

Adolescent Obesity Prevalence and Its Related Factors Among High School Students of Karaj City, Iran



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Citation: Tajvidi, M & Charmari, M 2016, 'Adolescent Obesity Prevalence and Its Related Factors Among High School Students of Karaj City, Iran', *Journal of Client-Centered Nursing Care*, vol. 2, no. 2, pp. 89-96. <https://doi.org/10.32598/jccnc.2.2.89>

doi: <https://doi.org/10.32598/jccnc.2.2.89>

Article info:

Received: 28 Oct. 2015

Accepted: 05 Mar. 2016

ABSTRACT

Background: In recent decades, the prevalence of overweight and obesity in adolescents have increased in Iran and other countries. This study aimed to assess the prevalence of obesity and its associated factors among high school students of Karaj City, Iran.

Methods: A total of 700 students in different age groups were selected by random sampling method. The study samples were divided into 2 groups of case and control and their characteristics were compared. The data were collected by nutritional frequencies and remembrance of 24 hours of nutrition questionnaires. Finally, the obtained information (BMI and its percentile) was statistically analyzed with respect to samples' nutritional pattern and physical activities.

Results: The prevalence of obesity and overweight in teenagers were 13.5% and 17.4%, respectively. The obesity rate in boys was higher than that in girls. The amount of daily fat, carbohydrate, protein, and calorie intake (2700 kcal) was higher in obese students compared to normal ones. Significant differences were observed between two groups in terms of fat, protein, carbohydrate intake, and calorie consumption as well as physical activity.

Conclusion: The obesity prevalence in Karaj students is high and the intake of carbohydrate, fat, and calorie should be adjusted with regard to different age groups. The relevant education should be started in school and families, by considering the importance of diet reform in lowering the rate of obesity and overweight.

Keywords:

Nutritional status,
Adolescents, Obesity

1. Background

Over the past few years, the stunning changes in lifestyle of people, especially kids and teenagers in the western societies, seriously altered their nutritional

pattern and physical activities (Galal 2003; Ghassemi et al. 2002). The nutritional pattern have changed into consuming foods with high amount of calorie and attractive appearances, but without nutritional values. Furthermore, walking for doing daily errands and group playing with

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friends have given their places to using cars, playing video games, and watching TV (Neumark-Sztainer et al. 1996).

The children are the first consumers of fast food, sold on the street (Neffati et al. 2004). Moreover, the physical and social changes during puberty can significantly affect eating behaviors and nutritional health of the young (Storry et al. 2002). The lack of eating healthy foods in this period of life can result in problems like iron deficiency, malnutrition, obesity, as well as bone and teeth problems (Center of Disease Control & Prevention 1996).

In lots of cases, snacks with no nutritional values but attractive appearances and tastes substituted healthy foods and put the teenagers at risk of nutritional problems like obesity and malnutrition. Furthermore, there are some association between lack of exercise and unhealthy habits of eating in teenagers (Neumark-Sztainer et al. 1997).

The studies show that the health quality of foods eaten in the period of childhood to puberty decreases. For example, the consumption of fruits, vegetables, milk, and water decreases and instead, consumption of carbonated drinks increases (Lytle et al. 2000). Investigations reveal that in our society more than half of our children eat oily and sour snacks (Kelishadi et al. 2003). Other studies show high prevalence of blood lipid disorders, overweight, and obesity among children and teenagers of our society (Kelishadi et al. 2004).

According to latest reports of National Center of Sanitation Statistics, 16% of Americans aged 6-12 years are obese. This number shows 45% increase in one decade (Zenzen & Kridli 2009). In Tehran, the percentage of obesity among boys and girls aged 5-12 years are reported 14.5% and 14.4%, respectively (Amini 2005). Besides, 21.1% of students aged 6-11 in Tehran have overweight and 7.8% of them are obese; overweight in girls (23.1%) is seen more than boys (18.8%) (Mohammadpour Ahranyani et al. 2004).

The prevalence of overweight in boys and girls of prep school in Shiraz are 6.8% and 3.8%, respectively and of obesity are 3.3% and 6.1%, respectively. This study reveals that the average Body mass index (BMI) in children is on 38th percentile, while this level was on 20th percentile ten years ago which shows that obesity rate has increased in children of Iran (>15 years old) (Ayatollahi & Mostajabi 2007).

