©*Genus Homo* (ISSN 2457-0028)
Dept of Anthropology
West Bengal State University

Genus *Homo*, Vol. 9, 2025
Chandra*et al*, pp 59-67
Accepted on 27th December 2025
Published on 31st December 2025

Original article

NUTRITIONAL STATUS USING ANTHROPOMETRIC MEASURES BETWEEN PREMENSTRUAL AND MENSTRUAL ADOLESCENT GIRLS OF PURULIA DISTRICT IN WEST BENGAL, INDIA

Kailash Chandra[1], Saraswati Mahato[1], Astami Mahato[1], Manoj Kumar Mahato[1], Sadaruddin Biswas[1*]

ABSTRACT

Background:
Undernutrition is still a critical health burden among adolescent girls in developing countries, including India. Notable differences have been observed in anthropometric parameters between premenstrual and menstrual girls. These observations have prompted us to assess the nutritional status of girls in both categories using anthropometric measurements.

Methods:
This cross-sectional study was carried out among 481 adolescent girls (216 were in the premenstrual stage and 265 were in the menstrual stage) from two high schools in Purulia-I Community Development Block, Purulia district, aged between 10 and 16 years. Nutritional status was assessed in terms of stunting (Height-for-age) and thinness (BMI-for-age) using age- and sex-specific -2 z-score values from the WHO reference median. The Independent sample t-test was used to assess significant differences in anthropometric variables between two groups (premenstrual stage and menstrual stage). Association between menstrual status and thinness were examined using the Chi-square test.

Result:
Menstrual girls showed consistently higher mean height, weight, and BMI across ages, with significant differences observed particularly at ages 11 and 13 ($p < 0.05$ to $p < 0.001$). The mean height, weight, and BMI were significantly higher among menstrual girls compared to premenstrual girls. Stunting and thinness were more common among premenstrual girls, with a total prevalence of 27.5% and 39.6%, respectively, compared to 23.1% and 20.4% among menstrual girls. Significantly, premenstrual girls were thinner compared to their counterparts ($\chi^2 = 20.629$, $p < 0.001$).

Conclusion:
This study found a significant association between menstrual status and thinness among adolescent girls. Premenstrual girls were more likely to be thin, underscoring the importance of early nutritional intervention to support healthy growth and development.

KEY WORDS: Adolescent, Premenstrual, Menstrual, Stunting, Thinness, Purulia, West Bengal, India

INTRODUCTION

Adolescence is a transitional phase of human growth and development, marked by rapid physical, psychological, and physiological changes, which significantly increase nutritional requirements (Patton et al., 2016; Engidaw & Gebremariam, 2019; Mahata et al., 2022). This phase is crucial, as it marks the onset of menarche, a biological milestone that signifies the beginning of reproductive capability (Onyiriuka & Egbagbe, 2013; Wang et al., 2016) in girls. The timing of menarche varies across populations and is influenced by genetic, nutritional, environmental, and socio-economic factors (Parent et al.,

[1]Department of Anthropology and Tribal Studies, Sidho-Kanho-Birsha University, Purulia, West Bengal India, Pin-723104
*Corresponding author: sadaruddin-biswas@skbu.ac.in

2003; Juliyatmi et al., 2015; Wang et al., 2016). Nutritional status during this period not only affects the timing of menarche but also has long-term consequences on health outcomes, including reproductive health, bone development, and risk of chronic diseases in later life (Sawaya & Roberts, 2003).

Premenstrual girls are typically in the early to mid-stages of adolescence and require adequate macro- and micronutrients to support the growth spurt. Menstrual girls, on the other hand, have higher nutritional demands due to the additional requirements of menstruation and continued development of secondary sexual characteristics (WHO, 2005). The need for nutrients is highest during adolescence due to the rapid growth and development that occur during this stage (De & Bose, 2016). Inadequate nutrition during these phases can lead to undernutrition, stunted growth, delayed puberty, iron deficiency anaemia, and increased susceptibility to infections (UNICEF, 2023).

Anthropometry is a method used to assess growth patterns during the adolescent stage (De, 2017). Anthropometry offers a reliable, low-cost, and non-invasive method for assessing body size, proportion, and composition, thereby evaluating nutritional and health status (WHO, 1995). Evaluating the nutritional status of adolescent girls in relation to their menstrual stage is important for gaining insight into the connection between physical development and nutritional intake. Several studies have highlighted that menstrual girls often show higher body mass index (BMI) compared to their premenstrual counterparts (Wang et al., 2016; Bhowmik & Khatun, 2024), which may reflect the influence of hormonal changes on body composition (Papadimitriou, 2016). However, these changes are also shaped by socio-demographic variables such as education, household income, and access to health services, particularly in developing countries like India (Patel et al., 2010).

