Obesity among Saudi male adolescents in Riyadh, Saudi Arabia

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ABSTRACT

Objectives: The purpose of the study was to determine the prevalence of overweight and obesity and its correlates among Saudi male adolescents in Riyadh. As well as evaluating their knowledge, attitude and practice towards obesity.

Methods: A cross-sectional study conducted in intermediate and secondary schools in Riyadh, Saudi Arabia was carried out during a 5-month period, September 2001 - January 2002. A sample of 894 Saudi male adolescents (age 12-20 years) was selected through the multi-stage sampling technique. Socio-demographic characteristics; dietary and activity history; obesity-related knowledge and behavior; and family and past medical history data were obtained by a self-administered questionnaire. Anthropometric measurements of weight and height were performed. Body mass index (BMI) was calculated, and adolescents with a BMI age-specific percentile of ≥85th - <95th were considered overweight and ≥95th were considered obese.

Results: The prevalence of overweight was 13.8% and obesity was 20.5%. Family history (odds ratio, 2.49; 95% confidence interval, 1.72-3.61) and lack of physical activity (odds ratio, 1.63; 95% confidence interval, 1.01-2.62) were associated with adolescent obesity. Twenty percent of overweight participants did not think they were overweight.

Conclusion: Obesity constitutes an important public health problem among male adolescents in Riyadh. A national prevention program with involvement of schools is recommended to avoid obesity-related morbidity in adulthood.

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Obesity is one of the most common disorders encountered in clinical practice and has major public health implications. Unfortunately, it is also one of the most difficult and frustrating disorders to manage successfully.[1] Obesity is defined as the presence of excess adipose tissue.[1] It is a complex condition, with serious social and psychological dimensions[2,3] that affect virtually all age and socioeconomic groups and threatens to overwhelm both developed and developing countries.[4] Mortality rises exponentially with increasing body weight. The risk of coronary heart disease is doubled if the body mass index (BMI) is >25 and nearly quadrupled if the index is >29.[5,6] The risk of developing diabetes increases with increasing weight and people with a body mass index >35 have a 40 fold higher risk of developing the disease than non-obese people.[5,7] Osteoarthritis and respiratory diseases, particularly sleep apnoea are more common in obese people.[5] Obesity was significantly associated with an increase in both systolic and diastolic blood pressure,[8,9] stroke, and certain forms of cancer.[4] The prevalence of overweight and obesity has increased in the last few years.[10] Between 1980 and 1995, the prevalence of obesity in Britain doubled from 8-15%.[5] In 1995, there were an estimated 200 million obese adults worldwide and another 18 million children under-5-years classified as overweight. By the year 2000, the number of obese adults had increased to over 300 million.[4] Children and adolescents are also involved

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in those changes. In the United States of America (USA), the percentage of children and adolescents who are overweight has more than doubled in the past 30 years.[11] Although obesity in children is rarely associated with morbidity or mortality, it is rapidly emerging as a global epidemic that will have profound public health consequences as overweight children become overweight adults particularly if obesity is present in adolesence.[12] For example, the risk of developing adult obesity in children aged >9 years who are obese is up to 80% at age 35 years.[13] Unfortunately, it is evident that obesity is a common health problem among Saudis.[14] Overweight and obesity in the adult Saudi population were reported in different studies with a range of males overweight 26-34%, obesity 12-23% and females overweight 24-29%, obesity 19-41%.[14-19] This high prevalence of overweight and obesity is a cause of concern, as obesity is associated with several complications that increase both morbidity and mortality.

Although the statistics on the status of school health in the Kingdom of Saudi Arabia (KSA) is scanty, a few studies have shown the prevalence of obesity among adolescents and children in the last few years. In 1991, Al Sekait et al[20] found that the prevalence of overweight in Saudi school children boys were 17.6% and obesity 9.5%, girls overweight was 20.5% and obesity 11.3%. Five years later, Al-Nuaim et al[21] found that the prevalence of overweight and obesity in school children boys was 11.7% and 15.8%. The aims of this study are: 1. To provide current estimate of the prevalence of overweight and obesity and its correlates among Saudi male adolescents, aged 12-20 years, in Riyadh city. 2. To determine adolescents' knowledge, attitude and practice towards obesity.

Methods.

Study design. A cross-sectional study was conducted in intermediate and secondary schools in Riyadh, KSA, over a 5-month period from September 2001 - January 2002.

Sample size. A sample size of 865 was calculated on assumption of a 10% prevalence of obesity, and degree of precision of 0.02 at a 95% level of confidence. The sample size was increased to consider non-participant rate.

