

Menarcheal Age Variation Between Chakma Tribal and Bengali Non-Tribal Girls of Tripura, North-East India

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Abstract: Menarche is the first onset of menstrual bleeding and considered as a significant marker of attaining sexual maturity in girls. Various factors may influence age at menarche like genetic, nutritional status, environment, socioeconomic status and education. The main purpose of this study is to determine mean age at menarche of Chakma tribal and Bengali non tribal girls of Tripura with their ethnicity and socio economic condition. Data on age at menarche have been collected by using Status quo method of recall from adolescent Chakma tribal and Bengali non tribal girls of different schools of North, Unokoti, Dhalai and South District of Tripura. An effect of socioeconomic condition on age at menarche was taken in consideration. Among studied sample 357 Chakma tribal girls and 368 Bengali girls have experienced menarche. Median age at menarche, estimated by probits, is 12.53 years (0.12) and 11.83 years (0.13) for the Chakma and Bengali girls respectively. However, the age differences are found to be statistically highly significant ($P < 0.001$). Mean age at menarche of Bengali girls is earlier than the Chakma tribal girls and their age differences in menarcheal status is stated due to ethnic effect and earlier growth spurt. The mean age at menarche of both the study population was also influenced by their socio economic and demographic condition. Future longitudinal studies of other tribal population of Tripura are needed for understanding the effect on onset of menarche.

Keywords: Chakma Tribal, Bengali, Menarche, Socio-Economic, Tripura

1. Introduction

Menarche refers to the first menstrual period, and the age at which it occurs in girls is the most commonly reported maturity sign of female adolescence [1]. Although it is a late incident of puberty, but it is a well accepted indicator and an easily memorize experience when compared to other events associated with female sexual maturity. Although menarche is a discrete event with a sudden onset but it has been widely studied in various population as well as different ethnic groups [2]. Various factors may affect age at menarche like nutritional status, environmental condition, socioeconomic status, urban and rural residence, family size and income, diet, sibling-ship, birth order, genetics, physical activity and level of education [3, 4]. Except inheritance different socioeconomic and environmental factors are related with different age at menarche. The development of quality of life

during childhood can cause early menarche. Clinically age at menarche plays a vital role in diagnosis of late puberty due to pathological or hormonal disorder. Age at menarche also effect the health condition of a population.

In different parts of the world especially in North America and Europe early mean age at menarche was observed [5-8]. Decreasing trends in mean age at menarche of these countries was found approximate 0.3 years/decade till it become steady at approximate the years 13 [8-11]. This kind of declination in menarcheal age is also found in developing countries where better socioeconomic and health condition, nutrition, hygiene, education is available [7, 8, 12-17]. Similarly girls from lower socio-economic groups with insufficient diet, poor nutrition and health condition, lack of education experience menarche at late [18-24]. The age of onset of menarche varies from 9 to 18 years with the average age in USA being about 12.8 years, whereas in India it is lower to some extent and has been reported to be around 12 years [25, 26]. Some studies in North

East India have been reported varying mean age at menarche in different population variation [27-32] and in different parts of India, ranging from 12.3 years in Bengali girls [33] to 15.4 years in lower socio-economic group of western India [34]. Early age at menarche is well-established risk factors for ovarian cancer, breast cancer, risk of heart and other diseases [35]. On the other hand late menarche is associated with the risk of arising Alzheimer's disease [36]. Though age at menarche has been reported in various Indian subpopulations, but no information is available on the Chakma tribal and Bengali population of Tripura. In the present study of the Chakma tribal and Bengali girls of Tripura, an attempt has been made to study the variation in age at menarche with influence of ethnicity and socio-economic condition.

