudi adolescents. This is consistent with several studies that compared the US NHANES/WHO criteria with those of the more recent NCHS/CDC, and the IOTF.[34] These different methods gave approximately similar results, but with some significant discrepancies especially among younger children.[1]

The findings of this study indicate the need for a prevention program to tackle the problems of obesity and eating disturbances among children and adolescents. These programs must be based on dietary education and inclusion of physical activity classes (physical education) in the school curriculum.[35] Dietary interventions in combination with physical activities have been reported to have better outcomes compared with dietary modulation alone.[36] Eating behavior is learned and if we are to prevent obesity, correct health messages and behavior should be adopted at an early age.[37] Educational efforts to both manage and prevent childhood and adolescent obesity should be directed also toward policy makers, health care professionals, community leaders, and parents.[38] The BMI monitoring could be carried out in schools through systematic, perhaps yearly measurement of weights and heights. Those students above 95th percentile for age and gender could be referred to health services for further assessment and counseling.[39]

In order to develop appropriate anthropometric reference data, a multi-country study, with longitudinal and cross-sectional components, on adolescents' somatic growth and maturation should be considered a high priority. Such data are needed to define not only cut-off points, but also rates of too low or too high values that should trigger action at programmed or individual level. In addition, research into the etiology, treatment, and prevention of childhood and adolescents' obesity should also be given a priority.

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