In light of these considerations, evaluating the nutritional status of pre- and menstrual girls provides vital insights into adolescent health and development. It also helps inform targeted interventions to improve nutrition and reproductive health outcomes across different stages of adolescence.

OBJECTIVE

The present study aimed to assess the nutritional status of premenstrual and menstrual adolescent girls of Purulia district, West Bengal, India.

MATERIALS AND METHODS

Study Area: This cross-sectional study was conducted at Lagda High School and Lagda Girls High School in Purulia I CD Block, Purulia district, West Bengal. Purulia is a district in the eastern part of India, located in the state of West Bengal. The district lies between 22.60° and 23.5° north latitude, and between 85.75° and 86.65° east longitude. It is about 292.8 km away from Kolkata, which serves as the capital of West Bengal.

Study Participants: All school enrolled girls aged 10-16 years from Lagda High School and Lagda Girls High School in Purulia-I Community Development block who expressed willingness to participate were included in the study. Girls with any chronic health conditions were excluded from the study.

Sample Size: The study included a sample size of 481 apparently healthy school enrolled girls aged 10-16 years. Among the total participants, 216 girls were in the premenstrual stage, and 265 were in the menstrual stage. The age of the participants was verified using their school identity cards.

Ethical Approval: Ethical approval for the study was obtained from the Institutional Ethical Committee of Sidho-Kanho-Birsha University. The study proceeded only after receiving informed consent from the head of each school.

Anthropometric Measurements: Standardised procedures were employed to measure the height and weight of all participants (Lohman et al., 1988). Height was measured with a Martin's anthropometer to the nearest 1.0 mm, and weight was recorded to the nearest 0.5 kg using a spring balance weighing machine.

Socio-demographic and socio-economic data: Information on parental education, occupational status, ethnicity, household assets, birth order, and number of siblings was recorded using a pre-tested schedule. Data on menstrual status were collected through the recall method by the female investigator.

Assessment of nutritional status: According to internationally accepted guidelines by the World Health Organisation (WHO, 2007), age- and sex-specific -2 z-scores were used to define undernutrition indicators, such as stunting and thinness. Z-scores were calculated (on WHO AnthroPlus Software) based on standard WHO cut-off values:

(a) Stunting: Low height-for-age <-2 SD from the WHO reference median

(b) Thinness: Low BMI-for-age <-2 SD from the WHO reference median

Statistical analysis: All statistical analyses were carried out using SPSS (version 25). The Independent sample t-test was used to assess significant differences in anthropometric variables between two groups (premenstrual girls and menstrual girls) across all ages. The Chi-square test was performed to examine the associations between categorical variables, i.e., menstrual status and thinness. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1 shows the age-wise distribution of the study participants. The ages of premenstrual girls were between 10 and 14 years, while menstrual girls were between 11 and 16 years old.

Table 1: Age-wise distribution of premenstrual and menstrual girls

Age in Years	Premenstrual girls		Menstrual girls		Overall	
	N	%	n	%	N	%
10	55	20.8	-	-	55	11.4
11	97	36.6	7	3.2	104	21.6
12	72	27.2	31	14.4	103	21.4
13	36	13.6	56	25.9	92	19.1
14	5	1.9	60	27.8	65	13.5
15	-	-	50	23.1	50	10.4
16	-	-	12	5.6	12	2.5
Overall	265	55.09	216	44.91	481	100

Table 2. Age-specific anthropometric characteristics of premenstrual and menstrual girls

Anthropometric Characteristics	Height (cm)					Weight (kg)					BMI(kg/m^2)				
Age (y)	Premenstrual Girls		Menstrual Girls		t	Premenstrual Girls		Menstrual Girls		t	Premenstrual Girls		Menstrual Girls		t
	Mean	sd	Mean	sd		Mean	sd	Mean	Sd		Mean	sd	Mean	sd	
10	132.79	6.49	-	-	-	25.63	4.21	-	-	-	14.47	1.62	-	-	-
11	136.63	7.63	143.81	5.09	-2.443*	27.04	5.92	36.07	8.03	-3.805***	14.39	1.92	17.33	3.08	-3.74***
12	141.63	7.55	142.57	6.46	-0.602	30.89	6.84	33.23	6.12	-1.639	15.29	2.54	16.24	2.13	-1.817
13	144.84	6.48	149.14	5.94	-3.275**	32.53	5.33	37.08	5.01	-4.148***	15.47	2.08	16.67	2.03	0.782**
14	145.64	6.76	148.43	5.41	-1.088	36.5	10.02	37.83	5.01	-0.293	17.05	3.88	17.17	2.05	-0.067
15	-	-	149.75	4.14	-	-	-	39.38	5.11	-	-	-	17.57	2.23	-
16	-	-	150.3	4.12	-	-	-	39.83	4.04	-	-	-	17.65	1.94	-
Overall	138.5	8.30	148.0	5.90	-14.27***	28.70	6.50	37.40	5.60	-15.57***	14.80	2.20	17.00	2.20	-10.99***

