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Original Article

DOI: 10.53389/RJAHS.2026050113

Association of Lifestyle Factors with Menstrual Irregularities Among Female University Students

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Author`s Contribution

KT, HA Conception and design, UA, AI Collection and assembly of data, MA, HA, IA Analysis and interpretation of the data, Statistical expertise, MI, HA Final approval and guarantor of the article

Article Info.

Received: Feb 5, 2026

Acceptance: April 10, 2026

Conflict of Interest: None

Funding Sources: None

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ABSTRACT

Background: Menstrual irregularities are a prevalent concern among females of reproductive age, often causing anxiety, and potentially impacting their physical, psychological and social health along with the quality of life. The global prevalence of irregular menstrual cycle is reported to range between 14% and 35%, depending on the geographical region and diagnostic criteria.

Aim and Objective: While recent studies have examined physical activity, smoking, nutrition and sleep in relation to menstrual health, there is limited research on how they all together influence menstrual irregularities in female university students in Pakistan. Studying these factors together could offer a more extensive understanding of lifestyle patterns related to menstrual health.

To determine the association between lifestyle factors and menstrual irregularities among female university students aged 18 to 26 years, a descriptive cross-sectional research design was employed.

Methodology: This research was conducted at Ibadat International University Islamabad comprising of a sample size of (n=350) using random sampling technique. Two tools were used such as "lifestyle pattern associated with menstrual irregularities questionnaire" and "sleep quality scale".

Results: A high prevalence of menstrual irregularities was observed among female students, with dysmenorrhea and premenstrual syndrome being the most common. Significant associations were found between menstrual irregularities and BMI, dietary frequency, sleep duration, and dietary habits ($p<0.05$). Chi-square analysis identified irregular breakfast intake ($p=0.0001$) and difficulty sleeping during menstruation ($p=0.008$) as the strongest risk factors

Conclusion: The finding of this study concluded that menstrual irregularities were associated with a variety of lifestyle patterns. Furthermore, there was a statistically significant correlation between multiple menstrual irregularities and sleep, body mass index and skipping breakfast and dinner. University should put in place health education programs to increase awareness of how lifestyle factors. affect menstrual health. It is important to encourage the female to follow the balanced diet, practice regular exercise and obtain adequate sleep.

Promoting good sleep pattern and frequent exercise can help to promote the hormonal balance and reduce premenstrual syndrome symptoms. To better understand the underlying cause of menstrual irregularities, future research should use longitudinal design and explore other factors of stress and hormonal level.

Key words: Lifestyle patterns, Menstruation, University students, Women's health.

Introduction

The menstrual cycle, usually ranging from 21 to 35 days, is governed by hormonal communication between the brain and ovaries and divided into four phases: menstrual, follicular, ovulatory, and luteal. Balanced activity of estrogen, progesterone, follicle-stimulating hormone (FSH), and luteinizing hormone (LH) ensure normal function, while disturbances can

cause irregular or absent periods. Such irregularities are associated with infertility, reduced bone strength, and higher risk of metabolic problems.[1] Elevated body mass index (BMI) often contributes by increasing insulin and androgen levels and lowering sex hormone–binding globulin (SHBG), while obesity combined with polycystic metabolic ovary syndrome (PMOS) further disrupts hormonal control.[2]

Nutrition strongly influences reproductive health, diets rich in processed sugars and refined foods aggravate insulin resistance, while deficiencies in vitamins and minerals such as vitamin D, magnesium, and zinc impair hormone metabolism. In contrast, balanced diets containing lean protein, fiber, omega-3 fatty acids, and antioxidants support hormone regulation and ease menstrual discomfort.[3]

Sleep is another major determinant leading to menstrual irregularities, as poor or insufficient sleep disturbs circadian rhythms, increases cortisol, and interferes with GnRH release, all of which can prevent ovulation and cause cycle irregularity. Women with inadequate rest often report heavier bleeding, more painful periods, and worse premenstrual symptoms. Menorrhagia, the most common disorder, is further intensified when poor sleep coincides with unhealthy eating, creating a cycle of hormonal imbalance, nutrient deficiency, and emotional stress.[4]

This study examines how dietary choices, sleep quality, and BMI influence menstrual patterns among female university students aged 18–26 years. Although limited to a single institution, self-reported data, and a short time frame, the research emphasizes the importance of lifestyle in reproductive health. Findings may guide awareness campaigns and health promotion programs that encourage proper nutrition and sleep to improve menstrual well-being.[5]

