National Journal of Physiology, Pharmacy and Pharmacology

RESEARCH ARTICLE

A cross-sectional study on the age of onset of menarche in females among rural and urban areas of Kanchipuram district in the past 5 years, since 2014

Latha Ramalingam, Akshaya Veeraraghavan

Department of Physiology, Shri Sathya Sai Medical College and Research Institute, Kanchipuram, Tamil Nadu, India

Correspondence to: Latha Ramalingam, E-mail: lathura@gmail.com

Received: November 15, 2019; **Accepted:** December 05, 2019

ABSTRACT

Background: Hormonal imbalance, obesity, altered food habits, chemicals in cosmetics, and sedentary life have been the main causes of early onset of menarche. There has been a secular trend in the age of menarche of females at the rate of decrease of 1 month per decade since 1995. **Aims and Objectives:** The objective of the study is to find out the trend of age of the onset of menarche in females of rural and urban areas in the past 5 years, from 2014 to 2018. **Materials and Methods:** A cross-sectional study was conducted among 378 females (196 rural and 182 urban) of the age group of 7–15 years in the rural and urban population of Kanchipuram district. After obtaining written consent, a questionnaire was administered to know their current age and age of menarche and noted. **Results:** Majority of the females had the age of menarche between 12 and 13 years in the rural and urban population, but the number of females who attained menarche at 13 years was comparatively more in the rural population (n = 96) when compared with the urban (n = 37), though there was no statistical difference between the both. Furthermore, we observed that the early age of onset starts in early 2015 in the urban population, compared with the trend establishing in the rural population in the recent 2017 and 2018. **Conclusion:** There is a trend of early age of menarche among the females of the urban population when compared with the rural population.

KEY WORDS: 2014–2018; Age of Menarche; Rural; Urban

INTRODUCTION

Premature sexual changes and attaining menarche are common reasons for visits to pediatric endocrinologists. The normal age of onset of menarche in females of Indian population is between 12 and 15 years. A defined criterion for precocious puberty is not available as the puberty is the combination of attainment of thelarche, pubarche, and menarche. The precocious appearance of these stages is due to various factors such as hormonal imbalance, obesity, altered food habits, chemicals in cosmetics, and sedentary lifestyle.[1,2] Stress also reported to be one of the causes of early onset of puberty.[3]

Access this article online	
Website: www.njppp.com	Quick Response code
DOI: 10.5455/njppp.2020.9.1136405122019	

The age limit for precocious puberty is changing to a lower value as the age of onset of menarche in girls is declining.[4] There has been a secular trend in the age of menarche of females at the rate of decrease of 1 month per decade since 1995.[5] Not just that, but the development of breast buds (tanner staging II) which indicates impending menarche also occurs earlier in girls, and hence, there is a huge widening in between the development of breast tissues and the onset of menarche.[6,7] Girls in Southern India tend to attain earlier menarche when compared with North India.[8]

The early onset of puberty results from premature activation of hypothalamo-pituitary-adrenal axis.[9,10] The early onset of puberty might have consequences in terms of malnutrition, anemia, and sexual abuse. The early onset of puberty also increases the period of her reproductive life and hence increased number of menstrual cycles and hence blood loss, leading to iron deficiency anemia. There are also studies which report increased incidence of breast cancer in females with a history of early puberty.[11,12]

A study reports that girls with early onset of puberty are more likely to have mental health problems when compared with the peers.[13] Mensah *et al*. reported an earlier onset of social and behavioral maladjustment in girls with early puberty.[14] Short stature due to accelerated bone maturation resulting in earlier fusion of epiphysis is also a consequence of early puberty in females.[15] Not many studies report about the difference in age of onset of puberty among females in the rural and urban areas. There are differences in the exposure level of risk factors for premature menarche among the rural and urban females. Due to sedentary lifestyle, the girls in the urban areas may be more likely to attain puberty earlier when compared to girls in the rural area. Hence, this study was conducted to find out the secular trend in the age of menarche in females of the urban and rural parts of Kanchipuram district of Tamil Nadu, India, from 2015 to 2018, and explore the causative factors of early menarche.

MATERIALS AND METHODS

The Institute Ethics Committee clearance was obtained before the beginning of the study. The study was conducted in the rural and urban areas of Kanchipuram district of Southern Tamil Nadu. A total of 378 females were recruited randomly for the study, 196 girls from the rural areas and 182 girls from the urban areas. Females of the age group between 7 and 15 years were recruited for participation in the study. The participation was completely voluntary and written informed consent was obtained from all the participants before including them for the study.