*=p<0.05; **=p<0.01; ***=p<0.001.

Anthropometric characteristics of premenstrual and menstrual girls were shows in table 2. Menstrual girls exhibited significantly higher mean values of height, weight, and BMI than their premenstrual counterparts. Specifically, menstrual girls had an overall greater mean height (148.0 ± 5.9 vs. 138.5 ± 8.3), weight (37.4 ± 5.6 vs. 28.7 ± 6.5), and BMI (17.0 ± 2.2 vs. 14.8 ± 2.2). Independent sample t-tests revealed statistically significant differences in all three variables, indicating a strong association between menstrual status and physical growth indicators. The age-wise anthropometric characteristics of the participants are summarized. A consistent pattern was observed across all ages, with menstrual girls showing higher mean height, weight, and BMI than their premenstrual counterparts. Significant differences in height were observed at ages 11 and 13 years, where menstrual girls were notably taller ($p < 0.05$ and $p < 0.01$, respectively). Weight differences were more pronounced, with menstrual girls showing significantly greater mean values at ages 11 and 13 years ($p < 0.001$). BMI also differed significantly at age 11 ($p < 0.001$) and 13 years ($p<0.01$) respectively, with menstrual girls having higher values.

Table 3 presents the age-wise prevalence of stunting among premenstrual and menstrual girls. Overall, the prevalence of stunting was slightly higher among premenstrual girls (27.5%) compared to menstrual girls (23.1%). Among premenstrual girls, the highest rate of stunting was observed at age 14 year (40%), followed by age 13 year (38.9%). In contrast, menstrual girls showed the maximum prevalence of stunting at the age 15 (34%) followed by age 16 years (33.3%). The overall prevalence of stunting across all age groups was 25.6%. These findings suggest a declining trend in stunting with increasing age and menstrual status, indicating improved growth outcomes menstrual.

Table 3: Age wise prevalence of stunting among the studied adolescent girls

Age in Years	Premenstrual girls			Menstrual girls			Overall		
	Stunted	%	N	Stunted	%	n	Stunted	%	N
10	10	18.2	55	-	-	-	10	18.2	55
11	28	28.9	97	0	0.0	7	28	26.9	104
12	19	26.4	72	7	22.6	31	26	25.2	103
13	14	38.9	36	6	10.7	56	20	21.7	92
14	2	40.0	5	16	26.7	60	18	27.7	65
15	-	-	-	17	34.0	50	17	34.0	50
16	-	-	-	4	33.3	12	4	33.3	12
Overall	73	27.5	265	50	23.1	216	123	25.6	481

Table 4 shows the age-wise prevalence of thinness among the studied adolescent girls. It is depicted that thinness was more common among premenstrual girls, with a total prevalence of 39.6%, compared to 20.4% among menstrual al girls. The highest rate of thinness in premenstrual girls was observed at age 13 (44.4%), followed by ages 12 (43.1%) and 11 (42.3%). In contrast, menstrual girls showed lower rates, with

Table 4: Age wise prevalence of thinness among the studied adolescent girls

Age in Years	Premenstrual girls			Menstrual girls			Overall girls		
	Thinness	%	N	Thinness	%	n	Thinness	%	N
10	15	27.3	55	-	-	-	15	27.3	55
11	41	42.3	97	0	0.0	7	41	39.4	104
12	31	43.1	72	5	16.1	31	36	35.0	103
13	16	44.4	36	12	21.4	56	28	30.4	92
14	2	40.0	5	13	21.7	60	15	23.1	65
15	-	-	-	11	22.0	50	11	22.0	50
16	-	-	-	3	25.0	12	3	25.0	12
Total	105	39.6	265	44	20.4	216	149	31.1	481

