Original Article

Physiological Variables, Psychosocial Factors and Age at Menarche Among Punjabi Girls

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Abstract

The term menarche signifying the onset of menstruation is merely one manifestation of puberty. The age at menarche has been getting earlier all over the world with varying rates. An average decline of about 4 months per decade has been reported from the United States and in Western Europe over the period 1830–1960, while that in Eastern Europe since the late nineteenth century. There have been reports that there is a fairly good correlation between the age of menarche of mothers' and their daughters' (1, 2). The objective of this study was to find out the present age at menarche among Punjabi girls and correlate it with relevant variables. The age at menarche in the present study has been found to be significantly less as compared to data from the same region (Punjab, India). The decline in the mean age at menarche between the mothers and the daughters was statistically highly significant. There was a positive correlation between menarche and weight, height, triceps skinfold thickness, body mass index and maternal age at menarche. No significant correlation was obtained between menarche and income class and a negative correlation was obtained between menarche and birth order.

Introduction

The term 'menarche' was introduced into medical literature by Kisch in 1910, to denote the period of life in which, as a sign of puberty, menstruation first makes its appearance. The mean age of puberty in girls in the Western population has been falling for

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the last 150 years with a slowing of this decline since 1960s suggesting a biological limit. Evolution biologists believe the lower menarcheal age to be closer to the early human populations of 'Hunter-Gatherers'. The later onset of menarche maybe attributed to poor nutrition and agrarian societies and infections (3). The age at menarche is now 2½ to 3½ years earlier than it was a century ago – this has been termed the "secular trend" in the declining age of menarche. This lowering of menarcheal age together with increased adult size has been termed "one of the most considerable phenomena of human biology" at present, with a host of medical, educational and sociological effects.

The issue of correlation between the mothers and daughters ages at menarche is controversial. Unless data for both mothers and daughters are obtained prospectively comparison of their menarcheal ages is complicated by the fact that the data on the two generations are not really comparable. Either the data for the daughters are prospective, whereas those for the mothers are retrospective, or if both sets are retrospective, the daughters account of the recent events of menarche are likely to be more accurate than the mothers' recollections of the much more distant event. A good correlation between the age of menarche of mothers' and their daughters' has been obtained by few authors (1, 2, 4).

This study was aimed at assessing the present age at menarche among Punjabi girls. To find out whether the secular trend in menarche was continuing or the rate of fall in menarcheal age had declined or stopped. The study also aimed to correlate this age at menarche with physiological and psychosocial factors like weight, height, body mass index (BMI), triceps skin fold thickness, income class, birth order and maternal age at menarche.

Materials and Methods

A cross sectional study on schoolgirls from the city of Ludhiana, selected at random was carried out, after approval of the institutional research and ethics committees. Those who had attained menarche within 6 months of the date of contact (of our meeting them) were included in the study. A preliminary screening questionnaire was given to all the girls in middle and high school (classes 5–10th), which was collected later. The screening questionnaire included the child's name, age, class and section, name of the school, an informed consent for participating in this study which was to be signed by both the parents and the student, the daughter's date of menarche and the maternal age at menarche was asked. The date of menarche was asked from the subject by the "status quo method" and from her mother by the "recall method" (4). Using Prasad's updated social classification five income classes were defined taking the prevalent consumer price index into consideration. Anthropometric measures of weight, height and triceps skin fold thickness were taken according to

guidelines by the WHO Tech Rep Series, 1995c (5) by a single observer. The correlation between continuous variables were assessed for their relationship to the age at menarche by using Pearson's product moment correlation. Wherever the data was not found to be normally distributed (evidenced by a high SD in relation to the mean) the correlation was done by determining Spearman's correlation coefficient. All variables which showed significant relationships with age at menarche were subjected to stepwise (forward) multiple regression analysis. All the variables which were retained in the stepwise selection were used for constructing multiple regression equations. For all this purpose, Statistical Package for Social Sciences (Windows version 11) software library was used.

Results

A total of 400 girls in these five schools had attained menarche in the 6 months prior to our contact. About one-third (34%) of girls attained menarche between the age of 12.1 and 13 years. The mean age at menarche was 12.38 years. 3 girls attained menarche at less than 10 years of age and 16 girls attained menarche after 15 years of age. The youngest and the oldest girl at menarche were 9.67 years (116 months) and 17 years (204 months) old respectively.

The weights ranged from 23.5 kg to 100.4 kg showing the wide variability of weight at menarche. The mean weight of the girls at menarche was 45.25 kg. A positive correlation (r=0.26) between age at menarche and weight was obtained suggesting a later menarche in heavier girls. The mean height and triceps skinfold thickness were 151.7 cm and 19.56 mm respectively. Height ranged between 125.5 cm to 176.5 cm and triceps skinfold thickness ranged from 5.6 to 60 mm. A positive correlation (r=0.387) was obtained between menarche and height that was statistically highly significant (P<0.001) suggesting a later menarche in taller girls. Similarly a positive correlation (r=0.113) was obtained between age at menarche and triceps skinfold thickness, which was statistically significant (p=0.012).

