Obesity, overweight, underweight and stunting among the female adolescents in Shahroud, Iran

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Abstract

Adolescence is one of the most critical stages of human growth. Its rate and scale is varied around the world; therefore, the consideration of young girls' dietary intake is highly important. The aim of this study was to determine obesity, overweight, Underweight and stunting using anthropometric index among female adolescent population in Shahroud, Iran. In this cross-sectional study, 731 female students from secondary school with a range of 11-14 years old were studied using the two-phase cluster sampling method. After the initial assesmnets, their anthropometric data was calculated and compared with CDC 2000 standard and finally, all the information was recorded in questionnaire forms. The research data was analyzed using SPSS software. The comparison of Body Mass Index (BMI) with the standards showed that 12.9% of the girls were underweight, 12.71% were overweight and 1.7% of them were obese respectively. Besides, 8.2% were suffering from chronic malnutrition and 16.7% from mild malnutrition. The results showed that the studied female students were suffering from malnutrition and in urgent need of macronutrients and micronutrients due to a rapid growth rate. Consequently, it is recommended to monitor them and provide nutritional services for them, individually and collectively.

Keywords: Adolescent, Female, Obesity, Overweight, Underweight

Introduction

Adolescence is a physical growth stage from childhood into adulthood which starts with physiological factors and affects all the body. This stage is considered as one of the primary and most delicate stages of human growth [1]. Considering the pace of the adolescents' growth and hence their accelerated need to receive more energy, vitamins and minerals, the recommended amount of such nutrients for them is higher than those for adults. The noteworthy point is that adolescents constitute 20% of the world's population and 84% of them are living in developing countries [2]. Their nutrition is not only important because of the vast range of physical and behavioral changes during adolescence but also because of its decisive effects on the kind of

diseases they might catch in adulthood and the subsequent death indexes [3]. The unpleasant nutritional condition in young girls as the future mothers which will result in obesity, overweight, underweight and malnutrition due to a lack of necessary micronutreints is worrying. The prevalence of girls' malnutrition in southern Asia has been reported [4]. Obesity and overweight has also increased in some Middle Eastern countries [5]. Different studies in various parts of Iran showed an unpleasant nutritional condition among young girls. A research in Sistan-Baluchestan, Iran, the prevalence of underweight, overweight and Obesity among the females were respectively16.2%, 8.6%, and 1.5% [6]; and also, a similar study in Yazd, Iran, reported the prevalence of above mentioned factors as 18%, 8.8%, and 4.3%, respectively [7]. Another research in Tehran showed that 54.9% of young girls were overweight and 14.3% underweight [8]. On the other hand, overweight which happens to most female adolescents affects the beginning age of their menstruation (menarche) [9]. An irregular eating pattern, skipping meals especially breakfasts, an increasing use of fatty snacks [10], the lack of iron and its resulted anemia [11] and its relation with fatness [12], insufficient amount of calcium intake , hyper lipid, blood pressure, a change in menarche age and obesity are among the recent problems of adolescents worldwide [13,14]. According to the results of Tehran Lipid and Glucose Study (TLGS), many nutritional predictors causing heart and vascular diseases were found among the adolescents of this city [15]. Studies have shown that the adolescents dietary intake often does not provide the recommended amounts of their required vitamins and minerals [16]. Since the health promotion of female adolescents as future mothers can improve the posterity's health, adolescence would be considered as an excellent opportunity to make their nutritional condition better. Hence the analysis of the current problem in the study group before any interference with their dietary intake is pivotal. Regarding the lack of information on adolescents' nutritional condition and their nutrients intake in different regions of Iran, including Shahroud, conducting a research in this field seemed necessary.