2. Materials and Method

This cross-sectional study was carried out among 725 (357 Chakma tribal and 368 Bengali girls) school going rural girls aged 6 to 18 years residing in North, Dhalai, Unokoti and South districts of Tripura. Tripura is one of the North- Eastern states of India which is the main homeland of 19 different tribes. Geographically, it locates between 22°56' & 24°32', North longitude & between 91°10' & 92°21', East longitude with a total area of 10,491 Sq.km. According to 2011 census, in Tripura, out of the territories' total population of 36,71,032, Scheduled tribes numbered 11,66,813 which constitute 31.78% of the total population. The subjects were chosen from rural areas (villages) of the state of Tripura, which is the habitat of the Chakma tribal and Bengali people. The school going Chakma and Bengali girls were selected using a stratified multistage clustered random sampling method. The age of each subject was recorded from their birth certificates and school register. Mothers of every child were included as respondents. The questionnaire was finalized by pretest and discussion prior to beginning of the study. All the data were collected after receiving the consent from school authorities and their parents. Decimal age calendar is mainly used to find out the student's decimal age by subtracting the date of birth from the date of data collected. The subjects in different age groups were classified by following the same principle. Children who had undergone any major surgical operation or suffering from any systemic disease were excluded from the study. This study was carried out in accordance with the ethical guidelines for human experiments, as laid down by the Helsinki Declaration of 2000 [37]. The data were collected during the period from August 2018 through July 2019. Other general information regarding their food habit, socio-economic and demographic condition, parent's education and occupation, family income, size, structure and property etc., was also recorded. According to the modified Kuppuswamy scale, the socio-economic status of all the Chakma and Bengali girls was low [38].

Data on age at menarche was collected by status quo method. In this method, each subject in a representative sample of the population was asked her precise age at the time of questioning (or her date of birth) and whether she had yet begun to menstruate or not. This leads to a record of the percentage of affirmative answers at each successive age.

The retrospective method was limited to post-menarcheal adolescents, those in whom menarche had already occurred. Pre-menarcheal girls in the sample were excluded. In the retrospective method, girls were asked to recall as accurately as possible when menarche occurred. The median age of menarche of Chakma and Bengali girls has been calculated by Probit analysis [39].

An effect of socioeconomic condition on age at menarche was calculated by using Cox's proportional hazards regression model [40]. Descriptive statistics and ANOVA has been used to calculate the level of significance. The statistical analysis was performed using Microsoft excel 2007 and statistical package for social science (SPSS 17.0) software.

3. Result

Tables 1 and 2, represents the status of menarcheal age distribution of Chakma and Bengali girls respectively. It is found that at the age 7 years no girls of both Chakma and Bengali had experience menarche. Only one Bengali girl belonging to age group 8 years had reported the event of menarche; whereas, Chakma girls of age group 10 years first reported the occurrence of menarche. It also shows that before the age 12 years small number of Chakma girls experience menarche 2 (3.77%) and 11 (21.57%) at the age 10 and 11 years respectively.

Status quo data have been collected by asking the participant where they have been experienced menarche or not in the form of "Yes" or "no" along with their correct information on date of birth. Median age at menarche of the Chakma tribal girls has been determined from this data by using Probit analysis [39]. For Probit analysis data has calculated by the following equation:

$$\text{Probit (Prevalence of Menarche)} = -9.2655 + 0.73971 * \text{Age} \\ (0.738) \quad (0.058)$$

Table 1. Menarcheal age distribution of Chakma girls of Tripura (Status-quo data).

Age (Years)	n	Not menstruating		Menstruating	
		frequency	%	frequency	%
6.0	55	55	100	0	-
7.0	54	54	100	0	-
8.0	51	51	100	0	-
9.0	52	52	100	0	-
10.0	53	51	96.23	2	3.77
11.0	51	40	78.43	11	21.57
12.0	50	26	52.00	24	48.00
13.0	54	12	22.22	42	77.78
14.0	54	3	5.56	51	94.44
15.0	59	1	1.69	58	98.31
16.0	60	1	1.67	59	98.33
17.0	50	0	-	50	100
18.0	60	0	-	60	100
Total	703	346	-	357	-

Both the coefficient are found to be highly significant (p-value <0.001). In case of chi square (χ^2) test for Probit model, it has not signified any kind of misfit. Standard Error (SE) of the coefficients is mentioned in the parenthesis. By fitting

Probit, the estimated median age at onset of menarche is found to be 12.53 years ± 0.12 (Figures 1&2). Median age at onset of menarche of Chakma girls is found to be 12.53 years

± 0.12 (Figures 1&2). It is estimated by fitting Probit. For the age 95% confidence limits are 12.29 years (lower limit) and 12.77 years (upper limit) respectively.

