

AGE OF MENARCHE IN RELATION TO EXOGENOUS FACTORS AMONG RURAL AND URBAN SCHOOL GOING GIRLS

Anushree Adoor¹, Shailaja Moodithaya²

¹4th Year MBBS, K. S. Hedge Medical Academy, Nitte (Deemed to be) University, Deralakatte, Mangalore, Karnataka, India.

²Additional Professor, Department of Physiology, K. S. Hedge Medical Academy, Nitte (Deemed to be) University, Deralakatte, Mangalore, Karnataka, India.

ABSTRACT

BACKGROUND

Age at menarche is one of the significant traits which are generally used for retrospective epidemiological studies of female sexual maturation. The current study aimed to compare the age of menarche among urban and rural school going girls in Karnataka and to correlate the dietary pattern, physical activity and socioeconomic status with timings of menarche.

MATERIALS AND METHODS

In this cross-sectional study, we examined 100 high school going female volunteers, 50 each from rural and urban schools of Karnataka. All the participants were assessed for their age at menarche, dietary pattern, body mass index, socio-economic status, and physical activity level.

RESULTS

The finding of the study suggested that the average age at menarche among the girls of Southern Karnataka is 12.05±0.873 years. The rural girls experienced 1.2 years higher mean age at menarche compared to the girls from the urban region which is statistically significant. The results of the present study also suggest that there is a significant association of dietary pattern and body composition and socio-economic status with the menarcheal age.

CONCLUSION

The study concludes that age at menarche is significantly early among urban girls compared to the rural adolescent respondents in our study population. The results of the present study also indicate that there is a significant association of dietary pattern and body composition and socio-economic status with menarcheal age. Age at menarche could be multifactorial, and thus the onset of menarche cannot be attributed to a single factor.

KEY WORDS

Diet, Menarche, Physical Activity

HOW TO CITE THIS ARTICLE: Adoor A, Moodithaya S. Age of menarche in relation to exogenous factors among rural and urban school going girls. *J. Evolution Med. Dent. Sci.* 2019;8(10):745-748, DOI: 10.14260/jemds/2019/163

BACKGROUND

Menarche is the first menstrual bleeding in female humans. From both social and medical perspectives, it is often considered the central event of female puberty, as it signals the possibility of fertility. In females, age at menarche is a very significant biological marker to assess the sexual maturation or in other words adolescence.

Attaining menarche is a complex process where nutritional, physical, endocrinal and social factors come into play. Loss of sensitivity of a negative feedback mechanism of oestrogen on the hypothalamic pituitary system is one of the endocrinal causes of attaining menarche. The levels of gonadal steroids and gonadotropins are low until the age of 6-8 years.

This is mainly due to the negative feedback effect of oestrogen to the hypothalamic pituitary system. This system remains sensitive even when the estradiol levels remain low during that time. As puberty approaches, this negative feedback effect of oestrogen is gradually lost. This results in some significant changes in the endocrine function of the girl. A regular menstrual cycle denotes an intact hypothalamic pituitary ovarian axis.¹

Menarcheal age has important health implications. The acceleration of pubertal development is an important medical and social problem, as it may result in increased morbidity and mortality in later life. Menarche is usually attained within a period of 12 to 14 years, and it varies from population to population. Endocrine regulation of sexual maturation is susceptible to various factors from the beginning of the prenatal life. Both genetic and non-genetic can influence the timing of menarche, though genetic factors contribute a role, the non-genetic or exogenous determinants are important since these can be regulated to some extent.

The mean age at menarche varies from population to population and is known to be a sensitive indicator of various characteristics of a population including nutritional status, geographical location, environmental conditions and magnitude of socioeconomic inequalities in a society.^{2,3,4} Studies suggested that menarche tends to appear earlier in life as the sanitary, nutritional and economic conditions of a

Financial or Other Competing Interest: None.

Submission 13-01-2019, *Peer Review* 19-02-2019,

Acceptance 26-02-2019, *Published* 11-03-2019.

Corresponding Author:

Dr. Shailaja Moodithaya,

Additional Professor,

Department of Physiology,

K. S. Hegde Medical Academy,

Nitte (deemed to be) University,

Deralakatte-575018,

Mangalore, Karnataka, India.

E-mail: shailaja.moodithaya@nitte.edu.in

DOI: 10.14260/jemds/2019/163



society improve.^{5,6} Broadly it depends on genetic and nongenetic factors, some of the nongenetic factors being dietary intake, body composition, physical activity, and socioeconomic status.

Variation in the timing of puberty (Onset/Timing of Menarche) is marked between well of and underprivileged population with a marked delay in menarche reported in underprivileged girls.⁷ These data highlight the role of socioeconomic and nutritional condition in the timing of puberty.