Table 5: Association of thinness with menstrual status among adolescent girls

Menstrual status	Thinness status		Total (%)
	Thinness (%)	Normal (%)	
Premenstrual girls	105(39.6)	160 (60.4)	265 (55.09)
Menstrual girls	44 (20.4)	172(79.6)	216(44.91)
Total	149 (31)	332 (69)	481(100)

χ^2=20.629, df=1, p<0.001

the highest prevalence at age 16 (25%) and age 15 years (22%). The overall prevalence of thinness among all girls was 31.1%. These results suggest that thinness tends to decrease after the onset of menarche, indicating a possible link between nutritional status and menstrual development. The results of chi-square test revealed that (Table 5) there is a statistically significant association between menstrual status and thinness ($\chi^2 = 20.629$, $p < 0.001$). the premenstrual girls (39.6%) were significantly thinner compared to the of menstrual girls (20.4%).

DISCUSSION

The present study revealed that all anthropometric characteristics, including height, weight, and BMI, were higher in menstrual girls compared to premenstrual girls. Several previous studies have also demonstrated that adolescent girls who have attained menarche exhibit significantly greater height, weight, and BMI than those who have not yet commenced menstruation (Wang et al., 2016; Bhowmik & Khatun, 2024). It also indicates that adolescent girls (12–14 years) in the menstrual stage exhibit a lower prevalence of stunting and thinness compared to those in the same age group who are still premenstrual.

There was a significant association between menstrual status and the prevalence of thinness among adolescent girls. Thinness was found to be considerably more prevalent among premenstrual girls (39.6%) compared to menstrual al girls (20.4%). This finding is consistent with the understanding that menarche is an important biological milestone often associated with physical and nutritional maturity. A study reported the burden of thinness (defined as a BMI-for-age below the 5th percentile based on NCHS standards) to be 48% among premenstrual girls and 18% among menstrual girls (Paramanik et al., 2015).

The results of the present study confirmed an association between thinness and menstrual status. This suggests that thinness is not randomly distributed among the two groups, but is more concentrated in girls who have not yet experienced menarche (Pramanik et al., 2015; De, 2016). Hormonal changes that occur during and after menarche influence fat accumulation and redistribution, which may account for the lower rates of thinness in menstrual al girls (Rogol et al., 2002). These findings are consistent with studies conducted in other parts of India and globally, which highlight the nutritional vulnerabilities during early adolescence (Kurz, 1996; Venkaiah et al., 2002).

Such evidence highlights the importance of early nutritional interventions, particularly for younger adolescent girls. Improving nutrition before the onset of menarche may not only help in reducing the risk of thinness but also support healthy growth and timely pubertal development, ultimately contributing to better reproductive and overall health outcomes later in life (Patton et al., 2016).

CNCLUSION:

The present study concluded that there was a significant association between menstrual status and nutritional status within adolescent girls residing in Purulia district, West Bengal. The burden of thinness was markedly higher in premenstrual girls compared to those who had attained menarche, indicating that girls who have not yet reached menarche may be at greater nutritional risk. This association highlights the importance of early identification and intervention strategies targeting undernutrition in younger adolescent girls. Timely nutritional support during early adolescence is crucial for promoting healthy growth, ensuring timely pubertal development, and reducing long-term health risks associated with malnutrition. These findings also suggest the importance of integrating adolescent health programs with school-based nutrition and awareness campaigns, especially in rural and underserved regions.

REFERENCES

Bhowmik, S., & Khatun, A. (2024) Anthropometric and Body Composition variations among Pre-and Menstrual school girls. *Antrocom Journal of Anthropology*, 20(2): 191–198

De, K. (2016) Nutritional Status and Menarcheal Age of Rural Adolescent Girls of Salboni Block of Paschim Medinipur, West Bengal, India. *Journal of Child and Adolescent Behaviour*, 04(05): 8–11. https://doi.org/ 10.4172/ 2375-4494.1000316

De, K. (2017) Study of anthropometric characteristics of pre-menarcheal and post-menarcheal girls of West Medinipur, India. *Journal of Probiotics & Health, 5*(166): 1-3 https://doi.org/10.4172/2329-8901. 1000166

De, K., & Bose, K. (2016) Nutritional status and menarcheal age of rural adolescent girls of Salboni Block of Paschim Medinipur, West Bengal, India. *International Journal of Experimental Research and Review*, 6: 1–5

Engidaw, M. T., & Gebremariam, A. D. (2019) Prevalence and associated factors of stunting and thinness among adolescent Somalian refugee girls living in eastern Somali refugee camps, Somali regional state, Southeast Ethiopia. *Conflict and Health*, 13(17): 1-8. https://doi.org/10.1186/s13031-019-0203-3

Juliyatmi, R. H., Handayani, L., Ahmad, U., Jalan, D., &Soepomo, S. H. (2015) Nutritional status and age at menarche among female students of junior high school. *International Journal of Evaluation and Research in Education (IJERE)*, 4(2): 71–75

Kurz, K. M. (1996). Adolescent nutritional status in developing countries. *The Proceedings of the Nutrition Society*, 55(1B): 321–331.