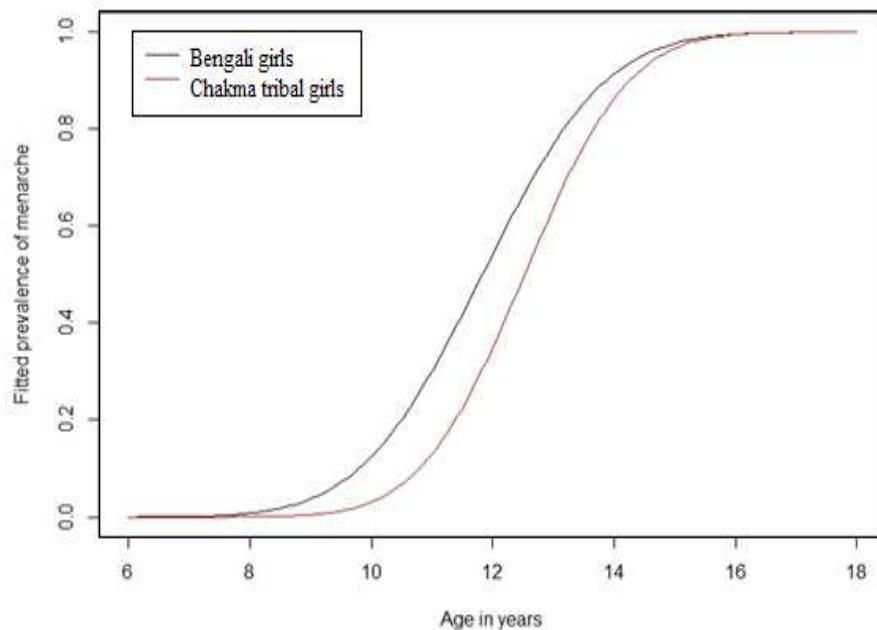


Figure 1. Determination of median age at menarche of Bengali and Chakma girls from Status quo data (Probit analysis).

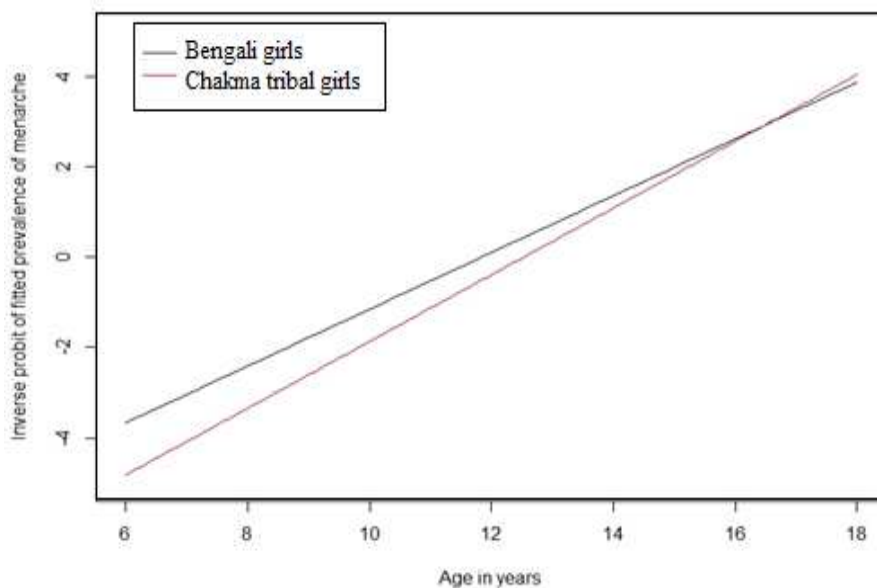


Figure 2. Fitting of Inverse Probit curve on the occurrence of menarche of the Bengali and Chakma girls.

In present study the range of Chakma tribal girls is 6 to 18 years which is much wider than the established recommended range of menarcheal age, viz. 9 to 17 years [41]. At the age group of 6-9 years there is no observed cases of menarche are found, while all the participants older than 17 years are reported facing menarche. In Probit model, the full data set (6 to 18 years) has been used (including the age groups outside the range 9 to 17 years), to collect maximum number of information congregate from the present study.