Method

This cross-sectional survey was conducted with analytical method by applying interview and anthropometric measuring on 11-14 year old adolescents (731 female students) of Shahroud schools, Iran in 2014. participants were chosen by two-phase random sampling method which made up 85% of all female students. In the first stage, 15 clusters (schools) were chosen out of 24 schools of Shahroud and then 49 students were selected from each school randomly. The gathering data tools were questionnaires with demographic specifications, BMI (Body Mass Index) criterion and questions about the frequency of consumed foods within the last 24 hours (recall) of the students' diet. Then the researchers weighed the students (with minimal clothing and no shoes) by the accuracy of 0.1 kilograms in their schools and with the students' consent. A portable accurate scale, which was controlled daily by a 5-kilogram weight control for balance stability, was used to weight the students. While they were standing on a smooth surface with their legs and feet together closely, their arms on their sides straightly, as well their knees, pelvis, shoulders and heads straightly in one direction, their height was measured by placing a set-square tangent at their head with an accuracy of 0.5 centimeters using a height gauge. The BMI was calculated in square meters by dividing the weight amount by height amount. Considering the BMI index for age, a percentile equal or less than 5 was considered as underweight, a percentile ranging from 5 to 85 as normal weight, a percentile of 85 and 95 in the risk of obesity and a percentile equal or more than 95 as obese. Also, according to the height index for age, less than 5 percentile was considered as stunting. These numbers were compared with the CDC 2000 (Center for Disease Control and Prevention) standard Table.

Table 1 *The classification of nutritional status indexes of present and present and past*

Categorization Index	≤5%	5% - 84.9%	85% - 94.9%	≥95%
BMI Percentile for Age	Underweight	Normal	Overweight	Obesity
Weight for Age	Underweight	Normal	Overweight	Obesity

Table 2 *The classification of the nutritional condition index of the past (stunting)*

Categorization Index	≤ 5%	5% - 84.9%	≥85%
Height for Age	Nutritional Shortness	Normal	Tallness

In this study height index for age has been used as the index of nutritional condition of the past, weight index for age as the index of nutritional condition of both past and present while BMI index for age as the index of nutritional condition of the present [17]. Regarding the Table less than 5% were underweight and nutritional shortness, about 80% normal height and weight, and also about 10% were overweight but only 5% were obese and 15% tall in the study sample[18].

The data related to the energy intake and some of the nutrients were collected using the questionnaire designed for recording the eaten foods with their frequency in the last three non-consecutive days of the students' life. The students were asked to record all the eaten foods, beverages and dietary supplements during the last 24 hours[19]. Since this questionnaire was based on memory, a questionnaire with some items about the eaten food frequency questionnaire (FFQ) was used to reduce the error rate. The recorded foods were broken into their components and calculated by using the Tables of cooked or raw ingredients in the taken amounts of energy, carbohydrates, protein and some nutrients (Vitamin B groups, Vitamin C, minerals, iron and calcium) [20].

Finally, the average of the calculated amounts was compared with DRI's (Dietary Reference Intakes) recommended daily dietary amount. Recommended amounts of DRI's as the standard, classifies the nutrients intake as less than, more than and equal to 75% of the standard. According to this criterion, if at least 20% of the studied people in a society get less than 75% of the recommended nutrients, the nutrient is considered as a deficient one in the dietary-sanitary supplement of that society[21].

Generally, some questions about the date of the first menstruation, family income, parents' job, family size, and parents' literacy were also asked. The data was analyzed using SPSS and EPi-Info software. Qualitative data and the percentage of quantitative data were presented as averages and standard deviations. Chi-square and T tests were used to compare the groups (girls on menstruation versus those not yet) with the 0.05 level of significance.

Results

Totally 731 female students participated in this study. 32.6% of them (237 students) were in the sixth grade of elementary school and 33.7% (247 students) were both in the first and second grades of high school. The analysis of these students' demographic data revealed that 55.5% of them belonged to 4-member families. 43.8% of the students' fathers were self-administered and 82.8% of the of the students' mothers were housewives. 34.2% of the students' fathers and 31.8% of mothers had high school diploma. The comparison of the BMI categorization for age with CDC2000 standard showed that 94 of these students (12.9%) were underweight, 93 of them (12.71%) overweight and 12 (1.7%) of them obese. Considering the weight index for age which indicates malnutrition of both past and present, 6.5% were suffered from chronic malnutrition, 18.2% from mild malnutrition and 1.2% of them from obesity. BMI and nutrition status and weight for age is presented in Table 3. The chronic malnutrition status of the students based on the height for age is presented in Table 4. Results showed that chronic and mild malnutrition was 8.2% and 16.7% respectively.

