International Journal of Comprehensive Health, Medicine, and Dentistry

IJCHMD 2026;2(1) 1-10

Original Article

Unraveling the Impact of Modifiable Behaviors on Menstrual Health in Medical Students of Nawaz Sharif Medical College Gujrat: A Cross sectional Study

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Abstract

Background:

Menstrual cycle is a sensitive indicator of women's physical and psychological health, and disturbances in its timing or flow can impair well-being, academic performance, and daily functioning. University students are especially vulnerable to menstrual irregularity due to rapidly changing lifestyle patterns, nutritional habits, stress levels, and sleep behaviors. This study aimed to determine the prevalence of menstrual irregularities among female medical students and to identify lifestyle factors associated with these disturbances.

Methods:

A cross-sectional study was conducted among female students aged 18–28 years at Nawaz Sharif Medical College in Pakistan. Participants were selected through simple random sampling and completed a structured questionnaire that assessed menstrual patterns, sleep quality, stress, physical activity, diet, and body mass index. Data were analyzed using descriptive statistics, chi-square testing, non-parametric group comparisons, correlation analysis, and binary logistic regression.

Results:

Results showed that nearly one in four students experienced irregular menstrual cycles. Higher body mass index and elevated perceived stress were significantly associated with irregularity, while regression analysis revealed that higher body mass index, poor sleep quality, a nd greater caffeine intake independently predicted menstrual disturbances. Dietary patterns and physical activity did not show significant associations after adjustment.

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Received: 7 December 2025 **Revised:** 15 January 2026 **Accepted**: 27 January 2026

Published: 31 January 2026

Conclusion:
The findings indicate that modifiable lifestyle factors play a meaningful role in menstrual health among young women. Promoting healthy weight maintenance, improving sleep hygiene, reducing excessive caffeine use, and supporting stress-management strategies may enhance menstrual regularity and overall well-being in university populations.

Keywords:
menstrual irregularity, body mass index, stress, sleep quality, caffeine intake, female students .

Introduction:

Menstrual irregularity is defined as any variation from the normal menstrual cycle length of 24–38 days, bleeding duration of 2–8 days, or regularity varying by more than 20 days between cycles, as per WHO and FIGO criteria. Any disruption in the rhythm of the menstrual cycle, whether it be oligomenorrhea, polymenorrhea, amenorrhoea, or irregular cycles, can have wide-ranging effects, from infertility to psychological distress and a reduced quality of life. The hypothalamic–pituitary–ovarian axis functions in coordination during a normal menstrual cycle [1].

Worldwide, adolescent and young adult women frequently experience irregular periods, particularly university students undergoing significant physical, psychological, and lifestyle changes. Studies have shown that menstrual irregularities are common globally and are strongly associated with sedentary lifestyles, dietary habits, elevated body mass index, and altered sleep duration [2, 3, 4, 5].

Research further indicates that both extremes of body weight—underweight and obesity—as well as irregular eating habits and sleep disturbances can disrupt hormonal balance and menstrual cycle regularity [6, 7].

Despite these findings, there is limited information from Pakistan that explores the relationship between menstrual irregularities and lifestyle factors such as stress, sleep, physical activity, and diet among female university students. This population is especially vulnerable due to lifestyle changes, irregular schedules, and academic stress. Since these factors are modifiable, understanding their association with menstrual irregularity is essential for developing targeted interventions to improve menstrual health and quality of life. Therefore, the main aims of this study are to determine the prevalence of menstrual irregularities among female medical students and to identify associated lifestyle factors such as diet, physical activity, sleep, and BMI

Methods

Study Design and Setting

This cross-sectional study was conducted at the Nawaz Sharif Medical College (UOG), Punjab, Pakistan in the month of October 2025 in which data collection, analysis, and report preparation all were completed.

Inclusion and Exclusion Criteria

Inclusion Criteria:

All the female students aged between 18–28 years, currently studying in any year of Nawaz Sharif Medical College, and who also provided informed consent were included.

Exclusion Criteria:
Students already diagnosed with known medical or gynecological disorders such as hyperthyroidism, hypothyroidism, PID, polycystic ovarian syndrome (PCOS) or endometriosis, those who were pregnant or lactating, and those using hormonal therapy or contraceptive pills were excluded from the study.

Sample Size
According to university records, the total female student population of the Nawaz Sharif Medical College, UOG is approximately 500 (73.3% of total enrollment). A Raosoft sample size calculator was used with a 95% confidence interval, 5% margin of error, and a 50% response distribution and minimum required sample size was estimated to be 218 participants, yet data were collected from 260 participants of whom 251 completed the survey yielding response rate of 96.53%.

