Original Article

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Personal and Behavioral Factors Affecting Body Mass Index in First Grade Highschool Students of Babol, Iran

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ABSTRACT

BACKGROUND AND OBJECTIVE: Nowadays, increasing body mass index (BMI) in adolescents is a major threat for communities, and various factors can play a role in this regard. This study aimed to evaluate several personal and behavioral factors contributing to the increasing trend in BMI of students of Babol, Iran.

METHODS: This cross-sectional study was conducted in 504 students, who were selected through random stratified sampling during spring 2014. The data were collected using a researcher-made questionnaire evaluating demographic and behavioral variables including age, fast food consumption, exercise, walking, physiological puberty, and breastfeeding. The questionnaires were filled out by the students and their mothers. BMI of the students was calculated and analyzed based on the percentiles of CDC 2000 standards.

FINDINGS: The mean BMI of 496 students was 21.5±4.4 kg/m^2; 78(15.7%) students were overweight and 71(14.3%) were obese. Mean BMI of the female students was higher than males (21.9±4.3 vs. 21.0±4.5); the mean BMI of the pubertal students was higher than those who had not reached puberty (21.9±4.3 vs. 20.5±4.3), and mean BMI of the students who owned a family car was higher than those who did not (21.6±4.2 vs. 20.9±4.3). Moreover, duration of breastfeeding (r=-0.103, p=0.021), motor vehicle ownership, consumption of fast foods and soft drinks, as well as walking had a significant relationship with BMI (p<0.05). Contrastingly, BMI did not have a significant relationship with birth order, possessing a bicycle, commuting between home and school, knowledge of computer, watching television, hours of reading, as well as parental age, education, and occupation.

CONCLUSION: The results showed that some personal and social factors could increase BMI of the students.

KEY WORDS: *Body Mass Index, Students, Overweight, Obesity.*

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Introduction

The prevalence of obesity in children and adolescents is on a growing trend and has become a major problem across the world (1). Obesity and overweight cause elevated cholesterol level and hypertension in children (2, 3) and promote the future risk of chronic diseases, hyperlipidemia, type 2 diabetes, metabolic syndrome, cardiovascular diseases, musculoskeletal problems, asthma, sleep apnea, polycystic ovarian syndrome (PCOS), and psychosocial problems (4-6).

Former studies indicated a significant relationship between obesity and increased rates of disability and mortality (7). Although obesity might be secondary to several factors including genetics, hormonal factors, as well as metabolic and behavioral components (8), it seems that nutrition transition, lifestyle changes, low physical activity, and urban development play a great role in developing overweight and obesity (9, 10). In a study performed by Ghanbari et al. in Shiraz, it was reported that the prevalence rates of overweight and obesity among students were 11.9% and 7.1%, respectively.

Moreover, they revealed inverse significant relationship of BMI with age and parental education level (11). A study conducted by Didarloo et al. at a junior high school of Maku, Iran, demonstrated that the prevalence rates of overweight and obesity were 10.1% and 8%, respectively. Moreover, there was an inverse significant relationship between physical activity and BMI and a significant direct relationship between BMI and parental education level, hours of television viewing, and computer use (12). In a study conducted on control and study groups, Gortmaker et al. were able to significantly reduce BMI of the study group by declining hours of television viewing and consumption of dietary fats, enhanced fruit and vegetable intake, as well as increased physical activity (13). A study by Hajian et al. indicated that the prevalence rates of underweight, overweight, and obesity were 13.5%, 12.3%, and 5.8%, respectively. The risk of obesity and overweight were significantly lower in females compared to males.

The risks of obesity and overweight were higher in students with educated parents, and with every additional score increase in physical activity during leisure time, the risks of obesity and overweight were significantly diminished (14). Former studies noted that the rates of overweight and obesity were varied among different countries (15), and studies on the role of socioeconomic factors yielded conflicting results (16,17). BMI in adolescence is on a progressive trend (1), and it is closely associated with behavioral, economic, and social patterns. Moreover, transition of obesity from adolescence to adulthood is highly probable.

