RESEARCH PAPER

Age Of Menarche And Its Associated Factors Among Girls Of Tamil Nadu

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Abstract

Introduction: Menarche refers to the onset of the first menstrual cycle in a female. This study aims to assess the age of menarche and its associated factors among girls of Tamil Nadu in selected institutes of Higher Education.

Materials and methods: A cross-sectional survey was conducted among 530 college-going girls between 18-24 years at the constituent colleges of Sri Ramachandra Institute of Higher Education and Research (DU), Chennai. Using convenience sampling technique, students who met the inclusion criteria were recruited. The survey method was used to collect the data. The data related to background variables and menstrual history of age at menarche and its associated factors were obtained using a self-administered questionnaire (Google form). The study was analyzed using descriptive and inferential statistics.

Results: In this study, menarche began at an average age of 12.84±1.65 years in a female population with a mean age of 20.79±2.17 years. The age of menarche of the participants had a moderately positive correlation of 0.33 with their sister's age of menarche and was statistically significant ($p<0.05$). An association was noted between residential mothers', eating junk food ($p< 0.04$) and physical activity with age of menarche ($p< 0.05$). Outside eating habits and eating junk food were associated with acne during menstrual cycles ($p=0.04$ and 0.02 respectively). Out of 530 girls, 11 (2%) had precocious puberty (<10 years of age) and 261(49.3%) girls attained early menarche (≤ 12 years). Hirsutism (Excessive hair growth) and menstrual disorder were present in 53 (10%) and 52 (10%) students respectively. The residential area of the women has a major impact on their menstrual practices.

Conclusion: The available evidence highlights a genuine generational decline in the age of menarche among girls in Tamil Nadu. While this trend is evident, the causal pathways and its broader implications for public health remain insufficiently clarified. Addressing these gaps requires sustained, methodologically rigorous research that can provide deeper insights and guide the development of targeted interventions.

Keywords: Age at menarche, Adolescent girls, Puberty, Associated factors

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Introduction

Menarche or first menstruation is an important indicator for the onset of reproductive maturation in girls. It involves a series of changes in the developmental status of pubertal females. Age at menarche reflects the health status of a population [1]. The average age at menarche varies by demographics and reflects a variety of parameters such as nutritional status, geographic location, environmental condition, and financial status in society [2,19]. Earlier menarche has also been linked to an elevated risk of metabolic syndrome and cardiovascular risk [2,20].

In the majority of females in India, menarche commonly occurs between 12 and 14 years of age [1,19]. The age at menarche is of considerable clinical importance, as it aids in the identification of delayed puberty as well as underlying pathological and hormonal disturbances [3]. Menarcheal age varies among individuals and is influenced by a complex interplay of genetic and environmental factors [4,8,22]. During the 20th century, increasing emphasis was placed on additional determinants associated with age at menarche, including season and month of birth, body physique, family income, parental employment and education, and family size [4,14,22]. However, pubertal maturation and age at menarche are closely interrelated; therefore, the onset of menarche cannot be attributed to a single factor [4].

Globally, a secular decline in pubertal age has been observed between 1983 and 2002, with the mean age at menarche decreasing from approximately 13.4 to 12.1 years across several countries [5]. Similar trends have been documented across different populations and geographical regions [20,24,25]. According to the World Health Organization (WHO), adolescence—defined as the age range of 10 to 19 years—is a critical and challenging yet significant phase of life, characterized by the transition from childhood to adulthood and often described as a period of "stress and storm" [6]. Monitoring pubertal development is essential to assess progress at local, national, and global levels and to support governments and development partners in guiding investments and implementing targeted interventions [6].

Currently, anovulation, pimples associated with periods, hirsutism and oligomenorrhea are constant problems among adolescent girls diagnosed with PCOS because of hyperandrogenism [7,17,28]. There were two menarcheal scenarios resulting in PCOS: overweight and underweight at the time of puberty resulting in early menarche [8]. Environmental and genetic factors significantly influence age at menarche in women with polycystic ovary syndrome [8,28]. Therefore, education about awareness, overcoming management and acceptance of the maturation period, and safe effective menstrual hygiene practices is a trigger for better and stronger development for adolescent girls and women [9].

Secular trends in menarcheal age in India have been documented using data from the Indian Human Development Survey (IHDS), which is conducted every ten years. The earliest estimates reported a mean age at menarche of 14.02 years in 1955, whereas more recent IHDS data show a decline to 12.76 years. Specifically, the two nationally representative survey waves conducted in 2004–05 and 2011–12 revealed a significant generational reduction in the mean age of menarche,
underscoring a marked downward trend over time [10]. Studies from various regions of India have shown similar patterns of declining menarcheal age [19,21,27].

