# Obesity among Elementary Schoolchildren: A Growing Concern in the North of Iran, 2012

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## ABSTRACT

**Background:** The aim of the present study is to assess the elementary schoolchildren's nutritional status based on anthropometric indices due to the sudden spread of obesity in children and adolescents in both developed and developing countries.

**Methods:** This cross-sectional study was conducted on 3647 children with an age range of 7–11 years of primary schools in Babol using cluster random sampling method in 2012. Children younger than 7 years or older than 11 years, children with chronic diseases, pupils treated with corticosteroids or growth hormone replacement therapy and children with chromosomal abnormalities were excluded from the study. Anthropometric indices were measured by medical students and evaluated according to the Centers for Disease Control and Prevention standard percentiles. Data were analyzed using statistical software SPSS version 18 with Chi-square and independent samples $t$-test.

**Results:** The body mass index of 26.1% of children was greater than the 85th percentile, and 4.7% was less than the 5th percentile. The prevalence of obesity among boys was significantly higher than girls ($P = 0.007$). Moreover, urban children ($P = 0.0001$) and children who studied in private schools ($P = 0.0001$) had a significantly higher proportion of obesity and overweight than the urban and private schoolstudents. The highest prevalence of obesity and overweight belonged to 18.0% of the students among fifth graders and 15.3% of schoolchildren among third graders, respectively ($P < 0.001$).

**Conclusions:** The results showed that the prevalence of overweight and obesity in the study was higher. It seems it is necessary to implement the intervention programs to prevent overweight and obesity among schoolchildren.

**Keywords:** Body mass index, obesity, overweight, schoolchildren

## INTRODUCTION

Overweight and obesity are defined as a weight that is greater than what is generally considered healthy for a given height. Various indices such as body mass index (BMI), waist-to-hip ratios, and waist circumference and body fat percentage are used as anthropometric indicators to measure obesity.[1] Obesity is frequently

a problem in modern societies and has passed a progressive trend of 4.2% in 1990 to 6.7% in 2010 and is expected to reach 9.1% in 2020,[2-4] and would become a major public health problem in both developed and developing countries. The results of several studies conducted in Iran showed its 7–16% prevalence in these children.[5-7] Besides, in mapping study among Iranian different provinces in ages 15–64, the greatest prevalence of obesity was found in Mazandaran province 17.8% of men and 29.8% of women.[8] Obesity is a multifactorial disease in which factors such as heredity, birth weight, and nutritional status during breastfeeding, economic status, and nutritional behavior plays an important role.[9-11] Childhood obesity has several complications including rapid growth, early maturation, decreased exercise tolerance, adult obesity, abnormal glucose metabolism, glucose intolerance, insulin resistance and risk of cardiovascular diseases, cancers, and the risk of premature mortality an increase in many other diseases and physical and social problems in adulthood.[9] Furthermore, obesity in children and adolescents causes adverse psychological consequences such as sleep disorders, lack of confidence, anxiety, and depression that affect social and educational status.[10] Childhood obesity can connect with adiposity in adulthood and consequently increases the prevalence of several noncommunicable chronic diseases including type 2 diabetes and cardiovascular diseases.[12,13] Therefore, one of the priorities of research and the food industry in Iran is to evaluate the status of weight disorders in high-risk groups and identify and analyze the related factors. According to the national document of nutrition and food security, labeling, increasing low fat products, modifying the traditional food, introducing healthy dietary patterns, and nutrition education are the national plan to decrease the prevalence and incidence of obesity.[14] Therefore, 5 years following a previous study (2006–2011), the present study focused on assessing the obesity status of schoolchildren based on BMI index in Babol.

## METHODS

### Study design and participants

This cross-sectional study was carried out among 7–11-year-old elementary schoolchildren in Babol, Mazanradan province in 2012. Subjects were selected by multistage cluster sampling method from urban and rural areas. Children younger than 7 or older than 11 years old, children with chronic illnesses, patients on corticosteroids treatment or replacement of growth hormone, and children with chromosomal abnormalities were excluded from the study.

First, the selected primary schools were considered as the defined clusters according to the Department of Education in Babol and its statistical data. Schools with more than 100 students were considered as clusters. The clusters were selected with respect to the proportion of each of the variables such as residential area (urban and rural), gender (girls and boys), and type of school (public and private). Therefore, a total of 25 clusters (13 schools in urban and 12 schools in rural areas) and 3649 students were selected. Then, all children of different grades in each school were assessed based on anthropometric indices by a trained research team, school principal, and the health teacher.

