

Differential Age at Menarche among Dongria Kondh Tribe and Neighbouring Non-tribal Adolescents of Niyamgiri Hill, Rayagada, Odisha

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KEYWORDS: Age at menarche. Dongria Kondh tribe. Non-tribals. Socio-economic status. BMI. Niyamgiri Hills. Odisha.

ABSTRACT: Menarche is an important phase of sexual development in females. In this study an attempt has been made to determine the mean AAM and to examine its relationship with socio-economic status (SES) as well as to test whether SES influences AAM or not, and simultaneously to know the differential mean AAM among both the tribes and non-tribes. A total of 915 adolescent girls in age of 10-18 years participated from Dongria Kondh Tribe (PVTG) of Niyamgiri hill and neighbouring non-tribal population. The mean age at menarche was found 12.06 ± 0.77 and 12.45 ± 0.91 years respectively among the tribe and non-tribal adolescents respectively. It is found that age at menarche have significant association with the socio-economic status among both the populations ($p < 0.05$). The ANOVA test was also found significant ($F = 13.813$, $df = 2$, $p < 0.05$).

INTRODUCTION

Onset of age at menarche (AAM) has been considered as an important indicator of reproductive maturity in females and reflects the health status of the population (Karim *et al.*, 2021). Puberty is stage in which a child is sexually and physically mature. During this span of life hormones changes taken place resulting in a series of physiological and biological changes (Thakur and Gautam, 2017). According to Nagar and Aimol (2010) many physical, physiological and psychological changes are witnessed among the adolescent girls. AAM is an important developmental milestone known to be modulated by social and environmental factors (Chavarro *et al.*, 2004). Menarche indicates the specific stage of the first periodical regular flow of blood from the womb in all healthy normal females. At a particular level of

biological development, the girls begin to menstruate for the first time which is continued for a period of four to five days (Biswas and Kapoor, 2005).

Among the girls who come from lower socioeconomic strata, menarche is delayed by exposure to adverse environmental and nutritional factors during early childhood or even deficient nutrition during adolescence (Amigo *et al.*, 2012). AAM is regarded as a sensitive indicator of the physical, biological, and psychosocial environment (Orden *et al.*, 2011). Culture and ethnicity are known to have strong influences on the events experienced throughout one's life, Menarche is not an exception (White, 2013). According to Wronka and Pawlińska-Chmara, (2005) girls from families with high socioeconomic status experience menarche at an earlier age than girls from families with lower socioeconomic status; however, it also depends on the geographical region, population size, and other factors. Genetic and

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nutritional factors are strong markers for early menarche (Rigon *et al.*, 2010).

The present study was undertaken among the Dongria Kondh tribe — a Particularly Vulnerable Tribal Group of Niyamgiri hill of Rayagada district of Odisha. This district falls under the underdeveloped region of Odisha in the context of infrastructure and literacy. This study focused on the age at onset of menarche and its determinants among a PVTG — Dongria Kondh and the neighboring non-tribal population of Niyamgiri hills. Here an attempt has been made to determine the mean AAM and to examine its relationship with socio-economic status (SES) as well as to test whether SES influences AAM or not, and simultaneously to know the differential mean AAM among both the tribes and non-tribes.

RESEARCH METHODOLOGY

The cross-sectional study was carried out among a total of 915 adolescent girls at the age of 10-18 years. Out of the total respondents, a total of 320 (34.97%) participants were from Dongria Kondh tribe (PVTG) of Niyamgiri Hill of Rayagada district, Odisha and remaining 595 (65.02%) adolescents were from the neighbouring non-tribal population. The data collection was carried out with the help of an interview schedule. The sample was taken by using the purposive sampling method. The Status-quo method was used to collect menarche related data. Anthropometric measurements were carried out by following Marfell-Jones *et al.*, (2012) for further details (Das and Gautam, 2022) can be referred. The height was measured with an anthropometer rod to the nearest 0.1cm and the weight was measured to the nearest 0.01 kg with the help of Omron Bi electric weight measurement equipment.