Accordingly, based on environmental conditions, prevalence of obesity, and the risk factors for obesity, health authorities of each region should design and implement effective plans to address the relatively high prevalence of overweight and obesity in Iran. As the most recent study on this issue was conducted by Hajian in Babol, Iran, eight years earlier (14), this study aimed to identify personal and behavioral factors affecting BMI of first grade high school students of Babol.

Methods

This cross-sectional study was performed in first grade high students of Babol, Iran, in spring 2014. The sample size was calculated to be 504 using sample size determination equation. Considering the large study population, we selected 10 urban and 8 rural schools using stratified multistage random sampling method. Economic, social, and geographical status as well as female to male ratio was taken into account during the sampling process.

Each school invited 25-30 of its students to the study using systematic sampling. The data were collected using a self-made questionnaire with open- and closed-ended items. The first part of the questionnaire contained 15 items on personal variables including gender, place of residence (rural/urban), type of residence (apartment/ others), physiological puberty, possession of family car, motorcycle, and bicycle (18), breastfeeding, birth order, as well as parental age, education level, and occupation. The second part contained behavioral variables with 15 items including fast food and soft drink consumption, tea intake, aerobic exercise at school, sports, walking during the week, commuting between home and school, time spent using computer, television viewing, and daily hours of seated reading.

While the items on age, fast food consumption, exercise, and walking were responded to by the students themselves, their mothers answered the rest of the items including physiological puberty, breastfeeding, and birth order. Same-gender interviewer-respondent was used for the study. The

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validity of the variables such as weight, height and BMI were confirmed by previous studies (11, 12) and five nutritionists and health experts. In addition, the Cronbach's reliability of the personal and behavioral variables was calculated to be 89%. Stadiometer seca (Japan), with high stability, was used to measure height with accuracy of 0.5 cm.

The height of the participants was measured through standing perfectly upright without having shoes, hat, or scarf on the head and neck, looking straight ahead so that the five parts of the body including the head, anterior part of the back (shoulders), hips, back, and heel bumps formed a straight line with the stadiometer. Afterwards, we measured height by placing a plastic level, perpendicular to stadiometer, on the head. The subjects' weight was quantified by means of Beurer scale (Germany) with accuracy of 0.5 kg. We calculated the students' weight while they had minimal clothing (no coat, chador, hat, jacket, or shoes) and standing vertically steady on the scale. In order to maintain the reliability of the scale, after placing it in the right place and before initiatiation of the weighing, we examined its accuracy with a 2 kg control weight and repeated this process after each five times of measurements.

We assessed the students' BMI in Excel using the associated formula (weight in kilogram divided by height in squared meter). Afterwards, the subjects were categorized separately by SPSS, version 18, based on the percentiles of CDC 2000 standards the students were divided into four groups based on gender and age as lean (below the 5^{th} percentile), normal (between the 5^{th}-85^{th} percentiles), overweight (between the 85^{th}-95^{th} percentiles), and obese (above the 95^{th} percentile) (19). The open- and closed-ended items were imported into Excel as continuous and discrete quantitative variables as well as pre-defined codes, respectively.

To analyze the data, Pearson's correlation coefficient was run for ordinal variables, t-test and multivariate analysis of variance (MANOVA) tests were performed to compare means, Chi-square test was used for qualitative variables, and linear regression was carried out for simultaneous measurement of dichotomous qualitative and quantitative variables and $p<0.05$ was considered statistically significant.

Results

The total sample size was 496 students from whom 276 (55.6%) were female. The mean ages of the girls and boys were 13.1±0.8 years and 13.2±0.8 years, respectively.

Physiological puberty was experienced by 228 (83.5%) of the girls and 108 (50.9%) of the boys. The mean BMI of the students was 21.5±4.4 kg/m^2, while the distribution of the participants in the BMI categories were follows: underweight (n=31, 6.3%), normal weight (n=316, 63.7%), overweight (n=78, 15.7%), and obese (n=71, 14.3%). Regarding higher BMI in girls compare to boys (21.9±4.3 vs. 21.0±4.5), there was a significant relationship between BMI and gender (p=0.028).