Table 3 *Students' distribution based on BMI percentile for age and weight for age in comparison with CDC2000 standard*

Categorization Index	Percentile	Percentile	Percentile	Percentile
BMI Percentile for Age	Underweight 94 (12.9%)	Normal 532 (72.69%)	Overweight 93 (12.71%)	Obese 12 (1.7%)
Nutrition Status	Chronic Malnutrition	Mild Malnutrition	Normal	Overweight
Weight for Age	47 (6.5%)	133 (18.2%)	542 (74.1%)	9 (1.2%)

Table 4: *Status distribution of the students based on height index for age (Past Malnutrition)*

Nutrition Status	Chronic Malnutrition	Mild Malnutrition	Normal	Tallness
Height for Age	60 (8.2%)	122 (16.7%)	540 (73.9%)	9 (1.2%)

No significant meaningful relation was existed between these students' BMI, their parents' education and jobs. But there was a significant meaningful difference between BMI average, the number of family members and the type of the school in which these students were studying in (p=0.000). The analysis of food frequency questionnaire (FFQ) revealed that the most consumed snack among the students was bread and cheese (274 students, 37.5%). Also, a significant relation was observed between breakfast eating and menstruation condition (p=0.0001). 322 (44%) out of 731 students were already on their menstruation with the average menstruation age of 12.9 and the standard deviation of 0.8 years (a range from 11 to 14 years old). There was a significant meaningful relation between BMI and menstruation beginning age: the girls with higher BMI had earlier menstruation. The most consumed fruit among the students was apple. 365 students (50%) and 91 students (12.4%) consumed date and raisin. 259 students (35.4%) consumed milk two or three times a week, but 94 students (12.9%) didn't consume milk daily. 525 students (71.8%) consumed snack. According to the definition [21], a large number of the studied adolescents were suffering from lack of vitamins such as folic acid, B12, B2 and calcium. The average intake of some nutrients in the students whether on menstruation or not has been presented in Table 5. In regard to the energy intake, it should be said that according to sufficient intake definition and its measurement, chronic insufficiency is highly important. If a society receives less than 80% of the required energy, it suffers from a severe lack, if it gets between 81% to 90%,it suffers from a minor lack while if it gets between 90% to 100%, it has a normal status. An intake of more than 120 calories of what is needed has been defined as over gain[21]. Therefore, both of the groups, those on menstruation or not, suffered from a severe lack of energy intake, however, their iron and protein intake was enough.

Discussion

According to the findings of the present survey, 12.9% of the students were underweight. Mirmiran et al showed that 30.7% of 10-18 year-old young girls in the east of Tehran were underweight [22]. Jafari et al reported 3.8% of adolescent girls in Sari schools as underweight [23]. Esfarjani et al revealed that 5.2% of young girls in the second year of high school in Tehran were underweight[8]. Taheri et al study on 6 to 12 year-old children in Birjand showed that 69.5% of the girls were underweight [24]. Fallah et al reported that 5% of young girls were underweight in the private schools of Damghan [25] also Doustmohammadian et al reported 5.9% of female adolescents as underweight in Semnan based on BMI [26]. In this study, comparing the present nutritional condition of Shahroud female students with the standard and nearby cities such as Damghan, Semnan, Sari and Tehran revealed their nutrition undesirability. However, these students had a better nutritional condition in comparison with those in Birjand or the girls in the east of Tehran in Esfarjani's 2000 study or Bengali

Table 5 *The comparison of macronutrients and micronutrients intake with the recommended daily intake among the young girls of Shahroud based on their menstruation*

Different Nutrients	On Menstruation	Not Yet on Menstruation	DRI*
Energy (kilocalorie)	489.8±1542.9	463.3±1386.3	2200
Carbohydrates (gr)	34.6±138.9	34.6±136.3	130g
Protein (gr)	4.91±46.4	15.1±41.1	45g
Iron (mg)	2.08±16	9.6±11	15mg
Calcium (mg)	259.9±482.4	200.6±380.1	1300mg
Vitamin C (mg)	56.6±39.4	53.7±38.5	45mg
B1 (mg)	0.5±0.88	0.4±0.73	0.9mg
B2 (mg)	0.19±0.5	0.16±0.5	0.9mg
B3 (mg)	6.5±12.9	0.6.3±10.3	12mg
B6 (mg)	0.07±0.07	0.08±0.09	1mg
B12 (µg)	0.41±0.22	0.13±0.27	1.8mcg
folic acid (µg)	0.99±100	0.99± 95	mcg 300