Data, SES of the participants and their family i.e. caste, category, occupation of parents, total family income, housing pattern, living standard, and respondents' educational status, etc. were collected. The entire studied variable was redesigned under-sub category or subgroup on the availability of data. The Dongria Kondh tribal group was included in the section of PVTG. And other caste groups (except other

Scheduled tribes) like Brahmin, Domb, Karan, Tanti, Nai, Kumhar, etc. those who come under General, Other Backward Caste (OBC), Scheduled Caste (SC) category are merged under non-tribal group. The father's occupation were categorized into two groups' sedentary and labour-intensive occupation. Based on the social and economic data, socio-economic status (SES) was classified into three subgroups as low, low-middle, and middle SES groups. Data were analysed by using SPSS v.25. Initially descriptive method was used to compute the mean and standard deviation (SD). ANOVA and multivariate analysis were used to determine the relationship between AAM and SES.

Age Enumeration: Age enumeration of the participants were an important part of the present study. Without exact age, the entire age-related data will be biased. Hence the age of the girls was calculated in the proper manner. As the participants were recruited from many schools their age was obtained from the school admission records and birth certificates. The age was recorded in the complete years, for example, if the girl was 11 years and 6 months old, it refers to 11 years, at the same time, if she was 12 years and 7 months then the age was rounded up to 13 years.

RESULTS

It is evident from Table 1 that the mean AAM among the Dongria Kondh and neighbouring non-tribal adolescents were 12.06 ± 0.77 and 12.45 ± 0.91 years respectively, the difference in average AAM was found to be significant ($t = 6.85$, $p < 0.05$).

The distribution of the sample as per first menstruation indicates that the majority of tribal (58.1%) and non-tribe (42.9%) girls had first menstruation at 12 years of age. Although the earliest menstruation was reported at 10 years of age by 5.3% of tribes and 3.2% of non-tribes. For further elucidation; a comparative bar diagram is drawn (Fig. 1). The mean AAM of pool data was 12.31 ± 0.88 and the median age and mode are found to be 12 years among adolescents of both populations. Error bar diagram showing differential AAM among tribe and non-tribe (Fig. 1a).

TABLE 1

Distribution of sample as per AAM among Dongria Kondh tribal (PVTG) girls and girls of non-tribal group

AAM	PVTG			Non- Tribal Group			Total		
	N	%	Cf	N	%	Cf	N	%	Cf
10	17	5.3	5.3	19	3.2	3.2	36	3.9	3.9
11	33	10.3	15.6	41	6.9	10.1	74	8.0	11.9
12	186	58.1	73.8	255	42.9	52.9	440	48.0	59.9
13	82	25.6	99.4	222	37.3	90.3	305	33.3	93.2
14	2	0.6	100.0	50	8.4	98.7	52	5.6	98.8
15	0	0	0	8	1.3	100.0	8	0.8	100.0
Total	320	100.0	100.0	595	100.0	100.0	915	100.0	100.0
Mean	12.06			12.45			12.31		
Median	12.00			12.00			12.00		
Mode	12.00			12.00			12.00		
SD	0.77			0.91			0.88		

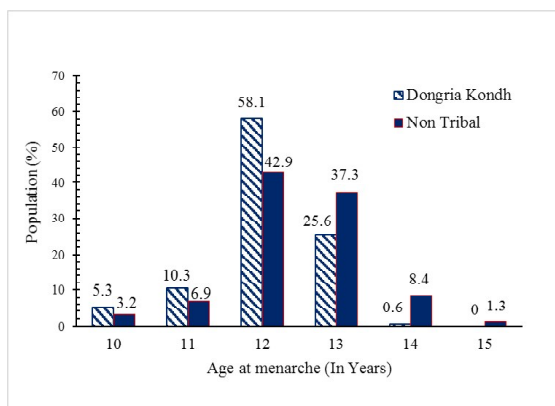


Figure 1: Comparative distribution of sample as per age at first menstruation among Dongria Kondh (PVTG) and non-tribal girls

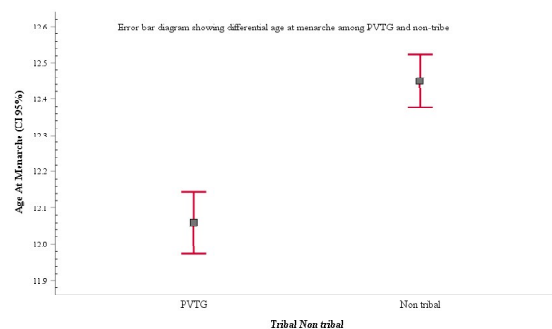


Figure 1a: Error bar diagram showing different age at menarche among PVTG and non-tribal

A total of 915 cases were analyzed of which 34.97% were Dongria Kondh (PVTG) and the remaining 65.02% were the non-tribal. Among the non-tribal population, only 3.86% of adolescent girls belong to low social-economic status, simultaneously 67.39% and 28.73% belong to lower-middle (LM) and

middle social-economic status respectively. Among PVTG 24.06%, 65.93%, and 10% belong to low, low middle, and middle socioeconomic status respectively.