Study population. The study population included Saudi male adolescents (age 12-20 years), studying in intermediate and secondary schools in Riyadh city, KSA. After taking permission from educational authorities in Riyadh area, the sample was collected randomly by using multi-stage sampling technique. The sample units at the first stage are governmental male schools in Riyadh city, KSA. The city was divided into 5 sectors and one or 2 schools according to number of students in each school randomly selected from each sector. The frame for the selection of the primary sampling units was based on school's list provided by educational authorities in Riyadh, KSA. The 2nd stage was the classes within the school. Each class was considered as a cluster and all students in the selected classes were included in the study. Either in the first or 2nd stage of sampling, the process of selection of schools was simple random selection. Non-Saudi adolescents were excluded after selection and substituted by the consecutive student from the class list.

Data collection. Socio-demographic characteristics; dietary and activity history; obesity-related knowledge and behavior; family and past medical history data were obtained by a self-administered questionnaire. Exercise was defined as "at least 30 minutes of exercise or physical activity each time". A pilot study was used to evaluate the validity of the questionnaire and the ability of adolescents to answer it. Trained staff collected anthropometric measurements of weight and height. Height was measured without shoes to the nearest "0.5cm", and weight to the nearest "100g" with the subject in light clothes and without shoes. The weighing scale used was "Health o meter" lever type (made in USA) which could read to the nearest 100g placed on a hard, level, uncarpeted floor. A single scale was used for weighing all the students. This scale was calibrated daily, and zero is assured before weighing any student. Body mass index which is the weight in kilogram divided by the height in meters squared (kg/m^2), was calculated for all the study participants.

Data analysis. Underweight among adolescents is defined as BMI ≤5th age-specific percentile, overweight as BMI ≥85th and <95th age-specific percentile, and obesity as BMI ≥95th age-specific percentile value of the American National Health and Nutrition Examination Survey (NHANES) growth curves, which has been adopted by World Health Organization (WHO) as the international anthropometrical reference.[22-24]

EPI-info program was used for data analysis. Odds ratio and its 95% confidence interval and Chi-square test were used to assess the statistical association at 95% confidence level.

Results.

A total of 894 Saudi male adolescents, from 7 schools selected from 5 sectors of Riyadh, participated in this study. Anthropometric measurements were not recorded for 9 of them. The age of adolescents ranged from 12-20 years (mean age=15.7 ± 1.8 years). The students were distributed across 6 grades of intermediate and secondary schools with the largest proportion of students (23.3%) at the first grade of the secondary school. **Table 1** shows the mean BMI and body weight status among various education levels. Of the 885 adolescents, 81 (9.2%) were underweight, 122 (13.8%) were overweight and 181 (20.5%) were obese according to the criteria used (**Table 2**). The prevalence of obesity was increasing with age, it was 20.1% in the young adolescents (≤15 years) while it was 20.7% in the older adolescents (>15 years), however, it is not statistically significant (P>0.05). **Table 3** shows the relationship between body weight status and common

Table 1 - Mean BMI and body weight status among various education levels in Saudi male adolescents in Riyadh, Kingdom of Saudi Arabia, 2002.

Education level*	n	(%)	BMI (mean ± SD)	Underweight n	(%)	Normal weight n	(%)	Overweight n	(%)	Obese n	(%)	P value
Intermediate												
Grade 1	108	(12.2)	20.1 ± 5.3	14	(17.3)	60	(12)	17	(13.9)	17	(9.4)	
Grade II	140	(15.8)	21.3 ± 4.7	16	(19.8)	74	(14.8)	21	(17.2)	29	(16)	0.4
Grade III	128	(14.5)	22.7 ± 5.5	7	(8.6)	76	(15.2)	17	(13.9)	28	(15.5)	
Secondary												
Grade I	201	(22.7)	23.3 ± 5.4	15	(18.5)	114	(22.7)	28	(22.9)	44	(24.3)	
Grade II	168	(19)	23.1 ± 5.2	16	(19.8)	101	(20.1)	21	(17.2)	30	(16.6)	0.9
Grade III	140	(15.8)	25 ± 6.3	13	(16)	76	(15.2)	18	(14.7)	33	(18.2)	
Total	**885**	**(100)**	**22.8 ± 5.6**	**81**	**(9.2)**	**501**	**(56.6)**	**122**	**(13.8)**	**181**	**(20.5)**	

* P>0.05 (no statistical significant difference in the prevalence of obesity and overweight between various education levels
BMI - body mass index

Table 2 - Prevalence of underweight, overweight and obesity among Saudi male adolescents in Riyadh, Kingdom of Saudi Arabia, 2002.

