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Original article

NUTRITIONAL STATUS AND MENSTRUAL PATTERNS: A CROSS-SECTIONAL STUDY ON UNIVERSITY STUDENTS IN WEST BENGAL

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ABSTRACT

Background:
Menstrual health reflects women's reproductive and metabolic status and is influenced by nutritional indices such as body mass index (BMI). Data on this relationship among young women in eastern India remain limited.
Objectives:
This study aimed to assess menstrual patterns and examine their association with nutritional status among adult female students of West Bengal State University, North 24 Parganas, West Bengal, India.
Methods:
A cross-sectional study was conducted among 180 women aged 21–25 years using a pre-structured schedule assessing menstrual characteristics and related symptoms. Anthropometric data were collected and categorized following standardized protocols. Statistical analyses were performed using chi-square tests ($p < 0.05$).
Results:
Most participants were observed to have normal weight (52.2%), followed by underweight (19.4%), overweight (16.1%), and obese (12.2%). A significant association was found between BMI and menstrual cycle regularity ($\chi^2 = 12.556$; $p = 0.006$), with irregular cycles more prevalent among overweight (24.1%) and obese (50%) women. No significant associations were observed between BMI and menstrual duration, flow, or menstrual-associated syndromes.
Conclusion:
Higher BMI is associated with increased menstrual irregularities but not with menstrual duration, flow, or related syndromes. These findings highlight nutritional status as a potential modifiable factor influencing menstrual regularity and emphasize the need for early lifestyle interventions to promote reproductive health among young women.

KEY WORDS: Body mass index, menstrual pattern, menstrual irregularity, reproductive health, young adult females, West Bengal

INTRODUCTION

Menstruation represents a complex physiological process governed by the hypothalamic–pituitary–ovarian (HPO) axis and serves as a key indicator of women's reproductive and metabolic health (Singh et al., 2019). The menstrual cycle—derived from the Latin *menses* and Greek *mene* ("moon")—reflects rhythmic hormonal fluctuations that regulate endometrial shedding approximately every 28 days (Rai et al., 2020). Menstrual patterns encompass the regularity, duration, and volume of bleeding; deviations such as oligomenorrhea, menorrhagia, or dysmenorrhea are increasingly prevalent among young women, often linked to lifestyle and metabolic factors (Nisar et al., 2008; Ganesan et al., 2019; Dwivedi et al., 2024).

Body mass index (BMI), a key marker of nutritional status, exerts a strong influence

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on menstrual function through its effect on gonadotropin release, leptin signaling, and ovarian steroidogenesis (Popat et al., 2009; Banu et al., 2023). Both underweight and overweight women exhibit higher rates of menstrual irregularity, altered age at menarche, and increased risk of anovulation (Rai et al., 2020). Such disturbances can adversely affect fertility, metabolic homeostasis, and long-term psychosocial well-being (Harlow & Campbell, 2000).

Despite growing evidence globally, region-specific data on menstrual characteristics and BMI from eastern India remain limited. This study therefore aims to assess menstrual patterns and examine their association with nutritional status (in the form of body mass index) among adult female students of *West Bengal State University*, North 24 Parganas, by evaluating BMI distribution, and its association with menstrual-related symptoms or syndromes, to provide insights relevant for reproductive health monitoring and intervention strategies.

MATERIALS AND METHODS

A cross-sectional study was conducted among 180 adult female students (21–25 years) of West Bengal State University, North 24 Parganas, West Bengal, India. Data was collected during November and December of 2023. Participants were recruited using convenience sampling across various departments following voluntary participation. Data were collected via face-to-face interviews using a pre-structured schedule covering the demographic details, age at menarche, menstrual cycle characteristics (regularity, duration, and flow), and menstrual-related symptoms (dysmenorrhea, menorrhagia, oligomenorrhea, hypomenorrhea, PMS).

Anthropometric measurements included height and weight, obtained following the standard protocol provided by Lohman et al. (1988). BMI was calculated as weight (kg)/height² (m²) and classified according to the World Health Organization's (WHO) classification (1995): underweight (<18.5), normal (18.5–24.9), overweight (25–29.9), and obese (≥30). Menstrual cycle regularity was defined as short (<21 days), normal (21–35 days), or long (>35 days) in accordance with established clinical and epidemiological definitions (Munro et al., 2011; Rai et al., 2020), and menstrual flow was categorized as scanty, medium, or heavy according to self-reported perception, consistent with the Federation of Gynecology and Obstetrics (FIGO) guidelines (Higham & Shaw, 1990; Munro et al., 2018).

