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ABSTRACT

Variation in mean menarcheal age is a global phenomenon and is influenced by a number of community-specific factors. The present paper endeavours to ascertain the mean age at menarche within two endogamous communities: the Kisan tribe (including Nagesia tribe who are the same as Kisan) of Duars and the Kisan claimants of Malda district. A sample of 602 eligible girls and women participated in this comparative analysis, with 301 hailing from Kisan tribe (aged 10-66 years) and 301 from the Kisan claimants (aged 9-80 years); the mean menarcheal age of both groups are calculated as 12.99 ± 0.18 years and 12.46 ± 0.07 years respectively. Furthermore, the findings unveiled a discernible secular trend concerning age at menarche within these communities, results reveal a decrease of approximately 3.56 months (KT) and 4.53 months (KC) per decade in these populations. The study also reveals significant negative correlation estimates between the mean age at menarche and the birth year of Kisan and Kisan claimants (-0.415 and -0.614, respectively), indicating that with the decrease in age of the respondents, the mean age at menarche also tends to decrease. The linear regression analysis (F = 62.279 and 180.826) supports this finding, showing a statistically significant negative association. This means that over time, there is a trend towards earlier menarche in these populations. These results highlight the reproductive patterns and trends within the studied communities, suggesting a potential shift towards earlier menarche over time.

Key words: *Menarche, secular trend, demography, Kisan tribe, Kisan claimants.*

INTRODUCTION

The age of menarche, marking the initiation of menstruation in females, stands as a pivotal juncture in the reproductive process. It serves as a key indicator of overall health and well-being. The onset of menarche exhibits considerable diversity among individuals and communities, shaped by a multifaceted interplay of genetic, nutritional, socio-economic, and environmental elements. Numerous research studies indicate that the timing of menarche exhibits variation among populations across different geographical regions worldwide. (Robertson 1845, Malina et al. 1973, Chakravarthi and Renuka 1977, Chumlea et al. 2003, Diaz et at. 2006, Raji et al. 2006). The age at menarche depends upon a myriad of environmental and intrinsic factors, including hormonal activation, nutritional status, ethnicity, geography, physical activity, socio-economic factors, and other contributing elements. (Bhalla et al. 1983, Eveleth and Tanner 1990, Merzenich et al. 1993, Chavarro et al. 2004, Delavar and Hajian-Tilaki 2008, Gaudineau et al. 2010, Rigon et al. 2010, Orden et al. 2011, Wiley 2011, White 2013 and Wronka et al. 2013).

Studying the distribution of menarcheal age enables exploration of the prevalence and patterns of early, average, and late menarche within and across populations. Understanding this

distribution is crucial for assessing population health and well-being. Early menarche has been linked to various adverse health outcomes, including increased risks of obesity, metabolic disorders, reproductive cancers, and psychological issues. Conversely, delayed menarche may impact fertility, bone health, and overall reproductive lifespan. Analysing the distribution of menarcheal age helps to identify groups at risk of early or delayed reproductive maturation, allowing tailored interventions to promote optimal health outcomes. Over the past century, significant global shifts in mean menarcheal age have occurred (Laslett 1971, Dann and Roberts 1973, Tanner 1973, Wyshack and Frisch 1982, Cameron et al. 1991, Thomas et al. 2001, Winchup et al. 2001, McDowell et al. 2007, Walvoord 2010). Numerous studies have also observed a secular trend in menarche within the Indian population, mirroring trends seen in many other regions globally (Bagga and Kulkarni 2000, Gaudineau 2010, Prakash et al. 2010, Pathak et al. 2014, Deshpande 2020, Ramraj and Subramanian 2021, Bajpai et al. 2023, Meher and Sahoo 2024).

Understanding the event of age at menarche is of paramount importance, as it can provide insights into population health, reproductive patterns, and long-term health outcomes. This research paper aims to provide a comprehensive review of two populations influencing the age at menarche.

OBJECTIVE

The objective of this paper is to compute and compare the mean menarcheal age of two endogamous communities, Kisan tribe (including Nagesia tribe) of Duars and Kisan claimants of Malda district of West Bengal, India.

