International Journal of Contemporary Pediatrics
Pandey M et al. Int J Contemp Pediatr. 2017 Nov;4(6):2187-2192
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20174754

Original Research Article

Age of attainment of menarche and factors affecting it amongst school girls of Gangtok, Sikkim, India

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Received: 14 September 2017
Accepted: 06 October 2017

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ABSTRACT

Background: Studies have shown trends of decreasing age at menarche in most of the Indian states. However, there are no such studies reported from the state of Sikkim.
Methods: It was a cross sectional prospective study done in four school across Gangtok town. 430 menstruating girls between the age group 10-19 years were the participants. Data regarding chronological age, menstrual age, diet, mother's age at menarche and socioeconomic status was collected using self-administered pre-tested questionnaire from the girls and their parents. Height, weight and general physical examination of the girls were done.
Results: Mean age of attainment of menarche was 12.52 years. 3% girls were undernourished and 20.70% girls had their body mass index more than 85th percentile. A positive correlation between age of onset of menarche with height ($r = 0.282$), weight ($r = 0.130$) and mothers age at menarche ($r = 0.549$) and negative correlation with body mass index ($r = -0.155$). Menarche was earlier in girls belonging to lower socioeconomic classes ($P < 0.001$). Peak incidence of menarche was noticed in winter months in this hilly area. Diet, ethnicity and sibling order did not show statistically significant effect.
Conclusions: The mean age of menarche in this region is comparable to many Indian states. The major determinant of age at menarche in this study was body mass index and mother's age at menarche similar to other Indian and international studies. Further similar studies on girls from other parts of Sikkim are needed for scientific data.

Keywords: Body mass index, Mean age at menarche, Menarche, Socio-economic status

INTRODUCTION

The age at menarche considered as a marker of attainment of reproductive maturity in females has important implications on women's health. Various factors have been postulated to affect the age of menarche like nutritional status, socioeconomic status, diet, environment, sibling-ship, hereditary and genetic factors, religion, ethnicity, psychological stress, migration and chronic illness with opinions both supporting and rejecting it.[1-8]

The average age of menarche has decreased in both developed and developing countries due to improved health and nutrition. Most Indian studies have shown similar trends of decreasing age at menarche.[1,2,4] There are no such studies reported from Sikkim. Sikkim is one of the eight north eastern state of India situated in the Himalayas. It has international boundaries with China, Nepal and Bhutan and domestic boundaries with West Bengal. Sikkim's population consists of three indigenous ethnic groups.

The ethnic groups are the Lepchas who have migrated from Bhutan and adjoining areas, the Bhutias who migrated from the Kham district of Tibet, China in the 15th century and the Indian Gorkhas, descendants of Hindu who arrived from Nepal in the 19th century.

At present the population is approximately 13% Lepchas, 16% Bhutias and 67% Indian Gorkhas. Gangtok is a municipality and the capital city of Sikkim and caters to children from all over Sikkim belonging to the ethnic community as well as the other states of India.

Hence this study is planned to find the variation in the age at menarche amongst school girls from Gangtok, East Sikkim and also to investigate whether the age at menarche is influenced by anthropometric variables, socioeconomic status, mother's age at menarche, sibling order, ethnicity and type of diet.

METHODS

This study is a prospective school based cross sectional study. The study was conducted in four schools of Gangtok. The data was collected from July to November 2012 after the approval of Institutional Ethic Committee of Sikkim Manipal Institute of Medical Sciences and the Headmasters of the selected schools. Two self-financed and two government sponsored schools were randomly selected from the official list of schools of Gangtok by lottery method. The study group included school girls between the age group of 10 to 19 years excluding girls suffering from chronic medical disorders or on prolonged corticosteroid use. The sample size was calculated as 426 based on age at menarche above 12 years of 50.0%, 13 with 95% confidence interval, design effect of 1.0 for using simple random sampling, 10% of margin of error and 10% non-response rate. During the initial phase of the study the teachers and girl students were explained in local and English language the nature and importance of the study. The students willing to participate were given a written informed consent explaining the nature and confidentiality of the study to be read and signed by their parents. They were also provided with a pre-structured questionnaire to be filled by them with the help of their parents.

The pre-structured questionnaire contained questions about date of birth, current age in years and months, month and year of menarche, age at menarche, history of chronic illness and medication use, socioeconomic status, mother's age at menarche and dietary habits. The birth dates were confirmed from school records. During the next visit on a date selected by the school authorities the consents and questionnaire were collected from the students. The students whose parents had consented for the study were examined clinically after a relevant interview. Confidentiality in the data collected was ensured.

