

Secular trend of menarche age in an immigrant urban city in Turkey: İzmir

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The purpose of this study was to investigate the secular trend of menarche age within the last 35 years in an immigrant urban city in Turkey-İzmir.

We found the mean age at menarche as 13.10 ± 1.18 years for 121,257 women. The reported mean age at menarche showed a decreasing trend over time. For women born before 1963 (≥ 40 years of age), the mean age at menarche was 13.08 ± 1.21 years. For women born from 1964-1973 (30-39 years of age), the mean age at menarche was 13.12 ± 1.19 years. For women born from 1974-1983 (20-29 years of age), the mean age at menarche was 13.11 ± 1.18 years, and for those born after 1984 (15-19 years of age), the mean age at menarche was 13.06 ± 1.16 years ($p=0.000$). When divided according to socioeconomic status, the mean age at menarche was 13.11 ± 1.11 in the high socioeconomic group, 13.22 ± 1.25 in the middle socioeconomic group, and 12.75 ± 1.02 in the low socioeconomic group ($p=0.000$).

In conclusion, in the Turkish population, the mean age at menarche has decreased from 13.12 to 13.06 over the past 30 years, and the mean age at menarche was lower in the low socioeconomic group.

Key words: mean menarcheal age, menarche, socioeconomic status, women, puberty, Turkish adolescent girls.

The onset of puberty in adolescent girls is marked by numerous changes, the most significant of which is the commencement of menstruation¹⁻³. The mean age at menarche reflects numerous health aspects of a population, including the timing of sexual maturation, growth, nutritional status, and environmental conditions^{4,5}.

Menarche is the most robust historical marker of the timing of puberty⁶. European populations have some of the oldest records regarding the age of the onset of menarche. Data have shown marked trends toward younger ages for menarche over the last 150 years, as the mean age of the onset of menarche was approximately 16-17 years in the mid-19th century⁷. In various countries, these advances have occurred at a surprisingly consistent rate of approximately 3 years for every 100 years (3.6 months/decade)⁸.

Overall, heterogeneity has been seen in the more recent European data, with results

showing both faster and slower rates in the decrease in the mean age of menarche. This heterogeneity is related to social class, income, urban versus rural background, education, and family size. These are factors that reflect differences in general health and nutrition, and they are also associated with cross-sectional differences in the age at menarche, particularly in developing or transforming countries such as ours⁹. If nutritional status and general health are improving, then faster secular trends, or longitudinal rates of decline in the age at menarche, should be seen. For example, during the political and economic transformation of 1989 in Poland, faster rates of decline in the age at menarche were observed in rural (from a mean age of 13.88 to 13.42 years) compared to urban (13.18 to 13.04 years) populations¹⁰. Similarly, a faster decline was observed among girls with less-educated fathers in Brazil (3.6 months/decade) than in those with better-educated fathers (1.2

months/decade)¹¹. The fastest rates worldwide are observed in countries with more recent economic transformations, e.g., South Korea, where a decline of 4.1 years was observed from 1920 to 1988 (7.5 months/decade)^{12,13}.

Since lower socioeconomic class or poorer nutrition is associated cross-sectionally with higher age at menarche, these observations suggest that more rapid rates of decline in the mean age of the onset of menarche are currently still observed among these less-advantaged populations or population subgroups, in which the mean age at menarche is higher.

In the populations in which the secular trends in puberty have slowed, and mean age at menarche is near the genetic limit, we would no longer see significant cross-sectional associations with socioeconomic influences or environmental factors. In support of this hypothesis, in a large United Kingdom-based population study, there was no correlation between the mother's age at menarche and either social class¹⁴. There is increasing evidence that the age at menarche has decreased in Europe and the United States during the last century and in Japan over the last several decades¹⁵. The age at menarche has declined in developed countries, and this decline has also been observed in developing countries in recent years¹⁶.

Yet we know little about what determines menarcheal age. Genetic influences, nutrition, physical activity, and the pattern of childhood weight gain are thought to play a role¹⁷. Timing of puberty is determined by a large number of genetic factors. There is a strong biological basis for links between weight gain, growth and age at pubertal development. Several studies have described leptin as a strong candidate link between nutritional status and the onset of puberty¹⁸. Both puberty onset and leptin levels are positively related to body size and body fat mass. There is also some epidemiological evidence that markers such as more rapid infant weight gain, earlier birth order and formula feeding are associated with subsequent earlier menarche¹⁹.

In addition to differences between countries, the trends within each country are often varied according to nutritional circumstances, as in France, Germany and the Netherlands, a sharp increase in the mean age at menarche

was seen in women born between 1920 and 1934, corresponding to age at puberty during the Second World War, after which steady declines were seen²⁰. It is likely that wide heterogeneity in the rates of advance in puberty has long existed even among the historical European data.