MATERIAL AND METHODS

The study is conducted among two endogamous communities, viz, Kisan tribe (including Nagesia tribe who are the same as Kisan) of Duars and Kisan claimants of Malda district. The Kisan and Nagesia tribes of Duars are classified as Scheduled Tribes. According to community participants and leaders, the terms "Kisan" and "Nagesia" are considered synonymous. The Kisan claimants constitute a community residing in the Malda district of West Bengal (approximately 300 km away from Duras), claiming themselves as the Kisan tribe. However, they are presently categorized as a General caste under Hindu religion. Throughout the paper, Kisan Tribe of Duars including the nomenclature Nagesia are identified as Kisan tribe (abbreviated as KT), and the community who are in identity crisis, claim themselves to be Kisan and are recognized as Kisan claimants (abbreviated as KC).

A total of 602 girls and women, who had experienced menarche participated in this comparative analysis, comprising 301 individuals from Kisan (including Nagesia tribe), aged 10-66 years and 301 from the Kisan claimants (aged 9-80 years). Sampling was conducted using purposive method, targeting individuals who could provide relevant data on menarcheal age. To determine the age at menarche, a retrospective method relying on participants' recall was employed. Additionally, pretested interview schedule was utilized to gather pertinent information related to onset of menstrual cycle. This approach aimed to ensure consistency and accuracy in data collection across the study population. The collected data underwent analysis examining descriptive statistics, such as frequency, percentage, mean, median, standard deviation and standard error to understand the central tendency and dispersion of menarcheal

age distribution. Additionally, inferential statistics including correlation, chi-square test and regression using SPSS (20.0) was conducted to explore relationship to birth cohorts.

RESULT and DISCUSSION

Table 1 depicts the data on the mean age at which menarche, the onset of menstruation occurs within two distinct communities. Specifically, the mean age at menarche for the Kisan tribe (including Nagesia tribe) is recorded as 12.99 years with a standard error of ± 0.18 years, while for the Kisan claimants, it is 12.46 years with a standard error of ± 0.07 years. Upon comparing these figures, it becomes evident that the Kisan claimants, experience menarche at a notably lower mean age. Their average age at menarche is approximately 6 months earlier than that of the Kisan tribe (including Nagesia tribe) members. This difference suggests potential factors influencing the timing of menarche within these populations, such as genetic predispositions, socio-economic conditions, or cultural practices. Furthermore, statistical analysis confirms the significance of this difference. The calculated t-value of 5.231, with a corresponding p-value less than 0.00001, indicates that the observed difference in mean age at menarche between Kisan claimants and the Kisan tribe (including Nagesia tribe) is unlikely to have occurred by random chance.

Table 1. Age at Menarche of Studied Population

	N	**RANGE (years)**	**MEAN ± SE**	**t-value**	**df**	***p*-value**
KT	301	10-18	12.99 ± 0.18	**5.231**	**600**	**<0.00001**
KC	301	9-17	12.46 ± 0.07			

Table 2 represents a comprehensive overview of the frequency distribution of women categorized by their age at menarche within two studied communities. Specifically, it outlines the age ranges within which girls/women (participants) from the Kisan tribe (including Nagesia tribe) reach menarche, spanning from 10 to 18 years. Additionally, it delineates the corresponding age range for Kisan claimants, which extends from 9 to 17 years. It is to be mentioned that, with reference to this table, age 9 years means who have completed 9^{th} birthday but not 10^{th} birthday, which is applicable for all other ages. An intriguing observation within the dataset is the occurrence of the earliest menarche, which is documented among Kisan claimants at the remarkably young age of 9 years, representing a minority of cases (0.66%). This finding underscores the variability in the onset of menstruation across different demographic groups. Further analysis reveals that the most prevalent age at menarche for participants from the Kisan tribe (including Nagesia tribe) is 13 years, comprising nearly one third of the recorded cases (29.90%). Following closely behind is the age of 12, accounting for over a fifth of instances (20.56%). Interestingly, a comparable frequency distribution is observed among participants of the Kisan claimants, indicating a similar pattern in the timing of menarche despite slight variations in the age range. Notably, the prevalence of menarche at ages 12 and 13 is prominent among Kisan claimants, mirroring the trend observed in the Kisan tribe (including Nagesia tribe). Overall, these findings shed light on the age at which girls and women in these communities typically experience menarche, highlighting both similarities and nuances across two demographic groups.