### Variables assessment

Anthropometric parameters including weight and height were evaluated using standard tools. The measurement was carried out in a private room, which often was a health office or an unused classroom in schools. Younger children often liked to be taken to the measuring room with their parents. For the most part, however, the above system was the most satisfactory to the measurement team and to the children participating. Weight was measured in the morning before breakfast, in light clothing using Omron digital scale model BF-511 with a precision of 0.1 kg, seca stadiometer with a precision of 0.1 cm to measure the height standing without shoes. The prevalence of weight disorders was evaluated based on BMI (weight [kg]/height [m]$^2$) using standard percentiles CDC2000. In this study, overweigh and obesity and morbid obesity were defined as age and gender-specific BMI 85th to 95th percentile, equal or higher than the 95th percentile and more than 99th percentile, respectively. Moreover, BMI less than the 5th percentile is considered underweight.[15] This research was approved by the Ethics Committee of Babol University of Medical Sciences. The written invitations were sent to the principals and schoolchildren and they participated in the study with informed consent.

### Statistical analysis

All data were analyzed using SPSS software version 18 (Chicago, IL, USA). The preliminary assumption was tested on the normality of variables. Descriptive analysis was used to determine the percentage of overweight, general obesity, and underweight among students. Moreover, the independent samples *t*-test and Chi-square test were applied to indicate the difference between BMI and other variables (gender, type of schools, habitat, and school grades) ($P < 0.05$).

## RESULTS

The current study was conducted on 3649 elementary schoolchildren of Babol included 1780 (48.8%) boys and 1869 (51.2%) girls. About 546 (15%) cases were in first grade, 882 (24.2%) second grade, 903 (24.7%) third grade, 806 (22/1%) fourth grade, and 512 (14%)

fifth grade. According to residence areas, 56.7% of the schoolchildren lived in the rural areas and 43.3% in the urban areas. Also, 2812 (77.1%) of them studied in public schools and 837 (22.9%) in private schools. Two students were excluded from the study due to lack of adequate data. Therefore, the study was carried out on 3647 elementary schoolchildren. The mean of BMI among boys was 18.0 ± 3.7 and girls was 18.2 ± 3.6. According to habitat and type of school, the mean of BMI was 17.8 ± 3.5 for rural students, 18.3 ± 3.8 for urban students, 17.9 ± 3.5 for public schools, and 18.6 ± 4 of private schools. The prevalence of obesity among boys was significantly higher than girls (15.0% vs. 13.7%, P = 0.007). While the prevalence of overweight was significantly higher in girls (P < 0.05). Moreover, urban children (16.8% vs. 11.2%, P = 0.0001) and children who studied in private schools (18.0% vs. 13.3%, P = 0.0001) had significantly higher proportion of obesity and overweight than the urban and private school students. The prevalence of morbid obesity was 2.0% and no significant difference was observed between girls and boys (1.6% vs. 1.3%, respectively; P > 0.05).

According to the Centers for Disease Control and Prevention (CDC), 26.1% of the students had BMI greater than the 85th percentile while 4.7% had less than the 5th percentile. In more detail, the evaluation of BMI highlighted that 2521 (69.1), 523 (14.4), 430 (11.8), and 173 (4.7) of schoolchildren were normal, obese, overweight, and underweight, respectively. There was a significant difference between BMI and demographic indicators in this study (P < 0.001) [Table 1].

According to grades level, the highest prevalence of obesity was found in primary schools-16.4% and the highest prevalence of overweight was recognized in third grade-15.3% [Figure 1]. The range of healthy weight and underweight in different grades had slight variations. A significant difference was found between BMI and grade levels (P = 0.0004) [Figure 1]. Figure 1 shows generally the prevalence of overweight and obesity significantly increase from the first grade of education to the fifth grade even though, there was a marginal decrease in the prevalence of obesity and about 9% decrease in the prevalence of overweight in fourth grade.

## DISCUSSION

This cross-sectional study presents data on different BMI categories in a large sample of students aged 7–11 years in Babol, Mazandaran province. According to the current study, the total prevalence of overweight and obesity was 11.8% and 14.3%, respectively. Kelishadi et al. investigated the weight and growth disorders in 6-year-old Iranian children and the result showed that 20% of them were underweight and 14.3% had a BMI higher than normal, including 10.9% overweight and 3.4% obesity.[16] Furthermore, the study in Rafsanjan evaluated the anthropometric characteristics of schoolchildren and concluded that 11.5% of children were at risk of overweight, 9.4% were overweight, and 6.4% had abdominal obesity.[17] In 2010, a study in the USA depicted that the prevalence of overweight and obesity in children and adolescents aged 2–19-year-old people was 31.7% and 16.9%, respectively.[18]

This study showed that the prevalence of obesity was higher among boys while, the highest rate of overweight was reported among girls. In contrast, a study among schoolchildren in the city of Ahvaz reported the obesity among girls were significantly higher than boys.[19] Moreover, other studies among schoolchildren concluded that obesity and overweight were higher among girls than boys.[20-23] Similar to our study, Wickramasinghe et al. found a higher prevalence of obesity among boys who lived in the urban areas of Sri Lanka,[24] and the first national study on the prevalence of obesity has illustrated the higher frequency of general obesity among boys than girls (national cut-offs: 2.4% vs. 2.39%; CDC: 2.5% vs. 2% and IOTF criteria: 1.6% vs. 1.3%, respectively).[25]