Furthermore, pubertal subjects had higher mean BMI (n=333, 21.9±4.3) than those who had not reached puberty (n=149, 20.5±4.3); there was a significant correlation between physiological puberty and BMI of the students (p=0.001). Furthermore, there was a significant correlation between duration of breastfeeding and BMI of the students (r=-0.103, p=0.021). There was a significant relationship between BMI and family car ownership, that is, mean BMI of the students with a car (n=222) was higher than those without it (n=211; 21.6±4.2 vs. 20.9±4.3; p=0.023). Among the students who had history of exercise at least once a week (n=203, 40.3%), 75 (36.9%) cases had signed up for gym. There was a significant association between location of exercise and BMI (p=0.008), that is, those who signed up for gym had higher BMI. There was also a significant link between BMI and the number of times students had weekly exercise at school (n=384, 71.8%; p=0.036).

Bivariate analysis of the data did not demonstrate a significant correlation between BMI of the students and age, place of residence, residence type, owning a bicycle in the family, birth order, consumption of fast foods and soft drinks, doing sports, walking during a week, commuting between home and school, and time spent using computer, viewing television, or reading during a day. In multivariate regression, no significant relationship was evident between gender, duration of breastfeeding, physiological puberty, and owning a family car. While, there was a significant association between BMI and fast food consumption, walking, and owning a family bicycle ($p<0.05$; table 1).

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Table 1. The relationship of personal and social variables with body mass index among high school students of Babol, Iran

Variable	Exp(B)OR	CI-95%	P-value
Student gender (female*/male)	1.280	0.645-2.54	0.479
Age (12-13*, 14-15)	1.139	0.606-2.14	0.686
Breastfeeding(yes*/no)	0.348	0.046-2.655	0.309
Breastfeeding duration (0-6, 7-36 months)	1.094	0.248-4.819	0.906
Birth order(first, second*, third-tenth)	1.140	0.615-2.116	0.677
Physiological puberty(yes*/no)	1.268	0.631-2.548	0.505
Fast food consumption(yes*/no)	0.345	0.174-0.683	0.002
Soft drink consumption(yes*/no)	1.545	0.8-2.983	0.195
Walking(no*/yes)	0.403	0.226-0.721	0.002
Exercise(no/yes)	0.948	0.514-1.747	0.864
Exercise at school(no*/yes)	0.561	0.288-1.094	0.090
Use of computer(no*/yes)	0.790	0.440-1.417	0.429
Viewing television(no*/yes)	0.796	0.449-1.409	0.434
Reading(0-1*, 2-6 hours)	0.845	0.459-1.556	0.589
Family car ownership(yes*/no)	0.999	0.569-1.755	0.997
Family bicycle ownership(yes*/no)	0.434	0.219-0.862	0.017
Place of residence(rural*/urban)	0.707	0.367-1.365	0.302
Type of residence (apartment*/other)	0.889	0.409-1.934	0.768

***All the variables were categorized as dichotomous, and each reference group is marked with an asterisk**

Discussion

The results revealed that BMI of approximately a third of the studied students was higher than standard of the country based on previous studies (20-23). High prevalence of overweight and obesity might be due to the economic status and low physical activity in North of Iran. In line with previous studies, in this region, easy access to food in both quantitative and qualitative (wide diversity of foods) terms increased the consumption rate (24). Nutrition transition and lifestyle changes affected most parts of Iran even in small towns, and patterns of overweight and obesity are growing beyond the Asian regions and are approaching the European, Middle Easterner, and American patterns (25, 26).

Based on the study by Hajian et al., the prevalence rates of underweight, overweight, and obesity in students was reported to be 13.5%, 12.3%, and 5.8%, respectively (14); additionally, it was noted that BMI was on a growing trend in North of Iran. The relationship between duration of breastfeeding was inversely associated with BMI, which was consistent with results of Kalantari et al. (27).