Physical activity is also a very important parameter to be considered for age at menarche. Research has reported that there is the delay in menarche in athletes due to inherent physique, the imbalance between energy intake and output and disordered eating habits.⁸ Body weight, BMI and body composition of a subject are also very important parameters reported in the literature to influence the age at menarche.⁹

Knowledge of the length and variation of the menstrual cycle is necessary for patient education and for identifying deviations from normal to guide clinical evaluation.¹⁰ Among the gynecological problems, menstrual problems are said to be the major ones especially among adolescent females.^{10,11} These disorders are often the source of anxiety for female adolescents and their families at large. The common menstrual disorders for female adolescents are amenorrhea, abnormal/excessive uterine bleeding, dysmenorrhea, and premenstrual syndrome.^{10,11}

The variation in age at onset of menarche and differences in the effect of nutritional status, physical activity and socioeconomic status on the reproductive characteristics of young females remains subject of controversy and not well-researched area. Therefore, this study attempted to compare the age of Menarche among urban and rural school going girls in Dakshina Kannada, Karnataka and also to correlate Dietary pattern, Physical activity and Socioeconomic status with age of menarche.

MATERIALS AND METHODS

In this cross-sectional study, a total of 100 high school going female volunteers (50 from rural and 50 from the urban region) were recruited by convenient sampling from high schools in urban and rural region in Dakshina Kannada district of Karnataka state. Sample size was estimated using the following formula for comparing the age at menarche between urban and rural girls.

$$N = \frac{2[Z_{1-\alpha/2} + Z_{\beta}]^2 X \sigma^2}{d^2}$$

Where $\alpha = 5\%$; $\beta = 20$; $\sigma = 1.4$; $d = 0.8$.

For the study, the subjects were recruited after obtaining the approval from the institutional ethics committee. The subjects will be enrolled in the study after taking the permission from school authorities explaining the procedure in detail and written informed consent from the parents. Female postpubertal subjects of age group 12-15 years were included, and subjects with chronic illness were excluded from the study.

After obtaining a brief history of all the participants will undergo the following experimental protocols-

1. Anthropometric Measurements

These include height, weight, and Body mass index (BMI) and waist-hip circumferences (W/H ratio).

2. Physical Activity Level Assessment (PAL)

Following the anthropometric measurement, PAL will be estimated using a validated physical activity Questionnaire. PAL pattern will be calculated as 24-hour energy expenditure/basal metabolic rate. 24-hour energy expenditure will be calculated as the sum of energy expenditure related to sleep, occupational and residual energy expenditure. BMR would be derived from standard age and gender-specific regression equation. Cut-offs for physical activity level that describe grades of physical activity are <1.4 =sedentary, 1.55 - 1.5 =moderately active and >1.75 =heavily active.¹²

3. Dietary Intake

Dietary status of the participants will be assessed using a food frequency questionnaire. This method consists of asking individuals how often specific foods are eaten. This is then used as an index of diet pattern of the population group. An underlying principle of this method is that average long diet, for example, intake over weeks, months or years is the conceptually important exposure rather than intake on a few specific days.¹³

4. Socio-Economic Status

Socioeconomic factors or life setting, such as urban/rural residence, family size, family income, level of parental education, may also influence pubertal development. The urban girls will be assessed for socio-economic status by Modified Kuppaswamy Scale ¹⁴& in rural girls according to Pareek scale.¹⁴

5. Assessment of Menarcheal Age

Menarcheal age was determined by recall method, menstrual data was obtained by asking participants to recall their age at menses.¹⁵ Time elapsed between menarche querying the data was quite short; therefore, accuracy would be better.

Statistical Analysis

Data will be expressed as Mean \pm SD. All the variables were compared between 2 study groups using unpaired student t-test. Association of factors like physical activity, dietary intake and anthropometric measures with age of menarche was tested using Pearson's correlation coefficient tests. Menarcheal age between three groups socioeconomic status was assessed using One-way ANOVA. Statistical significance was tested at a probability threshold of $p < 0.05$.

RESULTS

	Urban	Rural
Age (Years)	13.42 \pm 0.86	13.70 \pm 0.89
Height (Metres)	153.54 \pm 7.92	150.74 \pm 8.05
Weight (Kilograms)	44.88 \pm 6.89	38.14 \pm 7.64*
BMI (Kg/m ²)	18.95 \pm 2.84	16.7 \pm 2.8*
Waist Hip Ratio	0.79 \pm 0.065	0.77 \pm 0.035
Table 1. Subject Characteristics		
* Significantly lower than urban counterparts.		