Shapiro-Wilk test (see Table 2) confirmed significant relationship between AAM and socio-economic status among both populations ($p < 0.05$).

TABLE 2

The relationship between socio-economic status and AAM among PVTGs and non-tribal population (Shapiro-Wilk Test)

Age at Menarche	SES	PVTG				Non-tribal			
		N%	Statistic	df	Sig.	N%	Statistic	df	Sig.
	Low	24.06	0.723	77	0.001*	3.86	0.804	23	0.001*
	Low- middle	65.93	0.781	211	0.001*	67.39	0.875	401	0.001*
	middle	10	0.900	32	0.006*	28.73	0.887	171	0.001*

*Shapiro-Wilk test value significant, $p < 0.05$

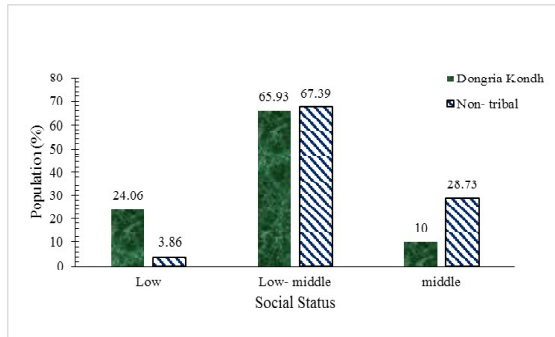


Figure 2: Socio-economic status among adolescent Dongria Kondh and non-tribal girls

A relationship with socio-economic status, among

both PVTG and non-tribal adolescent groups was found. The low SES group get early menarche than the low-middle SES group. And mean BMI was found 18.47 ± 2.14 and 17.48 ± 2.27 kg/m² among low SES groups of both the ethnic populations i.e. PVTG and non-tribe respectively. Simultaneously the mean BMI among lower-middle and middle SES among PVTG were 19.34 ± 1.83 and 20.50 ± 2.46 respectively; whereas in case of the non-tribal Population, the mean BMI among adolescents from lower-middle and middle SES backgrounds were 18.37 ± 1.97 and 19.08 ± 2.50 respectively. The ANOVA test was also found significant between girls' present age BMI and SES (F value= 13.813, df= 2, p<0.05) among both ethnic populations.

TABLE 3

Correlation of socio-economic status with AAM and BMI (ANOVA test)

Factors	Low	SES LM	Middle	F value	P value	Total
PVTG (n=320)						
N	77	211	32	16.6	0.001*	320
Girl's AAM	11.82 ± 0.78	12.22 ± 0.68	11.56 ± 1.10			12.06 ± 77
Girl's Present BMI	18.47 ± 2.14	19.34 ± 1.83	20.50 ± 2.46	12.5	0.001*	19.25 ± 2.05
Non-tribe (n=595)						
N	23	401	171	5.5	0.001*	595
Girl's AAM	12.83 ± 0.71	12.50 ± 0.90	12.28 ± 0.92			12.45 ± 0.90
Girl's Present BMI	17.48 ± 2.27	18.37 ± 1.97	19.08 ± 2.50	9.3	0.001*	18.54 ± 2.18

*ANOVA test found Significant, p<0.05

It is evident from the occupational profile of the respondent's parents that the fathers of 47.3% of non-tribal and 1.3% of PVTG respondents were engaged in sedentary type of jobs; whereas the father of 52.7% and 98.7% of non-tribal and PVTG respectively were found involved in the labour-intensive occupation. A total of 67.4% of respondents from the non-tribal population and 65.9% of respondents among the Dongria Kondh (PVTG) tribe belong to low income category i.e. INR 5000-10000/- per month.

The Fisher Exact test (FET) found insignificant between AAM and father's occupation among PVTG, (FET Value= 3.642, p>0.05), but it was found significant among non-tribal (FET Value=12.360, p<0.05). The relationship between AAM and family income among non-tribe was found insignificant (FET value = 18.832, p>0.05); but, it was found significant among the Dongria Kondh tribe (FET value = 44.809, p<0.05) (Table 4).