According to a study by Siqueria et al., the risk of obesity in children deprived of mother's milk was twice higher than in those who were breastfed (28). Following reviewing 28 papers, 298,900 samples, and adjusting for confounding variables, Owen et al. exhibited slight protective effect of breastfeeding against obesity (29).

Pairwise bivariate analysis indicated that family car ownership was directly correlated with BMI, while this association was not confirmed in MANOVA. The significant relationship between family car ownership and BMI can signify the role of economic and behavioral statuses. Having a family car might superior economic status, which can insinuate increased food intake and reduced physical activities; therefore, it implicates weight gain and obesity (30). In addition, use of motor vehicles account for low levels of daily physical activity and adopting a sedentary lifestyle that lead to weight gain and obesity.

Pairwise bivariate analysis performed in the current study reflected the significant relationship of BMI with gender and pubertal status. In MANOVA, regression slope significantly decreased from pubertal to not pubertal and from girl to boy. There might be a relationship between the aforementioned variables since higher mean BMI compared to boys of the same age might be due to pubertal preponderance in girls. Some studies pinpointed that BMI in girls was significantly higher than boys due to hormonal changes (20). Moreover, there was a significant link

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between walking and BMI in MANOVA, it showed that BMI in adolescents with a history of walking was higher than those who were not physically active. In fact, overweight or obese adolescents regard walking as one of the most effective strategies for weight loss. A multitude of studies investigated the correlation between leisure time walking, exercise, or physical activity and BMI and reported different results. In this regard, Moqaddam et al. stated that although a quarter of the students had moderate and vigorous physical activity, there was not any significant relationship between physical activity and BMI (23). The results obtained by Fam et al. revealed that people with normal weight were more physically activity compared to obese ones, but the difference was not statistically significant (31). BMI was noted to be significantly associated with physical activity in studies by Shakeri et al. and Moayeri et al. (32, 33). According to the current study, there was a significant correlation between consumption of fast foods and BMI of the students with a positive slope of the regression (11, 12); however, this result was incongruent with those of other studies, which may be due to the type of employed statistical test, for instance pairwise bivariate analysis in this study did not confirm the significant relationship. Another possible reason can be the growing prevalence of fast food consumption in small town; however, it has not become a major risk factor for overweight and obesity on its own yet.

Although MANOVA marked a significant association between BMI and consumption of soft drinks, similar to walking, those with lower soft drink intake are more prone to becoming obese. This finding was inconsistent with the results of other studies such as the one by Darvishi et al. (34). This inconsistency might be due to the fact that parents of overweight children omit soft drinks and restrict their diet afterwards. Nevertheless, further studies should be conducted to confirm this finding. There was no significant association between daily television viewing and BMI, this finding was similar to those of the study by Farzane et al. (20), but inconsistent with Maffis et al. and Berkey et al. findings (35, 36). One of the reasons for the discrepancy among the results of studies conducted in foreign and domestic studies may be inaccuracy of responses in the domestic studies, that is, the mean hours of television viewing were not reported veraciously. One of the limitations of the current study was not being able to perform the study in some of the selected urban schools because of final exams. Future studies are recommended to make the necessary coordination with the elected school and take examination periods into consideration.

This study showed that prevalence rates of overweight and obesity among students of Babol, which are associated with personal, behavioral, and demographic variables such as gender, duration of breastfeeding, puberty, family vehicle ownership, fast food and soft drink intake, and walking, are higher than most regions of Iran. Given the considerable potential risk in a great number of adolescents, which can endanger their well-being at advanced ages, it is suggested to observe the following guidelines:

1- Since most researchers believe a preventive approach is the most effective way to control the spread of obesity, and given adolescent population is the best target population for interventions, authorities of healthcare network and department of education of each city are recommended to develop and implement intervention programs to raise awareness among students and their parents.

2- To evaluate the relationship between personal variables and BMI, several large population-based studies should be conducted in several neighboring provinces (eastern, central, or western provinces).

3-Given the role of genetic and cultural factors, ethnicity, and even climatic conditions in the growth of children and adolescents (37), other studies should be carried out to simultaneously evaluate BMI of students, their parents, and other factors.

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