Data Collection:
To ensure proportional representation from all students simple random sampling method was used. The official attendance registers of each class served as participant selection tool. A self-administered online questionnaire, using the composite, validated and minimally adapted tools(Sources: FIGO MQ, PSQI, IPAQ-SF, PSS-10, WHO STEPS), was created using Google Forms. Stress was assessed using the Perceived Stress Scale- 10 (PSS-10), which measures perceived stress over the previous month, with higher scores indicating greater stress. Sleep quality was assessed using the Pittsburgh Sleep Quality I ndex (PSQI), where a global score >5 indicates poor sleep quality. All tools are freely available for academic use.

Data Collection Procedure
The questionnaire link included a brief study description and informed consent at the start. Participation was voluntary, anonymous, and non-incentivized. Data were collected over 2 weeks and stored in a p assword-protected file accessible only to the principal investigator. Of 260 invited participants, 251 completed the questionnaire, resulting in a response rate of 96.53%. A pilot test was performed on 25 participants before starting the data collection to check the face validity of Questionnaire. The results were discussed with senior faculty and necessary modifications were made in the questionnaire.

Data Analysis
The primary outcome variable was menstrual regularity, categorized as regular or irregular based on FIGO criteria. Data were analyzed in SPSS version 21 using descriptive statistics such as frequencies, percentages, means, and standard deviations and inferential statistics such as Chi-square tests were used to assess associations between menstrual irregularity and categorical variables (BMI categories, stress levels, sleep quality, dietary habits, and physical activity levels). Mann–Whitney U tests were applied for non-normally distributed continuous variables. Binary logistic regression was performed to identify independent predictors of menstrual irregularity A p-value of <0.05 was considered statistically significant.

Ethical Considerations
The ethical approval for this study was granted by the Institutional Review board (IRB) of the Nawaz Sharif Medical College, Gujrat. All the participants provided informed consent online as the first step of questionnaire, while confidentiality and anonymity were strictly maintained. Participants were free to withdraw from the study at any point.

Results

Participant Characteristics

251 female students were selected for this study. The mean age of participants was 21.32 ± 1.74 years, and the mean age at menarche was calculated to be 13.04 ± 1.48 years. The majority of participants were urban residents (79.3%) and unmarried (96.8%). Regarding body mass index (BMI), 58.2% of the participants had a normal BMI (18.5–24.9 kg/m²), 21.1% were underweight, 17.5% overweight, and 3.2% obese. The mean BMI was 21.48 ± 3.98 kg/m² among students with regular menstrual cycles and 31.30 ± 4.12 kg/m² among those with irregular menstrual cycles. Normality testing showed that age and age at menarche were approximately normally distributed; therefore, these variables are presented as mean ± standard deviation.

Menstrual and Reproductive Characteristics

77.3% (n = 194) of participants reported regular menstrual cycles, while 22.7% (n = 57) reported irregular ones. Moderate menstrual flow was reported by the majority of respondents (76.1%), followed by heavy flow (14.7%) and light flow (9.2%). With 93.1% of participants reporting dysmenorrhea 40.2% moderate, 39.8% mild, and 13.1% severe contributing to college absenteeism. 23.1% reported missing or absent periods during the previous six months.

Lifestyle and Behavioral Factors

44.2% of participants said they frequently skipped breakfast, while more than half (55.8%) said they never skipped breakfast. The majority of participants (57.0%) reported eating fast food one to two times per week, and 66.9% said they drank one to two cups of caffeinated beverages (energy drinks, tea, or coffee) per day. In terms of physical activity, 1.7% highly active, 28.9% do low physical activity, and 69.4% were moderately active.

Stress and Sleep Quality

The mean Perceived Stress Score (PSS) was 2.17 ± 0.65, with 54.2% experiencing moderate stress, 31.5% high stress, and 14.3% low stress. The mean Pittsburgh Sleep Quality (PSQ) score was 4.34 ± 2.03, indicating overall fair sleep quality.

Factors Associated with Menstrual Irregularity

BMI was significantly associated with menstrual irregularity ($\chi^2 = 9.10$, df = 3, $p = 0.028$), as was perceived stress level ($\chi^2 = 6.31$, df = 2, $p = 0.043$). BMI ($p = 0.028$) and perceived stress scores ($p = 0.035$) differed significantly between students with regular and irregular cycles, while no significant differences were observed for other variables ($p > 0.05$). Spearman's rank correlation revealed a significant positive correlation between perceived stress and poor sleep quality ($\rho = 0.189$, $p = 0.003$*) and a negative correlation between perceived stress and physical activity (MET) ($\rho = –0.129$, $p = 0.046$*).
No significant correlation was found between BMI and either stress, sleep, or activity levels.