The existing literature on menarcheal trends within our population remains limited, with no published studies providing a comprehensive analysis of the current pattern. Although a general shift toward earlier onset of menarche has been observed, systematic evaluation is lacking. Physical activity has been shown to have associations with menarcheal timing in several populations [23]. Additionally, body mass index and nutritional status play crucial roles in determining the age of menarche [20,21]. Educational attainment and socioeconomic factors have also been linked to menarcheal age and subsequent health outcomes [24]. The present study was therefore designed to determine the mean age at menarche among university girls aged 18–24 years in Tamil Nadu and to identify the factors associated with its variation.

Materials and Methods

A quantitative approach with a cross-sectional survey research design was used. A convenience sampling technique was adopted. All the young girls between 18 and 24 years old studying at Sri Ramachandra Institute of Higher Education and Research (DU), Porur, Chennai were invited to participate in the study. The constituent units included in the study are Sri Ramachandra Faculty of Nursing, Sri Ramachandra Faculty of Pharmacy, Sri Ramachandra Faculty of Physiotherapy and Sri Ramachandra Faculty of Allied Health Sciences. Permission was obtained from the respective Principals of the above-mentioned branches. Students from different places in Tamil Nadu, especially adolescent girls who were studying in the above-mentioned branches were included. The study setting was changed from classroom to online after completing the pilot study due to the pandemic. Ethical clearance was obtained from the Institutional Ethics Committee of Sri

Ramachandra Institute of Higher Education and Research (DU). Totally, 530 students who fulfilled the inclusion criteria were chosen as participants.

Inclusion criteria

- Post-menarcheal girls aged between 18 to 24 years
- Who could understand Tamil or English
- Willing to participate in the study
- Who were permanent residents of Tamil Nadu

Exclusion criteria

- Attained menarche after hormonal pills
- Chronic condition and on treatment for more than 3 months (viz DM, Asthma, Epilepsy, TB)

Questionnaire

A self-administered questionnaire was developed by the investigator consisting of 2 sections

Section A - Background variables: Date of birth, height, weight, religion, place of residence, monthly income of the family, total number of family members, socio-economic status, type of family, father's education and occupation, mother's education and occupation, siblings, physical activity, type of diet and food habits, physical activity.

Section B - Clinical variables: History of age of menarche and its associated factors includes date, month, year of first menses, own sister's age of first menses, mother's age of first menses, any medicine or home remedies given for puberty occurrence, history of irregular periods, medical problems, nature of menstrual flow, number of days, regularity of menses, painful periods during the first year of menstruation, mode of management for painful periods, any absenteeism of school during menstruation, taking medicine to postpone periods, the present menstrual pattern, nature of menstrual flow, number of days, frequency and painful periods. Family history of any medical problems, pimples associated with periods and their treatment, current medical problems and details of their treatment, abnormal hair growth and details of its treatment, weight gain and weight loss in the last year.

Score Interrpretation

Section B consists of 24 questions with options (Yes/No/Not applicable). If the participant answered yes it will continue to answer the sub-question of the previous one. If the answer is NO or NA, then the sub question will not appear. A total 26 number of sub questions contained descriptive types from sections A and B, like open-ended questions. It has a survey method of questions. The participants were explained clearly about the purpose of the study and informed consent was obtained. Data through Google form. The data were analyzed by descriptive and inferential statistics. Confidentiality of the responses was assured and maintained throughout the study .

Results

The age at menarche of the girls is presented in Figure 1.

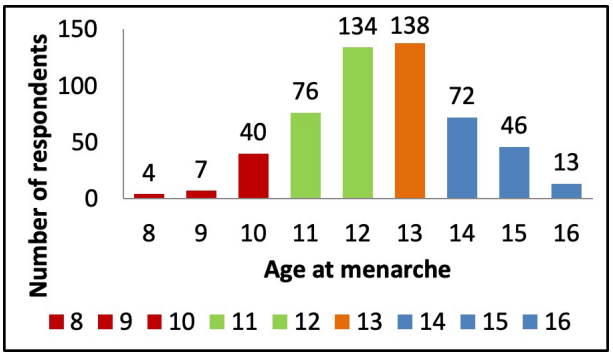

Figure 1. Distribution of age at menarche among the participants (N = 530).

