ORIGINAL ARTICLE

School Screening Program in Kingdom of Bahrain: Obesity and Overweight Outcome

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Abstract

Background and objective: Overweight and obesity is one of the most common chronic disorders among adolescents and in adulthood. Obese adolescents are more likely to have high cholesterol, high blood pressure, and high blood glucose levels and be at a higher risk for cardiovascular diseases, and diabetes. The aim of this article is to describe the anthropometric status of males and females, aged between 10 and 12 years, based on data collected during pre-intermediate school entrance examination, between 2012 and 2014. Recent researches on this aspect are few, which create the need for establishing the updated studies as an outcome of school screening program in the Kingdom of Bahrain.

Setting: Primary health care centers in Bahrain.

Methods: A retrospective review of the records of all the students, attending pre-intermediate school entrance examination, between January 2012 and December 2014, was conducted. Body mass index was calculated for each individual, and the World Health Organization 2007 references were used to estimate the prevalence of overweight, obesity, underweight and stunting. Logistic regression analyses were used to identify factors associated with overweight and obesity.

Results: The prevalence of overweight and obesity was 21.7% and 22.5%, respectively. Multiple logistic regression analysis showed that, belonging to a younger age group, and lack of physical activity, were the only factors significantly associated with overweight and obesity in our study. The problems of underweight and stunting were less common, with a prevalence of 3.3% (95% CI: 2.7, 4.0%) and 4.2% (95% CI: 3.5, 5.0), respectively.

Conclusion: The prevalence of overweight and obesity among adolescents has reached an unprecedented high level, which necessitates an immediate intervention, to halt this increase. Under-nutrition is still an important health issue among adolescents in Bahrain and needs to be tackled, appropriately.

Keywords: Obesity; Adolescent; Overweight; School screening

Introduction

Overweight and obesity is one of the most common chronic disorders among adolescents and in adulthood.[1] Obese adolescents are more likely to have high cholesterol, high blood pressure, and high blood glucose levels. They are also at a higher risk for developing cardiovascular diseases, and diabetes, bone and joint problems, and sleep apnea. Furthermore, they are prone to social and psychological problems such as stigmatization, and poor self-esteem.[2]

Non-communicable diseases (NCDs) such as cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes, are the main cause of death, worldwide. Accordingly, the World Health Organization (WHO) has launched an action plan for the prevention and control of NCDs.[3] They have also formulated a "Global monitoring framework on NCDs" to track the implementation of the action plan, through monitoring the achievement of nine global targets and 25 indicators; one of these indicators is the prevalence of overweight and obesity among the adolescents.[4]

A systematic review published in 2013 studied the literature on the prevalence of overweight and obesity among adolescents, worldwide and concluded that overweight and obesity prevalence ranged widely. In 16 of the 23 countries included in the review, prevalence of overweight and obesity among adolescents was higher than 20%, five countries had a prevalence >30%, and the prevalence was <10% in two countries.[1]

In Bahrain, a study was conducted in 2007 taking into consideration the studies from Saudi Arabia, Bahrain, Kuwait, Egypt, Lebanon, and Tunisia, which showed that the prevalence of overweight and obesity in school children (6-10 years) and among adolescents (11-18 years) was 10-25% and 15-45%, respectively.[5] According to a cross-sectional study conducted in 2006, the prevalence of overweight and obesity among secondary school students (15-18 years) was 29.5% in males and 36.8% in females.[6, 7] In 2008, a national task force was established to produce a series of national Obesity Clinical Guidelines and since then a growing number of nutrition clinics was opened to encourage people to adopt a healthy lifestyle, in order to reduce their risk of overweight or obesity.[8]

The aim of this article is to describe the anthropometric status of males and females, aged between 10 and 12 years, based on data collected during pre-intermediate school entrance examination, between 2012 and 2014. Recent researches on this aspect are few, which create the need for establishing the updated studies.

Materials & methods

Data source

In Bahrain, pre-intermediate school entrance examination was launched in 2012, to evaluate the health status of students, and to ensure completion of the planned vaccinations.[9] This service is available free-of-charge, in all health centers in Bahrain. The examination includes a set of questions which is asked by the examining physician, followed by full physical examination. Nurses also check the height and weight of each student, without shoes, and with light clothing. The retrospective study, conducted after an official approval from Dr. Mariam Ebrahim Al Hajiri Public health directorate, Undersecretary of Public Health, attempted to record and review data of all the students attending examination between January 2012 and December 2014. The collected data was entered anonymously into a Spreadsheet (Microsoft Excel 2010; Microsoft), for further analysis.