Participant data sheet was given to the participants as hardcopy and also shared through media as softcopies, wherein the participant fills in all the details in the questionnaire forms and submits to the investigator. All the participants were assigned with a unique identifier for any future references and follow-up purpose. The participant's current age, age of onset of menarche, and the year of onset of menarche were noted. Females with family history of precocious puberty were excluded from the study.

Height and weight of the subjects were checked. Body mass index (BMI) was calculated using the Quetelet's index. The subjects falling into all ranges of BMI, as per the classification of BMI for Asian population (normal, overweight, and obese) were recruited randomly in both the groups.[16]

All the data were pooled in Microsoft Excel sheet. The data were analyzed using descriptive statistics using SPSS version 23 for statistical significance. Igor Pro software and Microsoft Excel were used for graphical representations. Student's unpaired *t*-test was used to calculate the level of significance between the groups.

RESULTS

Out of the 378 girls randomly recruited for the study, 182 girls were from the urban areas of the Kanchipuram district and 196 girls were from the rural areas of Kanchipuram district, as depicted in Figure 1.

There is no statistically significant difference in the BMI between the urban and rural groups [Table 1]. The number of females with age of menarche at 10, 14, and 15 years was less in both the groups, hence, not taken here for a comparison of BMI in those age groups.

The mean age of menarche in the urban and rural population for the past 5 years, since 2015, is shown in Table 2. There is an overall significant difference in the mean age of menarche when compared across the years with $P < 0.001$ with 95% of confidence interval (−0.646, −0.387) between the urban and rural population using Student's unpaired *t*-test.

Graph 1 shows that the number of girls with age of menarche of 12 was almost similar in both the urban and rural population.

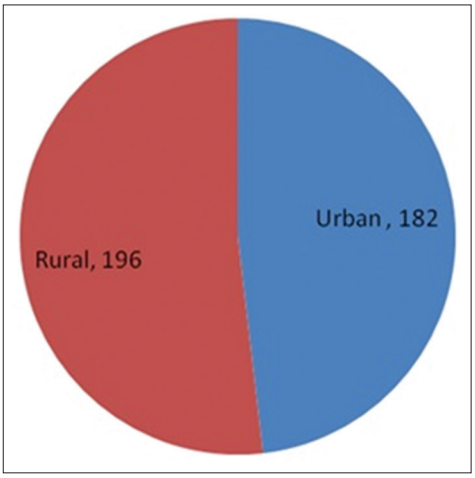


Figure 1: Distribution of urban (182) and rural (196) girls among the selected population

Table 1: Body mass index of the girls with age of menarche at 11, 12, and 13 years

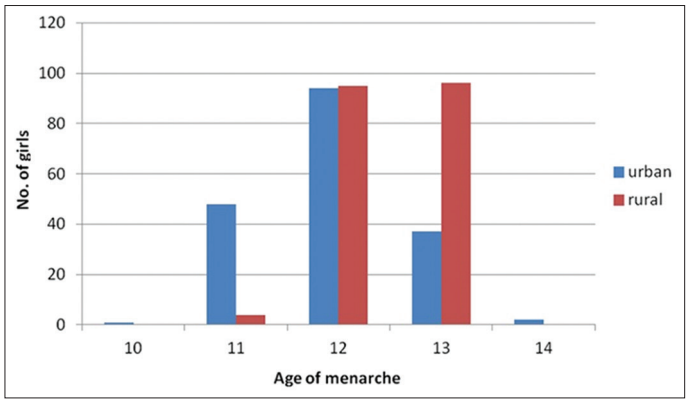
Age of menarche (years)	Urban (kg/m²)	Rural (kg/m²)	*P*-value
11	22.7±1.85	20.9±2.62	0.584
12	23.67±2.06	19.05±0.83	0.522
13	21.85±1.33	20.76±1.65	0.731

Table 2: Mean age of menarche in the urban and rural population

Age of menarche (years)	*n*	Mean (years)	Standard deviation	Standard error of mean
Urban	183	11.95	0.730	0.054
Rural	196	12.47	0.540	0.039

Table 3: Mean age of menarche in the urban and rural population

Year	Average age of menarche urban	Average age of menarche rural	Age of menarche urban and rural *P*-value
2015	11.33	11	0.190
2016	11.7	12.39	0.611
2017	12.3	12.2	0.868



Graph 1: Age of menarche of girls in urban and rural areas of Kanchipuram district

However, the number of girls who attained at the age of 11 was more (n = 46) in the urban population as compared with the rural population (n = 4), although there is no statistically significant difference between them, as shown in Table 3. Similarly, age of menarche at 13 was comparatively larger in the rural population (n = 96) than the urban population (n = 37). The girls with onset of menarche at extremes of ages of 11 and 14 were meager in number, occurring only in the urban population, hence not considered for statistical differences.

