

# Relation of Obesity and Menarche Age among Adolescent Students

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## Abstract

**Objective:** The aim of this study was to investigate the relation between overweight and obesity among adolescent students and age of menarche.

**Materials and Methods:** In a cross-sectional study 399 urban adolescent girls aged 11-14 years old were selected from schools of Kermanshah city in Iran. Anthropometric examinations including, triceps skin fold (TSF), mid arm circumference (MAC), body fat percentage (BF %), were measured and information on age of menarche and student's demographics were collected.

**Results:** The results showed that age, body mass index (BMI) and menarche age were:  $12.63 \pm 1.01$  year,  $17.71 \pm 2.94$  kg/m<sup>2</sup> and  $12.16 \pm 1.18$  year respectively. Prevalence of overweight in respondents was 23.2%, however; prevalence of obesity was 23.2% for 11 years old, 22.4% for 12 years olds, 24% of 13 years old and 23.5% of 14 years old.

**Conclusion:** There was a reverse relation between BMI and age of menarche, however; it was not significant ( $p > 0.1$ ). This study suggests a high prevalence of obesity and relation between BMI and anthropometric parameters in adolescent girls.

**Key words:** Menarche, Adolescent, Anthropometry, Obesity

## Introduction

Adolescence is a period of important distinctions together with physiological, physical, behavioral and social changes. Adolescence is a crucial period for major changes in human body, especially in females. In dealing with the adolescent's nutritional issues, factors such as fast physical growth, Changes at puberty, characteristic and psychological changes should be taken into consideration (1).

Obesity is an increasingly prevalent nutritional disorder throughout the world (2) and its prevalence increases with age (3,4). Obesity is a risk factor for many chronic diseases, such as cardiovascular diseases, type 2 diabetes, and musculoskeletal disorder (5).

Adolescents are faced with various nutritional disorders, one of the most important, being obesity. Obesity may start at childhood and 80% of obese children become obese adults (4,6). Obese children are threatened by arteriosclerosis, diabetes type II, high blood pressure, strokes, osteo-arthritis and some types of cancer and the fatality rate in obese women is double that of ordinary ones (7).

In Iran, data on the prevalence of overweight and obesity among children and adolescents are few and

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scattered. According to the Moayeri et al study in 2006 (8) prevalence of overweight and obesity in male and female secondary students in Tehran was 17.9 and 7.1% respectively. In another study prevalence of overweight and obesity among female adolescents were reported 13.3% and 4.4%, respectively (9).

Nonetheless, obesity is increasing in the adolescents. For example, the prevalence of obesity in American adolescents has reached 21% which shows an increase of 6% in the recent decade. Among the causes of obesity genetics, physiological metabolism and environment, nutritional habits and physical inactivity are very important (1). The review of obesity in adolescents may be made through an anthropometric study such as height, weight, triceps skin folds (T.S.F), mid arm circumference (MAC) and sub-skin fat thickness (10,11). Among these, BMI (body mass index or  $\text{weight/height}^2 = \text{kg/m}^2$ ) has a great correlation with body fatness. However adolescents with BMIs at or above the 85<sup>th</sup> percentile for age and sex, but less than 95<sup>th</sup> percentile, are placed in overweight-risk group and those with BMIs at or above 95<sup>th</sup> percentile for age and sex, considered overweight and must be referred for further in-depth medical assessment and treatment (12). It seems that BMI may be related to other anthropometric parameters, and various studies have also shown the relation between the age menstruation starts (menarche) and the status of body fat and the other anthropometric parameters (13). The adolescents obesity seems to be an increase in Iran, thus there is a requirement to confirm the findings through up-to-date studies. The aim of this study was to investigate the relation of overweight and obesity among adolescent students and age of menarche.

## Materials and Methods

The study included 399 female secondary school students, aged between 11-14 years, in Kermanshah-Iran (Sep, 2006) selected in accordance with two stage stratified sampling. Kermanshah province had 76 female secondary schools, with 26500 total amounts of students. The students were attending grades 1 to 3 of secondary schools. The number of schools was determined based on proportional allocation to ensure that the sample was the representative of the clusters. The schools were selected from different zones in the city to get an equal distribution of children by socio-economic strata. Written informed consent was obtained from the parents. In the

first stage, twelve schools were selected. In the second stage, 31 to 35 students from each grade (first, second, and third, n=11-12) in every school were randomly selected.