TABLE 4

Relationship of AAM with fathers' occupation and family income among non-tribals and Dongria Kondh tribe

Variable	Level	Non-tribal		FET value	P value	PVTG		FETvalue	P value
		N	%			N	%		
Fathers' Occupation	Sedentary Job	269	47.3	12.360	0.028*	4	1.3	3.642	0.662
	Labour Intensive Job	300	52.7			305	98.7		
Family income	Below INR 5000/-	23	3.9	18.832	0.136	77	24.1	44.809	0.001*
	INR 5000-10000/-	401	67.4			211	65.9		
	INR 10000/-20000/-	145	24.4			32	10.0		
	above INR 20000	26	4.4			0	0		

*Fisher exact test found Significant, p<0.05

DISCUSSION

In the present study, the mean AAM was found 12.06 ± 0.77 and 12.45 ± 0.91 years among the Dongria Kondh and neighbouring non-tribal adolescents respectively, and the mean AAM of pool data was found 12.31 ± 0.88 years. The majority i.e. 58.1% (tribe) and 42.9% (non-tribe) girls had their first menstruation at 12 years of age. The earliest menstruation was reported at 10 years of age by 5.3% and 3.2% of tribes and non-tribes respectively. The difference in average AAM was found to be significant ($t = 6.85$, $p < 0.05$). Mean AAM among the women of different Tribes of Odisha i.e. Bhumij, and Sabara of Mayurbhanj, were reported 12.65, and 12.97 years respectively, (Satapathy *et al.*, 2018). It was 12.4 years among the Paraja tribe and Rana community of Koraput district of Odisha (Swain and Nayak, 2018). Similar results were also reported among the Dongria Kondh tribal group where the mean AAM was 12.74 ± 0.943 years (Nanda and Dhar, 2017). The mean AAM was found to be 12.67 years among adolescents in the Rongram block of the West-Garo Hills district of Meghalaya (Nagar and Aimol, 2010). There is a secular decline of AAM among Indian women (Pathak *et al.*, 2014).

Early or late AAM is linked with the diet and nutritional status, family socio-economic standing as expressed by parental income and education, area of residence, number of children in the family, genetics, environmental stress, sport, and physical activity (Amigo *et al.*, 2012; Singh and Singh, 2020; Kosińska *et al.*, 2019; Meyer *et al.*, 1991; Zacharias and Wurtman, 1969; Ellis and Essex, 2007; Merzenich *et al.*, 1993; Berkey *et al.*, 2000; Krzyzanowska *et al.*, 2016; Delemarre-van de Waal, 1993; Bagga and Kulkarni, 2000; Rigon *et al.*, 2010; Liczbińska *et al.*, 2020).

In the present study, the Shapiro-Wilk test confirmed significant relationship in between AAM and socio-economic status among both the populations ($p < 0.05$). It was found that the low SES group get early menarche than the low-middle SES groups. The ANOVA test was also found significant ($F = 10.750$, $df = 2$, $p < 0.05$). There are contradictory findings about the role of SES on the onset of puberty. Lower family income and larger family size at birth were associated with a daughter's earlier menarche and girls from low SES environments are more likely

to be exposed to cumulative risk factors both in utero and during childhood, that are believed to contribute to early puberty (Deardorff, *et al.*, 2014; Forman *et al.*, 2013; Braithwaite *et al.*, 2009; Attallah, 1978). Contradictorily it was reported that low socioeconomic status was associated with delayed menarche; it is found that girls belonging to low SES had delayed onset of menarche as compared to those belonging to middle/high SES. (Karim *et al.*, 2021; Wronka and Pawlińska-Chmara, 2005; Amigo *et al.*, 2012; Ayatollahi *et al.*, 2002; Orden *et al.*, 2011).

In general, SES is described in terms of income, parental schooling, household assets, family size, and other factors; or a combination of them. Nevertheless, these indicators can vary, depending on their measurement, and may be differently expressed within different contexts (Parent *et al.*, 2003). According to Abioye-Kuteyi *et al.*, (1997) mean AAM was slowest in girls from high socio-economic households. Chavarro *et al.*, (2004) found that AAM was positively associated with family size and the practice of at least 2 daily hours of physical activity.