Lohman, T. G., Roche, A. F., & Martorell, R. (1988) *Anthropometric standardization reference manual*. Human Kinetics Books, Chicago.

Mahata, L. L., Biswas, S., & Bisai, S. (2022) Comparison of body composition between pre-menarche and menstrual Sabar girls of Purulia District, West Bengal, India. *Anthropology – Open Journal, 5*(1): 7–13. https://doi.org/ 10.17140/ANTPOJ-5-124

Onyiriuka, A. N., & Egbagbe, E. E. (2013) Anthropometry and menarchealstatus of adolescent Nigerian urban senior secondary school girls. *International Journal of Endocrinology and Metabolism*, 11(2): 71–75. https:// doi.org/10.5812/ijem.8052

Papadimitriou, A. (2016) The evolution of the age at menarche from prehistorical to modern times. *Journal of Pediatric and Adolescent Gynecology*, 29(6): 527–530.

Parent, A. S., Teilmann, G., Juul, A., Skakkebaek, N. E., Toppari, J., & Bourguignon, J. P. (2003) The timing of normal puberty and the age limits of sexual precocity: variations around the world, secular trends, and changes after migration. *Endocrine Reviews*, 24(5): 668–693

Patel, V., Flisher, A. J., Hetrick, S., & McGorry, P. (2010) Mental health of young people: a global public-health challenge. *The Lancet*, 369(9569): 1302–1313

Patton, G. C., Sawyer, S. M., Santelli, J. S., Ross, D. A., Afifi, R., Allen, N. B., ... & Viner, R. M. (2016) Our future: a Lancet commission on adolescent health and wellbeing. *The Lancet*, 387(10036): 2423–2478. https://doi.org/10.1016/ S0140-6736 (16)00579-1

Pramanik, P., Banerjee, S., & Dutta, S. (2015) Health status of pre-menarcheal and post-menarcheal adolescent girls in West Bengal, India. *International Journal of Research in Medical Sciences*, 3(8): 1979–1984. https://doi.org/ 10.18203/2320-6012. ijrms20150312

Rogol, A. D., Roemmich, J. N., & Clark, P. A. (2002) Growth at puberty. *The Journal of Adolescent Health: Official Publication of the Society for Adolescent Medicine*, 31(6 Suppl): 192–200.https://doi.org/10.1016 s1054-139x(02)00485-8

Sawaya, A. L., & Roberts, S. B. (2003) Stunting and future risk of obesity: principal physiological mechanisms. *Cadernos de Saude Publica*, 19: S21–S28

UNICEF (2023) *Undernourished and overlooked: A global nutrition crisis in adolescent girls and women*. UNICEF, New York

Venkaiah, K., Damayanti, K., Nayak, M. U., & Vijayaraghavan, K. (2002) Diet and nutritional status of rural adolescents in India. *European Journal of Clinical Nutrition*, 56(11): 1119–1125. https:// doi.org/0.1038/ sj.ejcn.1601457

Wang, Z., Dang, S., Xing, Y., Li, Q., & Yan, H. (2016) Correlation of body mass index levels with menarche in adolescent girls in Shaanxi, China: A cross sectional study. *BMC Women's Health*, 16(1): 1–9. https://doi.org/ 10.1186/s12905-016-0340-4

World Health Organization (1995) *Physical status: The use and Interpretation of anthropometry*. *Report of a WHO Expert Committee* (WHO Technical Report Series No. 854). Geneva: World Health Organization. <https://iris.who.int/handle/10665/37003> Retrieved on 21st, April 2025

World Health Organization (2005) *Nutrition in adolescence: Issues and challenges for the health sector*. Geneva: WHO.<https://www.who.int/publications/i/item/9241593660>Retrieved on 21st, April 2025.

World Health Organization (2007) *WHO reference 2007: Growth reference data for 5–19 years*. Geneva: World Health Organization. <https://www.who.int/tools/growth-reference-data-for-5to19-years> Retrieved on 21st, April 2025