

A Study of Menarcheal Age in Northern Iran (Rasht)

Maryam Asgharnia, Roya Faraji, Hajar Sharami, Merhnoosh Yadak, Mona Oudi

Abstract

Objectives: The event of menarche is an exceptional phenomenon, which occurs once in a lifetime. It is the precursor of future fertility. The onset of menarche is mainly dependent on genetic factors, however geographical and nutritional factors among other factors have been attributed to the events of menarche. The aim of this study is to determine the age of onset of menarche and the factors which induce it in northern Iran.

Methods: This is a cross sectional study which will assess the onset of menarche in girls between the age of 11-16 years. The subjects were either in middle or high school and had experienced menarche within 6 months prior to the study. This study revolves around 600 girls who were selected using stratified randomized sampling techniques. The data was collected in the form of a questionnaire which focused on age, weight (was measured to the nearest 0.1 kg using a balance beam scale), height (was measured to nearest 0.1cm with a manual height board), and Body Mass Index (BMI: kg/m²) was used as an index of relative weight. Principal Component Analysis (PCA) was applied to analyze Socio-economic Status (SES). The defined standard age of the first menstrual event was applied as the standard. The data collected was analyzed using the Statistical Package for the Social Sciences (SPSS.10) statistical analysis software and the Chi-square and Analysis of Variance (ANOVA) tests were applied. In an effort to establish the factors associated with the age of menarche, multivariate analysis was performed based on linear logistic regression which was performed using a model where all the variables changing the risk estimated by more than 10%. Statistical significance was determined at $P < 0.05$.

Results: The mean age at menarche was observed to be 12.99 ± 1.33 yrs (ranging from 10.16 to 15.91 yrs). The study showed that menarche occurred during the summer for 270 (45%) patients making it the most common season for menarche while winter was the least common season. The mean age of menarche was delayed in patients from low SES groups and it occurred earlier in patients from high SES. In girls with low BMI, menarche occurred earlier in comparison to girls with high BMI. There was a significant correlation between season and age of menarche ($p < 0.05$). There was no significant relationship statistically between BMI and age of menarche ($p > 0.05$). Linear regressions showed no significant effect of BMI on the age of menarche but there was a significant correlation between season and SES on the age of menarche.

Conclusion: The age of menarche and the most common seasons for menarche were similar to previous studies. Results from this study showed that the age of menarche decreased with higher SES, and also the age of menarche in girls with high and low BMI occurred earlier. However, previous studies showed that it occurred earlier in high BMI and later in low BMI. It appears that genetic and environmental factors have influenced these differences.

From Guilan University of Medical Sciences, Islamic Republic of Iran.

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Address correspondence and reprint request to: Dr Maryam Asgharnia, Guilan University of Medical Sciences, Guilan, Islamic Republic of Iran.

E-mail: maryamasgharnia@yahoo.com

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Introduction

Puberty is a process leading to physical and sexual maturation that involves the development of secondary sexual characteristics as well as growth and changes in body composition and psychosocial maturation.¹ Normally, puberty in girls begins between 8 and 14 years of age.² The age of onset of puberty varies and is influenced by genetic factors, family size, BMI, environment, socioeconomic conditions and general health. They can influence the onset in manifestation of puberty to differ throughout the world. Menarche is the onset of menstruation and is the manifestation of puberty among females.³⁻⁵

The onset of the first menstrual period is a qualitative event of major significance, denoting the achievement of a functional state, which involves, if not the ability to regularly conceive at least

the hypothalamic control of the ovarian cycle via the pituitary gland.⁶⁻⁸ The knowledge of age at menarche is very important demographically as one can consider the distribution of the age at menarche as the potential starting point of reproduction. More recently, the average age at menarche has been used as a measure of reproductive risk for miscarriage and unsuccessful pregnancy outcomes and as a proposed basis for public health planning related to targeting sex education.^{8,9} The onset of menarche is generally much earlier today than in the past, this is undoubtedly due to improved nutrition and better health.¹⁰ It has been suggested that initiation of growth and menarche occur at a particular body weight (48 kg) and percentage of body fat (17%), but some studies showed that weight and BMI

did not effect menarche.^{4,5} Although this hypothesis of critical weight is a helpful concept, the extreme variability in onset of menarche indicates that there is no particular age or size at which an individual girl should be expected to experience menarche.^{10,11} Thus nutritional status, weather and genetics are factors that can influence the onset and differences in manifestation of puberty throughout the world. Despite extensive research regarding the age of menarche, results have not confirmed the normal range for the age of menarche and the factors influencing it.¹²⁻¹⁹ In some studies conducted in Kashan, Kermanshah and Mazandaran in Iran, where a random sample of 4,020 urban Iranian girls showed that the age of menarche was 12.91±1.39, 13.4±0.7, 12.5 and 14.5 years respectively.^{8,20-22} However, there were limitations in study design for example small sample size and unsuitable analysis for controlling confounding variables.