In this study, we aimed to investigate the age of menarche in western Anatolia.

Material and Methods

Study Population

In 2003, the population of Bornova, İzmir (third largest city in western Turkey) was 445,911, which is even larger than some of the major cities in Turkey. As Ege University is in Bornova, it has emerged as a place where highly educated people live and where the birth rate is low. However, due to immigration, less-educated people with high birth rates who infrequently use birth control live away from the center. This area is also considered an industrial region, so together with the university campus, there is a wide variation in the age and social status groups. Because the young age group is large and still increasing, there is a necessity for special research regarding adolescents.

The population for this study was 133,368 females between the ages of 15 and 49 years from 21 village clinics in Bornova in 2003. Our method was to reach out to all of the women and to query them regarding their age at menarche. Face-to-face interviews by their own nurses or midwives were performed. The average number of women seen by each nurse or midwife was 3,400.

Data Collection and Statistical Analysis

Data of female natives of Bornova, İzmir aged 15-49 years were recorded on index cards. Name, surname, age at menarche, date of birth, education, and economic status were recorded. Data were collected from the Health Directory of Bornova using the Statistical Package for the Social Sciences (SPSS) 11 program. Data included that of individuals who could not be reached because they were out of the city or at work, and also those who could not remember their age at menarche. Mean ages of menarche in the different age and socioeconomic groups were compared by means of analysis of variance (one-way ANOVA).

Categorization of socioeconomic class was based on their occupation (none, laborer, blue collar worker, white collar worker, professional), and educational level (none, elementary school, middle school, high school, university) by applying the Hollingshead index (Hollingshead 1957). Five educational levels and five occupational categories were used to identify socioeconomic classes. A score of 0 was given to the lowest level of education and occupation and a score of 4 was given to the highest. Hollingshead scoring was modified according to the national Turkish standards. Three socioeconomic classes were identified ranging from lowest to the highest on the basis of the sum of scores. The first and second socioeconomic classes in Hollingshead scoring were defined as low and middle socioeconomic classes, respectively. The third and fourth classes were defined as high socioeconomic class²¹. We also searched for a decrease in the age of menarche by dividing our population into different age cohorts (≥ 40 , 30-39, 20-29, and 15-19 years).

A total of 4,538 (3.4%) women could not be reached, 7,571 (5.7%) could not remember the age at which menarche began, and 1 never began menstruation secondary to Turner syndrome. Therefore, 12,110 (9.1%) women were excluded from the study.

Results

In this study, we physically reached 96.6% of the target population (128,830 women). Information could not be obtained in face-to-face interviews from 4,598 people (3.4%) because they were out of the city or at work, so they were excluded from the study (Fig. 1).

Those who could not remember their age at menarche onset (7,571, 5.7%) and the one who never had menarche secondary to Turner syndrome were excluded from the study. Within the target population, we determined the age at menarche in 121,258 (90.9%) of the women.

The mean age at menarche was 13.10 ± 1.18 years in 121,258 (90.9%) of the women. The earliest age at the onset of menarche was 9 years, and 83 (0.7%) of the women were 9 years old when menarche began. The latest age at menarche was 21 years, and 2 (0.016%) of the women were 21 years old when menarche began. The most common age at the onset of

menarche was 13 (33.8%).

The women aged 15-49 years were divided into three socioeconomic groups (high, medium, and low) according to their educational level and occupation. When divided by socioeconomic status, the mean age at menarche was 13.11 ± 1.11 years in the high socioeconomic group, 13.22 ± 1.25 years in the medium socioeconomic group, and 12.75 ± 1.02 years in the low socioeconomic group. The difference in the mean age at menarche between these three socioeconomic groups was statistically significant ($p=0.000$) (Table I).

Turkish women born between 1954 and 1984 (15-49 years of age) were analyzed. We began with the adolescent age group (15-19 years of age) and divided the population into 10-year birth cohorts. The reported mean age at menarche showed a decreasing trend over 35 years. For women born before 1963 (≥ 40 years of age), the mean age at menarche was 13.08 ± 1.21 years. For women born from 1964-1973 (30-39 years of age), the mean age at menarche was 13.12 ± 1.19 years. For women born from 1974-1983 (20-29 years of age), the mean age at menarche was 13.11 ± 1.18 years, and for those born after 1984 (15-19 years of age), the mean age at menarche was 13.06 ± 1.16 years ($p=0.000$) (Table II, Fig. 2).