A large majority of girls (72.5%) had their body mass index in the normal range. The mean body mass

index at menarche was obtained to be 19.5 kg/m². Body mass index was positively correlated with age at menarche, which was statistically significant, suggesting that girls with a higher body mass index had a later menarche. A majority (71.50%) of the mothers attained menarche between the ages 14 and

TABLE I : Mean and SD of the age at menarche with weight, height, BMI, income class and birth order.

Age at menarche (years)	Number	Weight (kg)	Height (cm)	BMI (kg/cm²)	Income Class (Prasad's)	Birth Order
< 11	48	39.91±10.71	145.51±8.70	18.62±3.66	1.40±0.81	1.69±0.69
11.1–12	100	44.02±10.72	149.63±6.95	19.49±3.76	1.48±0.84	1.63±0.61
12.1–13	137	45.8±11.26	152.92±7.43	19.45±3.93	1.32±0.70	1.53±0.62
>13	115	47.9±10.2	154.61±7.35	19.95±3.64	1.27±0.64	1.57±0.64

Data expressed as mean±SD. BMI: Body Mass index.

TABLE II : Correlation of age at menarche with physiological and psychosocial factors.

Age at menarche (years)	Number	Weight (kg)		Height (cm)		BMI (kg/cm²)		Income Class (Prasad's)		Birth Order		Maternal age at menarche	
		r	p	r	p	r	p	r	p	r	p	r	p
<11	48	0.142	>0.05	0.237	>0.05	0.05	>0.05	0.17	>0.05	−0.23	>0.05	−0.191	>0.05
11.1 - 12	100	0.161	>0.05	0.155	>0.05	0.13	>0.05	−0.126	>0.05	−0.082	>0.05	−0.88	>0.05
12.1 - 13	137	0.184	<0.05	0.122	>0.05	0.178	<0.05	−0.044	>0.05	−0.032	>0.05	−0.029	>0.05
>13	115	0.213	<0.05	0.261	<0.005	0.117	>0.05	−0.123	>0.05	0.028	>0.05	0.109	>0.05

BMI : Body Mass index.

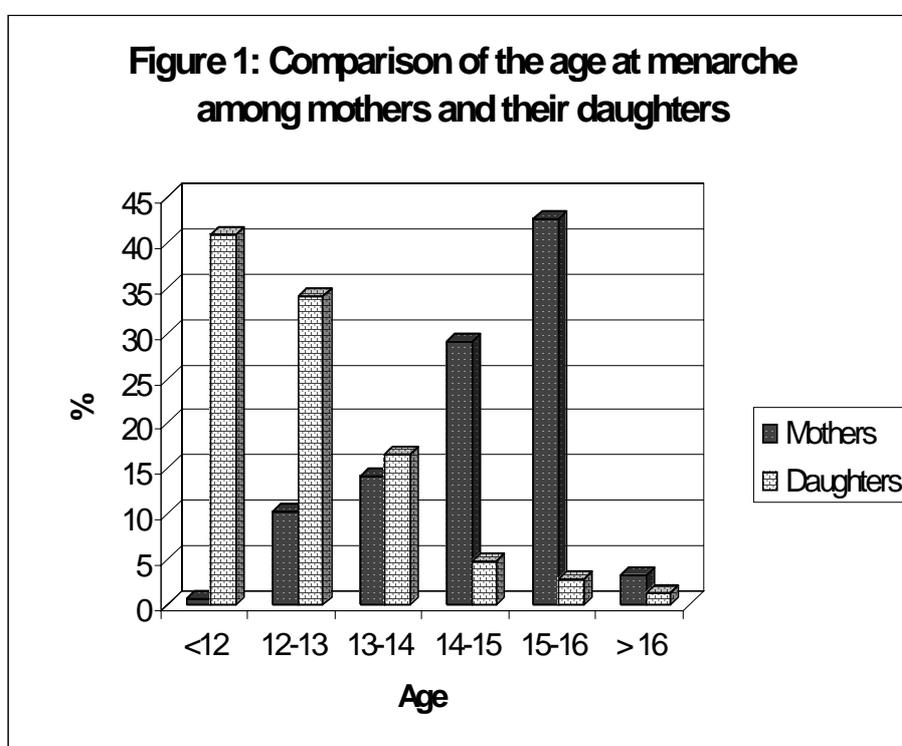Figure 1: Comparison of the age at menarche among mothers and their daughters

Fig. 1 : A majority (71.50%) of the mothers attained menarche between the ages 14 and 16 years. The mean maternal age at menarche was 14.31 years and the mean daughter's age at menarche 12.38 years. The decline in the mean age at menarche between the mothers and the daughters was 1.93 years, which was statistically highly significant (P<0.01).