Therefore, due to the importance of consuming healthy food during childhood and adolescence and regarding the high interest of children in snacking, further investigation

is required about the nutritional pattern of this group and its relation to physical activity. Also, changing lifestyle in childhood is much more effective and less expensive compared to intervening plans aimed to cure dangerous behaviors when they are fully formed in adult people.

2. Materials & Methods

This research was a descriptive and analytic study. The statistical population comprised all students studying in high schools of Karaj City, Iran. Sampling was done randomly among the students of the first grade by stratified sampling method. The study process included two steps. First, a list of all governmental and non-profit schools in Karaj was prepared and 4 schools were chosen in each section so that it included one governmental high school for girls, one governmental high school for boys, one non-profit high school for girls and one non-profit high school for boys. Then, these schools were added into the study in predetermined amount according to population in that section. Total number of samples was 700. To collect the data, a demographic questionnaire was administered and the weight and height of students were measured with the lowest amount of clothes possible wearing no shoes using a standard 500 g balance and a 0.1 cm stadiometer. Body mass index (BMI) of students was calculated by division of their body mass over their squared height. Then, we used CDC 2000 growth chart and BMI weight profile for examining their age with respect to their nutritional status. Based on this reference, students were divided into 4 group of low-weight (<5th percentile), normal (5-84.9th percentile), heavy-weight (>85-94.9th percentile) and obese (\geq 95th percentile) (Kuczmarski et al. 2000).

In the second step, obese students were chosen as the case group and normal weight students with matched demographic characteristics to the obese students were assigned in the control group. Information about physical activities, nutrition frequency and a questionnaire of remembering their food in the last 24 hours were obtained from them. The frequency questionnaire contained 7 questions which asked about the amount of consuming diary, red meat, chicken and fish, carbonated drink, chips, snacks, coco chocolate, fruits, and vegetables in the past week. Validity and reliability of these questionnaires were justified in previous studies in Iran.

To estimate the approximate amount of consumed energy and nutrients, the questionnaire of "remembering the last 24 hours food" was used. First some questions about the appetite, consumption of drugs and supplements, their level of activity, and whether they are following some special sort of diet were asked. In continu-

ation, in an interview with the students and their mothers and after showing them the scale of normal dishes frequently by families and households, they were asked to report the amount of 1 day (24 hours) consumption of food by the student.

Next section of the questionnaire consisted the raw food used as the ingredients of the cooked food and the consumption amount of these materials was asked for the mothers to answer and was recorded. To complete this section with utmost precision, by using food consumption table, the percentage of water in raw and cooked food were determined. Next, using the formula of converting raw food into cooked food, this quotient was calculated, multiplied by the amount of raw food, to find the amount of cooked food in the last 24 hours (Ghaffarpour et al. 2000).

Therefore, having the total amount of cooked food and uncooked food, the energy and nutrient consumption of each student in the last 24 hours were obtained using Dorošti Food Processor (DFP) software.

For analyzing the information, SPSS 11.5 was used. To compare the nutritional status of case and control groups, statistical tests of Chi-squared, Mann-Whitney, and Pearson coefficient tests were applied.

3. Results

Out of 700 students participating in this study, 52.1% were boys and 47.9% were girls. About 11.9% of them were low-weight (under 5th percentile), 57.2% with normal weight (5-84.9th percentile), 17.4% were heavy-weight (85-94.9th percentile), and 13.5% of these students were obese (>95th percentile). In most students in the case group (14.3%), both parents were obese or had a history of over-weight. While, in the control group, this number decreases down to 7.7% and the majority in control group (15.4%) had no history of obesity in their families. Mann-Whitney test revealed a significant difference between the two group and the Pearson coefficient test showed a positive relationship between obesity and history of obesity in the families ($P < 0.05$).

The association between food consumption and obesity is shown in Table 1. According to the results, consumption of proteins, carbohydrates, and fat on daily basis along with the amount of energy obtained from carbohydrates and fat are significantly associated with obesity. The relationship between consumption of snacks and chips and obesity is also significant.

The average consumption of chocolate, fruit juice, carbonated drinks, fast food, and milk in the case group are

Table 1. The Pearson coefficients between obese student's BMI and independent variables.

