INTRODUCTION

Childhood obesity has reached an alarming level in the Arab Gulf states, including Bahrain. The prevalence of overweight and obesity among school children (14-18 years) in these countries ranged from 30% to 45%.

It is well documented that obesity during childhood is a risk factor for establishing obesity and its related chronic diseases during adulthood, such as cardiovascular disease, diabetes mellitus, hypertension and some type of cancer.

Such diseases are representing more than 60% of annual morbidity and mortality in the Arab Gulf countries. The nutrition transition, which was happened in most Arab countries during the past three decades play an important role in changing dietary habits, lifestyle and socio-economic status in these countries. The results are high proportion of obesity among both children and adults.

Therefore, controlling obesity especially during childhood will decrease the health burden of these diseases.

Previous studies on obesity, which were carried out on school children in Bahrain were based on a small sample size for each age group, and focused on age 15-18 years or 12-18 years and one study...
covered 6-18 years. However, most of these studies used CDC reference standard or NHANES standard. Nowadays these two standards are rarely recommended for measuring obesity among children outside USA, as International Obesity Taskforce (IOTF) and World Health Organization (WHO) have developed international standards to be used in countries who did not have their local growth standards, and also used for the sake of comparison in prevalence of obesity between different countries.

Health authorities in Bahrain along with other Arab Gulf countries have become more aware about the health and economic burden of obesity and planning to develop plan of action to prevent and control of obesity. Such plan should focus on prevention of obesity during childhood. The need for comprehensive data on the prevalence of overweight and obesity is essential for planning of any intervention programme to combat obesity in school children in Bahrain. Therefore, the aim of this study was to provide sufficient information on obesity among school children aged 10-13 years in Bahrain; using two commonly used reference standards; IOTF and WHO standards.

**METHODS**

Data of this study were extracted from the national survey on food habits and lifestyle of primary school children in Bahrain. The target children were those enrolled in 4-6 levels of education. A multistage stratified random sampling method was used to select the children. Bahrain is composed of five governorates. The schools were divided into boys and girls primary schools, and selected proportionally from each governorate using simple random procedure. Then, the classes were selected from each primary levels (levels 4, 5 and 6), in each school using simple random method. The study was ethically approval by both the Arab Center for Nutrition, Bahrain and the Research Committee at the Ministry of Education, Bahrain. The total sample size was 2146 students (1068 males and 1078 females). Detailed information on distribution of the sample by age and gender is given in Table-I.

Prevalence of non-overweight, overweight and obesity among school children aged 10 to 13 years, using IOTF and WHO reference standards are presented in Table-II. In general, overweight and obesity ranged from 15.7% to 28.9% among males; and 21.1% to 30.7% among females. The WHO reference standards were used to classify the children to non-overweight, overweight and obese using Body Mass Index cut-offs by age and gender.

**RESULTS**

The distribution of studied school children by age and gender is shown in Table-I. The proportion of males was higher at age 10 and 13 years; whereas the proportion of females exceeded males at age 12 year. The proportion at age 11 year was almost equal (49.6% and 50.4%, for males and females, respectively).

Prevalence of non-overweight, overweight and obesity among school children aged 10 to 13 years, using IOTF and WHO reference standards are presented in Table-II. In general, overweight and obesity ranged from 15.7% to 28.9% among males; and 21.1% to 30.7% among females. The WHO

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### Table-I: Sample size of Bahraini school children (10-13 years) by age and gender.

| Age (years) | Male | Female | Total |
|-------------|------|--------|-------|
| 10-10.9     | 241  | 176    | 417   |
| 11-11.9     | 350  | 356    | 706   |
| 12-12.9     | 363  | 451    | 814   |
| 13-13.9     | 114  | 95     | 209   |
| **Total**   | 1068 | 1078   | 2146  |

### Table-II: Prevalence of non-overweight, overweight and obesity among school children (10-13 years) in Bahraini using IOTF and WHO reference standards.

| Age (years) | Reference | Non-overweight (%) | Overweight (%) | Obese (%) |
|-------------|-----------|--------------------|----------------|-----------|
|             |           | M      | F      | M      | F      | M      | F      |
| 10-10.9     | IOTF      | 80.9   | 80.1   | 12.4   | 9.7    | 6.6    | 10.2   |
|             | WHO       | 73.0   | 73.9   | 13.3   | 14.8   | 13.7   | 11.4   |
| 11-11.9     | IOTF      | 77.4   | 76.1   | 14.6   | 16.9   | 8.0    | 7.0    |
|             | WHO       | 70.6   | 69.4   | 14.6   | 19.7   | 14.9   | 11.0   |
| 12-12.9     | IOTF      | 80.4   | 77.4   | 12.9   | 14.2   | 6.6    | 8.4    |
|             | WHO       | 71.1   | 71.2   | 18.7   | 16.2   | 10.2   | 12.6   |
| 13-13.9     | IOTF      | 84.2   | 78.9   | 6.1    | 13.7   | 9.6    | 7.4    |
|             | WHO       | 82.5   | 73.7   | 6.1    | 15.8   | 11.4   | 10.5   |
reference standard provided higher prevalence of both overweight and obesity than IOTF reference standard. Using IOTF reference, males were less likely to have overweight than females at all ages, except at age 10 year, whereas for obesity males at ages 10 and 12 had lower proportion than females and the opposite at ages 11 and 13 years. Using WHO reference standard, males were more prone to have obesity than females, except at age 11 year, where females had higher prevalence of obesity (10.2% and 12.6%, for males and females, respectively).

