Original Article

A Comparative Study of Nutritional Status and Foodstuffs in Adolescent Girls in Iran

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Abstract

Background: The prevalence of obesity and overweight in children and adolescents is increasing world-wide. Obesity in children and adolescents is a major risk factor for diabetes, heart diseases, hypertension, and cancer in adulthood. **Aim:** The aim of the study was to compare the nutritional status and food-stuffs among high-school girls in Arak, Iran, in matter of body mass index (BMI) and associated factors. **Subjects and Methods:** A cross-sectional survey of a representative sample of 278 adolescents was conducted in six randomly chosen high-schools. Height and weight of students were collected using standard methods and the BMI calculated and BMI percentiles of these girls are compared with the Center of Disease Control and Prevention (CDC) reference data. The 5th, 8th, and 95th percentiles of the CDC were adopted as cut-off points for underweight, overweight and obese girls, respectively. Data were analyzed using SPSS by analysis of variance and Chi-square tests. **Results:** On the basis of CDC, the overall prevalence rates of underweight, overweight, and obesity were estimated 10.1% (28/278), 12.9% (36/278), and 1.4% (4/278), respectively. There was no significant difference between nutritional knowledge scores and the rate of physical activities in various groups. The mean age at menarche was significantly higher among the obese girls ($P = 0.02$). Consumption of ice-cream and chocolate was significantly higher in the obese girls group ($P = 0.03$). **Conclusion:** According to the present study, the prevalence of overweight and obesity in high-school girls of Arak is lower than that of many other parts of Iran and some neighboring countries, which are at the high-risk of overweight and obesity. This study warrants the necessity of paying attention to promote healthy life-style and weight control. The earlier age of menarche is alarming.

Keywords: Adolescent, Age at menarche, Body mass index, Nutritional knowledge, Nutritional status, Physical activity

Introduction

The prevalence of overweight and obesity in children and adolescents in both developed and developing countries is steadily increasing. In addition, in developing countries, it is often accompanied by underweight. Adolescence considered as one of the most important stages of growth and development and therefore, consideration of nutritional status of adolescents is essential.[1] Inappropriate nutritional habits and unhealthy life-style are important health threatening factors of this vulnerable group and may eventually, lead to chronic diseases in adulthood.[2]

A systematic review of publications between the years 1990 and 2010 showed an upward trends in prevalence of underweight among children and adolescents in South and West Asia.[3] This is an alarming for the countries that are in the nutritional transient phase that shows nutrition problems have increasing trend. Recent Iranian studies indicated that the prevalence of overweight and obesity, which has been reported to be 13.3-24.8% and 7.7-8%, respectively, while malnutrition and growth disorders remain as the major problems of public-health in the country.[4-6] Studies have also shown that Iranian people faced with poor nutritional status due to lack of absorption of energy, protein, and micronutrients as well as increasing prevalence of nutritional related diseases due to changes in

Access this article online

Quick Response Code:

Website: www.amhsr.org

DOI: 10.4103/2141-9248.126606

diets, meals, activity patterns and life-style.[7,8] Unhealthy dietary habits, increase in time spent watching television and playing computer games, as well as of a decrease in opportunities for physical activity in schools and communities are the most common causes of this phenomenon.[9]

World health organization confirmed body mass index (BMI) charts to be used world-wide as effective tools for the evaluation of children growth and in zones that there are no local-specific data they are appropriate indicators of physical growth. Furthermore, a recent study on Chinese students showed that BMI can predict body fat percentage better than waist-to-stature ratio (WSR) or waist circumference in adolescents.[10] In Iran, some research has been carried out to develop national-specific references and to compare their efficiency with recently available reference data.[11,12]

Overweight and obesity in children and adolescents is a complex health problem and associated with several factors such as socio-economic status and the level of physical activity.[13] According to performed studies, socio-economic status is strongly influenced by the parent's occupation and education.[14]

Excess weight in adolescents is in relation to factors such as improper nutritional habits and low-physical activity level. Considering behavior characteristics of adolescents, most of these factors are difficult to be changed from their life. Therefore, encouragement to increase physical activity levels provides adolescents with the chance to gain and maintain normal weight. The increased consumption of energy-dense foods and decreased consumption of high-fiber foods have been shown to increase the prevalence rates of excess weight and complications in adolescents.[15-17]

The present study was aimed to compare the nutritional status and foodstuffs among high-school girls in Arak, Iran, in different levels of BMI. Furthermore, we aimed to determine the associated factors in overweight and obese girls for nutritional and health education as an essential step for control and elimination of nutritional disorders.

