

A Study Of Age At Menarche, The Secular Trend And Factors Associated With It

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Abstract

Background: Considering the economic and industrial development of India, the secular trend in age at menarche, observed in European, North American and other countries is likely to exist in Indian girls. Aim : Present study attempts to find the mean age at menarche in girls of Pune city (Maharashtra), study its secular trend and the association of age at menarche with socioeconomic status, diet and exercise. Subjects and methods : Age of menarche of 742 Maharashtrian girls (age 9 to 16 years) was studied. Results and conclusion : Mean menarcheal age was 12.62 \pm 1.05 years. The secular trend in the age at menarche was well demonstrated in Maharashtrian urban girls. The mean age of menarche observed in our study possibly indicate the stabilization of the secular trend. The age at menarche is strongly associated with socioeconomic status, but not with type of diet and day-to-day physical activity. Knowledge of the age at menarche will help the government to design and implement programmes about reproductive health of women, to set laws about age at marriage, family planning, abortion etc and to decide the appropriate age at which the topics like the sex education, contraception and sanitary practices can be incorporated in schools.

INTRODUCTION

Menarche occurs earlier than it once did in many parts of the world especially in Europe and North America¹²³⁴. In these regions, it declined at the rate of approximately four months per decade till it stabilized at around 13 years¹⁵⁶⁷. This was attributed to better socioeconomic status and improved health & nutrition. This decline is expected in Indian girls considering the economic development of the country in past few decades. As the industrialization and hence the wealth is concentrated more in urban areas than the rural ones, its impact on the girls residing in urban areas is likely to be prompt.

Few studies were carried out in Maharashtra earlier to find the age of menarche. However, we are unaware of any such study in the past one decade.

Various factors have been postulated to affect the age at menarche like the socioeconomic status, diet, exercise, environment, sibship, religion, genetic and hereditary factors, ethnicity, psychological stress, migration and chronic illnesses with opinions both supporting and rejecting it⁸⁹¹⁰¹¹¹²¹³.

The present study attempts to find the age at menarche in

girls from Pune city of Maharashtra and study its secular trend, if exists. We also investigated whether the age at menarche is associated with socioeconomic status, diet & exercise. The findings are reported here.

MATERIAL AND METHODS

Total 748 Maharashtrian school going girls in the age group 9 to 16 years participated in this study. To ensure the data from all socioeconomic strata we selected one convent and one municipal corporation school in Pune city randomly. The data was collected during January to March 2003. The study, its importance and important concepts like age at menarche, per capita income etc were explained to the students and teachers in local language. Informed consent was taken from parents of students willing to participate. A prestructured pretested questionnaire having questions about date of birth, current age in years and months, month and year of menarche, age at menarche, history of any chronic illnesses / major illnesses in the preceding three years, socioeconomic status of parents, dietary habits and exercise was provided to the subjects, all of them returned it answered with the help of parents and teachers (100% response rate). The subjects giving history of major/ chronic illnesses were excluded from the study. The birthdates were confirmed from school records.

The mean age at menarche was calculated by probit analysis and the subjects were categorized in three groups viz. those attained early menarche (between 10 & 12 years of age), ideal menarche (between 12 to 14 years) and late menarche (between 14 to 16 years of age). The Kuppaswamy classification¹⁴ was followed to define the socioeconomic status and the criteria used were education & occupation of parents and per capita income of the family. Accordingly, subjects were divided into those belonged to upper, middle and lower socioeconomic status. The subjects were also classified into i) regularly exercising and ii) occasional / non exercising based on exercising / participating in outdoor games at least three times in a week or less respectively. Statistical analysis was done to study the association of the age at menarche with socioeconomic status, diet and exercise.

RESULTS

Of the total 748 subjects volunteered, 6 subjects who reported history of chronic illness / major illness in preceding three years were excluded from the study. Thus the data of 742 subjects was available and was analyzed. The age groupwise distribution of subjects is shown in table I.

49.74% of the total subjects reported that they had already attained menarche. The mean age of menarche was 12.62 \pm 1.05 years. None of the subjects attained menarche during 9 to 10 years of age. The earliest age of menarche reported was 10 years 2 months. 9 subjects reported that they attained menarche before completing 11 years of age. Distribution of subjects according to early, ideal and late onset of menarche is shown in table II. 24.92% subjects reported early menarche, 64.77% reported it during ideal age while 10.30% of them reported late menarche. As none of the subjects reported menarche during 9-10 years of age, to avoid unrealistic conclusions they were excluded from further analysis.