Body mass index	Frequency n	(%)	Cumulative %
Underweight	81	(9.1)	9.2
Ideal weight	501	(56.6)	65.8
Overweight	122	(13.8)	79.5
Obese	181	(20.5)	100
Total	**885**	**(100)**	

risk factors of obesity among adolescents. There is a strong association between obesity in adolescents and family history of obesity (P<0.01). It is also associated with frequency of exercise, the less exercise frequency; the more obesity, odds ratio (95% confidence interval) = 1.63 (1.01-2.62). No statistical difference between high caloric diet ingestion (soft drinks, fast food and sweet diet) or eating during watching TV among obese and non-obese adolescents (P>0.05). Overall, 388 of adolescents had true impression with regards to their body status (level of agreement = 39.3%). Only 70 (58.3%) and 54 (31.8%) of obese and overweight had true impression regarding their weight. Moreover, 4 (3.3%) and 2 (1.2%) of obese and overweight adolescents thought they are underweight. Two hundred and one (23.4%) adolescents cannot judge regarding their weight. **Table 4** shows the distribution of BMI according to the opinion of the adolescents regarding their weight status. The BMI was correlated with planning to overcome obesity in adolescents and significant correlation (P<0.01) between obesity and planning to reduce weight was obtained. **Table 5** shows that 691 (79.3%) adolescents are not regularly monitoring their weight, with no statistical significance deference between various body weight status. **Table 6** presents the assessment of knowledge of adolescents regarding obesity, and its risk factors; there is an association (P<0.01) between true answers and obesity. Less correct answers (609 [69.6%]) were obtained when they asked regarding the harmful contents of fast food.

Discussion. The results of this study no doubt provide evidence of a high prevalence of obesity among the adolescent population in Riyadh, KSA. Notwithstanding, the 13.8% prevalence of overweight observed among male adolescents in this study is similar to a value of 13.4% observed among adolescents in Jeddah, KSA, while the prevalence of obesity 20.5% is higher than the 13.5% observed in that study.[25] These figures are also higher than those among school children in KSA.[20,21,26] The difference may be attributed to the use of a different definition of obesity, or due to a definitive increase in the prevalence of obesity among adolescents since that time; the same finding was reported in other studies.[10,27,28] The prevalence of overweight and obesity observed in this study are within the range of national prevalence of obesity observed in other studies.[14-19,26] This study showed that Saudi male adolescents are more likely to be obese than American adolescents.[29] Body mass index was observed to be increased with age. The rates of obesity were 20.1% in those <15 years of age and 20.7% in those ≥15 years. Although this study did not show a significant statistical difference in that increase, but this trend has been reported in other studies.[9,14] The high prevalence of obesity among adolescents in Riyadh, KSA reflects the profound changes in social and behavioral patterns of the community over the last 30 years.[30] In recent years, with the huge advances in technology and improved living standards, the overall energy intake has increased due to

Table 3 - Distribution of BMI according to some risk factors of obesity in Saudi male adolescents in Riyadh, Kingdom of Saudi Arabia, 2002.

Risk factor	Total n (%)	Underweight n (%)	Normal weight n (%)	Overweight n (%)	Obese n (%)	Odds Ratio (95% CI)
Family history of obesity*						
Yes	**311 (36.4)**	16 (20.8)	149 (30.8)	54 (45.8)	92 (52.6)	2.49 (1.72 - 3.61)
No	**543 (63.6)**	61 (79.2)	335 (69.2)	64 (54.2)	83 (47.4)	
Soft drink ingestion						
Daily	**288 (33.4)**	28 (35)	169 (34.8)	34 (29.1)	57 (32)	1.03 (0.64 - 1.65)
2-4 times/week	**326 (37.9)**	24 (30)	177 (36.4)	50 (42.7)	75 (42.1)	1.29 (0.82 - 2.03)
≤1 time/week	**247 (28.7)**	28 (35)	140 (28.8)	33 (28.2)	46 (25.9)	
Eating fast food						
Daily	**66 (7.6)**	5 (6.4)	42 (8.5)	4 (3.4)	15 (8.4)	
2-4 times/week	**311 (35.7)**	32 (41)	173 (34.9)	43 (36.1)	63 (35.2)	1.02 (0.51 - 2.07)
≤1 time/week	**494 (56.7)**	41 (52.6)	280 (56.6)	72 (60.5)	101 (56.4)	1.01 (0.52 - 2.00)
Eating sweet diet						
Daily	**160 (18.2)**	16 (19.8)	100 (20.1)	17 (14.2)	27 (15.1)	
2-4 times/week	**460 (52.5)**	41 (50.6)	261 (52.5)	61 (50.8)	97 (54.2)	1.38 (0.83 - 2.30)
≤1 time/week	**257 (29.3)**	24 (29.6)	136 (27.4)	42 (35)	55 (30.7)	1.50 (0.86 - 2.63)
Eating whilst watching TV						
Daily	**271 (31.7)**	22 (27.5)	159 (32.6)	36 (31.3)	54 (31.2)	
2-4 times/week	**299 (35)**	30 (37.5)	179 (36.8)	30 (26.1)	60 (34.7)	0.99 (0.63 - 1.54)
≤1 time/week	**285 (33.3)**	28 (35)	149 (30.6)	49 (42.6)	59 (34.1)	1.17 (0.74 - 1.84)
Regular exercise >30 minutes/ time						
≤1 time/week*	**409 (48.4)**	32 (42.7)	225 (46.5)	53 (46.1)	99 (57.6)	1.63 (1.01 - 2.62)
2-3 times/week	**202 (23.9)**	20 (26.7)	122 (25.3)	27 (23.5)	33 (19.2)	
>3 times/week	**234 (27.7)**	23 (30.6)	136 (28.2)	35 (30.4)	40 (23.2)	1.09 (0.63 -1.89)