Weight and height measurements, general physical examination and systemic examination were done and data collected were recorded in a pre-structured data sheet. The height was measured using sliding stadiometer (Prajwal surgical and Scientifics, Bengaluru) and weight was recorded using a digital weighing machine. Girls were categorized based on body mass index (BMI) in kg/m^2 calculated from the weight and height recorded as defined by International Obesity Task Force criteria.[9] The socioeconomic status of the families of these children was graded as per Modified Kuppuswamy classification (2007).[10]

Descriptive statistical analysis has been carried out on the present study. Results on continuous measurements are presented as Mean ± standard deviation and results on categorical measurements in numbers. Chi-square / Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups. Pearson correlation has been used to find the correlation between the age at menarche and variables like mother's age at menarche, socioeconomic status, BMI, height and weight. The data collected was entered into Microsoft Excel 2010 master chart and the statistical software Statistical Package for Social Sciences SPSS version 17.0 was used for the analysis of data. Statistical significance was assessed at P <0. 05 (95% confidence interval).

RESULTS

Total 670 school going girls in the age group 10 to 19 years participated in this study, out of which 82 girls were excluded because of incomplete filling of the pro-forma. Total 588 girls were included in the study out of which 430 girls had attained menarche. The mean age was 15.00 ± 2.05 standard deviation with a range of 11 to 19 years. The age distribution of the 430 adolescent girls studied is shown as a histogram (Figure 1).

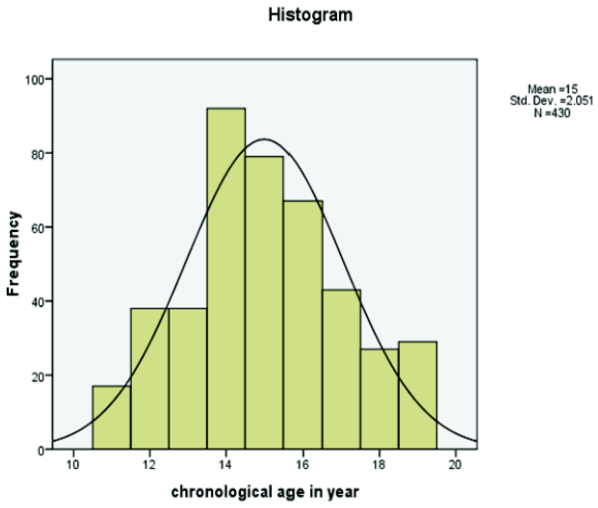

Figure 1: Histogram showing the age distribution of study subjects.

Out of the 430 studied girls; majority of 330 (76.70%) girls had attained menarche between the ages of 11 to 13 years. The mean age of attainment of menarche was 13.64 ±1.58 standard deviation with a range of 10 to 19 years. The distribution of girls according to their age at menarche is given in (Table 1).

Table 1: Distribution of girls according to their Age at Menarche (AAM).

Age at Menarche	Number of girls	%
10-11	19	4.4
11-12	74	17.2
12-13	126	29.3
13-14	130	30.2
14-15	49	11.4
15-16	23	5.3
16-17	5	1.2
17-18	4	0.9
18-19	0	0.0
Total	430	100

In present study 296 (68.8%) of the 430 girls belonged to upper and upper middle class and none belonged to lower class and most (88.60%) of the girls were non vegetarian.

It was observed that out of 430 girls, 255 (59.30%) were Indian Gorkhas, 154 (35.80%) were Bhutias, 14 (3.3%) were Lepchas and 7 belonged to the non-ethnic population. It was seen that majority 319 (74.2%) girls had their onset of menarche during the month of November to March.

The mean weight was 48.19±standard deviation of 8.37 with a range of 30 to 79 kg and mean height was 156.51±standard deviation of 7.06 and a range of 132 to 182 cm.

Table 2: Relationship of MAA, SES, Body Mass Index (BMI), diet and sibling order with AAM.