When the year-wise trend of change in the age of onset of menarche was compared between the groups, since 2015, there was no significant difference observed, as shown in Table 3. However, the trend of onset of age of menarche was statistically significant between the groups.

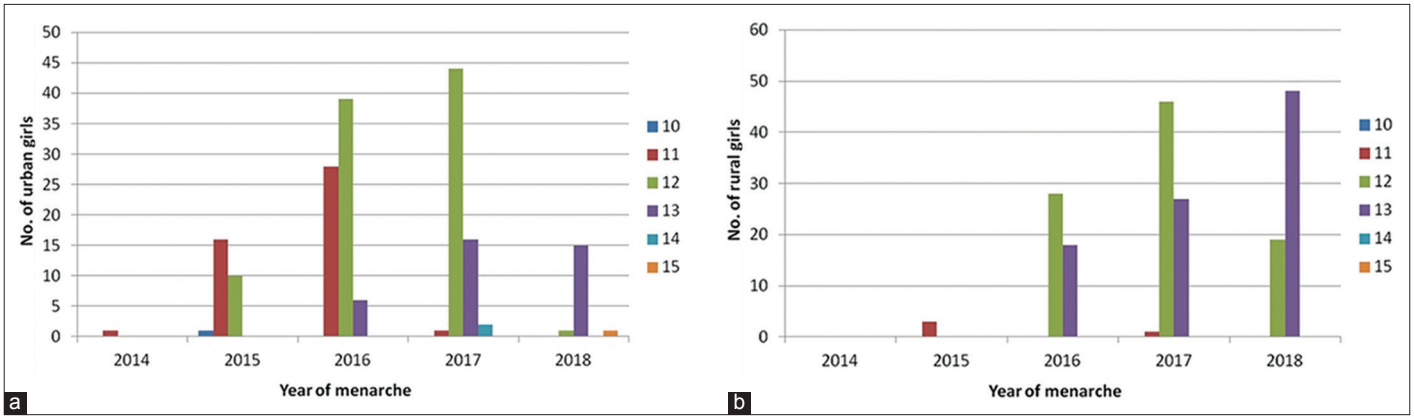
In the year 2017 and 2018, the number of girls attained menarche at 12 years (n = 39) was higher in the urban areas, whereas the number of girls attained menarche at 13 years (n = 47) was higher in the rural areas, as shown in Graph 2a and b. Similarly, in the years 2015, 16 girls and, in the year 2016, 28 girls have attained menarche at the age of 11 from the urban area, while in the rural population, only 3 girls attained menarche at the age of 11 in the year 2015. The mean age of menarche of 13.13 years in the urban females (n = 15) in the year 2018 may be due to the fact that the chosen random sampling involved only 16 females in total, of which 15 were from the urban areas and hence comparison cannot be done.

DISCUSSION

The age of menarche at 11 years was considerably higher in the urban population when compared with the rural side and also the number of females attaining menarche at 13 years was higher in the rural areas, though few girls attaining early menarche were present in the rural areas and few females with menarche at 13 years were prevalent in the urban areas too. Although there were no significant differences between the groups, this difference in trend among the urban and rural population of the Southern India district should be a matter of concern and the causes should be made out. In the past year, 2018, most of the urban girls attained menarche at 13 years which was not the scenario in the years 2015–2017.