Regression Analysis

A binary logistic regression was performed to identify independent factors associated with menstrual irregularity among female medical students. The multivariable logistic regression model included age, body mass index, perceived stress score, sleep quality, physical activity level, dietary variables (meal skipping, fruit and vegetable intake), caffeine intake, year of study, and residence. The overall model was statistically significant ($\chi^2 = 24.56$, df = 9, $p = 0.003$), indicating that the included variables collectively distinguished between students with regular and irregular menstrual cycles.

.The model accounted for 13.8% of the variance in menstrual regularity (Nagelkerke $R^2 = 0.138$) and correctly classified 79.7% of the cases.After adjustment, body mass index ($p = 0.019$), sleep quality ($p = 0.046$), and caffeine intake ($p = 0.031$) were independently associated with menstrual irregularity. Perceived stress did not reach statistical significance in the multivariable model ($p = 0.097$), and physical activity was not associated with menstrual irregularity ($p > 0.05$).
No statistically significant associations were observed for dietary variables or physical activity in the multivariable model ($p > 0.05$).

Discussion:

In the present study, the prevalence of menstrual irregularities among female university students was 22.7%. Although this rate is somewhat lower than that reported in several local and international studies, it remains clinically significant. Studies among college/university-aged women have reported prevalence in the range of 32–37 % for irregular cycles or broader menstrual disorders [1,2]. The comparatively lower prevalence observed in our study may be explained by the fact that the mean BMI of participants was within the normal range (23.71 kg/m²). Since menstrual irregularities tend to increase with deviations of BMI from normal range(18.5-24.9), the normal average BMI in our sample likely contributed to the reduced prevalence. Nevertheless, the findings highlight that menstrual disturbances remain a common and important health concern among young women in this population. While 93.1% of the participants with dysmenorrhea reported their pain as mild to severe, which is consistent with the findings of other local as well as international studies reporting dysmenorrhea between 83-87% [3,4].

According to our analysis, body-mass index (BMI), perceived stress, sleep quality and caffeine intake were significant indicators of irregular menstruation. 58.2% of participants had a normal BMI, with the remaining participants being either underweight or overweight. Higher BMI was significantly associated with irregular menstruation, as evidenced by the mean BMI of 21.48 kg/m² among those with regular cycles and 31.30 kg/m² among those with irregular cycles. The logistic-regression results indicated that each unit increase in BMI was associated with a substantial increase in odds of menstrual irregularity. Similar associations have been reported in previous research as one large cohort found obese women (BMI ≥ 25 kg/m²) had significantly greater odds of cycle irregularity compared to normal weight peers [5].

The second significant predictor of irregular menstrual cycles was elevated perceived stress. The logistic regression indicated that students reporting higher levels of perceived stress were approximately twice as likely to experience irregular cycles. Stress has also been shown to correlate strongly with irregular cycles: a study in Indian medical students found higher mean Perceived Stress Scale (PSS) scores among those with menstrual disturbances [6]. Sleep quality also emerged as a significant predictor as students reporting poor sleep had 1.6 times higher odds of irregular cycles (OR = 1.615, 95% CI: 1.009–2.584, $p = 0.046$). This is consistent with the established literature; for example, Fitriani et al. found that poor sleep quality is a significant risk factor for menstrual cycle disorders among adolescents (adjusted odds for poor sleep ~2.05) [9].Caffeine intake (≥3 cups/day) also emerged as an independent predictor, with students c onsuming higher amounts are having 4.78 times higher odds of irregular cycles (OR = 4.778, 95% CI: 1.151–19.83, $p = 0.031$), a fact already proven in previous literature [10].

The biological plausibility for these associations is well established. Elevated adiposity influences the hypothalamic–pituitary–ovarian (HPO) axis by increased peripheral conversion of androgens to estrogens, altered leptin signalling, insulin-resistance driven changes in sex-hormone-binding globulin, and disruptions in gonadotropin-releasing hormone pulsatility [7]. Similarly, psychosocial stress activates the hypothalamic–pituitary–adrenal (HPA) axis, elevating cortisol levels, which may suppress gonadotropin release and alter ovulatory patterns [8]. It is possible that larger sample sizes or more precise measurement of physical activity

and sleep (e.g., device-based monitoring) might reveal stronger associations in future studies.
It's interesting that, in the multivariate analysis, direct measures dietary habits, such as frequent fast-food consumption, and meal skipping, did not emerge as independent predictors. A possible reason could be that eating patterns play a notable role in the state of chronic energy balance, which is ultimately represented by the BMI variable. If a student skips meals and eats fast food frequently, the primary physiological consequence that disrupts the endocrine system is the long-term metabolic consequence (adiposity/BMI), not the single act of skipping breakfast. In this context, BMI acts as the major pathway through which these dietary habits exert their influence, rather not directly [11].
From a public-health perspective, modifiable risk factors as higher BMI, perceived stress, sleep quality and caffeine intake, provides promising and actionable targets for preventive interventions in a university setting where 13.1% are reporting absenteeism from classes due to dysmenorrhea.