Data collection

Data was abstracted by history-guided questionnaire from the students' medical records, during the period 2012-2014. The questionnaire was modified from Center of Disease Control (CDC) Global School-based Student Health Survey, and recorded information about age, gender, eating habits (breakfast, fast food, and fruits), and physical activity .The weight of the students was recorded to the resolution of the scale: the nearest 0.1 or 0.2 kg, and height was measured by making the students stand, with bare feet on the flat floor, against a wall with fit parallel, and with heels buttocks, shoulders, and occiput, touching the wall.

Data analysis

Descriptive statistics were calculated for both continuous and categorical variables. The differences between the groups were tested using the Student's t-test, non-parametric test, or the $\chi 2$-test. BMI was calculated for each student, and

WHO 2007 references were used to categorize them into normal, overweight (>1 SD of median of BMI for age and gender), obese (>2 SD of median of BMI for age and gender), and underweight (<-2 SD of median for BMI for age and gender).[10] The prevalence of stunting was also calculated based on WHO definition for stunting (<-2 SD of median of height for age).[11] Logistic regression analyses were used to identify the factors associated with overweight and obesity, and odds ratios (ORs), and corresponding 95% confidence intervals (CIs), were calculated.

The variables analyzed using univariable logistic regression analysis, for possible association with overweight and obesity are age, gender, frequency of breakfast, frequency of fruit intake, frequency of fast food intake, and physical activity. Variables that had a p-value of <0.2, were included in multiple logistic regression analysis. All the analyses were conducted using STATA (version 12) and p-values <0.05, were considered statistically significant.

Results

A total of 2852 students attended primary healthcare centers for pre-intermediate school entrance examination in the period between January 2012 and December 2014. Majority were females and belonged to the 11 years-age group. Males were significantly older than females, with 42.4% belonging to the 12 years-age group, compared to only 12.7% in females. Males were also more physically active and were more regular in eating breakfast, compared to females (Table 1).

The mean weight was not significantly different between genders in the 10 years-age category. Females, 11 years or older, were significantly heavier than males belonging to the same age categories (Table 2).

Table 1: Characteristics of the study participants

Variable	Age (years)	Male No.%	Female No. %	Total No. %	p-value
Age (years)	10	28 (4.1)	108 (5.0)	136 (4.8)	
	11	364 (53.5)	1786 (82.3)	2150 (75.4)	<0.001^
	12	289 (42.4)	277 (12.7)	566 (19.8)	
Eating Breakfast	Mostly-Always	377 (59.5)	1088 (53.3)	1465 (54.8)	
	Rarely-sometimes	191 (30.1)	696 (34.1)	887 (33.2)	0.02^
	Never	66 (10.4)	256 (12.6)	256 (12.0)	
Eating Fruits*	No	239 (37.9)	832 (41.2)	1071 (40.4)	0.14
	Yes	391 (62.1)	1187 (58.8)	1578 (59.6)	
Eating Fast food	Occasionally	194 (30.9)	653 (32.3)	847 (31.9)	
	Weekly	332 (52.9)	1050 (52.0)	1382 (52.2)	0.80
	Daily	102 (16.2)	318 (15.7)	420 (15.9)	
Physically active**	No	124 (20.0)	709 (36.0)	833 (32.1)	<0.001^
	Yes	497 (80.0)	1262 (64.0)	2592 (67.9)	

Test: Chi-square test; *Eating 4 or more fruits daily; **Physically active at least 4-6 times per week for approximately 30 minutes each time; ^ clinically significant

A similar pattern was observed in both height and BMI, where females were significantly taller, and have higher BMI than males, when they reach 11 years of age and thereafter (Table 2).

Prevalence of obesity, overweight and underweight

Overall, 21.7% of the students were overweight and 22.5% were obese. The prevalence of overweight and obesity was higher in females, compared to males. On the other hand, only 3.3% of the students were thin, and the prevalence of underweight was higher in males, compared to females (Table 3).