Many factors are related to the early onset of puberty in the urban areas when compared with the rural areas. Our society seems to be accepting early puberty as a trend. In our study, we have found a changing trend with the urban girls having early age of menarche when compared with the rural girls. In a study conducted in South Africa, Urban and rural women attained menarche at 12.7 and 14.5 years respectively which resulted in early cessation of growth process leading to central abdominal adiposity in adulthood.[17]

Another study conducted by Ameade and Garti showed earlier menarche in the urban and suburban dwellers of Northern Ghana region.[18] About 10% of school-aged children, between 5 and 17 years of age, are overweight or obese worldwide and Indian population, it varies between 10% and 30%.[19-23] Risk of overweight is 2 times higher and obesity is 3 times higher in non-poor women of Indian population.[24] About 23% of women in the urban India are overweight and obese when compared to only 7% in the rural India.[25] Intake of high fatty processed foods may be the cause. Obesity and sedentary lifestyle have been implicated as one of the most common causes of early menarche in girls. In our study, we



Graph 2: (a) Number of urban females with different age of menarche from 2015 to 2018. (b) Number of rural females with different age of menarche from 2015 to 2018

found that the difference still exists even after comparing for the effect of BMI in the urban and rural females. Hence, obesity or overweight alone may not be the cause of concern for early menarche.

Another important area of consideration is the trend of early menarche in the past 5 years. This might be taken as a point of awareness among public about the rate of obesity, avoidance of processed foods, which people started adopting and also follow to certain extent. Similar group in the rural females was 48 girls attaining menarche at 13 years, where the normal pattern as for other years persisted.

Overnutrition in the urban population can trigger early puberty. Chronic primary malnutrition affects the timing of sexual maturation in adolescent period.[26-28] There are studies which substantiate increased adiposity prevalence in early puberty. Advancements in technology should be a serious matter of concern which is booming in the world on a day-to-day basis. The radio signals and waves are also to be thought of for this changing trend as the rural population are comparatively less exposed to these radiations when compared with the urban population. Exposure to xenoestrogens from cosmetics, industrial wastes, pesticides, insecticides, etc., is high among the urban population and this has been linked to breast cancer.[29] Although the direct effect of xenoestrogens on the early menarche has not yet been studied, this factor should be found in the list of causative factors considering the pervasion of xenoestrogens in all the products of the modern world. The rural girls are less exposed to them when compared with the urban girls, substantiating one of the reasons for early menarche.

Socioeconomic status at the prepubertal age becomes another important factor for the determination of age of menarche. Requirement of micro- and macronutrients increases as the girl is approaching the age of menarche.[30] Inadequate and surplus supply in the rural and urban population, respectively, could also be one of the factors for the differences in the age of menarche observed in our study.

The strengths of our study are exploring the latest trend in the age of menarche in the Kanchipuram urban and rural population which was not explored by many. However, the causes should be further evaluated in continuation with the data collected in the population selected.

There is a trend of early onset of menarche in the urban females of Kanchipuram district of Tamil Nadu. Although the same has been observed in the rural population also, the number of females is considerably higher in the urban population. Sedentary lifestyle, higher incidence of obesity, exposure to fast food chemicals, junk foods, and radiations could be among the general causes of this difference. Early menarche and late menopause could have effects on the physical, mental, and social well-being of the women.

CONCLUSION

There is trend of early age of menarche among the females of the urban population when compared with the rural population. Understanding the consequences of early menarche, effective preliminary interventions and awareness are required to revert back to the normal trend to build up healthier future generations.

REFERENCES

1. Li W, Liu Q, Deng X, Chen Y, Liu S, Story M. Association between obesity and puberty timing: A systematic review and meta-analysis. Int J Environ Res Public Health 2017;14:E1266.
2. Lee EY, Pabayo R, Kawachi I. Timing of spermarche and menarche are associated with physical activity and sedentary behavior among Korean adolescents. Osong Public Health Res Perspect 2016;7:266-72.
3. Berkey CS, Gardner JD, Frazier AL, Colditz GA. Relation of childhood diet and body size to menarche and adolescent growth in girls. Am J Epidemiol 2000;152:446-52.
4. Walvoord EC. The timing of puberty: Is it changing? Does it matter? J Adolesc Health 2010;47:433-9.
5. Pathak PK, Tripathi N, Subramanian SV. Secular trends in