**DISCUSSION**

This study suggests a high prevalence of overweight and obesity among Bahraini children aged 10-13 years. Comparing the proportion of overweight and obesity among children aged 12 to 13 years with those reported previously using same standard (IOTF), we can notice that our study provide lower prevalence of overweight and obesity. This could be attributed to the very small sample size for each age group in the previous study. However, when we compared the prevalence of obesity among the children in this study with those reported among 1-5 years old, we can observe a sharp increase in obesity. The proportion of overweight and obesity in Bahraini children aged 1-5 years old was 15% and 18% in males and females, respectively, and it reached 25% and 28% in males and females, at age 10-13 years old in this study, respectively. However, this finding is a rough indicator rather than absolute trends, as the two studies were cross-sectional and did not deal with the same children.

Several factors could have contributed to high prevalence of obesity among Bahraini children, such as high intake of energy density foods, sedentary lifestyle and inactivity. The dietary habits of school children in Bahrain characterized by high consumption of fast food, sweet and chocolates and sugary beverages, and low consumption of fruit and vegetables, and milk. There is good evidence that high consumption of fast food and sugary beverages have positive association with obesity. Furthermore, the frequent intakes of fruit and vegetables and milk products have shown to have negative association with obesity. Sedentary lifestyle has increased markedly among Bahraini school children, with long viewing of television, long use of video games and internet. Gharib and Rasheeda showed that non-overweight school children in Bahrain were less likely to watch television per week and less using electronic-computer games per week, than overweight and obese children.

Previous studies in Bahrain found that girls were less prone to practice exercise than boys, especially out of school. This may indicate that girls are more at risk of obesity at adulthood. Data from Bahraini Ministry of Health indicate that 67% of men and 71% of women were overweight and obese. Therefore it is important to promote physical activity and healthy eating at school age. However, girls in the Arab World in general are facing many socio-cultural factors and male-biased related to practicing physical activity. For example, most of public sport facilities are male oriented and very few available to females. Most girls and women cannot practice exercise outdoor and with sport dress because of cultural or religious reasons. In Bahrain, the majority of girls or women who are allowed by their families to practice exercise outdoor, do such with traditional dress, which is not comfortable for exercise purpose.

The obesity epidemic environment in Bahrain, especially in school children and youth creates the need for establishing an intervention programme to prevent and control of obesity among these age groups. The standard used to determine the overweight and obesity prevalence should be carefully selected, as these standards do not give same findings. The current data of this study provide additional information, which may be used in planning appropriate intervention programme, which should consider promoting healthy eating habits and physical activity.

**Conflict of interest:** The Authors declare no conflict of interest.

**REFERENCES**

1. Musaiger AO. Overweight and Obesity in Eastern Mediterranean region: Prevalence and possible causes. J Obesity. 2011; DOI: 10.1155/2011/407237.
2. Campbell KJ, Crawford DA, Salmon J, Carver A, Garnelt SP, Baur LA. Association between the home food environment and obesity - promoting eating behaviours in adolescence. Obesity. 2007;15:719-730.
3. Musaiger AO, Al-Hazzaa HM. Prevalence and risk factors associated with diet-related non-communicable diseases in the Eastern Mediterranean Region. Int J General Med. 2012;5:199-217. DOI: 10.2147/IJGM.S29663.
4. Bader Z, Musaiger AO, Al-Roomi K, D’Souza R. Overweight and obesity among adolescents in Bahrain. Anthropol Anz. 2008;66:401-407.
5. Al-Sendi AM, Shetty P, Musaiger AO. Prevalence of overweight and obesity among Bahraini adolescents: a comparison between three different sets of criteria. Euro J Clin Nutr. 2003;57:471-474.
6. Gharib NM, Rasheed P. Obesity among Bahraini Children and adolescents: Prevalence and associate factors, Bahrain Med Bull. 2008;20:114-132.
7. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. Br Med J. 2000;320:1240-1243.
8. World Health Organization (WHO). The WHO Child Growth Standards. http://www.who.int/childgrowth/en/
9. Arab Center for Nutrition/Bahrain Center for Studies and Research/Ministry of Education. National survey on obesity and lifestyle of primary school children in Bahrain (2003-2005). Bahrain.
10. Al-Raees GY, Al-Amer MA, Musaiger AO, D’Souza R. Prevalence of overweight and obesity among children aged 2-6 years in Bahrain: A comparison between two reference standards. Int J Obes Pediatr. 2009;4:414-416.
11. Musaiger AO, Bader Z, Al-Roomi K, D’Souza R. Dietary and lifestyle habits amongst adolescents in Bahrain. Food Nutr Res. 2011; DOI: 10.3402/fnr.v55i0.7122.
12. Niemeier HM, Raynor HA, Lloyd-Richardson EE, Rogers ML, Wing RR. Fast food consumption and breakfast skipping: Predictors of weight gain from adolescence to adulthood in nationally representative sample. J Adol Health. 2009;39:842-849.
13. Collison KS, Zaidi MZ, Subhani SN, Al-Rubeaan K, Shoukri M, Al-Mohanna FA. Sugar-sweetened carbonated beverage consumption correlates with BMI, waist circumference, and poor dietary choices in school children. BMC Public Health. 2010;10:234-246. DOI: 10.1186/1471-2458-10-234.
14. Ledoux TA, Hingle MD, Baranowski T. Relationship of fruit and vegetable intake with adiposity: A systematic review. Obesity Rev. 2011;12:c143-50.
15. Spence LA, Cifelli CJ, Miller GD. The role of dairy products in healthy weight and body composition in children and adolescents. Curr Nutr Food Sci. 2011;7:40-49.
16. Ministry of Health. National Non-communicable Diseases Risk Factors Survey 2007, Bahrain, 2010.

Authors’ Contribution:
AOM and QA: Participated in conception and design the study. QA: Supervised the data collection. MA: Did the statistical analysis. AOM: Drafted the manuscript. All authors approved the final version of the manuscript.