Table 2: Mean weight, height, and body mass index by age and gender

Age (years)	Male		Female		*P*-value
	No.	**Mean (95% CI)**	**No./%**	**Mean (95% CI)**	
Weight (kg)					
10	28 (4.1)	43.0 (39.2, 46.9)	103 (4.9)	43.9 (41.1, 46.7)	0.71
11	350 (52.47)	43.7 (42.2, 45.1)	1689 (81.8)	46.6 (45.9, 47.3)	0.0006^
12	284 (42.57)	42.5 (41.0, 44.0)	263 (12.7)	50.1 (48.3, 51.9)	<0.0001^
Total	667	43.1 (42.1, 44.1)	2064	46.9 (46.3, 47.5)	<0.0001^
Height					
10	28 (4.21)	144.2 (141.6, 146.7)	103 (5)	144.0 (142.4, 145.6)	0.94
11	348 (52.4)	145.8 (144.9, 146.6)	1685 (81.7)	147.0 (146.6, 147.3)	0.01^
12	283 (42.6)	144.9 (144.0, 145.9)	263 (12.7)	150.5 (149.5, 151.4)	<0.0001^
Total	664	145.3 (144.7, 145.9)	2060	147.3 (146.9, 147.6)	<0.0001^
Mean body mass index (kg/m²)					
10	28 (4.2)	20.6 (18.9, 22.3)	103 (5.02)	20.9 (19.8, 22.0)	0.82
11	348 (52.4)	20.3 (19.7, 20.8)	1679 (81.7)	21.4 (21.1, 21.6)	0.0003^
12	283 (42.6)	19.9 (19.4, 20.5)	263 (12.8)	22.0 (21.3, 22.7)	<0.0001^
Total	664	20.1 (19.8, 20.5)	2054	21.4 (21.2, 21.7)	<0.0001^

Test: Student's t-test; ^Clinically significant

Table 3: Prevalence of obesity, overweight, and underweight among adolescents

BMI categories	Male		Female		Total	
	No./ prevalence	**95%CI**	**No./ Prevalence**	**95%CI**	**No. (prevalence %)**	**95%CI**
Underweight	35(5.3%)	3.8,7.2	54(2.6%)	2.0,3.4	89(3.3%)	2.7,4.0
Normal weight	361(54.3%)	50.6,58.1	1066(51.9%)	49.7,54.1	1427(52.5%)	50.6,54.4
overweight	132(19.9%)	17.0,23.0	457(22.3%)	20.5,24.1	589(21.7%)	20.2,23.2
obese	136(20.5%)	17.5,23.7	477(23.2%)	21.4,25.1	613(22.5%)	21.0,24.2

BMI: body mass index

Prevalence of stunting

Almost 95.8% of students had normal height for their age. The prevalence of stunting was 4.2%, and it was similar in males and females.

Factors associated with overweight and obesity

From multiple logistic regression analysis, it could be observed that belonging to a younger age group, and lack of physical activity, were the only factors significantly associated with overweight and obesity in our study. Students in the age groups of 11 and 12 years had a significantly lower odds of being overweight or obese, than the age group of 10 (adjusted OR=0.65, 95% CI=0.44, 0.95 and adjusted OR=0.53, 95% CI=0.35, 0.80, respectively). Those who were physically active, had a significantly lower odds of overweight and obesity (adjusted OR=0.74, 95% CI=0.62, 0.88; Table 4).

Although females had higher odds of being overweight or obese in univariable logistic regression analysis, this association became insignificant after controlling physical activity. This was probably because in our sample, females were significantly younger than males, and were less active.

Discussion

This study provides information on the prevalence of overweight and obesity, among students at early adolescence (10-12 years), in Bahrain, and explores some factors that are associated with overweight and obesity. According to our results, overweight and obesity has reached alarming levels with prevalence of 40.4% and 45.5% among males and females, respectively. Despite all efforts, the problem of overweight and obesity among adolescents continues to grow in magnitude, as evidenced over the past few years, and has exceeded all the

Table 4: Results of univariable and multivariable logistic regression analysis for factors associated with overweight and obesity

		Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Age in years*	10	1.00	1.00
	11	0.68 (0.48,0.97)	0.65 (0.44,0.95)
	12	0.57 (0.39, 0.83)	0.53 (0.35,0.80)
Gender	Male	1.00	1.00
	Female	1.23 (1.03-1.47)	1.11 (0.90,1.36)
Eating breakfast	Mostly-always	1.00	1.00
	Rarely-sometimes	0.99 (0.84-1.18)	0.96 (0.80,1.14)
	Never	1.33 (1.04,1.71)	1.28 (0.99-1.66)
Eating fruits	No	1.00	-
	Yes	1.03 (0.88-1.21)	-
Eating fast food	Occasionally	1.00	-
	Weekly	1.04 (0.87,1.24)	-
	Daily	1.18 (0.93-1.49)	-
Physically active*	No	1.00	1.00
	Yes	0.71 (0.60-0.85)	0.74(0.62-0.88)