Table 2. Frequency Distribution of Women by Age at Menarche among Kisan Tribe (including Nagesia Tribe) and Kisan Claimants

Age in years	Population				Combined (N)	%
	KT (N)	%	KC (N)	%		
9	0	0.00	2	0.66	2	0.33
10	2	0.66	4	1.33	6	1.00
11	33	10.96	67	22.26	100	16.61
12	80	26.58	70	23.26	150	24.92
13	90	29.90	121	40.20	211	35.05
14	53	17.61	23	7.64	76	12.62
15	34	11.30	7	2.33	41	6.81
16	7	2.33	5	1.66	12	1.99
17	1	0.33	2	0.66	3	0.50
18	1	0.33	0	0.00	1	0.17
	301	100.00	301	100.00	602	100.00

Table 3 provides a comprehensive breakdown of the age distribution at menarche, offering insights into the timing of this significant physiological event across studied communities. In this study, the median age serves as a central point of reference for understanding the typical onset of menstruation among participants. By examining the data, it becomes evident that a substantial portion of individuals within the studied communities experienced menarche during early adolescence. Specifically, a noteworthy majority, comprising 68.11% of participants from the Kisan tribe (including Nagesia tribe) and 87.71% of participants from the Kisan claimants, encountered their first menstruation at or prior to the age of 13 years (median age). This observation underscores the prevalence of early menarche within these groups, suggesting a commonality in the timing of this developmental milestone. Conversely, a notable portion of participants, constituting 31.89% (KT) and 12.29% (KC) respectively, reported experiencing menarche beyond the age of 13. This phenomenon highlights the diversity in the onset of menstruation within these communities, with a subset of individuals exhibiting a delayed initiation of menstrual cycles.

Table 3. Categorical Data by Age at Menarche among Kisan Tribe (including Nagesia Tribe) and Kisan Claimants

	KT	KC	X^2 value	*p*-value
Mean age at menarche (in years)				**Significant at $p<0.01$.
≤ 13	205	264	**33.595**	**<0.00001****
>13	96	37		

Table 4 and Figure 1 summarize category of age at menarche on the basis of birth cohorts among the studied communities. The data is organized into eight distinct birth cohorts, spanning a decade from 1940 to 2019, allowing for a detailed examination of changes over time. Discernible pattern of decreasing mean age at menarche observed across successive birth cohorts. This trend suggests a notable shift towards earlier onset of menarche among younger

generations within these communities. For instance, when comparing the oldest and youngest birth cohorts, there emerges a substantial difference in the age at menarche. Specifically, among the Kisan tribe (including Nagesia tribe), the age at menarche differs by approximately 2.08 years, while for Kisan claimants, the difference is more pronounced at 2.42 years. This discrepancy underscores the magnitude of change in menarcheal age over time and highlights the Secular trend within these populations.

Table 4. Mean Menarcheal Age by Birth Cohorts

Birth year	MAM (Mean ± SD)	
	KT	KC
1940-1949	-	14.02 ± 0.58
1950-1959	14 ±1.73	13.99 ± 1.62
1960-1969	13.69 ±1.49	13.16 ± 1.01
1970-1979	13.35 ± 1.24	12.72 ± 0.87
1980-1989	12.81 ± 1.10	12.21 ± 0.88
1990-1999	12.82 ± 1.17	12.03 ± 0.99
2000-2009	12.72 ± 1.08	11.77 ± 0.87
2010-2019	11.92 ± 0.86	11.60 ± 1.00