16 years. The mean maternal age at menarche was 14.31 years with a SD of 1.24 years and the mean daughter's age at menarche 12.38±1.26 years. There was a positive correlation (r=0.020) between the two, which was not statistically significant (p=0.345) but the decline in the mean age at menarche between the mothers and the daughters was 1.93 years, was statistically highly significant (P<0.01).

No significant correlation was obtained (r=−0.041) between menarche and income class.

Of the subjects 55% were vegetarians and 45% were non-vegetarians. The mean age at menarche among the vegetarians was 12.37 years (148.43 months) and among the non-vegetarians was 12.39 years (148.69 months). The difference between the two groups was 0.26 months which was not statistically significant (p=0.861). With the concept of smaller families in the present times a large majority of girls (93.25%) were first or second born, while only 2 children had a birth order of 4. An increasing birth order was associated with early menarche although not statistically significant (p=0.058).

Discussion

The age at menarche in the present study has been found to be less as compared to data from the same region (Punjab, India). The age at menarche has declined by about 9.8 months in a period of about 15 years thus still following the secular trend of the age at menarche. This declining trend in the age at menarche has been reported worldwide from studies published years back (9, 11) to recent publications on the subject (6, 26, 27) with varying rates of decline. The weight of the individual girls at menarche is one of the most variable measurements of the adolescent development, though menarche appears towards the end of growth, when a girl is already 85% of the young adult weight one would expect less variability rather than more. Among Indian data, similar results have been obtained for the mean age at menarche by various authors (6, 7, 8, 9, and 29). A majority of girls (67.25%) weighed less than or equal to the critical weight of 48 kg proposed by Frisch and Revelle (10). Our results were against the "critical weight hypothesis" propounded

by Frisch and Revelle (10, 11) and against the hypothesis that degree of body fatness triggers menarche (11, 12, 13).

There is a general belief among pediatricians that girls with early menarche are shorter than those who have a late menarche but on the other hand data published show that the average impact of early menarche on adult height is less than 4 cm and is quite close to the population means (14). Taller girls have been found to attain early menarche by (6, 15, 16, 29) while no association between menarche and height was observed by Damon et al (28), both individually and between mothers and their daughters. Data from the National Health Examination Survey (NHES 1963–70) and National Health and Nutrition Examination Survey II, (NHANES II 1988–94) showed a positive association between weight, body mass index z-score and likelihood of having reached menarche, suggesting that the higher the body mass index, the higher the chances of attaining menarche. Similar results were also obtained by few other authors (17, 18, 19, 25) but our results were otherwise. Results similar to the present study regarding the income class have been reported by few authors (18). Explanations suggested for a negative correlation between age at menarche and income class could be increased crowding due to larger family size, increased psychosexual stimulation and an increased maternal age in later born girls and an earlier acquisition of day to day skills may be possible factors for early menarche. However many studies show early menarche with higher income class (6, 8, 20). The possible explanation is that, of the environmental factors, nutrition appears to be the most important since it has the best established influence on the rate of maturation. The median age at menarche in the higher and lower socioeconomic classes of girls from Patiala in 1974 was 12.9±0.64 years and 14.4±0.47 yrs respectively while in 1986 was 12.54±0.13 yrs and 13.65±0.47 years respectively (8). While in 1990 the median age at menarche from Chandigarh was 13.2±1.26 years (22) as compared to 12.38±1.26 years in the present study. The use of the recall method for determining maternal age at menarche is not a precise measure due to the long time interval between maternal menarche and the present date of contact. But menarche being a very important

event in a girls life, a majority of women are likely to remember the same, rather than not and that too with a fair degree of accuracy. In our study the decline in the mean age at menarche between the mothers and the daughters of 1.93 years, was statistically highly significant (P<0.01). A positive correlation between the daughters and the maternal age at menarche has been reported by other authors as well (1, 2, 21). Among other Indian studies, Bhalla and Shrivastava in 1974 (9) showed a definite relationship between mother's and daughter's age at menarche and similar results were obtained by Rana et al in 1986 (29) who found the coefficient of correlation between the two menarches to be 0.1946 which was statistically significant. A statistically significant decline in the age at menarche by 0.5 years was noted by Khanna and Kapoor (30).

There are reports of diet affecting menarche. Data from the Avon Longitudinal Study group of Parents and Children (ALSPAC) suggest that higher intakes of protein and meat in early to mid-childhood (23) and those children who were heavier in their mid

childhood had an earlier menarche (24). Our study did not show a significant difference between the age at menarche of vegetarians and non vegetarians. It is apparent that the age at menarche is a developmental milestone, which is highly variable and highly sensitive to a variety of internal and external forces. With so many associations, it has proved to be exceedingly difficult to sort out, in any meaningful fashion, the interactions between the various associations. The problem is perhaps best stated by Roberts and Dann who, after a complex multivariate analysis, found "ample variability" still unexplained by their statistical model.

Conclusion

The age at menarche is still declining thus following the secular trend. There was no single factor that influenced menarche though many factors with complex interplay may explain this advancing age at menarche. The decline in the age at menarche between the mothers and their daughters' is highly significant.

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