Subjects and Methods

This cross-sectional study was conducted on a representative sample of high-school girls, aged from 14 years to 18 years, in Arak, Iran, in 2010. Individuals were selected in two distinct stages including randomly selection of high-schools at the first and finally randomly selection of classes and students. In total, 300 students were selected of four high-school grades equally. The study protocol was approved by ethical committee of Arak Islamic Azad University and Informed consent was taken from participating subjects.

To calculate BMI values, anthropometric measures of participants including height and weight were taken. Height was recorded using a tapeline with 0.1 cm precision. Before measurement, students were asked to stand straight next to the wall without shoes and heels together. Furthermore, girls without shoes and in light clothes were weighed by means of a balance with 500 g precision. After each 10 measures, the balance was controlled using a standard weight. Nutritional status of students was evaluated using data issued by the Center for Disease Control and Prevention (CDC) in 2000 on the base of age-specific BMI. Students with BMI values under the 5th, between the 5th and 84.9th, between the 85th and 94.9th, and at or above the 95th percentiles were classified as underweight, normal weight, overweight and obese, respectively.[18] Other data such as socio-economic status, physical activity level and nutritional knowledge were collected by standardized questionnaires. Physical activity was evaluated by Baecke, *et al*. questionnaire.[19] Nutritional knowledge assessed by another questionnaire, which includes 15 items. The students score calculated from 100 and presented as percentage. Food frequency questionnaire also was used to evaluate the common consumption of 30 foodstuffs in students, monthly.

At the end of study, data were subjected to statistical analyses using a SPSS 11 (SPSS Inc., Chicago, IL, USA) statistical computer package. The analysis of variance and Chi-square tests were used for comparison the mean and percentage of groups, respectively.

Results

Out of 300 selected students, 22 were not included in the study due to their incomplete questionnaires. On the base of CDC criteria, the overall prevalence rates of underweight, overweight and obesity were estimated 10.1% (28/278), 12.9% (36/278), and 1.4% (4/278), respectively [Table 1]. Means and

Table 1: The prevalence of underweight, normal weight, overweight and obesity per age category among high-school girls of Arak province, Iran

Age	BMI (SD)	Underweight (number and percentage)	Normal weight (number and percentage)	Overweight (number and percentage)	Obesity (number and percentage)
14	19.6 (3.4)	5 (9.6)	39 (75)	7 (13.5)	1 (1.9)
15	20.5 (3.2)	5 (7.9)	48 (76.2)	9 (14.3)	1 (1.6)
16	20.8 (3.5)	10 (14.3)	49 (70)	10 (14.3)	1 (1.4)
17	21.07 (3.2)	6 (8.3)	59 (81.9)	6 (8.3)	1 (1.4)
18	21.6 (3.3)	2 (9.5)	15 (71.4)	4 (19)	0 (0)
Total	20.7 (3.3)	28 (10.1)	210 (75.5)	36 (12.9)	4 (1.4)

BMI: Body mass index, SD: Standard deviation

standard deviations of nutritional knowledge of adolescent girls in different groups are presented in Table 2. As can be seen, the mean nutritional knowledge of adolescent girls in the obese group was higher than those of other groups in an inverse manner, but differences found were not statistically significant. In Table 3, the prevalence rates of underweight, overweight and obesity among high-school girls in different socio-economic groups are detailed. Results of analysis of variance also revealed that association between the parent's educational level and the BMI values of students was not significant ($P = 0.13$).

