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Obese and female adolescents skip breakfast more than their non-obese and male peers

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Abstract: We examined the association between overweight/gender and skipping breakfast among adolescent students in Tehran city using a cross-sectional study and a multistage random sampling method. All educational zones in Tehran city were covered during the educational year of 2000-01. In total, 2321 students aged $11-16$ years (1068 male; 1263 female) participated in the study. Weight and height were measured and body mass index (BMI; kg/m^2) was calculated. Overweight, pre-obesity and obesity were defined as BMI $\geq 85^{th}$, 85^{th} to 95^{th}, and $\geq 95^{th}$ percentile of age-sex-specific BMI reference values, respectively. Self-reported frequency of breakfast consumption was categorized as usual/always, often, and rarely/never ($5-7$, $2-4$ and $0-1$ times/wk, respectively). Student's t and Chi-square tests were employed to analyze the data. Statistical inferences were made at $\alpha = 0.05$. In boys and girls, the mean±standard deviation of BMI was 19.8±4.0 and 20.6±4.1 kg/m^2, the 18.8% and 23.1% were overweight, and 7.3% and 8.3% were obese, respectively. There was a significant difference in the frequency of breakfast consumption between obese and normal male students ($P < 0.001$). Differences between pre-obese and normal, and obese and normal female students were also significant ($P < 0.002$ and $P < 0.001$, respectively). A significant difference was found in the frequency of breakfast consumption between male and female adolescents in all three categories ($P < 0.001$). These results suggest that obese and female adolescents are more likely to skip breakfast than their normal and male peers and are therefore at higher risk for growth deficits and low educational performance. Preventive/educational programs are urgently needed in this age group.

Keywords: *adolescents, overweight, obesity, breakfast skipping*

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1 Introduction

Inappropriate dietary practices, including self-administered dieting and skipping breakfast, can lead to negative nutritional outcomes as well as low educational performance among students. Some evidence suggests that these deviations are interrelated to obesity [1]. Therefore, the public impact of obesity epidemics must be judged not only on the basis of obesity-related complications [2, 3] but on the increased vulnerability to undernutrition due to restricted food intake caused by less than optimal dietary behaviors [4]. The latter may have more profound effects on children in developing countries, where several endemic deficiencies already exist [5, 6].

Skipping breakfast seen among obese adolescents [7] can significantly decrease the quality of the total diet [8]. This practice usually begins in adolescence and proceeds with age [8]. Reports show an alarming growth of this problem in European and North American countries [8, 10, 11].

The significant prevalence of overweight in Iran [12–14] necessitates studying different aspects of dietary habits, especially among adolescents. Appropriate public measures can then be designed according to any deviations from optimal eating practices.

The present study was carried out to determine the correlation between overweight/gender and breakfast skipping among adolescent students in Tehran city, Iran.

2 Statistical methods and Experimental Procedures

Using a multistage sampling method, 2321 adolescent students aged 11-16 years (1068 boys, 13.7 ± 1.54 years; 1253 girls, 13.4 ± 1.64 years) were randomly selected in Tehran between late 2000 and early 2001.

Trained nutritionists collected the data. Body weight and height were measured to the nearest 0.1 kg and 0.5 cm using digital scale (Soehnle, Germany) and non-stretch tape fixed to a vertical flat wall, respectively. The body mass index (BMI; weight in kg/height in m^2) was calculated for each student. Using NCHS/CDC2000 reference growth charts [15], overweight, pre-obesity, and obesity were defined as BMI values $\geq 85^{th}$, 85^{th} to 95^{th}, and $\geq 95^{th}$ percentiles of age-sex-specific BMI values, respectively [16]. Normal students were defined as those with BMI values between the 5^{th} and 85^{th} age-sex-specific BMI values. Students reported their dieting practices at the time of the study as well as the number of times per week they usually consumed breakfast (i.e., from 0 to 7 times per week). For this analysis, the frequency of consumption was categorized as follows: a) $0-1$ time/week as "never/rarely"; b) $2-4$ times/week as "often"; and c) $5-7$ times/week as "usually/always".

Data processing and analyses were performed using SPSS 10.0.5 software (SPSS Inc., USA). Values are presented as means±standard deviation. Differences in means of frequency of breakfast consumption between pre-obese and normal as well as between obese and normal students were analyzed by Student's t-test. A chi-square test was used to compare male and female students within each BMI category. All statistical inferences

have been made at $\alpha = 0.05$.

The study protocol was approved by the "Research Council", National Nutrition and Food Technology Research Institute, affiliated with Shaheed Beheshti University of Medical Sciences, and the Iranian Ministry of Education, Tehran.

3 Results

The mean±standard deviation for BMI in boys and girls was 19.8±3.95 and 20.63±4.11 kg/m^2, respectively. The corresponding values in normal, pre-obese, and obese individuals were 18.7±1.92, 23.8±1.66, and 29.3±5.07 Kg/m^2 among male students and 19.2±2.22, 24.3±1.84, and 29.8±3.23 in female students, respectively. The overall prevalence of overweight (pre-obesity + obesity) was 21.1% (18.8% and 23.1% in boys and girls, respectively). The prevalence of obesity was 7.3% among boys and 8.3% among girls. In this study, 73.7% and 72.8% of boys and girls, respectively, had normal weight status.