Clinical variables	AAM			P value
	10-11 years (n=93)	12-14 years (n=305)	15 and above (n=32)	
SES				
Upper	61 (65.6%)	112 (36.7%)	0 (0%)	P<0.001
Upper middle	27 (29%)	90 (29.5%)	6 (18.8%)	
Lower middle	3 (3.2%)	70 (23%)	16 (50%)	
Upper lower	2 (2.2%)	33 (10.8%)	10 (31.3%)	
MAA				
1-10	0 (0%)	2 (0.7%)	0 (0%)	P<0.001
11-15	93 (100%)	272 (89.2%)	8 (25%)	
16-20	0 (0%)	31 (10.2%)	24 (75%)	
BMI (kg/m^2)				
Under nutrition	2 (2.2%)	10 (3.3%)	1 (3.1%)	P=0.029
Normal weight	60 (64.5%)	240 (78.7%)	28 (87.5%)	
Over weight	18 (19.4%)	34 (11.1%)	3 (9.4%)	
Obesity	13 (14%)	21 (6.9%)	0 (0%)	
Diet				
Veg	10 (10.8%)	34 (11.1%)	5 (15.6%)	P=0.732
Non veg	83 (89.2%)	271 (88.9%)	27 (84.4%)	
Sibling order				
1st	52 (55.9%)	142 (46.6%)	13 (40.6%)	P=0.069
2nd	29 (31.2%)	89(29.2%)	9 (28.1%)	
3rd	9 (9.7%)	40 (13.1%)	3 (9.4%)	
4th and more	3 (3.2%)	33 (10.8%)	7 (21.9%)	

The BMI of the girls ranged from 11.0 to 32.0 kg/m^2 with a mean of 19.17±standard deviation of 3.19. In our study, 55 (12.80%) of the adolescent girls had their BMI in the risk for overweight category and 34 had BMI in the Risk for obesity category. The studied factors having significant statistical association with the age of onset of menarche were BMI (P = 0.029), mother's age at menarche (P <0.001) and socioeconomic status (P <0.001) whereas type of diet and sibling order did not show statistically significant effect as shown in (Table 2). The study showed a positive correlation between age at menarche with mother's age at menarche (r=0.549), height (r=0.282) and weight (r=0.130). A negative correlation was seen between BMI and age at menarche (r=-0.155). The correlation between the studied factors and age of attainment of menarche is shown in the Scatter plot (Figure 2).

DISCUSSION

This is the first time such a study has been conducted and reported from the Indian state of Sikkim. For the past 150 years, the mean age at menarche in various populations in India has varied from 11.5 years to 15.2 years.[4-5,11-13]

In some of the states where repeated studies have been done, the secular trend for the reduction in the mean age of menarche has been noted.[4-5] However, since no studies have been done in this region; it is difficult to comment about the secular trend in the population where we have assessed. However, the mean age at menarche of 12.52 observed in our study is comparable to that of girls from urban areas of Maharashtra (mean age 12.62 years).[1]

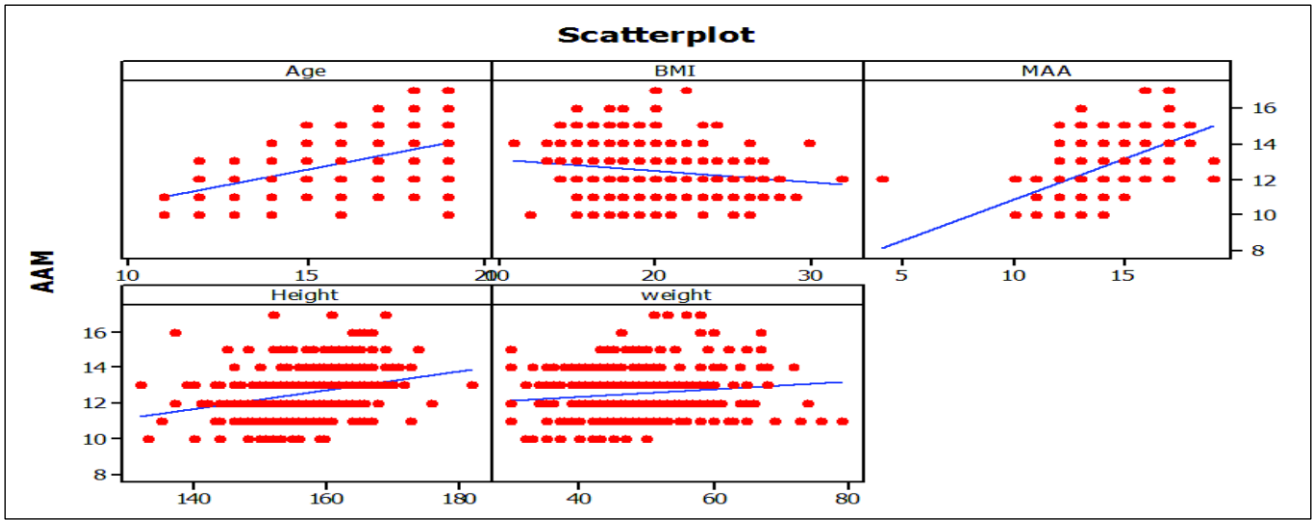

Figure 2: Scatter plot diagram depicting correlation of age at menarche with age, body mass index, mother's age at menarche, height, weight.