- Programs aimed at maintaining healthy body weight through balanced nutrition and regular physical activity, improving sleep hygiene, and reducing excessive caffeine consumption may help decrease the prevalence of menstrual irregularities.
- Integrating stress-management programs (for example mindfulness, cognitive behavioral techniques), promoting healthy body-weight and lean-body-composition maintenance (via balanced nutrition and regular physical activity), and educating students about menstrual health may contribute to fewer disturbances in menstrual regularity and improved quality of life and academic performance.

Limitations:

- The cross-sectional design of this study limits the ability to establish causality between menstrual irregularities and associated factors.
- Self-reported data on menstrual history, lifestyle behaviors, stress, and physical activity may introduce recall or social-desirability bias.
- Lack of objective hormonal, biochemical, or cortisol measurements restricts verification of underlying physiological mechanisms.
- Dietary assessment was limited in scope and may have been affected by reporting and measurement inaccuracies.

Conclusion:

Of the female students in this sample, approximately one in five said that their periods were irregular. Strong relationships between higher BMI and higher perceived stress indicate that both physical and psychological factors affect menstrual health. Given that these are modifiable factors, there is a dire need for integrated interventions in university settings. Students should be educated on the significant role of healthy dietary choices and physical exercise in safeguarding menstrual health. Interventions such as nutritional guidance programs and stress management workshops should be included.
In addition to increasing menstrual regularity, such programs may enhance young women's general wellbeing and academic achievement. These programs may prove effective not only in increasing menstrual regularity, but also enhancing general wellbeing, boosting academic performance and improving mental health in young female students.

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Table 1. Data Collection Tools

Domain	Tool Used
Menstrual patterns	FIGO MQ (8)
Sleep Quality	PSQI (short form) (9)
Physical Activity	IPAQ-SF (10)
Stress Level	PSS-10 (11)
Dietary Habits	WHO STEPs (12)

Table 2. Participants' Characteristics (n = 251)

Variable	Category / Mean ± SD	n (%)
Age (years)	21.32 ± 1.74	—
BMI (kg/m^2)	23.71	—
Residence	Urban	199 (79.3)
	Rural	52 (20.7)
Marital status	Unmarried	243 (96.8)
	Married	8 (3.2)
Year of study	1st year	25 (10.0)
	2nd year	80 (31.9)
	3rd year	56 (22.3)
	4th year	61 (24.3)
	Final year	29 (11.6)
Menstrual regularity	Regular	194 (77.3)
	Irregular	57 (22.7)
Flow pattern	Light	23 (9.2)
	Moderate	191 (76.1)
	Heavy	37 (14.7)
Dysmenorrhea	None	17 (6.8)
	Mild (no interference)	100 (39.8)
	Moderate (requires rest/medication)	101 (40.2)

Table 3. Comparison of Clinical and Lifestyle Variables Between Students With Regular and Irregular Menstrual Cycles

Variable	U Statistic	p Value	Significance
Total PSS	4516.5	**0.0347**	**Significant**
Physical Activity	5055.0	0.1060	Not Significant
BMI	4851.0	**0.028**	**Significant**
Fast Food	5742.5	0.4775	Not Significant
Fruit-Vegetables	5007.0	0.1862	Not Significant
Caffeine Intake	5194.0	0.3694	Not Significant
Skip Meals	5806.0	0.5048	Not Significant

Table 4. Binary Logistic Regression Analysis for Predictors of Menstrual Irregularity (n=251)

The multivariable model included age, BMI, perceived stress score, sleep quality, physical activity level, dietary variables, caffeine intake, year of study, and residence.

Variable	B (Coefficient)	SE	Wald X^2	p-value	Odds Ratio (OR)	95% CI for OR
Age (years)	-0.126	0.129	0.953	0.329	0.882	0.684 - 1.136
BMI (kg/m2)	0.265	0.263	5.524	0.019*	1.303	1.045 1.625
Perceived Stress (PSS)	0.523	0.316	2.750	0.097	1.688	0.911 - - 3.126
Sleep Quality (PSQ_CAT)	0.479	0.290	3.994	0.046*	1.615	1.009 - 2.584
Physical Activity (MET)	-0.058	0.388	0.022	0.881	0.944	0.440 - 2.027
Year of Study	0.155	0.192	0.648	0.421	1.167	0.798 - 1.706
Residence (Urban)	-0.793	0.527	2.265	0.132	0.452	0.158 - 1.293
Skip Meals (Yes)	0.155	0.381	0.167	0.683	1.168	0.557 - - 2.451
Caffeine Intake (>3 cups/day)	1.564	0.719	4.732	0.031*	4.778	1.151 - 19.83
Fruit & Vegetable Servings	0.223	0.483	0.223	0.636	1.250	0.483 - 3.243