The majority attained menarche at 13 years 26.02% (n=530); most of them attained menarche between the age of 10-12 years (47.2%), fewer attained menarche between the age of 14-16 years (24.71%), and 11 (2%) of girls had precocious puberty (<10 years of age) and 261(49.3%) girls attained early menarche (≤ 12 years) Figure 2. These findings are consistent with studies from other regions showing a trend toward earlier menarche [10,19,27].

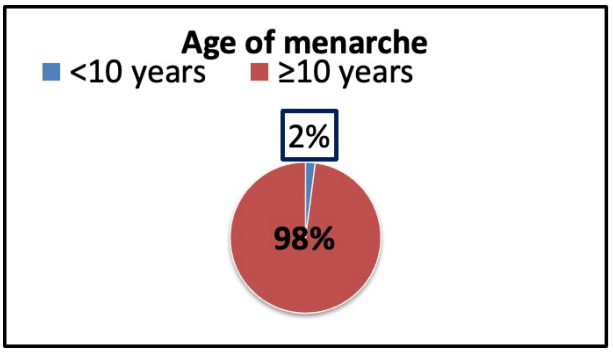

Figure 2. Distribution of precocious puberty among the participants (N=530).

The mean age of menarche of the participant was 12.84±1.65, the participants' sisters' menarche was 12.83±1.74, the participants' mothers' menarche was 14.26±1.69 (Table 1). This generational decline in menarcheal age is consistent with global secular trends [5,10,11,12].

Socio-demographic variables	n	Mean	SD
Age of Menarche	530	**12.84**	1.65
Sisters' age of menarche	264	12.83	1.50
Mother's age of menarche	244	14.6	1.69

Table 1. Mean and standard deviation of age of menarche of the participants, mother and sister.

Moderate positive correlation of r=0.242 between the age of menarche of the participants and with age of menarche of the sisters was found which was statistically significant ($p<0.05$). Although earlier studies have reported a weak positive correlation between maternal and daughter's age at menarche [11,12], such an corelation was not observed in the present study (r = 0.105, p = 0.102).The mean menarcheal age of the mothers was higher than the menarcheal age of the participants (Table 2), indicating a clear generational shift [10,24].

Correlation		Mean	N	Correlation	Sig
Pair 1	Age@menarche - participant	12.9465	243	.242	.000*
	Age@menarche - sister	12.88	243		
Pair 2	Age@menarche - participant	12.9078	244	.105	.102
	Age@menarche - mother	14.26	244		

Table 2. Correlation between the age of menarche of the participant with the age of menarche of the mother and sister.

Table 3 presents the results of the paired *t*-test comparing the age at menarche of the participants with that of their sisters and mothers. The mean age at menarche of the participants (12.95 ± 1.51 years) was marginally higher than that of their sisters (12.88 ± 1.48 years), with a mean difference of 0.06 years; however, this difference was not statistically significant (p = 0.602). In contrast, the mean age at menarche of the participants was significantly lower than that of their mothers (14.26 ± 1.70 years), with a mean difference of −1.35 years, indicating an earlier onset of menarche among the participants compared to their mothers (p < 0.001). These findings suggest a significant generational decline in the age at menarche, while sibling differences were minimal and not statistically meaningful.

Paired t test		Mean	N	Std. Deviation	Mean difference	P value
Pair 1	Age@ menarche - participant	12.9465	243	1.51259	0.06173	0.602
	Age@ menarche - sister	12.88	243	1.475		
Pair 2	Age@ menarche - participant	12.9078	244	1.51355	-1.35041	.000*
	Age@ menarche - mother	14.26	244	1.698		

Table 3. Comparing the age at menarche of the participants with that of their sisters and mothers.

Discussion

The age of menarche was assessed using a researcher's self-structured tool. The mean age of menarche was 12.84±1.65, the mean age of the participant's sister's menarche was 12.84±1.74, and the mean age of the mother's menarche was 14.26±1.69. The decline in the mean age at menarche between the mothers and the daughters was 1.42 years. In another study from Turkey, the mean menarcheal age of the mothers was higher than the mean menarcheal age of the girls; the mean age of menarche was 12.82 ±1.07 and for the mothers was a mean of 13.6±1.39. This difference persisted independent of the socio-economic status, nutritional state and physical activity of the girls [11]. The mean age of menarche of the participants and sisters was less when compared to the mother's menarcheal age [12]. Similar intergenerational differences have been documented in studies from Saudi Arabia and other Middle Eastern countries [12].