Table 2 indicates that 100% Bengali girls have

experienced menarche between age group 8.0 to 15.0 years. Few Bengali girls started menstruation before the age 12 years; 1 (1.85%), 2 (3.70%), 5 (9.62%) and 16 (29.09%) at the age 8, 9, 10 and 11 years respectively. A total 368 (52.57%) Bengali respondents experienced menarche. From this distribution the median age of menarche of Bengali girls has been determined by analysis of Probit [39]. For Probit analysis data was calculated by the following equation:

$$\text{Probit (Prevalence of Menarche)} = -7.4478 + 0.62936 * \text{Age} \\ (0.506) \quad (0.046)$$

Table 2. Menarcheal age distribution of Bengali girls of Tripura (Status-quo data).

Age (Years)	n	Not menstruating		Menstruating	
		frequency	%	frequency	%
6.0	55	55	100	0	-
7.0	55	55	100	0	-
8.0	54	53	98.15	1	1.85
9.0	54	52	96.30	2	3.70
10.0	52	47	90.38	5	9.62
11.0	55	39	70.91	16	29.09
12.0	53	19	35.85	34	64.15
13.0	51	8	15.69	43	84.31
14.0	52	3	5.77	49	94.23
15.0	57	1	1.75	56	98.25
16.0	53	0	-	53	100
17.0	57	0	-	57	100
18.0	52	0	-	52	100
Total	700	332	47.43	368	52.57

Both the coefficients are found to be statistically highly significant (p -value < 0.001). The chi square (χ^2) test for the probit model does not show any kind of misfit. The figures mentioned in parenthesis indicate standard error of the coefficients. By fitting Probit, calculated median age at menarche of Bengali girls is 11.83 years ± 0.13 (Figures 1&2). The confidence limits (95%) for this age are 11.57 years (lower limit) and 12.10 years (upper limit) respectively.

Table 3. Age distribution of menarcheal status of Chakma girls of Tripura (Retrospective data).

Age range (Years)	Frequency	% of menstruating girls
8.1-8.5	0	0.00
8.6-9.0	0	0.00
9.1-9.5	0	0.00
9.6-10.0	13	3.40
10.1-10.5	14	3.66
10.6-11.0	20	5.24
11.1-11.5	42	10.99
11.6-12.0	68	19.11
12.1-12.5	102	25.39
12.6-13.0	63	16.49
13.1-13.5	30	7.85
13.6-14.0	17	4.45
14.1-14.5	8	2.09
14.6-15.0	5	1.31
Total	382	100

Data on age at menarche of 382 Chakma tribal girls are collected by retrospective method. Distribution of age with frequencies and the percentage value of menstruating girls calculated from this data set are mentioned in Table 3. Mean age at menarche, derived from the retrospective data is 12.30 year ± 0.50 with standard deviation 1.66 year. However, mean age at menarche of the Chakma girls determined from retrospective data, is shown to be slightly lower (12.30 years) than that the median age derived by the Probit analysis from status quo data (12.53 year).

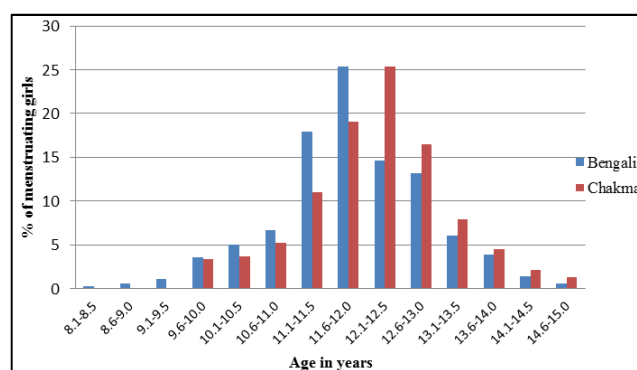
Retrospective data on age at onset of menarche are collected from 363 non tribal Bengali girls. Distribution of age with frequencies and the percentage value of menstruating Bengali girls calculated from this data set are mentioned in Table 4.

Mean age at menarche, derived from the retrospective data is 11.55 year ± 0.56 with standard deviation 2.09 year. However, mean age at menarche of Bengali girls evaluated from retrospective data, is shown to be slightly lower (11.55 years) than that the median age derived by the Probit analysis from status quo data (11.83 year).