Table 4 displays the frequency of consumption of some food stuffs among the different groups of nutritional status. Beef, chicken, beans, yoghurt, fruits, and nuts were foods with the highest rate of consumption per month in the group of obese girls but means of various groups were not statistically different ($P = 0.09$). However, obese students significantly consume more chocolate and ice-cream ($P = 0.03$).

As presented in Figure 1, obese girls had the lowest physical activity level in comparison to other groups which was however, found to be not significantly different ($P = 0.57$). The mean age at menarche for different groups of nutritional status on the base of age-specific BMI is presented in Figure 2. In the case of obese girls (12.4 years), it was significantly lower than that of other groups ($P = 0.02$).

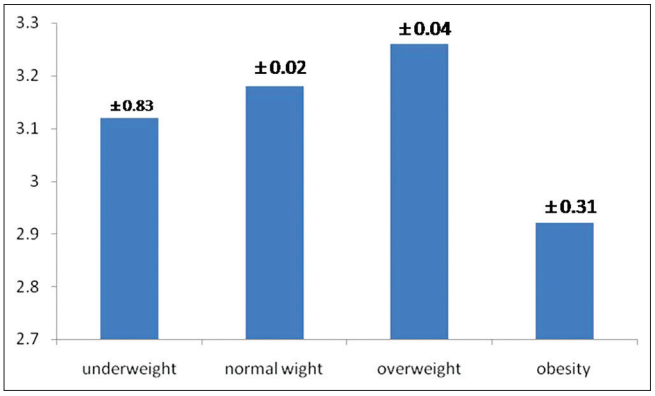

Figure 1: The level of physical activity (hours per week) in different classes of nutritional status

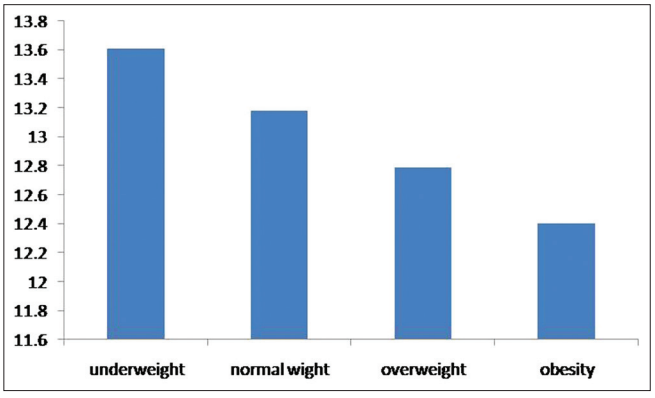

Figure 2: The mean of menarcheal age (Year) among high-school girls of Arak province, Iran

Table 2: Nutritional knowledge levels (from 100) in various groups of nutritional status based on the age-specific body mass index percentiles

Nutritional status	Nutritional knowledge		
	Number	Mean (%)	Standard deviation (%)
5th> percentile (underweight)	28	56.8	1.9
5th<85th percentile (normal weight)	210	52.2	1.6
85th<95th percentile (overweight)	36	56.1	1.4
<95th percentile (obesity)	4	48.3	1.4
Total	278	53	0

Table 3: The prevalence of underweight, normal weight, overweight, and obesity (number) per socio-economic status category among high-school girls of Arak province, Iran

	Under weight	Normal weight	Overweight	Obese	Total
Educational level (father)					
Illiterate, elementary	7	48	11	0	66
Guidance	8	70	8	3	89
High-school	7	60	12	1	80
University	6	32	5	0	43
Educational level (mother)					
Illiterate, elementary	16	78	14	1	109
Guidance	4	76	13	3	96
High-school	6	49	8	0	63
University	2	7	1	0	0

Table 4: The frequency of consumption of major foodstuffs (gram) in various groups of nutritional status based on the age-specific body mass index percentiles