The questionnaire provided information on occupation of parents, economic status and the age of menarche. Height was measured in the upright position with stadiometer (14). Weight was measured with the subjects wearing light clothes and without shoes by self zeroing scale. It was rounded to nearest 0.1 kg and the height to 0.5 cm.

Sub-skin fat thickness using caliper and mid arm circumference using tape measure with an accuracy of 0.1 mm, were performed. All the measurements repeated 3 times and their averages entered into the final notes. Body fat percentage was calculated according to the age and sex specific prediction formula (14).

The rate of total weight in kg to square of height in meter was taken as BMI. Standards used for this study were National Health and Nutrition Examination Survey II (NHANESII) and National Center for Health Statistics (NCHS).

We defined overweight as BMI  $\geq$  95th percentile, and risk for overweight as BMI between 85th and 95th percentiles according to age- and sex-specific NCHS/CDC 2000 BMI values (12, 15). The data were analyzed by SPSS software version 11.0. Data were expressed as mean and  $\pm$  SD. Student's *t*-test and Chi-square test were used to compare groups. Statistical significance was taken at  $P < 0.05$ .

## Results

Table 1, shows the socio-demographic profile of the respondents parents. The 43.8% of fathers,

**Table 1: Socio-demographic profile of the respondent parents.**

Socio-demographic profile	Father n= 397	Mother n=394
	n (%)	n (%)
<b>Education level</b>		
Illiterate	42.00 (10.60)	62.00 (15.7)
Primary	85.00 (21.50)	116.00 (29.40)
Secondary	174.00 (43.80)	160.00 (40.60)
High school and degree	96.00 (24.20)	56.00 (14.20)
<b>Age of parentes</b>		
30- 40 years	264.0 (66.40)	105.00 (26.60)
41 and above	133.00 (33.60)	289.00 (73.40)

Data were presented as n and percentage.

**Table 2 :** The BMI, menarche age and anthropometric parameters in adolescent (n= 399).

Parameters	Mean
Age (year)	12.63 ± 1.01
Height (cm)	154.24 ± 8.10
Weight (kg)	41.99 ± 9.04
Menarche age (year)	12.16 ± 1.18
TSF <sup>a</sup> (mm)	9.44 ± 0.28
MAC <sup>b</sup> (cm)	20.30 ± 2.94
BMI <sup>c</sup> (kg/m <sup>2</sup> )	17.71 ± 2.94
BF <sup>d</sup> (%)	19.38 ± 4.30

a) TSF: triceps skin fold; b) MAC: mid arm circumference; c) BMI: body mass index; d) BF%: body fat percentage.

40.6% of mothers had secondary school education, 24.2% of fathers, 14.2% of mothers had highschool and degree, and 21.5% of fathers, 29.4% of mothers had primary education and just 10.6% of fathers and 15.7% of mothers did not have any formal education. The majority of fathers (66.4%) and 26.6% of mothers had age of 30-40 years and 33.6% of fathers, 73.4% of mothers had age 41 and above.

The result shows that mean age of the study group was 12.63 ± 1.01 year (n=399), and the mean BMI was 17.71 ± 2.94 kg/m<sup>2</sup> (Table 2). The table 3 shows the anthropometric parameters, menarche age and obesity prevalence (%) in different ages of students (n=399). The menarche age was 14.30%, 22.20%, 31.00%, 27.00% and 5.5% in 10, 11, 12, 13 and 14 years old of age, respectively. However there was not any 10 years old participant in this research. However; 14.30% of menarche age was begun on 10 years of age.

The prevalence of obesity (BMI > 20 kg/m<sup>2</sup>) was 23.2% by 11 years old, 22.4% at 12 years old, 24% at 13 years old and 23.5% at 14 years old.

The prevalence of obesity (a percentile equal or higher to 95 s) in the total adolescents was 23.2% and BMI at 11, 12, 13 and 14 year increased linearly (Figure 1).

## Discussion

Review of anthropometric parameters is a simple way of evaluating the society's nutritional state and is a fundamental and applied pattern (16). The rate of growth and physiological, physical and psychological changes in the adolescence period concurrent with puberty, exerts an important effect on nutritional needs, and inattention to nutritional issues at this period and disregarding it will create risk factors in later growth periods and adulthood (17, 18). This is

more significant in girls, since not only themselves but the children of these future mothers may be in danger.