Table 4. Age distribution of menarcheal status of Bengali girls of Tripura (Retrospective data).

Age range (years)	Frequency	% of menstruating girls
8.1-8.5	1	0.28
8.6-9.0	2	0.55
9.1-9.5	4	1.10
9.6-10.0	13	3.58
10.1-10.5	18	4.96
10.6-11.0	24	6.61
11.1-11.5	65	17.91
11.6-12.0	92	25.34
12.1-12.5	53	14.60
12.6-13.0	48	13.22
13.1-13.5	22	6.06
13.6-14.0	14	3.86
14.1-14.5	5	1.38
14.6-15.0	2	0.55
Total	363	100

Out of the 745 studied girls (382 Chakma girls and 363 Bengali girls); majority of girls had attained their menarche between the ages of 11 years to 13 years (Figure 3). A large number of Chakma girls i.e. 102 (25.39%) girls started menstruation at the age between 12 years to 12.5 years. In case of Bengali girls majority of 92 (25.34%) girls attain their menarche at the age between 11.6 to 12 years.

**Figure 3.** Distribution of age at menarche of two comparing populations from retrospective data.

The Chakma and Bengali girls were separated into two categories according to their occurrence of menarche or not. Almost all the participated tribal and non tribal girls are non-vegetarian.

The effect of socioeconomic status on age at menarche has been investigated by Cox's proportional hazards regression model [40]. Only those were included in this study who can remember their actual date of onset of menarche or those cases where menarche has not experienced. Table 5 and 6 describe the statistical significance of the binary variable. Here Cox regression model for menarcheal age along with age as predictor is examined [FSH-1: father's educational

qualification is higher secondary and above and for others score is 0, MHS-1: mother's educational qualification is higher secondary and above and for others is 0, FMWR-1 if father is manual worker and for other profession it is 0, Affluent-1 in case of monthly expenditure per month is >5000 and above (INR) and 0 for less than 5000 (INR), Nuclear family-1 if family member is ≤ 3 and 0 for others, Sibling-1 when number of sib is ≤ 1 and 0 for others, Parity-1 in case of first born and 0 for others].

The effects of socioeconomic factors on age at menarche of Chakma tribal girls are summarized in table 5. From all the variables none of them is significant where more than one variable is inserted in the model. It represents that mothers' education, fathers' occupation and size of sibship is statistically significant at 5 % level. Further participating girls having mothers' education at secondary level, fathers' are manual worker and having no sibling are found to have earlier age at menarche than others.

Table 5. Effects of different socio-economic factors on age at menarche of Chakma tribal girls of Tripura.

Socio-economic factors	Estimated multiplier for baseline hazard of menarche (with standard error of regression coefficient)	p-value
FSH	exp[-0.12340*FSH]- 0.95408	0.897
MSH	exp[1.53054*MSH]- 0.61806	*
FMWR	exp[0.58191*FMWR]- 0.11318	*
Affluent	exp[-0.27597*Affluent]- 0.83310	0.740
Sibling	exp[0.34980*Sibling]- 0.16888	*
Parity	exp[-0.05572*Parity]- 0.09864	0.572

*p value <0.05

Table 6. Effects of different socio-economic factors on age at menarche of Bengali girls of Tripura.

Socio-economic factors	Estimated multiplier for baseline hazard of menarche (with standard error of regression coefficient)	p-value
FSH	exp[1.26415*FSH]-0.16153	*
MSH	exp[0.54248*MSH]-0.17828	*
FMWR	exp[0.05685*FMWR]-0.10882	0.601
Affluent	exp[1.95120*Affluent]-0.64988	*
Sibling	exp[2.02886*Sibling]-0.36186	*
Parity	exp[-2.08220*Parity]-0.34485	*

*p value <0.05

The results of the Bengali girls are summarized in table 6. None of these factors is significant when more than one of this factor is included in the model. It shows that parents education, monthly family expenditure, number of sibship and birth order (parity) is significant at 5 % level. Further, girls having father or mother with minimum secondary level of education, family with high monthly expenditure, having no sibling and first born girls are found to be earlier onset of menarche than others.