Foodstuff	Underweight (SD)	Normal weight (SD)	Overweight (SD)	Obese (SD)
Beef	14.07 (2.01)	15.58 (0.65)	13.31 (1.3)	21.7 (3.4)
Chicken	10.42 (1.45)	9.47 (0.43)	9.17 (1.02)	12 (2.3)
Egg	13.39 (1.6)	9.7 (0.6)	7.9 (10.8)	11.5 (6.6)
Beans	16.4 (2.4)	13.7 (0.61)	11.5 (1.01)	19 (3)
Milk	13.7 (2.6)	14.7 (0.95)	14.4 (2.2)	11.5 (6.6)
Yoghurt	22.7 (3.2)	25.2 (1.2)	24.6 (2.8)	32 (10.6)
Ice-cream	7.7 (1.75)	7.7 (0.6)	8.63 (1.7)	25.5 (4.5)
Rice	28.4 (2.5)	30.2 (0.9)	29.14 (3.1)	34.5 (4.5)
Fruits	25.7 (2.4)	26.3 (0.9)	25.3 (1.4)	41.2 (7.1)
Vegetables	14.04 (3.3)	19.2 (1.06)	15.69 (1.8)	13.5 (5.7)
Chocolate	16.8 (2.3)	13.7 (0.8)	8.3 (1.7)	23.5 (6.5)
Nuts	4.3 (1.45)	7.8 (0.6)	9.3 (1.7)	15.2 (6.9)

Discussion

BMI considered as an appropriate indicator for evaluation of nutritional status.[14] Limited researches on the prevalence of overweight and obesity among Iranian adolescents showed inconsistence results. In a recent study, the prevalence of overweight and obesity was the lowest in Zahedan (3.1% and 0.6% respectively) and Shahr-Kurd (6.2% and 2.3% respectively), intermediate in Shiraz (11.3% and 2.9% respectively) and Tabriz (11.1% and 2.9% respectively) and the highest in Tehran (21.1% and 7.8% respectively) and Ghom (18.4% and 7.3% respectively).[20] Differences observed between estimated overweight of 12.9% in the adolescents girls of Arak in the present study and those reported earlier in the case of Shiraz and Tabriz were not significant but they had significantly the higher rate of overweight than adolescent girls of Zahedan and Shahr-Kurd. On the other hand, the prevalence of obesity among these students (1.4%) was significantly lower than that of Tehran and Ghom high-school girls. Variation observed in the prevalence rates of overweight and obesity may be due to differences in the socio-economic status, nutritional habits, and physical activity level of participants. In previous studies, the prevalence of obesity among students of Saudi Arabia aged from 6 years to 18 years was estimated to be 15.8%.[21] In Turkey, the overall prevalence of underweight, overweight, and obesity among girls was 11.1%, 10.6% and 2.1%, respectively.[22] Among adolescents girls in Syria, the prevalence of overweight and obesity was reported to be 18.9% and 8.6%, respectively.[23] In another study in Qatar, the prevalence of underweight, overweight, and obesity was 5.8%, 18.9%, and 4.7%, respectively.[24] The high-rates of excess weight among the adolescents of the Middle-East including, our country may be resulted from the rapid changes in the life-style.

Comparing results of the present study with those of neighboring countries, the prevalence of overweight and obesity in Iran is similar to that of Turkey.[22] Keep in mind that in recent years underweight was a major health problem in Iran, the lower prevalence rate of excess weight among the adolescent girls of Arak than that of some neighboring countries is even alarming. Recently, life-style changes in Iran resulted in the higher consumption of simple sugars and fats and the lower physical activity level.

Due to the increasing prevalence of overweight and obesity all over the world, the lack of local-specific reference data especially, in developing countries is a major limitation in evaluation of nutritional status of children and adolescents because available references are provided based on the data from developed countries. Therefore, evaluation of children and adolescents growth should be performed according to the local-specific BMI percentiles.