Menstrual irregularities can arise from lifestyle factors such as inadequate sleep and unhealthy eating patterns. Among these irregularities, menorrhagia defined as excessive menstrual blood loss greater than 80 mL per cycle or longer than seven days is the most common type of menstrual irregularity.[6] It may lead to iron deficiency anemia, weakness, and reduced quality of life. Though structural causes like fibroids and hormonal disorders are most commonly elicited in etiology, lifestyle factors in particular sleep and dietary patterns have increasingly been recognized for their significant roles in both development and persistence of this condition. Poor sleep in particular, durations below six hours is found to disrupt the hypothalamic-pituitary-ovarian (HPO) axis that determines the regulation of reproductive hormones. Its disruption results in hormonal imbalances in which there is decreased progesterone as well as changes in melatonin secretion; these imbalances can be associated with heavier as well as more irregular patterns of menstrual bleeding.[7] It is seen that women with insufficient sleep were significantly more likely to have heavy bleeding and prolonged cycles compared to those with adequate rest.[8]

Meanwhile, diets rich in whole grains, lean proteins, fruits, and vegetables particularly those high in antioxidant and anti-inflammatory nutrients may help regulate hormone levels and also reduce menstrual blood loss.[9] The interaction between poor sleep and unhealthy diet sets up a bad cycle that not only throws hormones out of balance but makes emotional symptoms and general menstrual health results worse for women with menorrhagia.[5]

Materials and Methods

Design: A descriptive cross sectional research design was utilized to conduct this study at Ibadat International University Islamabad. This study design involved the collection of data on the presence of one or more variables of interest, whether exposure or outcome as they exist in a defined population at one time.

Subjects: The sample size of 350 participants was determined using Slovin's formula and selected through a random sampling technique, and met the following inclusion criteria:

- Women aged 18 to 26 years.
- Didn't take any hormonal therapy.

Exclusion Criteria

- Women who are pregnant or breastfeeding.
- Women with the history of blood clotting disorder
- Women with primary amenorrhea or PCOS or other medical conditions

Tools: The study used three tools for data collection:

Tool I: A structured interview schedule. It was designed by the researcher after reviewing related literature. It encompassed two major parts:

Part I: Demographic data which included age, academic year, residence, number of family members, and family income. **Part II:** Menstrual history which consisted of age at menarche, interval, duration, pattern, receiving information about menstruation, presence and severity of different menstrual irregularities such as premenstrual syndrome, Dysmenorrhea, Menorrhagia.

Tool II: Factors associated with menstrual irregularities questionnaire. This tool was designed by the researcher after reviewing related literature. It encompassed four major parts:

Part I: Anthropometric measurements including weight and height to calculate body mass index (BMI) by using this formula

"a person's weight in Kilograms divided by the square of the person's height in meters (kg /m^2)". Based on the calculated BMI, the study participants were classified as underweight (BMI <18.5), normal weight (BMI18.5–24.9), overweight (BMI 25–29.9), and obese (BMI≥ 30).[10]

Part II: Dietary habits which included the number of meals /days, main meals during the day and frequency of intake of protein, carbohydrates, fat, minerals, salt rich foods, candy foods, spicy foods.[11]

Part III: Physical activity levels which is composed of questions about performing exercise, duration and pattern of practicing exercises.

Part IV: Smoking consisted of data about smoking practice, and duration of exposure to smoking.

Tool III: The Sleep Quality Scale (SQS). Classic sleep quality assessment instrument influencing the menstrual cycle was used. It has 28 item scale that asked about the rest and sleep including times of comfort, duration of sleep, difficulty falling asleep during menstruation, waking up during sleep, and appetite status due to poor sleep.[12]

Methods

An official letter from The Dean of Faculty of Allied health and biological science was directed to the heads of departments of Faculty of Allied health to inform them about the study aim and to get their permission to conduct the study at the university level. Tool I and Tool II were developed by the researcher after revising relevant literature. Validity of the study tools was tested by a jury consisting of a group of experts in the field of human nutrition and dietetics. Reliability of Tool III was conducted by Yi, and colleagues found an internal consistency of .92 and a test-retest reliability of .81.

Data Collection:

The data was collected using Tool I, II & III over a period of 3 months.

Ethical considerations:

The research approval was obtained from The Ethical Committee of Ibadat International University Islamabad (Ref No IIUI/ISB/AHBS/DN/FYP/01) prior to the start of the study. A written informed consent was obtained from the study subjects to be included in the study after an explanation of the aim of the study and participants were assured that the collected data would be used only for the study purposes. Study subjects had the right to refuse to participate or withdraw from the study at any time. Confidentiality and privacy were maintained during the study.