Of the total subjects studied in the age group 10 to 16 years, the percentage of girl who reported having had their first period by their 11th birthday was 1.42%, 12th birthday 13.13%, 13th birthday 34.17%, 14th birthday 52.37%, 15th birthday 57.59% and 16th birthday was 58.38%. Thus the percentage of girls attaining menarche increases as the age advances, as expected.

Amongst the subjects who had attained menarche (n=369), about 1/4th of girls (24.92%) had their first menses before completing 12th year of age. 58.52% of them experienced their first menses before 13th year of age, 89.69% before 14

th year of age and 98.63% of the girls had their first menses before completing 15th year of age.

Figure 1

Table I Age group wise Distribution of Subjects

| Age Group (years) | No. of Subjects n |
|-------------------|-------------------|
| 9- | 110 |
| 10- | 108 |
| 11- | 96 |
| 12- | 112 |
| 13- | 122 |
| 14- | 100 |
| 15- | 94 |

Figure 2

Table II Distribution of subjects according to early, ideal and late onset of menarche

| | Age at menarche (years) | no. of subjects attained menarche n=369 | % of total subjects attained menarche n=369 | cumulative % | % of total subjects n=632 | cumulative % |
|-------|-------------------------|---|---|--------------|---------------------------|--------------|
| Early | 09- | 00 | 00.00 | 00.00 | --- | --- |
| | 10- | 09 | 02.43 | 02.43 | 01.42 | 01.42 |
| | 11- | 83 | 22.49 | 24.92 | 13.13 | 14.55 |
| Ideal | 12- | 124 | 33.60 | 58.52 | 19.62 | 34.17 |
| | 13- | 115 | 31.17 | 89.69 | 18.20 | 52.37 |
| Late | 14- | 33 | 08.94 | 98.63 | 05.22 | 57.59 |
| | 15- | 05 | 01.36 | 100.00 | 0.79 | 58.38 |

Figure 3

Table III Correlation Studies of Age of Menarche and Socioeconomic Status, Diet, Exercise

| Correlation tested for | n | no of subjects Attained menarche | % | mean age at menarche | S D |
|------------------------|-----------------|----------------------------------|-----|----------------------|------------------|
| S. E. Status | Upper | 08 | 08 | 100.00 | 12.20 \pm 0.95 |
| | Middle | 350 | 274 | 78.28 | 12.50 \pm 1.09 |
| | Lower | 129 | 82 | 63.56 | 13.14 \pm 1.02 |
| Diet | Vegetarian | 166 | 119 | 71.68 | 12.80 \pm 1.05 |
| | Mixed | 321 | 245 | 76.32 | 12.53 \pm 1.05 |
| Exercise | Regular | 358 | 285 | 79.61 | 12.60 \pm 1.02 |
| | Occasional / No | 129 | 78 | 61.24 | 12.77 \pm 1.02 |

DISCUSSION

The mean age of menarche observed in our study is comparable to that of girls from other urban areas of Maharashtra¹², (mean age 12.99 years). When compared to urban girls from other states of India, it is comparable to those of Kolkatta¹⁵ (mean age 12.3 years) but lower than that of girls in Chandigarh¹⁶ (mean age 13.2 years) and Delhi¹⁷ (mean age 13.34 years). This may be attributed to differences in socioeconomic status, environment and food habits in different states of India. When compared to rural

girls of Maharashtra ¹², (mean age 13.38 years) , the mean age at menarche in our study is significantly lower ($p<0.001$). This may be due to the better socioeconomic status of people leading to better living conditions, proper nutrition, better sanitary & health facilities in urban areas than rural areas. So also, the urban girls are more exposed to the psychosexual stimulation by suggestive posters, movies, literature etc than the rural girls, which may partially account for early age at menarche in these girls.