MAM- Mean Age at Menarche

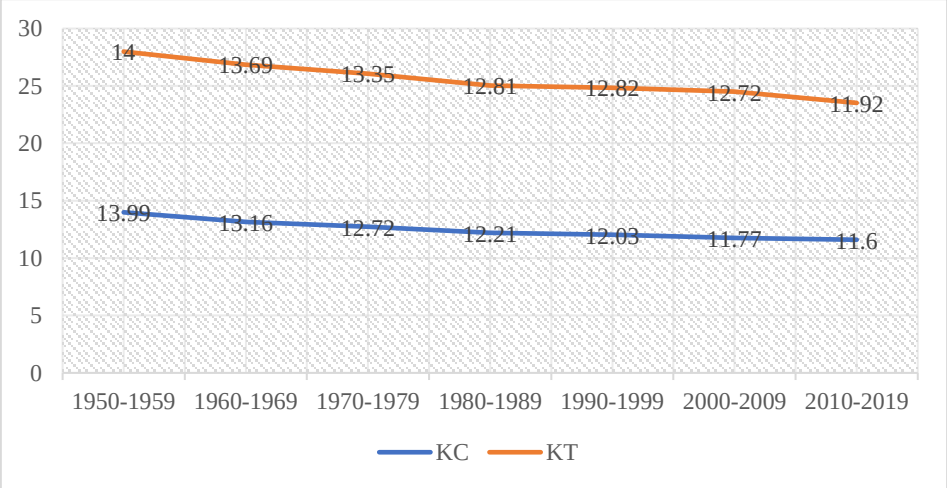

Figure 1. Mean Menarcheal Age by Birth Cohorts

Table 5 presents the correlation estimates between the mean age at menarche (MAM) and the birth year of the respondents within the studied populations. The statistical analysis reveals compelling evidence of a significant negative correlation ($P < 0.01$) between these variables, suggesting that as birth years progress, there is a corresponding decrease in the age at which menarche occurs. Specifically, for Kisan tribe (including Nagesia tribe), as well as the Kisan claimants, the correlations are notably negative, indicating a consistent trend of earlier onset of menarche across successive birth years. The correlation coefficients of -0.415 for the Kisan tribe (including Nagesia tribe), and -0.614 for Kisan claimants, signify a moderate to strong inverse relationship between MAM and birth year.

The results of the linear regression model, as detailed in Table 6, provides valuable insights into the relationship between birth cohorts and the mean age at menarche within the studied

communities. The analysis reveals a statistically significant negative association, indicating that as birth cohorts progress, there is a corresponding decrease in the average age at which menarche occurs. The β coefficient, which signifies the strength and direction of this association, suggests a robust predictive capability of the birth cohorts on the age at menarche.

These findings illuminate a clear secular trend in menarcheal timing within these communities, reflecting broader societal shifts and influences over time. The observed decline in MAM underscores the importance of considering generational changes when examining reproductive health dynamics.

Table 5. Correlation Matrix of Birth year and Mean Age at Menarche

VARIABLE	POPULATION	MAM
BIRTH YEAR	KT	-0.415**
	KC	-0.614**

** correlation is significant at the 0.01 level(2-tailed).
MAM- Mean Age at Menarche

Table 6. Linear Regression between Birth year and Mean Age at Menarche

VARIABLE	POPULATION	CO-EFFICENT	β	F-value	*p*-value
BIRTH YEAR	KT	76.486	-0.032	62.279	0.000
	KC	104.556	-0.046	180.862	0.000

Conclusion

The present study indicates that there is a notable difference of about six months in the mean age of menarche between the Kisan tribe (including Nagesia tribe) (12.99 years), and Kisan claimants (12.46 years), the latter are advanced in experiencing this event. Furthermore, the mean menarcheal age for both communities appear to be lower than the reported mean age of menarche in the Eastern region of India, which is documented as 13.21 years according to a study by Meher and Sahoo (2024). Interestingly, other studies have provided varying figures for the average age of menarche in Eastern India. For instance, Deb (2009) reported an average age of 12.35 years, while Deo and Gattarji (2004) documented it as 12.24 years. These differences highlight the phenomenon of regional and ethnic heterogeneity when it comes to the onset of menstruation, even within the confines of Eastern India. Such variations could be influenced by a multitude of factors, including genetic differences, socioeconomic conditions, nutritional status, and cultural practices prevalent in different communities.