Whereas 7.8% of students (5.3% of boys and 9.9% of girls) always skipped breakfast, approximately 63% of adolescents (70.5% of boys and 55.8% of girls) reported eating breakfast every day. The mean frequency of breakfast consumption among boys and girls was 5.7±2.3, and 4.7±2.8 times per week, respectively ($P < 0.001$).

Table 1 shows the frequency of breakfast consumption in three different BMI categories by gender. A chi-square test showed that there was a significant difference in the frequency of breakfast consumption between obese and normal male students ($P < 0.001$). Differences between pre-obese and normal and between obese and normal female students were also statistically significant ($P < 0.002$ and $P < 0.001$, respectively).

Table 1 Breakfast consumption among adolescent Tehrani students by gender and BMI categories.

Breakfast consumption	Normal		Overweight			
			Preobese		Obese	
	Male	Female	Male	Female	Male	Female
Never/Rarely (0-1 time/wk)	84 (9.9%)	221 (22.5%)	22 (15.1%)	69 (34.2%)	21 (26.3%)	55 (51.9%)
Often (2-4 times/wk)	103 (12.1%)	137 (14.0%)	22 (15.1%)	36 (17.8%)	11 (13.8%)	21 (19.8%)
Usually/Always (5-7 times/wk)	663 -78%	623 (63.5%)	102 (69.9%)	97 (48.0%)	48 (60.0%)	30 (28.3%)
Total	850 -100%	981 -100%	146 -100%	202 -100%	80 -100%	106 -100%

A chi-square test also revealed that there was a significant difference in the frequency of breakfast consumption between male and female adolescents within the three categories ($P < 0.001$). This difference remained significant after making an adjustment for "being on a weight-loss diet" at the time of the study (data not shown).

4 Discussion

This study found that 19.2% of students "never/rarely" (0-1 time per week) eat their breakfast. The proportion of students who reported consuming breakfast "often" ($2-4$ times per week) may be added to this figure, either because they fluctuate around the lower limit of this category (i.e., 2 times per week) or because the amount of their meal could not be considered an adequate breakfast. With respect to the latter case, Azizi et al. showed a negative correlation between BMI and daily share of energy from breakfast meals in 10- to 19-year old Tehrani girls [17]. This might be due to self-dieting practices.

Skipping breakfast may be common in both developing and developed societies. In Oman, it has been reported that breakfast is frequently skipped by 21% of adolescent girls aged $11-18$ years [18]. Pastore also showed that 58% of high school students in New York city skipped breakfast at least three times in the week preceding the study [19]. Skipping breakfast is also prevalent in many European and North American Countries [8–10]. Because there is evidence that skipping breakfast usually begins during adolescence and increases with age [18, 20], it might be predicted that this behavior not only exposes the affected adolescents to short-term health risks but also imposes complications later in life. Although there might be different reasons for omitting breakfast (e.g., lack of enough time for eating in the morning, false anorexia after wake-up, tension associated with daily educational assignments, a limited variety of breakfast foods available in Iranian culture, or a lack of supportive environment for eating early in the morning), self-administered dieting should be considered as a serious health threat.

Undesirable dietary habits can compromise growth and development. Moreover, "neurological hunger", resulting from insufficient provision of nutrients to the nervous system can significantly diminish educational capacity and learning performance through a variety of socio-biological mechanisms, such as decreased memory-related cognitive function and reduced school attendance [8]. This biological event could eventually be translated into an enormous loss of educational investments as well as future opportunities and productivity [21].

In both genders, skipping breakfast was about 2.5 times more frequent among obese than normal students. On the other hand, "regular" consumption of breakfast ($5-7$ times per week) among normal male and female students was significantly more common than in their pre-obese and obese peers. Wolfe also showed that students with higher BMI values missed their breakfast more often than children with lower BMI values [22]. This has also been reported in Spanish [23] and American children [24]. It has been estimated that a one-unit increase in BMI is associated with a decrease in the likelihood of breakfast consumption [20].

Another important finding in our study was that in all BMI categories, girls skipped breakfast more frequently than boys ($P < 0.001$). This is consistent with other published findings. Siega-Riz showed that adolescent males eat breakfast more frequently than females [20]. There could be some social determinants behind this phenomenon; female individuals seem to be more concerned about their body shape and fitness and are

therefore more prone to go on self-administered weight-loss diets.

Sleeping time may be considered a contributing factor in breakfast consumption [25], but the significant difference in the frequency of breakfast consumption between girls and boys in this study could not be explained by a difference in the sleeping hours (data not shown); however no adjustment was made when analyzing data for potential confounding variables, such as number of siblings [20] or parents' level of education. Undoubtedly, this should be regarded as an important point in designing follow-up studies because many socio-economic and psychological factors may lead to and/or accompany breakfast skipping [26].

The interrelationship between energy intake and skipping breakfast is not fully understood. Some suggest that skipping breakfast results in a decrease in the total daily intake of energy [27], but others have shown that it may instead lead to increased calorie consumption [28]. There is also evidence showing that lower food consumption at breakfast may accompany higher intakes at lunch and dinner [11, 29].

This study shows more frequent breakfast skipping among obese and female adolescent students in Tehran city. Considering the accelerated food and nutritional transition and the double burden of malnutrition in Iran [12], as observed in neighboring countries [30], this behavior may have a profound impact on the health and well-being of future generations. Well-designed educational campaigns aimed at promoting optimal eating and nutrition practices among vulnerable groups, including school children, are needed. Given the positive impact of some school feeding programs on reducing the number of breakfast skippers [31], food-based intervention may also be considered.

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