4. Discussion

Sexual maturation is a continuous process that extends from sexual differentiation in the stage of the embryo through puberty to complete sexual maturity and fertility [1]. Puberty is the transitional period between childhood and adulthood and includes the appearance of secondary sex characteristics, maturation of the reproductive system, and the adolescent growth spurt. Menarche refers to the first menstrual period, and the age at which menarche occurs is the most commonly reported maturity indicator of female adolescence. Although it is a late event of puberty, but it is a well accepted indicator and an easily memorize experience when compared to other events associated with female sexual maturity. This is the first time such type of study has been carried out and reported from the state of Tripura. For the past 50 years, the mean age at menarche in different Indian populations has varied from 11.5

years to 15.2 years [33, 42-44]. Many factors like socio-economic status (health, nutrition, living condition and family size), geographic atmosphere (temperature, altitude, humidity and seasonal variation) as well as genetic factors (race or ethnicity and family heredity) influence age at menarche. Changes of these factors may cause an increase or decrease in the onset of menarche. In the present study, the mean age of menarche of girls was 11.83 ± 0.13 years and 12.53 ± 0.12 years for the Bengali and the Chakma tribal girls respectively. Studies performed among the other tribal population of India show a similar trend of higher mean menarcheal age [30, 45-47], while a lower mean age at menarche is reported among Bengali girls of North Kolkata [33] and Assam [48]. The difference between the mean ages in the two groups is statistically significant at level 0.05. Mean age at menarche of the Bengali girls is earlier than the Chakma tribal girls and their age differences in menarcheal status is stated due to ethnic effect and earlier growth spurt. Some studies revealed that the population variation affect the mean age at menarche [27-29, 49, 50].

Different socio-economic factors influence the onset of menarche in these two populations. Mothers' education, fathers' occupation and family size influence the age at menarche in Chakma population. But among the Bengali girls, parental education, family income, size of sibship and parity also influence the onset of menarche. Association between various socio-economic factors with age at menarche differs according

to ethnicity in India [42-44, 51-56]. It is very difficult to determine the significant effect of psychological, social behavior and physical activity on maturation [57].

In our study the trend of higher mean age at menarche for Chakma tribal girls was well marked of lower socio-economic groups. The lower socio-economic status is usually associated with large family norms, poor living conditions, improper nutrition, could be the reason for growth retardation and poor physical and psychosexual maturity in them explaining the late onset of menarche. Higher mean age at menarche was observed in families with more children when comparing family with one or two children. The effect of family size and birth order on menarcheal age may be indirectly due to socio-economic influences [51].

5. Conclusion

The present study also found significantly higher mean age at menarche in Chakma tribal girls (12.53 ± 0.12 years) than the Bengali girls (11.83 ± 0.13 years). Although the health condition of the Chakma girls are better but the early age at menarche in Bengali girls signifies the ethnic differences between the two populations. The present study has documented that, an aggregation of multiple socio-economic and demographic factors are also influencing age at menarche of the Chakma tribal and Bengali girls of Tripura. This study seems that the menarcheal age variation is governed by the complex interaction with socioeconomic, demographic and genetic factors. There is scarcity on such data from this state of India; hence further study needs to be done among other tribal girls from other areas of the state before the data can be extrapolated to the Indian statistics. Present study sample experiences their late menarche is comparing to other tribes of north eastern region and to rest Indians. In global perspective the age at menarche in this study is less than European and North American countries most but closer to most African and Asian studies.

Availability of Data and Materials

Due to privacy limitations allied to the ethics endorsement for this study, no identifying information about participants may be unconstrained. As recipients, the authors were permitted to publish analytic results from the data only, but not to disclose data itself, due to privacy conditions.

Authors' Contributions

First author participated in the study design, data collection, statistical analysis and interpretation of data, drafting of manuscript and its critical revision for important intellectual content. Second author participated in the interpretation of data, analysis and interpretation of data, drafting of the manuscript and its critical revision for important intellectual and administrative content. All of the authors have read and approved the version of the manuscript.

Ethics Approval and Consent to Participate

The Ethics Committee of Tripura University (A Central University), Department of Human Physiology granted ethical approval prior to the study and the parents or guardians were provided with written informed consent.

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