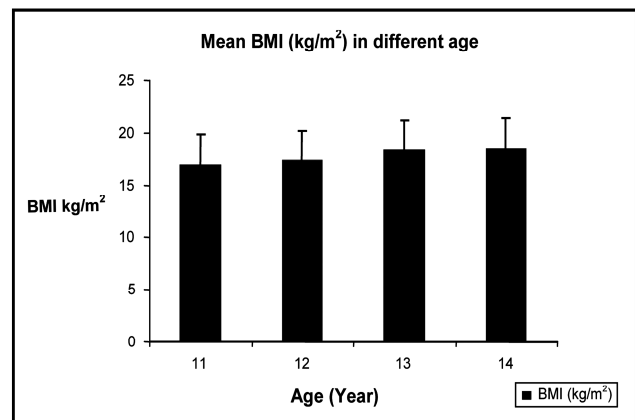
Teenagers are vulnerable to unrealistic attitudes regarding the amount of time and effort necessary for effective weight management. Diet fads and drugs appear to provide the quick remedy food they seek. It should be noted that the BMI differences in various age groups may not be solely due to nutritional status (19). As may be seen in this research, obesity was most prevalent in 13 year olds, consistent with previous study results (20).

In comparison to similar studies in Iran, the obesity figure is higher than the other cities and this difference may be explained by the different methods of survey and sample size of studies (21, 22). The prevalence of overweight and obesity in 11-14 years of age in Kermanshah female secondary schools was higher than reported, for example in an more up-to-date study in Tehran with similar age group, prevalence of obesity was reported 6.5% (23).

However menstruation started at 12.16 ± 1.18 years old of age. There was reverse relation between age menstruation and BMI; however it was not significant (P > 0.1). This parameters has been observed in similar studies (24).

The reverse relation of age of menarche with BMI and another anthropometric parameters has been observed in similar studies in Iran and other countries (25, 26).

The snacks that are used nowadays, have more calorie content and are more expensive than traditional Iranian snacks such as nuts, bread, cheese, herbs and dried fruits.



**Figure 1:** The body mass index (BMI) (mean and ± SD) between different ages of students (n= 399)

**Table 3:** Anthropometric parameters, Menarche age and Obesity (%) between different ages of students (n= 399).

Age (year)	10	11	12	13	14
n	-	66	105	138	90
M.A.C <sup>a</sup> ( cm)	-	21.04±2.63	21.25±2.50	22.70±3.30	22.67±2.69
TSF <sup>b</sup> (mm)	-	9.27±6.79	9.27±4.73	9.91±5.12	11.04±5.9
BF <sup>c</sup> (%)	-	19.01±4.47	19.18±3.57	19.75±6.01	19.36±4.20
Obesity (%)	-	23.20	22.40	24.00	23.50

a) MAC: mid arm circumference; b) TSF: triceps skin fold; c) BF%: body fat percentage.

Keeping regular meals, non-elimination of breakfast, insistence on consumption of vegetables, decreasing the consumption of fast food are among behavioral factors that help with the teenager's weight balance (27).

The previous study shows the association between early maturation and adulthood obesity is probably multifactorial, partly determined by behavioral factors. There was evidence of an interaction between obesity and age at menarche (28).

The studies have shown that programs implemented in schools can play a significant role in the preliminary prevention of nutritional disorders. The obesity problem in the adolescents may be solved through the cooperation of school officials, families and the adolescents themselves. The family's role as the main growing ground for the adolescents and forming their nutritional habits is very important. The adolescents, themselves, should have enough nutritional information through direct and indirect education and to choose their favorite foods wisely. While studies of teenagers' nutritional habits have consistently shown little use of complex carbohydrates, fiber and high use of basic sugars (20). We believe that the cooperation of school officials, families and the adolescents may be associated with lower BMI; therefore reduced the severity of obesity would be supposed. This study suggests a high prevalence of obesity and co-association between BMI and anthropometric parameters in adolescent girls. This may pose a serious threat to the current and future health of Iranian youth. In addition, adolescents that are maintaining diets to control their weight must be encouraged to have more healthy behavioral changes in their life style. We hope this study will be a step in the expansion of nutritional goals and plans by the authorities in order to attain a healthy and ideal society.

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