These findings suggest the occurrence of early menarche among the studied populations, which in turn implies a longer reproductive time span. Women who experience early menarche typically engage in reproductive activities at a younger age, potentially leading to a longer reproductive lifespan.

Additionally, the study reveals significant negative correlation estimates between the mean age at menarche and the birth year of the respondents within the studied populations (-0.415 for KT and -0.614 for KC). This suggests that as birth years progresses, the mean age at menarche tends to decrease. The linear regression analysis (F=62.279 for KT and F=180.826 for KC) further confirms a statistically significant negative association, indicating that as time progresses, there is a trend towards earlier menarche within these populations. These results

shed light on the reproductive patterns and trends within the studied communities, indicating a potential shift towards earlier menarche over time.

This implies that changes in birth cohorts are strongly indicative of shifts in menarcheal timing within these communities. Furthermore, these findings serve to underscore and reinforce the broader secular declining trend observed in the age at menarche among the studied populations. Similar secular trends were observed from several Indian studies done in 21st century (Bagga and Kulkarni 2000, Sharma et al. 2006, Rokade and Mane 2008, Pathak et al. 2014, Reddy and Radhika 2017, Ramraj and Subramanian 2021, Bajpai et al. 2023, Meher and Sahoo 2024). The secular decline in the mean age of menarche, is indeed a global phenomenon that has garnered attention from researchers across various continents as well. This trend has been extensively documented in numerous studies conducted worldwide, highlighting its significance and widespread nature. For instance, studies by, Hoshi and Kouchi (1981), Ouyang et al. (2006), Delavar and Hajian-Tilaki (2008), Song et al. (2011), Hosokawa et al. (2012), Su et al. (2013), Lee et al. (2016), Meng et al. (2017), Wahab et al. (2018) and Liu et al. (2021) have provided valuable insights into the declining age at menarche in different populations of Asia, emphasizing the impact of factors such as improved nutrition, healthcare advancements, and changes in lifestyle and environmental conditions. Similarly, research conducted by Tanner (1973), Merzenich et al. (1993), Moisan and Meyer (1993), de Muinich Keizer and Mul (2001), Ofuya (2007), Euling et al. (2008), Gaudineau et al. (2010), Rigon et al. (2010), Orden et al. 2011, Talma et al. (2013) and Ofuya (2007) has further contributed to our understanding of this global trend, exploring variations across regions, ethnicities, and socioeconomic backgrounds.

The mean age of menarche, has been observed to decrease over time among the studied populations. Specifically, results indicate that there has been a decline of approximately 3.56 months (KT) and 4.53 months (KC) per decade in these populations. This suggests that girls in these communities are reaching puberty at younger ages compared to previous generations. Furthermore, a study conducted by Meher and Sahoo in 2024 focused on pan Indian NFHS data and found a similar trend. They reported a reduction of one month in the age of menarche per decade. This aligns with a consistent pattern of decreasing age at menarche over time, broadly differing by ethnicities.

This trend reflects not only biological factors but also socio-cultural and environmental influences that shape reproductive health patterns over time. Overall, the results of the linear regression analysis provide compelling evidence of the dynamic nature of menarcheal age and its relationship with generational changes, contributing to our understanding of reproductive health trends in these communities.

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ETHICAL CONSIDERATIONS

The procedures employed in this study adhered strictly to ethical standards and protocols sanctioned by the Institutional Ethics Committee of West Bengal State University, as delineated in IEC Approval No. WBSU/IEC/30/03, dated 07.10.2021. Written consent was obtained from every participant, or from parents in instances where participants had not reached the age of adulthood. Ethical considerations were paramount throughout the study, with particular emphasis on mitigating any potential physical, social, or psychological harm that could arise from participation.

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