**Table 1: BMI according to demographic indicators among elementary school children of Babol**

| Demographic characteristics | n (%) | | | | P |
|---|---|---|---|---|---|
| | Underweight | Healthy | Overweight | Obesity | |
| Gender | | | | | |
| Boy | 104 (5.8) | 1209 (67.9) | 200 (11.2) | 267 (15.0) | 0.008 |
| Girl | 68 (3.6) | 1313 (70.3) | 230 (12.3) | 256 (13.7) | |
| Type of school | | | | | |
| Public | 136 (4.8) | 1989 (70.7) | 314 (11.2) | 373 (13.3) | 0.0001 |
| Private | 36 (4.3) | 532 (63.8) | 116 (13.9) | 150 (18.0) | |
| Residential area | | | | | |
| Rural | 76 (4.8) | 1171 (74.1) | 157 (9.1) | 177 (11.1) | 0.0001 |
| Urban | 96 (4.6) | 1350 (65.4) | 273 (13.2) | 346 (16.8) | |
| Total | 172 (4.7) | 2522 (69.2) | 430 (11.8) | 523 (14.3) | |

BMI=Body mass index
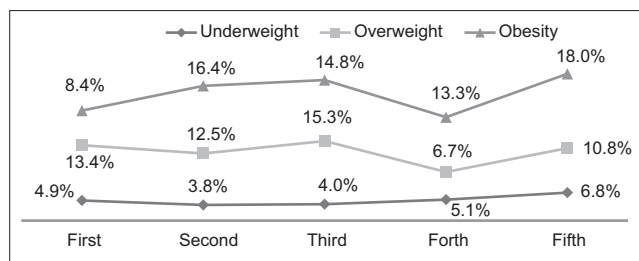
**Figure 1: The relationship between body mass index and grade level among elementary schoolchildren of Babol in 2012**

In addition, the study by Hajian *et al.* among the 4–12-year-old subjects studied in Babol confirmed the present results.[26] However, most studies represented that the risk of obesity among girls was higher and the differences between genders may result to the differences in growth pattern changes among the boys and girls of the same age, differences in dietary behaviors and less physical activity of girls due to hormonal physiology and social culture of the communities.[26]

In the current study, the prevalence of overweight and obesity was higher among the urban schoolchildren and those who studied in private schools. It is also highlighted that there is a high proportion of underweight children in rural areas. Other studies regarding the nutritional status of schoolchildren showed that the prevalence of underweight was higher among girls in rural areas.[9,26] Delavarianzaden *et al.* suggested that the prevalence of underweight in public schools was significantly higher than in private schools that reflected the socio-economic factors on the growth of children.[27] According to these studies along with the results of the present study, the prevalence of underweight among children may be due to the long distance from home to school and the amount of physical activity they have because of their geographical location.[27]

In the present study, the association between BMI and grade showed a significant difference. Ghanbari *et al.* in 2012 evaluated the prevalence of obesity and its relation to some effective factors among male children aged 8–12 in Shiraz and found that there was a significant negative relationship between BMI and age,[28] while the mean of increased in all genders with the increase of age in the study of Hajian *et al.*[29] Although, Aghamolaei and Sobhani expressed that the prevalence of underweight was enhanced with the increase of age and grade level in Bandar Abbas in 2003, the other cross-sectional study in 2011 in this city concluded that there was a significant association between obesity and age.[30,31] The difference in the prevalence of overweight in this study and other studies may be due to the possible causes such as sample size, different age groups and ranges, different economic and social conditions, and using different criteria for the diagnosis of obesity or in the other words, the different methodologies of the study.

Studies that focus on children have generally some limitations like other cross-sectional studies in general. Moreover, the obstacles and difficulties of the study were the lack of cooperation among the schoolchildren and their families in order to minimize the clothing for anthropometric measurements using standard methods. Although, applying BMI to identify body adiposity and obesity on the individual level has a good specificity, but it has a poor sensitivity with subjects who have high body fat percentage and also the non overweight children.[32,33] Therefore, BMI should not be considered as the only indicator of obesity in children.

## CONCLUSIONS

Findings of this study emphasized the significance of the prevalence of obesity among students living in Babol. The results also indicated that the highest frequency of obesity was found among boys, urban students, and students in private schools. The findings of the present study provide insights for policy makers to children obesity interventions for the prevention and control of childhood obesity and local programs. Therefore, the need of such studies in the different countries culturally and the different provinces of Iran using more samples to evaluate BMI changes overtime and the different age groups and the implementation of nutrition educational programs for patients with weight disorders to inform them about proper diets can plays an important role to create an appropriate pattern of nutrition and lifestyle.

## ACKNOWLEDGEMENTS

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