Data were analyzed using SPSS v25. Descriptive statistics summarized participants' demographic and menstrual characteristics, and associations between BMI and menstrual variables were assessed using chi-square tests, with significance level at $p<0.05$. Participants' consent was secured during data collection.

RESULTS

The study cohort had a mean age of 23 years, with anthropometric measurements reflecting a moderately diverse body size range (height: 142–174 cm; weight: 33–92 kg; BMI: 14.8–39.6 kg/m²). The mean age at menarche was 11.91 years, indicating onset of puberty within the typical range showing no dispersion from the normal pubertal age. Overall, the dataset highlights normal variability in anthropometric parameters and pubertal timing within this population (Table 1).

Table 1: Descriptive statistics of anthropometric and menstrual parameters along with the age of the participants (n= 180)

Variable	Minimum	Maximum	Mean	SD	S.E.
Age (years)	21.0	25.0	23.01	0.852	0.064
Height (cm)	142.0	174.0	156.86	7.10	0.53
Weight (kg)	33.0	92.0	57.56	13.00	0.97
BMI (kg/m²)	14.8	39.6	23.23	5.89	0.44
Age at Menarche (years)	8.0	15.0	11.91	0.13	1.71

Table 2: Association between Menstrual pattern with BMI category

Menstrual pattern	Underweight 35 (19.4%)	Normal 94 (52.2%)	Overweight 29 (16.1%)	Obese 22 (12.2%)	Total 180 (100.0%)
Irregular cycle					
No	32(91.4%)	71(75.5%)	22(75.9%)	11(50.0%)	136(75.6%)
Yes	3(8.6%)	23(24.5%)	7(24.1%)	11(50.0%)	44(24.4%)
χ^2 = 12.556**, df= 3, p= 0.006					
Intermenstrual period					
Short cycle	3(8.6%)	12(12.8%)	2(6.9%)	0(0.0%)	17(9.4%)
Long cycle	1(2.9%)	16(17.0%)	8(27.6%)	5(22.7%)	30(16.7%)
Normal cycle	31(88.6%)	66(70.2%)	19(65.5%)	17(77.3%)	133(73.9%)
χ^2 = 11.477, df= 6, p= 0.075					
Length of period					
<3 days	1(2.9%)	3(3.2%)	2(6.9%)	3(13.6%)	9(5.0%)
>5 days	6(17.1%)	27(28.7%)	5(17.2%)	4(18.2%)	42(23.3%)
3-5 days	28(80.0%)	64(68.1%)	22(75.9%)	15(68.2%)	129(71.7%)
χ^2 = 7.499, df= 6, p= 0.277					
Blood flow					
Heavy	8(22.9%)	38(40.0%)	14(48.3%)	5(22.7%)	65(36.1%)
Moderate	21(60.0%)	35(37.2%)	10(34.5%)	8(36.4%)	74(41.1%)
Scanty	6(17.1%)	21(22.3%)	5(17.2%)	9(40.9%)	41(22.8%)
χ^2 = 12.340, df= 6, p= 0.055					
**, significant at, p<0.01					

However, study revealed that the majority of participants (52.2%) were of normal weight, while 19.4% were underweight, 16.1% overweight and 12.2% obese. Irregular menstrual cycles were significantly associated with BMI categories (χ^2 = 12.556, df = 3, P = 0.006), with a higher prevalence of irregularity observed in overweight and obese women (24.1% and 50.0%, respectively) compared to underweight (8.6%) and normal-weight women (24.5%). No significant associations were found between BMI categories and intermenstrual period (χ^2 = 11.477, df = 6, P = 0.075), length of menstruation (χ^2 = 7.499, df = 6, P = 0.277), or menstrual blood flow (χ^2 = 12.340, df = 6, P = 0.055). These findings suggest that BMI primarily influences cycle regularity rather than other menstrual characteristics (Table 2).

Analysis revealed no statistically significant association between BMI categories and menstrual-associated syndromes, with all p-values exceeding 0.05. Leg pain was most frequent in underweight women (68.6%) and least in the overweight group (37.9%), showing a near-significant trend ($\chi^2 = 6.721$; $p = 0.081$). Hypomenorrhea was notably higher in obese participants (36.4%) compared to others (11.4–13.8%), also approaching significance ($\chi^2 = 7.722$; $p = 0.052$). Other symptoms, including breast pain, dysmenorrhea, menorrhagia, and oligomenorrhea, showed relatively uniform distributions across BMI groups. These findings suggest generally similar prevalence of menstrual syndromes across BMI categories, with possible BMI-related trends for leg pain and hypomenorrhea warranting further investigation (Table 3).