Statistical Analysis:

Data was fed to the computer and analyzed using SPSS version 26. The dataset was first summarized using descriptive statistics. In order to calculate the frequencies, percentages, means, and standard deviations.

Furthermore, a Pearson correlation analysis was conducted to explore the relationship between selected continuous variables. To explore the connection between categorical variables, a Chi-square test was applied. Significance of the results obtained was judged at the 5% level.

Results

The demographic analysis of the participants showed that the sample primarily consists of (N=350) young female university students with a majority (55.4%) of participants were aged18–20 years. Based on BMI, the majority (44%) of participants were underweighted. In terms of education, most (97.1%) were enrolled in bachelor's degree programs, more than half (55.7%) belonged to the middle class, living in nuclear families (64.3%). Furthermore, the vast majority of participants (73.4%) resided in urban areas (see Table1:Socio demographic characteristics of participants). This demographic summary provides essential context for understanding the health behaviors and lifestyle factors observed in the research population.

Table 2: Socio demographic characteristics of participants

Variables	Frequency (N=350)	Percent%
Age		
18-20	194	55.4
21-23	141	40.3
24-26	15	4.3
BMI		
<18.5	154	44
18.5-24.9	91	26
25.0-29.9	99	28.3
30.0-34.9	5	1.4
>40	1	3
Educational status		
Associate	7	2
Bachelor	340	97.1
Master	3	0.9
Economic status		
Lower class	64	18.3
Middle class	195	55.7
Upper class	91	26
Family member		
Joined	125	35.7
Nuclear	225	64.3
Residences status		
Rural	93	26.6
Urban	257	73.4

The correlation analysis gives out a strong and significant positive association between weight and BMI ($r = 0.725$, $p <$

0.01), meaning that when weight rises so does BMI also increases. A statistical correlation was found between height and BMI (*r = 0.01, p < 0.01*), suggesting a nominal relationship. Likewise, D2 (skipping dinner) also exhibited a weak positive correlation (r = 0.05). Moderately but still weak positive correlation was observed between BMI and D4 (eat plant protein) (r = 0.141, p < 0.01), encourage a statistically significant relationship. A significant negative correlation was seen between D8 (consume caffeine products) and M1(take medication during periods) (r = –0.185, p < 0.01), suggesting that individuals following dietary pattern may encounter more irregularities in menstrual cycle length or flow. M6 (anxiety /tension) also showed a positive correlation with D11(eat fast food) (r = 0.118, p < 0.05) and a negative correlation with D12 (eat homemade food) (r = -0.121, p < 0.05), reflecting a mixed dietary effect.

Additionally, M5 (experience anger/irritability) was significantly positively associated with D13(eat junk foods) (r = 0.163, p < 0.01), explaining a possible link between certain dietary habits and worsening PMS symptoms. M10 (decrease interest in home activities) shows an average and significant positive correlation with S5 (getting difficulty out of bed) (r = 0.306, p < 0.01), suggesting that increased PMS symptoms are linked to poorer sleep satisfaction. Similarly, M10 **(**decrease interest in home activities) also correlates with S1**(**difficulty falling asleep during menstrual cycle) **(**r = 0.246, p < 0.01) and S2 (r = 0.167, p < 0.01), indicating a relationship between PMS intensity and late bedtime or irregular sleep timing.

The present study found a notable relationship between dietary patterns and menstrual irregularities among participants. Those who rarely had breakfast reported higher prevalence of premenstrual syndrome (100%), dysmenorrhea (100%), and menorrhagia (181.67%), showing strong associations (*p* = .000, *p* = .001, *p* = .021 respectively) (see figure 1).

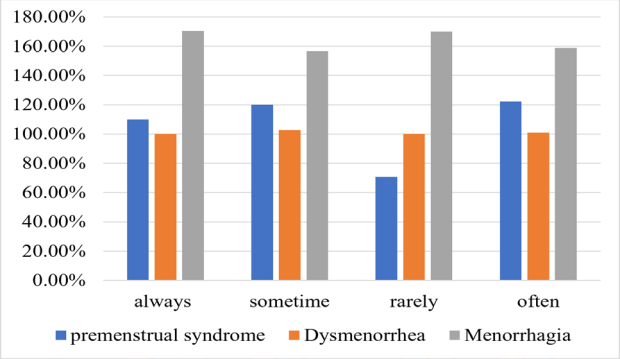

Figure 1: Relation of skipping breakfast with menstrual irregularities.

Similarly, individuals who rarely had dinner also reported high percentages of PMS (107.59%), dysmenorrhea (100%), and menorrhagia (170%), with significant union (*p* = .000, *p* = .0001, *p* = .018) (see figure 2).