*Dietary Reference Intakes

girls [4]. Besides, their status is almost similar to that of Hamedan in which 13.5% of young girls were suffering from underweight [27]. Also, the present study revealed that overweight was the same as Underweight among the students, and this may be one of the most crucial problems of the study sample. Doustmohammadian and Fallah reported obesity among young girls of Semnan [26] and Damghan [25] as 10.5% and 21% . They also found their overweight as 2.7% and 3% respectively. Young girls' obesity has been reported as 4.5% in Amini's study [28]. Mohammadpour Ahranjani reported 23.1% of the young females as overweight [29]. Lazzeri estimated overweight among Italian adolescents as 19.6% [30] while it has been reported 18.9% in Nasreddine's study in Syria [31]. In the present research, the students had a worse overweight status in comparison to Semnan [26] but they were better than those in private schools of Damghan [25] and generally, in comparison to other cited studies.

In the studies conducted in Chile [32], South Africa [33], India [34] and southern India, the outbreak of shortness has been reported respectively as 20%, 23.7% (25.5-51%) and 28.3% [35] . This shows a higher outbreak rate of shortness in comparison with our study population but conforms with LIY's study

(13.8%) in China[36]. Different social and economic factors were found to be effective on nutritional status in prior studies. Leslie [37] and Schmeer [38] have expressed these effects too. In Mines' study, there was a significant meaningful relation between BMI and the parents' jobs and literacy, $p < 0.05$. There was a significant meaningful relation between the number of family members and the type of school with the menarche age which conforms to Amigo's study [39]. In the study group, the intake of energy was less than 75% of the standard causing malnutrition which is in contrast with Fallah's study[25]. He reported that 53% of girls intake energy more than 120% of the standard. It seems that despite the lack of energy intake, the outbreak of overweight (12.9%) is related to low physical activities and more studies are needed in this regard. Also, according to the findings of Table 5, a high percent of the students intake was 75% less than the recommended amount of acid folic, vitamin B12 and calcium which conforms to Fallah's study on young girls of Damghan [25], Doustmohammadian's study on girls of Semnan, and Dadkhah's study on the students of east Tehran. The analysis and comparison of 1385 young American girls' dietary intakes (between 12-18 years old) with the recommended amounts

by DRI revealed that vitamin C, A, B, Folic acid, and Iron intakes were less than DRI's recommended amounts. Another study in 2007 on Hawaiian female adolescents showed that food consummation for more than 51% of girls include beverage with high sugar. The calcium intake in the current research was less than 75% of the recommended amount. Only 35% of the students consumed milk two or three times a week, so their training in this regard seems necessary. Vue's study on the young girls in a city of Minnesota showed a low amount of milk consumption too.

The national survey of micronutrients deficiency status in Iran on 11 regions in 2001 revealed that young girls suffer from Iron and Zinc deficiency [40]. The present study and other surveys revealed that the deficiency of energy intake and micronutrients is a substantial problem among young girls in Shahroud and some of the other cities of our country. From BMI point of view, nutritional status is highly important. Hence, to improve the students' life style a continuous planning may be a solution to enhance the society health. This would be performed through socio-cultural impacts, providing some nutrition-based educational materials and presenting the appropriate consumption patterns and physical activities. Consequently, detecting the problems and nutritional deficiencies of growth status among the adolescents is highly prominent for managers to discover the solutions to the existing problems. The results of the current study can help to promote the posterity's health status, especially young females as future mothers. Therefore, we should try hardly to raise the individuals' nutritional knowledge in order to have a growing and healthy society in the future. As mentioned previously, monitoring people and providing them with nutritional services, individually and collectively, is highly recommended.

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Contributions

Study design: M D, A B
Data collection and analysis: A B, S S, M D
Manuscript preparation: S S, M D, N BH, M P

Conflict of interest

"The authors declare that they have no competing interests."

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