* P<0.05 (statistically significant in comparing obese to normal weight)
BMI - body mass index, CI - confidence interval

Table 4 - Body mass index by opinion of weight in Saudi male adolescents in Riyadh, Kingdom of Saudi Arabia, 2002.

Impression/ BMI	Underweight n (%)	Ideal weight n (%)	Overweight n (%)	Obese n (%)	No idea n (%)	Total
Underweight	34 (30.6)	16 (7.1)	4 (1.6)	0 (0)	22 (11)	**76 (8.8)**
Ideal weight	71 (64)	180 (80)	96 (38.9)	15 (20)	131 (65.2)	**493 (57.4)**
Overweight	4 (3.6)	19 (8.4)	70 (28.3)	6 (8)	21 (10.4)	**120 (14)**
Obese	2 (1.8)	10 (4.5)	77 (31.2)	54 (37.2)	27 (13.4)	**170 (19.8)**
Total	**111 (12.9)**	**225 (26.2)**	**247 (28.8)**	**75 (8.7)**	**201 (23.4)**	**859 (100)**

* Level of agreement (reliability) = 338/859 = 39.3%
BMI - body mass index

Table 5 - Distribution of BMI according to regular weighing and planning to overcome obesity in Saudi male adolescents in Riyadh, Saudi Arabia, 2002.

Item	Total n (%)	Underweight n (%)	Normal weight n (%)	Overweight n (%)	Obese n (%)	P value
Regular weighing						
Yes	180 (20.7)	11 (14.1)	101 (20.5)	35 (28.7)	33 (18.5)	0.06
No	691 (79.3)	67 (85.9)	392 (79.5)	87 (71.3)	145 (81.5)	
Planning to reduce weight*						
Yes	420 (50.4)	4 (5.8)	159 (33.4)	95 (80.5)	162 (95.3)	<0.000001
No	413 (49.6)	65 (94.2)	317 (66.6)	23 (19.5)	8 (4.7)	
Planning to do regular exercise						
Yes	703 (82.7)	63 (84)	383 (80)	103 (85.8)	154 (87.5)	0.1
No	147 (17.3)	12 (16)	96 (20)	17 (14.2)	22 (12.5)	

* P<0.01 (statistically significant - comparing obese to normal weight)
BMI - body mass index

Table 6 - Assessment of knowledge of Saudi male adolescents in Riyadh, Saudi Arabia, 2002.

Item	Total n (%)	Underweight n (%)	Normal weight n (%)	Overweight n (%)	Obese n (%)	P value
Obesity is dangerous for health*						
True answer	**762 (87.6)**	60 (76.9)	428 (86.8)	113 (93.4)	161 (90.4)	0.004
False answer	**108 (12.4)**	18 (23.1)	65 (13.2)	8 (6.6)	17 (9.6)	
Exercise is essential for health						
True answer	**846 (96.8)**	74 (94.9)	477 (96.2)	120 (99.2)	175 (97.8)	0.2
False answer	**28 (3.2)**	4 (5.1)	19 (3.8)	1 (0.8)	4 (2.2)	
Fast food contain a lot of bad lipid*						
True answer	**606 (69.6)**	43 (53.8)	343 (69.4)	90 (74.4)	130 (73.9)	0.006
False answer	**265 (30.5)**	37 (46.3)	151 (30.6)	31 (25.6)	46 (26.1)	