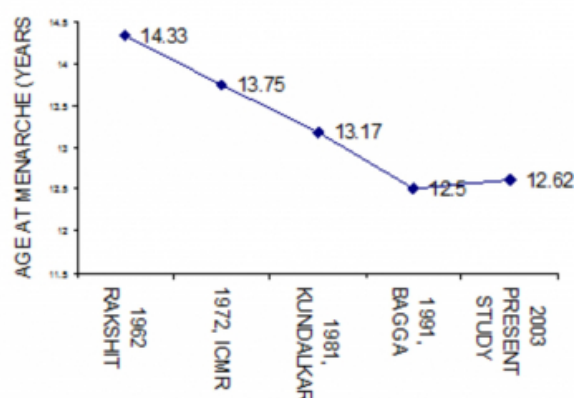
SECULAR TREND IN MAHARASHTRA

A review of studies on menarcheal age of Maharashtrian girls from 1960 onwards shows that there is a consistent decline in the age at menarche , on an average seven months per decade (figure 1). Rakshit

(1962) ¹⁸ reported the mean age of menarche in Brahmin women of Nagpur (Maharashtra) to be 14 years 4 months. A study by ICMR (1972) ¹⁹ noted the mean age of menarche of the girls in Pune city to be 13 years 9 months. Kundalkar (1981) ²⁰ observed it to be 13 years 2 months, while Bagga (2004) ¹¹ in a study carried out in 1991 reported that the girls in Pune city get their first menses at 12 years 6 months. Thus from 1962 to 1991, in three decades the age at menarche has lowered by about two years in urban Mharashtrian girls. Singh and Malhotra (1988) ²¹ recorded the secular shift in age of menarche in girls of higher and lower social class of Patiala (Punjab state, India) by 0.30 years and 0.63 years per decade respectively. Similarly, Tanner (1973) ³, reported the age of onset of menses to lower in English girls at an average rate of 4 months per decade. In Hungary too, the median age at menarche has declined at the rate of 2.6 months per decade by linear regression ²².

Figure 4

FIGURE 1. SECULAR TREND IN MAHARASHTRIAN URBAN GIRLS



This secular trend has been attributed to improved

socioeconomic status ²³²⁴. Likewise better living conditions, better nutrition, decreased bacterial infections, decreased severity and duration of infective diseases due to improved health status and availability & affordability of prompt and effective medical treatment may be the other factors responsible for it.

The decline in the age at menarche in Maharashtrian girls is relatively rapid compared to the girls from Patiala (Punjab) and British girls. This may be explained by the rapid industrialization and hence rapid development of urban Maharashtra during this period leading to improved socioeconomic status of its population.

From figure 1 it appears that after the initial decline till 1991, the mean age of menarche in Maharashtrian girls is stabilized at around 12.5 years. Once the age for optimum physical maturity required for menarche is achieved, the secular trend is expected to stabilize.

Similar observation has been noted by Eveleth (1986) ¹, Poppleton and Brown (1966) ⁵, Tanner (1981) ⁷ and Sandler (1984) ⁶ in European and North American countries where after rapid decline in the age of menarche during late 90th and early 20th century by about a year or so, it got stabilized at around 13 years. However, considering the restricted sample size in the present study, we are not in a position to have a decisive conclusion on this issue. A population based multicentric survey, having sufficiently large sample size may give a concrete conclusion on it.

AGE AT MENARCHE AND SOCIOECONOMIC STATUS

In our study, the trend of lowering of age at menarche was well marked as we moved from lower to higher socioeconomic groups (table III). It was further observed that majority of the subjects experiencing an earlier menarche belonged to middle and higher stratum (88.05%) compared to only 11.95% of girls from lower socioeconomic stratum. The difference was statistically significant ($p<0.001$).

Various researchers have investigated the relationship between age at menarche and socioeconomic status in India. The study by ICMR (1972) ¹⁹ reveals the decline in age at menarche with increase in per capita income of the family. Bagga and Kuklkarni (2000) ¹¹ observed a positive correlation between occupation of parents and age at menarche The other studies in India ⁸²⁵²⁶²⁷ and abroad ²⁸ revealed a strong association between socioeconomic status

and the age at menarche. The high socioeconomic status which is usually associated with small family norms, better living conditions, proper nutrition could be the reason along with other factors for earlier growth spurt and better physical & psychosexual maturity in them explaining the early onset of menarche.

However a few studies¹³²⁹ observed that the association of age at menarche with socioeconomic status is not significant.