menarcheal age in India-evidence from the Indian human development survey. PLoS One 2014;9:e111027.
6. Roche AF, Wellens R, Attie KM, Siervogel RM. The timing of sexual maturation in a group of US white youths. J Pediatr Endocrinol Metab 1995;8:11-8.
7. Parent AS, Teilmann G, Juul A, Skakkebaek NE, Toppari J, Bourguignon JP. The timing of normal puberty and the age limits of sexual precocity: Variations around the world, secular trends, and changes after migration. Endocr Rev 2003;24:668-93.
8. Albright DL, Voda AM, Smolensky MH, Hsi BP, Decker M. Seasonal characteristics of and age at menarche. Prog Clin Biol Res 1990;341A:709-20.
9. Abreu AP, Kaiser UB. Pubertal development and regulation. Lancet Diabetes Endocrinol 2016;4:254-64.
10. Gluckman PD, Hanson MA. Evolution, development and timing of puberty. Trends Endocrinol Metab 2006;17:7-12.
11. Bodicoat DH, Schoemaker MJ, Jones ME, McFadden E, Griffin J, Ashworth A, *et al*. Timing of pubertal stages and breast cancer risk: The breakthrough generations study. Breast Cancer Res 2014;16:R18.
12. Hamilton AS, Mack TM. Puberty and genetic susceptibility to breast cancer in a case-control study in twins. N Engl J Med 2003;348:2313-22.
13. Graber JA. Pubertal timing and the development of psychopathology in adolescence and beyond. Horm Behav 2013;64:262-9.
14. Mensah FK, Bayer JK, Wake M, Carlin JB, Allen NB, Patton GC. Early puberty and childhood social and behavioral adjustment. J Adolesc Health 2013;53:118-24.
15. Partsch CJ, Sippell WG. Pathogenesis and epidemiology of precocious puberty. Effects of exogenous oestrogens. Hum Reprod Update 2001;7:292-302.
16. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet 2004;363:157-63.
17. Said-Mohamed R, Prioreschi A, Nyati LH, van Heerden A, Munthali RJ, Kahn K, *et al*. Rural-urban variations in age at menarche, adult height, leg-length and abdominal adiposity in black South African women in transitioning South Africa. Indian J Endocrinol Metab 2014;18 Suppl 1:S39-47.
18. Ameade EP, Garti HA. Age at menarche and factors that influence it: A study among female university students in tamale, Northern Ghana. PLOS 2016;11:e0155310.
19. Stigler MH, Arora M, Dhavan P, Shrivastav R, Reddy KS, Perry CL. Weight-related concerns and weight-control behaviors among overweight adolescents in Delhi, India: A cross-sectional study. Int J Behav Nutr Phys Act 2011;8:9.
20. Gupta DK, Shah P, Misra A, Bharadwaj S, Gulati S, Gupta N, *et al*. Secular trends in prevalence of overweight and obesity from 2006 to 2009 in urban Asian Indian adolescents aged 14-17 years. PLoS One 2011;6:e17221.
21. Raj M. Dynamics of growth and weight transitions in a pediatric cohort from India. Nutr J 2009;8:55.
22. Bharati DR. Correlates of overweight and obesity among school going children of Wardha city, central India. Indian J Med Res 2008;127:539-43.
23. Kotian MS. Prevalence and determinants of overweight and obesity among adolescent school children of South Karnataka, India. Indian J Community Med 2010;35:176-8.
24. Kalra S, Unnikrishnan AG. Obesity in India: The weight of the nation. J Med Nutr Neutraceuticals 2012;1:37-41.
25. Gouda J, Prusty RK. Overweight and obesity among women by economic stratum in urban India. J Health Popul Nutr 2014;32:79-88.
26. Forbes GB. Influence of nutrition. In: Forbes GB, editor. Human Body Composition: Growth, Aging, Nutrition and Activity. New York: Springer-Verlag; 1987. p. 209-47.
27. Kulin HE, Bwibo N, Mutie D, Santner S. The efect of chronic childhod malnutriton on pubertal growth and development. Am J Clin Nutr 1982;36:527-36.
28. Sogbanmu MO, Aregbesola YA. Menarchal age in Nigerian scholgirls: Its relationship to their height, weight and menstrual profile. Int J Gynaecol Obstet 1979;16:39-40.
29. Dey S, Soliman AS, Hablas A, Seifeldin IA, Ismail K, Ramadan M, *et al*. Urban-rural differences in breast cancer incidence by hormone receptor status across 6 years in Egypt. Ann Hum Biol 2018;45:123-32.
30. Soliman A, De Sanctis V, Elalaily R. Nutrition and pubertal development. Indian J Endocrinol Metab 2014;18 Suppl 1:S39-47.

How to cite this article: Ramalingam L, Veeraraghavan A. A cross-sectional study on the age of onset of menarche in females among rural and urban areas of Kanchipuram district in the past 5 years, since 2014. Natl J Physiol Pharm Pharmacol 2020;10(01):94-98.

Source of Support: Nil, **Conflicts of Interest:** None declared.