	Urban	Rural	P value
Age at Menarche (Years)	11.40±0.833	12.68±0.957	<0.001*
Dietary Intake (kcal)	1375.60±106.76	1179.38±48.260	<0.001*
Physical Activity	1±0.00	1.19±0.31	<0.001*
BMI (Kg/m ²)	18.95±2.84	16.7±2.8	<0.001*

Table 2. Comparison of Dietary Intake, Physical Activity, Age of Menarche and BMI

*Indicates that there is significance difference of the respective parameter between rural and urban groups.

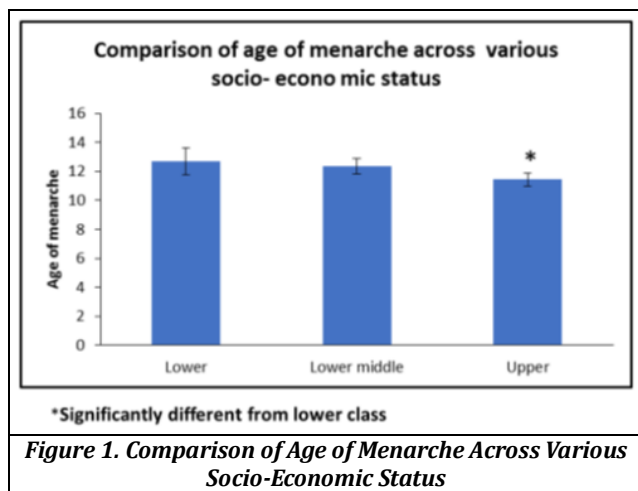


Figure 1. Comparison of Age of Menarche Across Various Socio-Economic Status

	Pearson Correlation	P value
BMI	-0.28	0.005*
Dietary Intake	-0.53	<0.001*
Physical Activity Level	0.13	0.18

Table 3. Correlation of Physical Activity, Dietary Intake, BMI with Age of Menarche

*Indicates that there is a significant relationship between those outcome measures and age at menarche

DISCUSSION

Age at menarche is one of the significant traits which are generally used for retrospective epidemiological studies of female sexual maturation. The hormonal control of sexual maturation could be attributed to both genetic and non-genetic factors. Though genetic factors primarily influence the age at menarche, the possible influence non-genetic factor has great importance, since these exogenous factors to some extent can be regulated. The current study evaluated the menarcheal age of urban and rural school going girls of southern Karnataka and also assessed the non-genetic factors like body composition, dietary pattern, level of physical activity and socio-economic status level that could influence the onset of menarche.

The finding of the study suggests that the average age at menarche among the girls of Southern Karnataka is 12.05 years. There is a significant difference in the onset of menstruation between girls from the urban and rural region, i.e., age at menarche is significantly earlier among urban girls compared to the rural in our study population. The results of the present study also indicate that there is a significant association of dietary pattern and body composition with age at menarche. Further, these findings of this study showed that

the menarcheal age is also influenced by the socio-economic status of their family. However, in this study, the age at menarche did not alter by their physical activity level.

The earlier study on Indian data suggests that in the past the onset of menarche is between 12-14 years, and a recent study showed that there is the consistent decrease in age for menarche on an average by about six months per decade¹⁶. The mean age of participants in the present study was 13.56 years during the data collection, and their mean recall age of menarche was 12.05 years. It has also been reported that the age of onset of menarche varies from population to population and changes with time. A study in 1979 had published the mean age of menarche for the southwest region of Karnataka was 14.13 years.

Participants of our study are from the southwest region of Karnataka and findings from our study population also showed there is the decline in age at menarche as reported by earlier studies. The rural girls in our study experienced 1.2 years higher mean age at menarche compared to the girls from the urban region which is statistically significant. A study in 2005, reported mean age of menarche was 13.2 years and observed that urban girls achieved menarche one year earlier than their rural counterparts.¹⁷

It has been reported that socioeconomic factors and nutritional status during childhood and adolescent may influence the timing of the menarche. In our study, participants from rural school had significantly different in socioeconomic status, nutritional status and physical activity levels.

Dietary intake regarding nutritive value in kilocalories was significantly higher among urban girls compared to that of rural participants, and dietary intake regarding kilocalories was significantly negatively correlated with the age at menarche. This indicates that onset of menarche is influenced by an individual's dietary pattern and this finding is concordant with earlier studies which assessed the onset of menarche in relation to dietary pattern. Nutritional status of the population generally associated with their dietary intake, accordingly, results of our study also shown urban girls have higher body mass index than the rural girls and timing of menarche was significantly correlated negatively with their body mass index. Studies report that delayed menarche is a sign of malnutrition and as nutritional status improves, the age at menarche is lowered drastically.¹⁸ The association between early onset of menses and increased body weight is explained as the ability of the leptin to stimulate pulsatile secretion of GnRH.