Discussion

Since the publication of the first Textbook of Human Growth by Johann Augustin Stoellerin in 1729, temporal changes (or secular trends) in growth and pubertal maturation have been observed throughout the world¹³. Data covering the longest time span are often reported from European populations. For example, in Norway and Denmark, the age at menarche has fallen rapidly since the 19th century, by up to 12 months per decade¹³.

In another longitudinal study, differences between the mean age at menarche of six different 10-year birth cohorts (1930-39, 1940-49, 1950-59, 1960-69, 1970-79, 1980-89) were studied. Although there was an increase in the age at menarche from 1930-70, there was an important decrease from 1980-89. The age at menarche was determined to be 12.34 years in girls born from 1980-89, which was a 3-6 month decrease from the previous decades²².

A systematic, population-based survey was used

Table I. Difference in the Mean Age at Menarche between Three Socioeconomic Groups

	N	Mean age at menarche	Standard deviation
Low	24.775	12.75	1.02
Medium	59.965	13.22	1.25
High	36.518	13.11	1.11
Total	121.258	13.10	1.184

(p=0.000)

Table II. Mean Age at Menarche for 10-Year Birth Cohorts

Birth cohort	N	Mean	Standard Deviation
1963-1954 (40-49 years old)	28.582	13.10	1.20
1973-1964 (30-39 years old)	36.177	13.12	1.19
1983-1974 (20-29 years old)	40.993	13.09	1.18
1988-1984 (15-19 years old)	10.956	13.02	1.13
Total (15-49 years old)	121.258	13.10	1.18

(p=0.000)

to collect data obtained from female recruits into the Israel Defense Force from 1986 to 2000. The reported mean age at menarche showed a trend over time, as it fell from 13.41 (± 1.30) years for women born before 1970 to 13.03 (± 1.28) years for those born after 1978 ($p < 0.001$)²³.

Another study regarding the age at menarche was performed with 1,017 female students studying in the high schools of Manisa, Turkey, from 1999 to 2000. The mean age at menarche for the girls was 12.82 ± 1.07 years, whereas their mothers' mean age at menarche was 13.6 ± 1.39 years ($p < 0.001$). The mean age at menarche for the mothers was higher than that of the girls ($p < 0.001$). These results correlate with our conclusion that the mean age at menarche has decreased over time.

In our study, data were collected by nurses and midwives from women aged 15-49 years by face- to-face interviews. While younger women could easily remember their age at menarche, some of the elder women had difficulty in remembering, despite posing questions such as 'Do you recall your grade in school when you began your period?' to assist participants in recalling the date.

The difference in the mean age at menarche between the different socioeconomic groups is another important outcome. We found a lower

mean age at menarche in the low socioeconomic group, which is known to include mostly immigrants. Even though İzmir is an urban city, because of its high immigration rates, Bornova has rural areas in which education and life standard levels are very low. We thus compared menarcheal ages across different socioeconomic groups. The low socioeconomic groups live in areas where immigration is common, and the nutritional state, physical activity, education levels, and sexual intercourse age of women living in these areas are very different from the other groups. In a study in Mozambique, the mean age at menarche was found to be

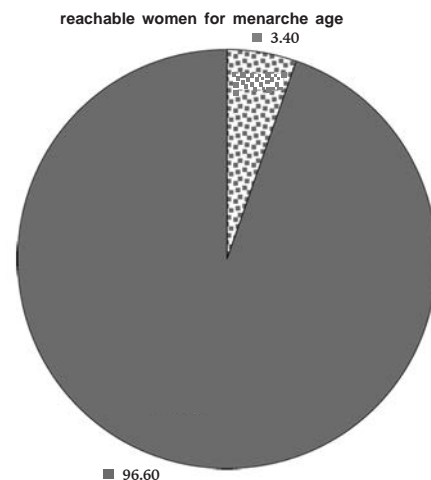


Fig. 1. Reachable women regarding menarche age in the health directory of Bornova area in 2003. Black: reachable Dotted: unreachable



Fig. 2. Trend for age at menarche among women aged 15-49 years in the area of the Health Directory of Bornova, Izmir in 2003.

lower in rural areas as well¹⁷.

In our study, we could not examine the nutritional state, body mass index or physical activities, which also affect the menarcheal age.

In conclusion, in our study, the mean age at menarche for women between aged 15-49 years was found to be 13.10 ± 1.18 years. Therefore, 13.10 ± 1.18 can serve as the reference data for these types of studies in Turkey. This population-based study of Turkish women demonstrates a trend over time of decreasing age at menarche, from 13.12 to 13.02 years, in the past 30 years. This result is parallel to the reports about marked trends toward younger ages for menarche throughout the world. Through our study, we aimed to find a reference mean age at menarche for our country and for other countries as well. We also wanted to prove that the mean menarche age decreases over time.

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