Another significant finding in the present study is the prevalence of precocious puberty less than 10 years of age 11 (2%). Although tumor, trauma, genetic issues, hypothyroidism and hormones can be the causative factor for early puberty [3,13], staying away from estrogen containing supplements or medicines for the girls and maintaining healthy weight can prevent the precocious puberty [7,13]. The first epidemiologic study from a Danish national registry estimated that 0.2% of females had some form of precocious puberty while it was less than 0.05% in males [13]. The current findings show increase in precocious puberty. Early menarche has been associated with various health outcomes later in life, including educational attainment and risk-taking behaviors [24].

Of girls who attained menarche greater than or equal to 10 years of age 389(75%) of them had their mother's occupation to be housewife. Also, the girls who attained menarche less than 10 years of age 9(81.8%) had their mother's occupations to be housewives. There was a significant association found between mothers' occupation and age of menarche indicates mothers awareness on puberty impacting factors can play a significant role. Among socioeconomic variables measured at age 9–11 years, only mother's education was a significant predictor of daughter's age at menarche [14]. Maternal stress and socioeconomic factors have been shown to influence the timing of menarche in daughters [14,22].

Unhealthy dietary habits, including the consumption of junk foods, were prevalent among the girls in the present study, suggesting that such practices continue to be common in this age group. Early onset of menarche was observed across participants, regardless of how frequently junk foods were consumed. These observations are in line with earlier studies among school-aged children, which have identified a relationship between junk food intake and earlier attainment of menarche [15]. In contrast, evidence from other studies indicates that girls experiencing food insecurity tend to attain menarche at a later age compared to their food-secure peers [16]. Taken together, existing evidence suggests that nutritional status whether reflecting excess consumption of calorie-dense foods or inadequate dietary intake has a substantial influence on the timing of menarche [16,21,25].

Physical activity levels have been systematically reviewed and shown to have associations with age at menarche [23]. In our study, physical activity showed trends toward association with menarcheal timing, though the relationship was complex. Studies have shown that chronic undernutrition can lead to later puberty onset [25], while adequate nutrition combined

with sedentary lifestyle may contribute to earlier menarche [20,23].

In the present study 52(9.8%) and 53(10%) of the girls were presented with PCOS and Hirsutism but no association was found between BMI (kg/m²), the Indian Cut-off, condition of eating outside, condition of eating junk food, physical activity and condition of eating non-veg food. In another Indian study conducted in Maharashtra shows the incidence of PCOS among the study population was 21% (N=100) and risk assessed were lack of physical activity, irregular menstrual cycle, body mass index more than 25, and Waist-hip ratio above 0.86 [17]. Clinical, hormonal and metabolic factors associated with PCOS have been documented in South Asian populations [28]. The relationship between early menarche and PCOS is well-established, with environmental and genetic factors playing significant roles [8,28]. Menstrual disorders are also common among women with other chronic conditions [26], highlighting the importance of comprehensive menstrual health assessment.

Pimples associated with periods were associated with eating outside and eating junk food. Diet can affect hormones that, in turn, could make acne worse. When high sugar and fat content foods are consumed can cause a rise in insulin levels, altering other hormones that can affect the skin. An energy-dense dietary pattern (high consumption of fatty and sugary products) was associated with current acne [18]. This finding underscores the importance of dietary counseling for adolescent girls, particularly regarding menstrual health [9].

Studies from rural Tamil Nadu have documented various menstrual problems among adolescent school girls [19], emphasizing the need for targeted interventions. The importance of menstrual hygiene education and awareness cannot be overstated [9]. Health status evaluation using various anthropometric indices has been used to assess pre-menarcheal and post-menarcheal girls [21], providing valuable insights into the relationship between physical development and menarcheal timing. Multiple factors including genetic predisposition, environmental exposures, nutritional status, and lifestyle behaviors collectively influence the age of menarche [4,5,22].

The current study contributes to the growing body of evidence on menarcheal trends in Tamil Nadu and highlights the need for continued surveillance and intervention programs targeting adolescent reproductive health [6,19,27].

Conclusion

The study underscores a concerning trend of decreasing age of menarche in Tamil Nadu, likely influenced by changing lifestyles and dietary habits. This shift has implications for menstrual health, with conditions like menstrual acne and hirsutism potentially linked to polycystic ovary syndrome (PCOS). Effective menstrual health education and awareness initiatives are imperative to address these issues. Policymakers can leverage these findings to craft targeted interventions aimed at promoting reproductive health and preventing complications such as PCOS and infertility. Further research into the hormonal dynamics and multifactorial influences driving these trends is crucial for informing future healthcare strategies and policy decisions.

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