Table 3: Association between Menstrual syndrome with BMI category

Menstrual Syndrome	Underweight 35 (19.4%)	Normal 94 (52.2%)	Overweight 29 (16.1%)	Obese 22 (12.2%)	Total 180 (100.0%)
Leg pain					
Yes	24(68.6%)	46(48.9%)	11(37.9%)	10(45.5%)	91(50.6%)
No	11(31.4%)	48(51.1%)	18(62.1%)	12(54.5%)	89(49.4%)
$\chi^2 = 6.721$, df = 3, p = 0.081					
Breast pain					
Yes	13(37.1%)	28(29.8%)	6(20.7%)	5(22.7%)	52(28.9%)
No	22(62.9%)	66(70.2%)	23(79.3%)	17(17.3%)	128(71.1%)
$\chi^2 = 2.553$, df = 3, p = 0.466					
Dysmenorrhea					
Yes	27(71.1%)	68(72.3%)	19(65.5%)	14(63.6%)	128(71.1%)
No	8(22.9%)	26(27.7%)	10(34.5%)	8(36.4%)	52(28.9%)
$\chi^2 = 1.729$, df = 3, p = 0.630					
Menorrhagia					
Yes	11(31.4%)	36(23.3%)	8(27.6%)	7(31.8%)	62(34.4%)
No	24(68.6%)	58(61.7%)	21(72.4%)	15(68.2%)	118(65.6%)
$\chi^2 = 1.430$, df = 3, p = 0.698					
Oligomenorrhea					
Yes	0(0.0%)	12(12.8%)	4(13.8%)	4(18.2%)	20(11.1%)
No	35(100%)	82(87.2%)	25(86.2%)	18(81.8%)	160(88.9%)
$\chi^2 = 5.960$, df = 3, p = 0.114					
Hypomenorrhea					
Yes	4(11.4%)	13(13.8%)	4(13.8%)	8(36.4%)	29(16.1%)
No	31(88.6%)	81(86.2%)	25(86.2%)	14(63.6%)	151(83.9%)
$\chi^2 = 7.722$, df = 3, p = 0.052					

DISCUSSION

Menstruation, a key physiological marker of female reproductive health, is intricately regulated by the hypothalamic–pituitary–ovarian axis. This study investigated the association between nutritional status and menstrual patterns among 180 young adult

females aged 21–25 years. The majority of participants (52.2%) were of normal weight in terms of BMI, while 19.4% were underweight, 16.1% overweight, and 12.2% obese, consistent with prior studies from India (Ganesh et al., 2015) and comparable regional data (Dars et al., 2014; Haniarti et al., 2020). Contrasting findings from Singh et al. (2008) highlighted higher undernutrition rates in certain populations, emphasizing regional and socio-economic influences on BMI.

Regarding menstrual regularity, 75.6% of participants reported regular cycles, while irregular cycles were more prevalent among obese participants (50%), suggesting a potential link between higher BMI and menstrual irregularity. This finding corroborates studies by Thapa & Shrestha (2015) and Zohora & Khanam (2024), who reported significant associations between BMI and cycle irregularities, underlining the bidirectional relationship between adiposity and reproductive hormone regulation. The majority of participants experienced normal cycle length (21–35 days) and standard period duration (3–5 days), with moderate menstrual blood flow reported in 41.1%, consistent with prior observations (Verma et al., 2020).

Menstrual disorders were also evaluated, with dysmenorrhea identified as the most common complaint (71.1%), followed by menorrhagia (32.2%). These findings align with existing literatures (Dars et al., 2014; Mohamed & Elsayed, 2016; Banu et al., 2023), highlighting dysmenorrhea as a prevalent functional reproductive disorder among young women. Less frequent menstrual syndromes, including oligomenorrhea (11.1%) and hypomenorrhea (16.1%), showed no significant association with nutritional status (BMI). Overall, nutritional status in terms of BMI did not appear to influence the presence of menstrual-associated syndromes in this cohort.

Collectively, these results suggest that while nutritional status may impact certain aspects of menstrual regularity, it does not significantly affect cycle length, period duration, blood flow, or most menstrual-associated syndromes in this population. The study emphasizes the importance of considering nutritional status along with other responsible factors when assessing menstrual health in young adult females.

CONCLUSION

In conclusion, the present study demonstrates that among young adult females, normal BMI predominates, and the average age at menarche occurs between 11 and 13 years. While higher BMI is associated with increased likelihood of menstrual irregularities, it does not significantly influence other menstrual characteristics or menstrual-associated syndromes such as dysmenorrhea, menorrhagia, oligomenorrhea, or hypomenorrhea. These findings underscore the multifactorial nature of menstrual health, indicating that factors beyond BMI may play critical roles in determining overall menstrual health among the young adult females.

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