A plausible explanation could be the ethnic differences, among other factors. The use of different criteria by different researchers to define the socioeconomic status makes it difficult to compare with such studies. So also, the differences in the norms about the per capita income set by different countries to decide the socioeconomic status, variation in currency exchange rates, inflation / deflation of the currency of a country have become the hindrance to compare the economic status of people of different countries. Thus it is a high time that we should categorize the parents on the basis of their occupation rather than income to establish the socioeconomic status. All manual workers like loaders, attendants, housemaids etc can easily be put in lower socioeconomic status and so on. Defining socioeconomic status by parental occupation has been used recently by Danker and Hopfe (1986)³⁰ and Serap (2009)¹³.

AGE AT MENARCHE AND DIET

Nutrition has always been considered a major influential factor in pubertal growth period.

It has to be noted that none of our subjects reported to be a strict nonvegetarian. Hence we classified the subjects into those taking vegetarian and mixed diet. Higher proportion of girls taking mixed diet attained menarche than those taking the vegetarian diet. The age at menarche in the girls taking mixed diet was marginally lower (0.27 years) than that of the vegetarians ones, the difference being not statistically significant (table III). Our finding is consistent with that of Logambal and Rao (1979)³¹ and Singh (1986)⁹. However another studies by Ghosh et al (1973)⁸ and Bagga & Kulkarni (2000)¹¹ on Maharashtrian girls observed a positive correlation between the age of menarche and nonvegetarian diet. The diet having high contents of calories and rich in proteins causes better physical maturation and early menarche³².

Dietetic habits in India are influenced by the religion, customs, dietary pattern and culture⁸. It is our general

observation that in most of the Indian families taking mixed diet, the nonvegetarian food is taken ones or twice per week. Even the quantity of the nonvegetarian items in such meal is restricted to one or two dishes and bulk of the rest is formed of vegetarian items. Thus the amount of proteins and calories in such diet may not be much higher than those of vegetarian diet. Padmavati et al (1974)³³ even reported that the nonvegetarian girls have a delayed onset of menarche by about six months than their vegetarian counterparts. The amount of proteins and calories in the nonvegetarian diet may also vary from family to family. Shastree et al (1974)³⁴ recorded two traditional nonvegetarian groups showing the lowest and highest menarcheal age. So rather than categorizing the girls on the basis of the type of diet consumed, it will be more logical to categorize on them on the basis of proteins and calorie intake.

AGE AT MENARCHE AND EXERCISE

Along with energy intake, the energy expenditure has been considered by researchers to be one of the factors influencing the age at menarche.

In our study, percentage of girls attaining menarche is more in girls undergoing occasional /no exercise than those with regular exercise, the difference being statistically significant ($p < 0.01$). The girls having regular exercise and/ or those participating in outdoor games showed a comparable age of onset of menarche to those with no / occasional exercise ($p > 0.05$) (table III).

It is well known that intensive exercise during pre pubertal and peripubertal period results in growth and pubertal delay. A Study by Sidhu and Grewal (1980)³⁵ have established that the age at menarche is delayed in sports women. Moison et al (1991)¹⁰ observed that participation in dance, ballet, gymnastics figure skating, synchronized swimming and diving competitions had lower risk of reaching menarche at an early age. Merzenish et al (1993)³² noted that the increased sport activity is associated with delay in age at menarche. It may be the vigorous exercise, intense physical and mental stress which delays the menarche. At the same time it is thought that the stress involved with strenuous exercise could inhibit or alter GnRH pulse generator³⁶.

In our study, none of the subjects reported to undergo such vigorous physical exercise. Schools in India normally have some or the other type of exercise few times a week which constitutes a part of the child's physical training. In the present study the girls came from nearby areas walked or cycled down to their schools. Besides, there were students

who used to participate in outdoor games. Thus, a day-to-day physical activity do not influence the age of menarche.

The knowledge of age of menarche in a given population is a pressing need of the society as no law about the age of marriage, age of consensual sex, abortion, family planning, rape and other aspects of female reproductive life can be made without it. With emergence of AIDS as one of major threat to mankind and teenage pregnancies as one of the major social problems, an urgent need is felt, in developed as well as developing countries to make the adolescents aware of it. The study will help the government to decide the appropriate age of children at which the topics like sex education, contraception, sanitary practices etc can be incorporated in schools. It will help the government to design and implement the various health programmes related to reproductive health of women of appropriate age. As the early age at menarche is one of the few established risk factors for breast carcinoma, the knowledge of it in a given population may help the clinicians for deciding high risk patients for breast carcinoma leading to its early detection and hence prompt and effective treatment.

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