Independent variable	Pearson coefficient	Level of significance
Daily energy consumption (kcal)	0.116	0.12
Daily protein consumption (g)	0.182	0.014*
Daily carbohydrate consumption (g)	0.332	0.000*
Daily fat consumption (g)	0.492	0.000*
Percentage of energy obtained from protein	0.071	0.34
Percentage of energy obtained from carbohydrate	-0.285	0.000*
Percentage of energy obtained from fat	0.279	0.000*
The number of consuming milk in a month	0.074	0.32
The number of consuming snacks in a month	0.169	0.022*
The number of consuming chips in a month	0.178	0.01*
The number of consuming fast food in a month	0.132	0.76
The number of consuming natural fruit juice in a month	0.001	0.991
The number of consuming industrial fruit juice in a month	-0.17	0.81

Table 2. Physical activity scores in the case and control groups.

Physical activity score	Group	Case	Control	Total
		No.(%)	No.(%)	No.(%)
<2.33		22(12)	8(4.5)	30(16.5)
2.33-2.57		14(7.7)	16(8.8)	30(16.5)
2.58-2.91		27(14.8)	30(16.5)	58(31.3)
>2.92		28(15.5)	37(20.2)	65(35.7)
Total		91(50)	91(50)	182(100)

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more than those in the control group, although these differences are not significant.

Physical activity scores in the case and control groups is shown in [Table 2](#). Investigating physical activities in two groups of obese and normally weighted students reveals that obese people are mostly placed in the first three quarters (34.5%). While control group are mostly placed in the third and fourth quarters (36.7%). The average physical activity score in the control group was 2.8 and in the case group, it was 2.6. Statistical test showed a significant difference between the two groups ($P<0.05$).

4. Discussion

Prevalence of obesity and overweight in students subjected to this study, based on CDC 2000 reference, was 13.5% and 17.4%, respectively. Separately, the prevalence of obesity and overweight in boys were 17.8% and 13.2%, respectively and in girls 8.3% and 22.6%, respectively. In 2006, a study was carried out on teenagers in governmental schools of east part of Tehran. It was found that 12% of them were overweight and 13% obese ([Haji Faraji et al. 2007](#)). Mohammadpour Ahranjani's research (2004) on 2321 students aged 11-16 years in Tehran showed that 21.1% of the students suffered from overweight and 7.8% of them were obese; and overweight in girls (23.1%) was more prevalent than in boys (18.8%), which agree with the results of this research ([Mohammadpour Ahranjani et al. 2004](#)). However, in this study the prevalence of obesity and overweight was found higher than that of previous studies; which indicates an increasing trend for overweight and obesity in teenagers. Based on a study in Baltimore (2006), the prevalence of obesity in girls and boys were 20.7% and 17.2%, respectively; also the prevalence of overweight were 15.3% and 14.1% in them, respectively.

Furthermore, a significant correlation between obese students' BMI and their physical activities can be spotted. Analysis of 20 years studies reveals that in teenagers aged 12-17, physical activities decrease by the amount of 20%. In a controlled trial study on 878 teenagers aged 11-15, lack of enough physical activity was the only risk factor for high BMI. Canadian children and teenagers aged 4 to 16 years, compared to non-obese children with the same age had lower scores in physical activities and allocated shorter times to activities with moderate intensity level ([Gillis et al. 2002](#)).

There is a significant relationship between BMI of obese students and the history of obesity in their families ($I=0.196$ and $P=0.008$). Research shows that children with both obese parents have 80% chance of becoming obese in their life; and in children with one obese parent this number decreases to 40%. While, just 7% of children who were born with skinny parents would become obese during childhood ([Sothem 2004](#)). In a study carried out in Spain, it was found that history of obesity in families can be a strong prediction of obesity. Children with at least an obese father, mother, or grandparent have 25% more chance of suffering from obesity ([Ochoa et al. 2007](#)).

The average daily energy consumption in the two groups had a significant difference, but no significant correlation between obese students' BMI and their daily energy consumption was found. Also, a significant relationship was found between obese students' BMI and their daily protein consumption, and there was a significant difference between the average daily protein consumption of the two groups. Also, there is a significant correlation between obese students' BMI and their daily carbohydrate consumption. Finally, there is a significant correlation between obese students' BMI and their daily fat consumption.

No significant relationship was found in daily energy, carbohydrate, and protein consumption of female students in Semnan City, but the relationship was significant with regard to fat consumption.

Also, a study in Spain found no significant relationship between energy and fat consumption. These research revealed that investigation of whole energy consumption of obese people was not an easy task, because these people tended to lie about the amount of their food consumption and reported that lower than real values (Ochoa et al. 2007).