Despite the importance of menarche age as an indicator of puberty, there is little information on menarche age in the northern region of Iran (Guilanian teenagers). Hence analytical research for recognizing the factors which influence the age of puberty and its stages is highly recommended.

Methods

This study is a cross sectional study. The subjects were girls between the ages of 11-16 years in either middle or high school who had experienced menarche within 6 months prior to the study. In this study, 600 girls were selected by means of stratified randomized sampling. Following the concept of menarche, a medical doctor (resident of Ob& Gyn) interviewed the subjects and the data was collected using a questionnaire focusing on age, weight (measured to the nearest 0.1 kg using a balance beam scale), height (measured to nearest 0.1 cm with a manual height board). Body mass index (BMI: kg/m²) was used as an index of relative weight. An index of SES was modelled as a linear combination of parents' education (FE and ME for fathers' and mothers' education, respectively), previous and present family social class (SC1 and SC2) based on fathers' occupation. The level of parents' education was categorized and valued as (0=illiterate, 1=ability to read and write, 2=elementary school, 3=secondary school, 4=higher education). While social class was valued as follows; 0=jobless, 1=unskilled manual, 2=semi skilled manual, 3=skilled manual, 4=clerical, 5=managerial, 6=professional. GLIM analysis was used to combine these two types of variables and to differentiate the SES values as low, middle and high classes. Using the principal component (PC) analysis, SES was given by first PC as:

SES=0.3 (FE + ME + SC₁ + SC₂).²⁰ The age of the first menstruation was defined according to a standard. SPSS.10 was applied for statistical analysis of the data using the Chi-squared

and ANOVA tests. In an effort to establish the factors associated with the age of menarche, multivariate analysis was performed based on linear logistic regression which was performed using a model where all the variables changed by more than 10%. p<0.05 was determined as statistical significance.

Results

In this study of 600 subjects, the mean age was 13.35±1.33 years old. The mean age at menarche was found to be 12.99±1.33 years (ranging from 10.16 to 15.91 years). The most common season where menarche occurred was during summer, this was true for 270 (45%) subjects, then fall, spring and then in winter and the results were 147 (24.5%), 123 (20.5%) and 60 (10%) respectively. The highest and lowest mean age of menarche in subjects who experienced menarche was in the summer (13.23±1.17 years) and winter (11.88±1.23 years) (p<0.05) (table 1). Summer can cause menarche to be delayed for 4 months, while in winter menarche occurred 14 months earlier than the standard menarche age.

Table 1: Age at menarche (years) according to the season of menarche

Season	Numbers (%)	Mean±SD
Summer	270 (45)	13.39±1.40
Fall	147 (24.5)	13.23±1.17
Spring	123 (20.5)	12.68±1.24
Winter	60 (10)	11.82±1.23

p value was significant

Results showed that there was a significant difference between the mean age at menarche and SES. Thus higher SES, middle SES and lower SES were associated with 12.13±0.92 years, 12.93±1.34 years and 13.44±1.18 years at menarche age respectively (P<0.05) (Table 2).

Table 2: Age at menarche (years) of high school girls according to body mass index (BMI).

BMI	Number of girls (%)	Mean±SD
<19	170 (28.3)	12.98±1.39
20-24	389 (64.8)	13±1.32
25-30	39 (6.5)	12.91±1.21
>30	2 (0.3)	12.91±1.76

p value was not significant

The data indicated that the age at menarche was not significantly

related to the BMI but the majority of menarche (64.8%, 13±1.2 years) occurred at a BMI of 20-24 kg/m² (p>0.05) (table 3).

Table 3: Age at menarche (years) of high school girls according to socioeconomic state (SES)

SES	Numbers (%)	Mean±SD
Low	82 (13.6)	13.44±1.18
Middle	509 (85.8)	12.93±1.34
High	9 (1.5)	12.13±0.92

p value was significant
SD: Standard Deviation

Linear regressions showed no significant correlation between BMI and the age of menarche (B=-0.13, S.E=0.16, p=0.001) however, there was a significant relation between the season (B=-0.32, S.E=0.06, Sig=0.000) and SES(B=-0.02, E=0.52, Sig=0.02) on age of menarche.