Mean BMI was found 18.47 ± 2.14 kg/m² (PVTG) and 17.48 ± 2.27 kg/m² (non-tribe) among low SES groups. The ANOVA test was also found significant for present age, BMI and SES ($F = 13.813$, $df = 2$, $p < 0.05$). The Fisher Exact test found insignificant between AAM and father's occupation among PVTG ($p > 0.05$), but it was found significant among non-tribal ($p < 0.05$). The relationship between AAM and family income among non-tribe was found insignificant ($p > 0.05$); but, it was found significant among the Dongria Kondh tribe ($p < 0.05$) In a study among girls from Punjab province of Pakistan it was found that girls who reached menarche were found to be taller and heavier with higher BMIs, having a greater waist and hip circumference as compared to their pre-menarcheal peers (Karim *et al.*, 2021). Body weight, intake of high animal protein, and single parenting are among those which are likely associated with early AAM (Yermachenko and Dvornyk, 2014). BMI is an important indicator of the timing of menarche (Wang *et al.*, 2016). Lower childhood SES and decreasing SES between birth and age 7 years were associated with earlier age at menarche (James-Todd *et al.*, 2010). In a study at the National University of Colombia, the mean age at menarche was found 12.68 ± 1.31 , and

AAM was found positively associated with family size and the practice of at least 2 daily hours of physical activity and was inversely related to urbanization level, SES, and year of birth (Chavarro *et al.*, 2004).

India is a welfare state hence to improve the health and nutritional status of its citizen various programs/schemes were launched in the recent past which includes: PDS (Public Distribution System), NHM (National Health Mission), MGNREGA (Mahatma Gandhi National Rural Employment Guarantee Act), ICDS (Integrated Child Development Scheme), and MDM (Mid-Day-Meal). Under PDS, poor people are being provided rice at the rate of one rupee/ Kg, which is quite cheaper. Children below 6 years as well as pregnant and lactating mothers are getting supplementary nutrition under the ICDS program (Integrated Child Development Scheme). Through the NHM scheme children and adolescents are taking albendazole, iron and folic acid (IFA) tablets per week. Under the Mid-Day-Meal scheme children at schools are being provided one meal. The people of Niyamgiri Hills live in a dense forest cover area. They have better nutrition, physical activity, a clean environment, and a healthy lifestyle this may impact early puberty among girls.

CONCLUSION

In the present study, the mean AAM was found at 12.06 ± 0.77 years among the Dongria Kondh tribe and 12.45 ± 0.91 years among non-tribal adolescents. Mean BMI was found 18.47 ± 2.14 and 17.48 ± 2.27 Kg/m² among low SES groups in both groups i.e. PVTG and non-tribe respectively. The ANOVA test was also found significant ($F= 13.813$, $df= 2$, $p<0.05$) for present age, BMI, and SES. The Fisher Exact test found insignificant between AAM and father's occupation among PVTG ($p>0.05$) it was found significant only in the case of non-tribal ($p<0.05$). A healthy lifestyle, better nutrition, physical activity, and a clean environment, may fluctuate the timing of onset of menarche and impact early puberty among girls.

Limitation: This study has certain limitations viz. it is limited to a particular geography i.e. Niyamgiri hills of Rayagada, Odisha (India). Sample size was 915 and only females of adolescence age group (10-18 years) were recruited for the study.

ACKNOWLEDGMENTS

This paper is a part of the doctoral research of the first author who is pursuing doctorate under the supervision of the second author at the Department of Anthropology, Dr. Harisingh Gour Viswavidyalaya, Sagar, Madhya Pradesh. She is thankful to the Government of India and the university authority for providing financial support for this research. She also expressed her gratitude to the district authority of Rayagada district as well as the officials and staff of the Dongria Kondh Development Agency (DKDA) and the people of the Dongria Kondh tribe without their prior consent it would not have been possible.

Contribution of authors: Author RKG, designed the research and planned the execution as well as supervised the design of manuscript, whereas author DD executed it, she did data collection, analysis, and drafting of the manuscript. Both the authors have approved the final manuscript. We confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication.

Ethical approval: The study protocol was approved by the Institutional Ethics Committee of Dr. Harisingh Gour Viswavidyalaya, Sagar, Madhya Pradesh vide, IEC Approval No. DHSGV/EC/ 2021/05. The authors assert that all procedures contributing to this work comply with the ethical standards as per Helsinki Declaration of 1975, as revised in 2008 for protecting human subjects. As part of the screening, written consent was obtained from all participants with due permission from their parents and respective authorities.

Funding: The study was funded by the University vide its scheme to Non-NET Fellowship Registration No Y18441005

Conflicts of interest: There are no conflicts of interest.

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