In Canadian children and teenagers aged 4-16, the energy and fat consumption of obese ones were more than those in normal weight people. The average amount of daily energy consumption in obese group was 2520 kcal and in non-obese group 2026 kcal (Gillis et al. 2002). Also, in Irish 5 to 10 years old children, energy, carbohydrate, and protein consumption in obese ones is significantly more than that of non-obese ones (McGloine et al. 2002). In Tehran (District 6), among girls aged 8 - 10, the average daily consumption of energy, protein, and fat in obese students was significantly more than those in non-obese students (Hajjat 2002), which agrees with the results of this research.

The studies reveal that consuming drinks with sugar can increase the risk of obesity up to 70%; and other studies have shown a positive relationship between these types of drinks and obesity in Spain and other western countries. However, there are some research that found no relationship between them. This contradictory results may be due to different study methods (characteristics of samples, size of samples, etc.) (Ochoa et al. 2007).

In girls aged 8-10 years in district 6 of Tehran, no significant difference was found with regard to average number of consuming industrial fruit juices per week between obese and non-obese girls. Several studies found no relationship between gaining weight and consuming non-alcoholic drinks. Dust Mohammadian also failed to find any significant relationship between drinking carbonated drinks and obesity in teenage high school girls (Doost Mohammadian et al. 2007).

The average frequency of consuming carbonated drinks in girls aged 8-10 years in District 6 of Tehran had a significant difference. So that, in obese students the frequency of consuming was 1.6 ± 1.5 and in non-obese students, the number was 1.3 ± 1.4 . The results obtained in this research is in agreement with the results obtained by Forshee et al. (Forshee & Storey 2003). This research

was carried out in cold weather of March and April, so the amount of drinking carbonated drinks in statistical population was low. This may be the result for lack of significant relationship between these two variables.

Consumption of chips in the amounts less than 4.4, 7 bags, and more than 8 bags a month was observed in 25.18%, 16.6%, and 7.6% of the case group and in 39%, 3.9%, and 7.1% of control group. The average number of consuming chips showed a significant difference between case and control groups. Obesity in teenagers aged 11.5-13 years in Japan had a significant relationship to consumption of junk food (Ishihara et al. 2003). Also, in Canadian obese children and teenagers, the consumption of potato chips was significantly more than non-obese ones (Gillis & Baror 2003). In obese students of Ahvaz City, the consumption of chips, compared to non-obese students, was significantly higher, but consumption of chocolate and snacks in the two groups did not have a significant difference. Around half of the people in both groups of case and control in this research consumed snacks less than 4 times a month, the consumption of chocolate was almost similar in both case and control groups and this may be the reason for not having a significant relationship between obesity and consumption of chocolate and snack. Also, no significant correlation was found between BMI of case group and consuming fast food per month.

In children and teenagers in Canada, the consumption of junk food (out of the house) by obese students, compared to non-obese students was significantly higher (Ishihara et al. 2003). Girls aged 8-10 years in district 6 of Tehran, compared to non-obese children with the same age, consumed more fast food, so that, the average number of consuming fast food by obese students in a week was 1.4 ± 1.1 and in non-obese students, 0.9 ± 0.8 times (Hajjat 2002).

The relationship between consuming fast food and obesity is due to the impact of these kinds of food on the amount of energy and other nutrients. The results obtained from the study on children and teenagers of 5 to 19 years olds in America revealed that people who consume fast food, compared to those who don't, consume more energy, fat, carbohydrate, and drinks with sugar, and less milk, fiber, fruits, and vegetables (Bowman et al. 2004).

In this study, fast food consumption per month did not show a significant difference between the two groups. Apparently, as the students in case and control groups were in the first and fourth quarters of consuming fast food per month, using this kind of food was mainly

in the form of prepared sandwiches that was popular among the students.

Therefore, regarding the importance of eating healthy food by children and adolescents, who have interests in snacking, they had better receive more education in this matter through their families and schools. In this regard, careful planning by schools and other responsible organizations is essential. Furthermore, performing interventions to reform lifestyle at childhood is much more effective and economic than going through these plans to correct the formed unhealthy eating habits in older ages.

Acknowledgements

At the end of this article, we express our sincere gratitude to Vice President for Research of Azad Islamic University, Karaj branch for supporting this research, as well as authorities of training and education, managers, and all the parents and students in Karaj City who assisted and provided us with their information. This research program was approved by Azad Islamic University, Karaj branch (code: 5115186020).

Conflict of Interest

The authors declared no conflict of interest.

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