When compared to urban girls from other states of India, it is comparable to those of Kolkata (mean age 12.3 years) but lower than that of girls in Chandigarh (mean age 13.2 years) and Delhi (mean age 13.34years).[13,15,16] This may be attributed to differences in environment and food habits in different states of India.

Our study showed peak incidence of menarche in winter months namely November to March with highest peak noticed in January. The lowest was observed in the month of May. Similar observation was made by JH. Rah, et al. (2009) in Bangladesh where he observed that about half of adolescents attained menarche in winter whereas less than 20% had onset in May through August.[17] Gueresi P (1997) reported: menarche occurrence showed peaks of frequency in January and through October to February.[18] A factor that most likely explains the winter peaking of menarche is the increase food consumption during the harvest season of Sikkim thereby improving nutritional status, a factor known to be associated with onset of menarche. Another potential explanation may be the relaxing and less stressful atmosphere during school vacation which has been postulated to trigger the onset of menarche by influencing the hypothalamus.[18]

Statistical analysis of our study shows that there is a negative correlation between BMI and age at menarche (r = -0.55) and is significant with P value of 0.001 which means higher the BMI earlier is the onset of menarche. Age at menarche is found to be significantly lower in obese girls (12.25±1.12 years) as compared to underweight girls (13.04±1.40 years). As the nutritional status of the child decreases age at menarche increases. Our findings are in accordance to a study conducted by T. Khatoon et al in Uttar Pradesh where it was observed that there was earlier mean age at menarche in obese (11.97±1.68) and later in underweight (12.72±1.18).[19] It has been observed that athlete girls and ballet dancers who keep their weight in control have a later onset of menarche. This might indicate the role of critical body weight and minimum body fat initiating menarche. Our study reveals that there is a large positive correlation between age of onset of menarche (r=0.549) and mothers age at menarche which is statistically significant (P < 0.001). Bhalla M et al reported that majority of girls tend to have their menarcheal age same as their mothers.[20] Tehrani FR et al also found a significant relationship between the pattern of menstruation in mothers and daughters.[21] This may be due to the inheritance of the absolute value of a critical weight which could be a component of the genetic control of age of attainment of menarche.

In our study the trend of lowering of age at menarche was well marked as we moved from lower to higher socio-economic groups. The study by ICMR (1972) reveals decline in age at menarche with increase in per capita income of the family. The higher socio-economic status is usually associated with small family norms, better living conditions, proper nutrition, could be the reason for

earlier growth spot and better physical and psychosexual maturity in them explaining the early onset of menarche. Higher mean menarcheal age for families with more children when compared with those from family with one or two children has been observed. The effect of family size and birth order on menarcheal age may be indirectly due to socio-economic influences.[22] Harvard longitudinal studies on childhood health and development found that girls had earlier menarche if they consumed more animal protein.[23] Shastree et al found that non vegetarian Maharashtrian girls would menstruate earlier than vegetarian Maharashtrian girls.[24] Similar findings were noted in a study by A. Bagga in 2000.[1] Sibling order and type of diet had no statistical significance on age at menarche in present study.

The limitations of present study were the recall bias associated with reported age at menarche and use of post-menarcheal BMI as a proxy. The other limitation was our study population was not a proper sample reflecting the state's population as only girls from schools in Gangtok was included, although children from all over the state pursue their study in both the government and private schools of Gangtok.

CONCLUSION

This study adds to data on age at menarche in girls from various states of India. Present study also gives data on the nutritional and health status of adolescent girls of Sikkim which influences the reproductive and child health indicators. There is paucity on such data from this region of India; hence further study needs to be done among girls from other areas of the state before the data can be extrapolated to the Indian statistics.

ACKNOWLEDGEMENTS

The authors thank the students for participating in this study voluntarily and the head of the institutions for granting permission to conduct the study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee IEC No: SMIMS/IEC/2011-Paed-DNB1

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Cite this article as: Pandey M, Pradhan A. Age of attainment of menarche and factors affecting it amongst school girls of Gangtok, Sikkim, India. Int J Contemp Pediatr 2017;4:2187-92.