As presented in Table 2, there were no significant differences among the nutritional knowledge of adolescent girls in the various groups of nutritional status. However, another study in Malaysia showed that appropriate level of nutritional knowledge leads to healthier eating habits.[25] This finding is in agreement with a previous study in America in which no significant association was found between level of knowledge with respect to nutrition and the prevalence of excess weight and underweight among adolescents.[26] Similarly, Jafarirad, *et al*.[27] also reported that relationship between nutritional status of high-school girls in Sari, Iran, and their nutritional knowledge was not significant. Obese high-school girls of Semnan, Iran, had the lower level of nutritional knowledge than those with normal weight.[28] It is concluded that nutritional knowledge alone doesn't seem to be enough to determine adolescent's nutritional status and there are other factors that strongly affect their physical growth.

Results of our study revealed that the effect of parent's educational level on BMI values of high-school girls was not significant. Accordingly, Hajifaraji, *et al*.[29] found no significant association between the parent's educational level and BMI values of adolescent's girls. Furthermore, BMI in Indian girls was not in relation to their socio-economic status[30] and in China a significant association was not observed between BMI values of adolescent's girls and their parent's occupation and educational level.[31] In contrast, in a study on adolescents of Isfahan province, Iran aged from 11 years to 18 years a higher prevalence rate of excess weight among adolescents with the lower level of mother's educational level has been reported.[4] Other researchers also found a significant relationship between BMI in adolescent's girls and their parent's educational level and socio-economic status in USA[32] and Australia,[33] respectively.

As can be seen in Table 4, although, there were no statistically differences among the means of various groups, the frequency of consumption of beef, chicken, beans, yoghurt, fruits, and nuts per month in obese girls was higher than that of other foodstuffs. In a previous study on adolescents of Isfahan province, Iran a linear relationship was found between BMI and frequency of consumption of rice, bread and fast foods.[21] In fact, while many studies demonstrated a positive relationship between energy uptake and nutritive foodstuffs and body weight,[34] such relation was not observed in other ones.[35]

Despite the lower physical activity of obese girls in comparison to other groups, differences observed were not significantly different. In American adolescents, the lower physical activity level has been reported to result in the higher BMI.[36] Likewise, other studies in Iran on adolescent girls of Semnan and Tehran provinces showed that BMI trends to increase with decreasing the level of physical activity.[28]

The relation between BMI and the level of physical activity may be explained by the fact that the low-physical activity levels reduce energy metabolism and muscular activities as well as fat oxidation in body tissues which favor body excess

weight. The lack of regular physical activity and exercise is considered as an important factor in obesity development.[37,38]

In the present study, menarcheal age differed significantly between various groups of nutritional status. In this respect, Chowdhury, *et al*.[39] reported that the mean weight of menstruate girls was significantly higher than that of other ones. In another study, the mean age at menarche was significantly associated with BMI values at the age of 14 and 31 years.[40] Furthermore, the increased incidence of obesity in adulthood has been reported to associate with the lower menarcheal age.[41] In contrast to our study, however, Hui Chang, *et al*.[42] found height as a more important determinant of menarcheal age. Among the high-school girls of other studies, the mean age at menarche was lower in those of relatively high-socio-economic status. Although, there was no significant relationship between nutritive intake and their menarcheal age in some others.[39,40]

Although, association between socioeconomic status and nutritional status of adolescent girls was not significant in our study, such relation may be better understood by increasing the size of sample. Furthermore, central obesity did not measure and since WSR is a practical indicator for monitoring the weight status of adolescents,[43] it is a limitation of the current work.

Conclusion

The prevalence of both underweight and overweight/obesity in Iranian adolescent girls are the major problems. Furthermore, nutritional knowledge has an inverse correlation with BMI status. Intervention strategies that increase the level of nutritional knowledge in adolescent girls and their parents, along with encouragement to increase physical activity levels may finally result in healthier nutritional status of adolescents.

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How to cite this article: Talaie-Zanjani A, Faraji F, Rafie M, Mohammadbeigi A. A comparative study of nutritional status and foodstuffs in adolescent girls in Iran. Ann Med Health Sci Res 2014;4:38-43.

Source of Support: Nil. **Conflict of Interest:** None declared.