Discussion

Age at menarche was first calculated in the mid-19th century in Denmark. Since then, many authors have used different methods to calculate age at menarche in different parts of the world.¹² Age at menarche, is when the appearance of the first menstruation, a stage in female maturation and an indicator of female physiological development, health and nutritional status.

There is no consensus definition of normal range for the age at menarche because it can be affected by numerous non biological factors within the population.¹⁹ The results from this study indicated that age at which menarche occurs was between 10.16 and 15.91 with a mean of 12.9±1.3 years. Similarly, a study in Kashan (west of Iran) age of menarche was also 12.91±1.39 years. On the contrary, girls in some European countries and in America experience menarche at a much younger age. Also, another study reported from Kermanshah reported the age of menarche was observed to be 13.4±0.7 years, which would be considered a high menarche age by some Western countries.^{8,12,20,21} This may reflect environmental as well as genetic factors affecting secondary school girls in Iran. The method of collecting and analyzing data differed between these studies.^{21,23} Therefore, it is difficult to draw a direct comparison on the mean age at menarche in different studies. The influence of BMI on menarche in early adulthood may have important health consequences. Menarche age was positively associated with height and negatively associated with weight and BMI.¹¹ Nutritional status is related to age of menarche and is particularly linked to increases in body weight. One report on menstruation age in Tehranian girls showed that around one fifth

of girls at the age of puberty were overweight.² It seems that being overweight is a major cause of the decrease in mean menarcheal age of daughters as compared to their mothers.^{2,24}

Garn et al found that women (ages 20-35 yrs.) who experienced menarche before the age of 11 years were 2 to 3 kg/m² heavier than those who experienced menarche aged 14years.²⁵ Ayatollahi et al also indicated that BMI was significantly correlated with age at menarche.²⁰ They demonstrated that menarche age was delayed for underweight subjects. Low body weight delayed menarche by approximately 15 weeks, while high body weight and obesity induce it by 13 and 19 weeks respectively compared to girls with normal body weight. However, this study showed no significant correlation between BMI and age of menarche.²⁰

The reason for this outcome may be due to the fact that the selected subjects had their menarche 6 months prior to the study, therefore the subjects have experienced maximum growth since then. The socio-economic status is a strong predictor of menarche.²⁶ Ersoy et al found that although the menarche age was found to be lower in girls with higher socioeconomic status, there was no significant difference between the three different socioeconomic status.¹⁸ While Gharavi et al reported that there was no significant difference in menarche age in the different socioeconomic classes (intermediate and university students).²⁷

Abioye-Kuteyi et al showed that a significant finding that the age at menarche was lowest in girls from high socio-economic households and school girls from the upper socio-economic class reached menarche 11 months earlier than their lower socio-economic counterparts.²⁸ This study also showed similar results; that age at menarche decreased as SES improved. Subjects in upper socio-economic class reached menarche 10 months earlier and subjects from lower socio-economic class experienced delayed menarche of up to 5 months compared to the standard age. It has been hypothesized that the yearly menarche rhythm could be caused by the seasonal variation of photoperiod and temperature or by the annual distribution of the scholar vacation and study periods. Vacation periods influenced menarche rhythm.²⁹ Park et al revealed that menarche is most common in August and January (summer), January and December (winter) in decreasing order.¹⁷ Ersoy et al indicated that menarche was most common in the summer and in fall than in spring and winter.¹⁸

Tavares et al showed that the difference between mean age at menarche in December (spring-summer transition) and in June (fall-winter transition) was not significant.³⁰ While Ayatollahi et al reported that menarche was more common in summer and spring then winter and fall. Subjects who experienced menarche in the spring were youngest at menarche; the age increased in girls who menstruated in summer and fall, and showed the highest value

in girls who menstruated in winter. The reason is mainly because menarche occurs more frequently than expected and coincides with school vacations (15 days from 21st March celebrating the Iranian New Year holidays, and about 3 months from mid-June to mid-September), while a marked decrease in frequency is observed with return-to-school activities.²⁰ Delavar and Hajian-Tilaki also showed that the most frequent occurrence of menarche was in summer and least frequent in winter.²² This report showed a significant correlation between mean age at menarche and seasonal variation, thus 45.5% of the subjects had menarche in spring and 81.6% of subjects had experienced menarche under the age of 13.5 years. This means that summer leads to menarche to occurring 4 months later, and in winter, menarche occurred 14 months earlier. Overall, the derived conclusion from this study indicates that the mean age at menarche during the month following the end of school year; beginning of school vacations was lower. Conditions of stress-relaxation transition, such as the end of the school year, beginning of school vacation are perhaps really important. Further studies are necessary to identify the inherent and specific factors in the Iranian population, which relate to and influence the age of menarche.

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