Socioeconomic factors have a significant impact on nutritional and psychological status during childhood and adolescent may influence age at menarche. We assessed socioeconomic status of our participants. Ninety-eight percent of our rural participants belonged to lower, and 100 percent of urban participants belong to the upper class. Further, analysis of data suggests that age at menarche is significantly higher in the group with lower socioeconomic status compared to that of upper socioeconomic class.

Though earlier studies reported that the excessive physical activity delays age at menarche¹⁹ our study did not show a significant correlation between the level of physical activity and timing of menarche, despite our rural participants had significantly higher physical activity level compared to that of their urban counterparts. This could be

attributed to the absence of participants with extremely high or low physical activity level.

CONCLUSION

Age at menarche is significantly earlier among urban girls compared to the rural counterparts in our study population. There is a significant association of dietary pattern and body composition and socio-economic status with the menarcheal age. Though these exogenous factors influence age at menarche, they interrelate, and thus the onset of menarche cannot be attributed to a single element.

ACKNOWLEDGMENT

Authors would like to acknowledge Dr. Amrit Mirajkar, Prof & Head Department of Physiology, Dr. Ankeeta, Assistant Professor, Dept. of Community Medicine, K. S. Hegde Medical Academy, NITTE (Deemed to be) University, for their input and support for completion of this study.

REFERENCES

- [1] Dutta DC. DC Dutta's Textbook of Gynecology. Jaypee Brothers Medical Publishers (P) Ltd., 2016.
- [2] Chumlea WC, Schubert CM, Roche AF, et al. Age at menarche and racial comparisons in US girls. *Pediatrics* 2003;111(1):110-3.
- [3] Swenson I, Havens B. Menarche and menstruation: a review of the literature. *Journal of Community Health Nursing* 1987;4(4):199-210.
- [4] Thomas F, Renaud F, Benefice E, et al. International variability of ages at menarche and menopause: patterns and main determinants. *Human Biology* 2001;73(2):271-90.
- [5] Kaplowitz P. Pubertal development in girls: secular trends. *Current Opinion in Obstetrics & Gynecology* 2006;18(5):487-91.
- [6] Abioye-Kuteyi EA, Ojofeitimi EO, Aina OI, et al. The influence of socioeconomic and nutritional status on menarche in Nigerian school girls. *Nutrition and Health* 1997;11(3):185-95.
- [7] Thomas F, Renaud F, Benefice E, et al. International variability of ages at menarche and menopause: patterns & main determinants. *Hum Biol* 2001;73(32):271-90.
- [8] Cavadini C, Decarli B, Grim J, et al. Food habits and sport activity during adolescence: difference between athletic and non-athletic teenagers in Switzerland. *Euro J Clin Nut* 2000;54(Suppl 1):S16-20.
- [9] Chang SH, Tzeng SJ, Cheng JY, et al. Height and weight change across menarche of school girls with early menarche. *Arch Pediatr Adolescent Med* 2000;154(9):880-4.
- [10] Diaz A, Laufer MR, Breech LL, et al. Menstruation in girls and adolescents: using the menstrual cycle as a vital sign. *Pediatrics* 2006;118(5):2245-50.
- [11] Hillard APJ. Menstruation in young girls: a clinical perspective. *Obstetrics & Gynecology* 2002;99(4):655-62.
- [12] Bharathi AV, Vaz M. The construct of a simple clinic questionnaire to assess physical activity and its relative validity. *Indian Heart J* 2000;52(5):601-3.
- [13] Mohanan KN. MNF-006 Public Nutrition, Indira Gandhi National Open University, 2006.
- [14] Park K. Park's Textbook of Preventive and social medicine. 18th edn. Jabalpur: Banarsidas Bhanot Publishers 2015: p. 1-2.
- [15] Cameron N. Human growth and development. In: Cameron N, edr. *Assessment of maturation*. San Diego, CA: Academic Press 2002: p. 363-82.
- [16] Bagga A, Kulkarni S. Age at menarche and secular trend in Maharashtrian (Indian) girls. *Acta Biol Szeged* 2000;44(1-4):53-7.
- [17] Shekhar A. Iron status of adolescent's girls and its effect on physical fitness. *The Indian J Nutr & Dietetics* 2005;42(10):451-6.
- [18] Acharya A, Reddaiah VP, Baridalyne N. Nutritional status and menarche in adolescent girls in an urban resettlement colony of South Delhi. *Indian Journal of Community Medicine* 2006;31(4):10-2.
- [19] Roupas ND, Georgopoulos NA. Menstrual function in sports. *Hormones (Athens)* 2011;10(2):104-16.