Test: Wald test

*Younger age group, and lack of physical activity, were the only factors significantly associated with overweight and obesity in the study.

estimates in previous studies. [5,7] In March 2003, a cross-sectional prevalence study was conducted to determine the prevalence of overweight and obesity among Bahraini adolescents (249 males and 257 females), between 12 and 17 years of age. The prevalence of overweight and obesity in Middle East countries including Saudi Arabia, Bahrain, Kuwait, Egypt, Lebanon, and Tunisia, reported the prevalence of in school children (6-10 years) to be 10-25%, and 15-45% in adolescent (11-18 years). [5] A household-based survey conducted between 2009 and 2010 in United Arab Emirates, estimated the prevalence of overweight and obesity among adolescents, 11-18 years of age, to be 27.9% in males and 40.2% in females. [12]

In our study, 80% of males were physically active for 30 minutes for at least 4-6 times per week, compared to 64% of females, and it was found that being physically active decreased the risk of being overweight and obese by 26%, among both the genders. Similarly, a study on measuring physical activity in obese and non-obese school-going boys (8–12 years) in Saudi Arabia showed that active boys had significantly lower body fat percentage, and BMI, compared to inactive peers. [7] Moreover, a study conducted in Portugal showed that adolescent males, who were moderately active, were more likely to be of normal weight, but this association was not found in females. [13] After physical activity, there was no significant gender difference in the odds of being overweight or obese. The observed increased prevalence of overweight and obesity among the females in our study could have occurred because, in our sample, females were significantly younger than males, and were less active.

The frequency of having breakfast was not significantly associated with overweight and obesity. Similarly, a Portuguese study found that breakfast skipping is not a predictor of being overweight or obese, among both the genders. [13] Contrary to this finding, a systematic review of 16 studies from Europe suggested that eating breakfast is associated with a lower risk of overweight and obesity, in children and adolescents. [14] The frequency of fruit intake was also not significantly associated with overweight and obesity, a finding further supported by a study conducted in The United states of America

(USA). It concluded that there was no relation between fruits' intake and subsequent changes in BMI Z-score, among children and adolescents. [15] Surprisingly, no significant association was found between the frequency of fast food intake and overweight/obesity. This can be due to under-reporting of fast food consumptions by adolescents, especially in those with weight problems. In contrast, a study conducted in Afghanistan showed that high intake of fast foods was significantly associated with overweight and obesity, among adolescent girls. [16]

Under nutrition is an important health problem. In our sample, 5.3% (95% CI: 3.8, 7.2%) of males and 2.6% (95% CI: 2.0, 3.4%) of females suffered from underweight. In Bahrain, the latest estimates on the prevalence of underweight was from the 2006 study, which showed that 8.6% of males and 2.3% of female secondary-school students, were underweight [6]. According to the CDC, the estimated prevalence of underweight among children (6-11 years of age) in USA is 3.6%, using the sex-specific 2000 CDC BMI-for-age growth charts and definition. [17] Stunting is also an important indicator of chronic undernutrition in children and adolescents. [18] In our study, 4.2% (95% CI: 3.5, 5.0) of the students were stunted, with minimal gender difference. The last study reporting the prevalence of stunting in Bahrain was conducted in 1995 and has estimated that 13.6% of children <5 years of age suffered from stunting. [19] A Turkish study has estimated the prevalence of stunting and underweight among school children to be 5.7 and 4.6%, respectively which is very similar to our estimates. [20]

Study limitation: There is a limited comparison to the previous studies done in Bahrain as there were not much studies to detect the prevalence of overweight and obesity among students at early adolescence (10-12 years) in Bahrain. Hence, we need to encourage the concerned people to do studies in this field.

Conclusion
Our study shows that the prevalence of overweight and obesity among adolescents has reached an unprecedented high level, which necessitates

an immediate intervention, to halt this increase. Although less common, underweight is still an important health issue among adolescents in Bahrain and needs to be tackled appropriately. Recent researches on this aspect are few, which create the need for establishing the updated studies.

Conflict of Interest
Authors have no conflict of interest to declare.

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