* P<0.01 (statistically significant - comparing obese to normal weight)

overnutrition. On the other hand, lifestyle is becoming more and more sedentary and energy expenditure is reduced. The apparent differences in the rates observed from different studies carried out in different parts of KSA may be partly attributed to different socio-economic status of the study samples, since social class is a pre-cursor to nutritional habit which is a risk factor of overweight and obesity.[31] In addition to different socio-economic status, ethnic and genetic difference may account for the variations in the prevalence of obesity between American and Saudi adolescents.[32]

The study shows a strong relation between obesity among adolescents and family history of obesity. This finding was supported by another study, which estimates that 80% of children with obese parents will become obese, compared to only 14% of non-obese parents.[33] It is worth noting that parental obesity has been established as the most important risk factor that predisposes adolescents to become obese.[34] This is related to genetics[5,35,36] behavioral and environmental factors.[37,38]

The 2nd important risk factor for obesity in adolescents observed in this study is lack of physical activity. The results of national and international studies agreed with this finding.[1,39]

In general, our adolescents exercise less than those in developed countries.[29] This may be due to inadequate school physical activity programs for these students. Lack of regular physical activity constitutes a major risk factor for cardiovascular diseases.[40] Diet and physical activity patterns together account for at least 300,000 deaths among adults in USA each year.[41] Encouraging adolescents into a sustainable active lifestyle should influence adult levels of heart disease and stroke in the future.[42] It is recommended to encourage physical activity as early as possible. Fortunately, students agreed that regular exercise is an important factor in developing

lifetime health and their attitudes toward physical activity were generally positive. Female college students in Dammam, KSA reported a similar result.[43] Our sample had a better insight towards physical activity than the females in that study. Ninety percent of overweight and obese adolescents are seriously planning to reduce weight and to involve in regular exercise in comparison to only 41.6% of females in that study.[43] The study shows no clear association between high calorie diet and obesity in adolescents. This finding is different from what was reported in other studies.[1,5,43] The reason for the difference in observations is not clear. It could be due to the difference in types of population or could be explained by the assumption that obese subjects tend to underreport both total energy (fatty foods and foods rich in carbohydrates) and protein intake which was observed in another study.[44]

However, eating habits of our adolescents shows excessive ingestion of soft drinks, sweaty diet and fast food. We need to take that into consideration whenever a dietary education program is established.

Approximately 30% and 60% of obese and overweight adolescents had a true impression regarding their weight. Almost similar results had been observed in American male adolescents[29] and female adolescents in Riyadh, KSA.[15] It is interesting to note that 20% and 7% of overweight and obese participants did not think they were overweight or obese. This may be attributed to the commonly held attitude that being overweight is a sign of good health. The obese adolescents had better knowledge regarding obesity and its correlates than non-obese. It is difficult to conclude that they had this knowledge before they become obese or gain it after obesity.

Obesity in adolescents must have a major concern, as there is evidence that obesity is likely to persist into adult life[12,13] and to increase the likelihood of morbidity and mortality.[4-9]

It represents one of the most frustrating and difficult diseases to treat. However, it is recommended for treatment of obesity in adolescents to start early, involve the family, and institute permanent changes in a stepwise manner. Parenting skills are the foundation for successful intervention that put in place gradual, targeted increases in activity and targeted reductions in high-fat, high-calorie foods.[45] Achieving ideal weight for height should be considered an unrealistic goal. Continuous monitoring, reinforcements, and ongoing support for families after the initial weight-management program will help families maintain their new behaviors.[45] Those below 20 years of age represent the largest segment of the Saudi population and could be the target of focused efforts to prevent obesity later in life.[46] As the majority of them and studying in schools, it is recommended to find out what schools are doing to promote healthy eating and encouraging physical activity.

Lack of nutritional education and reduced physical activity might lead to weight gain. Promoting nutritional awareness, encouraging a more physically active and more professionally self-fulfilling lifestyle would be expected to result in less weight gain later in life.[14] This study does not represent the whole male adolescents of KSA. However, future studies should be planned to ensure representativeness and, perhaps, longitudinality of sample and the ability to measure BMI more frequently over an extended period to establish a time trend and to provide a detailed description of changes in BMI. Though our study had its limitations, it highlights a strikingly high prevalence of clinically significant obesity among Saudi male adolescents in Riyadh, KSA. This is especially so among those who had a family history of obesity and who had less exercise. I recommend early development of a national program for the prevention and control of obesity, including school nutritional and physical activity educational programs, formation of a healthy lifestyle, including more physical activity, and replacement of high-calorie diet with a diet lower in energy density. I believe that preventive efforts might be more fruitful if they were focused on those at high risk for developing obesity.

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