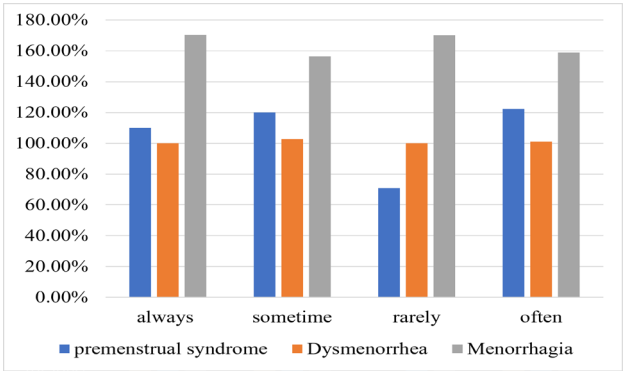

Figure 2: Relation of skipping dinner with menstrual irregularities.

Caffeine intake also illustrates significance for dysmenorrhea (100%) and menorrhagia (131.37%) (*p* = .001, *p* = .002) (see figure 3).

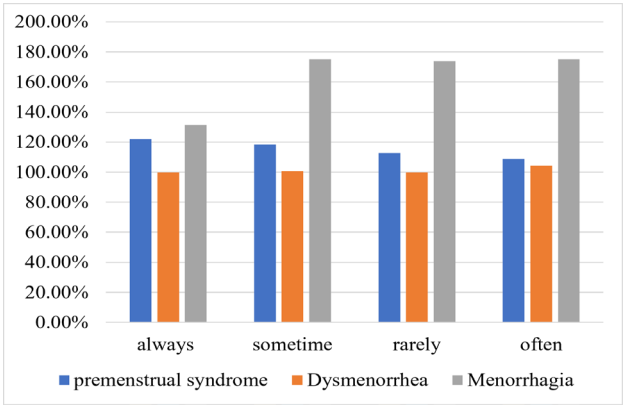

Figure 3: Relation of caffeine product with menstrual irregularities.

Fast food consumption was remarkably related to PMS (111.40%) (p = .008) (see figure 4).

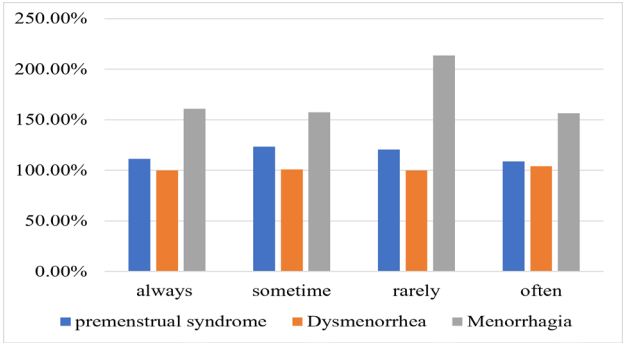

Figure 4: Relation of fast food with menstrual irregularities.

The dairy product consumption was highly significant for PMS (108.70%) and dysmenorrhea (100%) (p = .0001, p = .0001) (see figure 5).

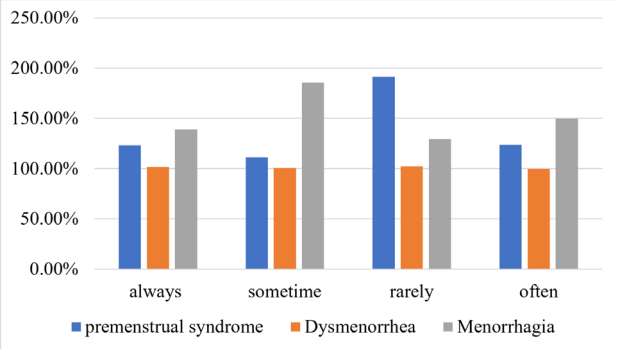

Figure 5: Relation of diary product with menstrual irregularities.

The findings of this study described that sleep disturbances were significantly associated with menstrual irregularities. Participants who reported always experiencing difficulty falling asleep showed a high prevalence of PMS (110.91%) and dysmenorrhea (100%), with a statistically significant association observed for PMS (p = .008). Similarly, waking up frequently during sleep was linked to elevated rates of PMS (105.71%) and dysmenorrhea (100%), with both showing significant associations (p = .003, p = .000, respectively). A strong well-built association was also observed between sleep sufficiency and all three menstrual problems. Those who felt they were never obtaining adequate sleep reported the highest levels of menorrhagia (201.56%), dysmenorrhea (100%), and PMS (107.50%) — all with significant associations (p = .000, p = .010, p = .008) (see figure 6).

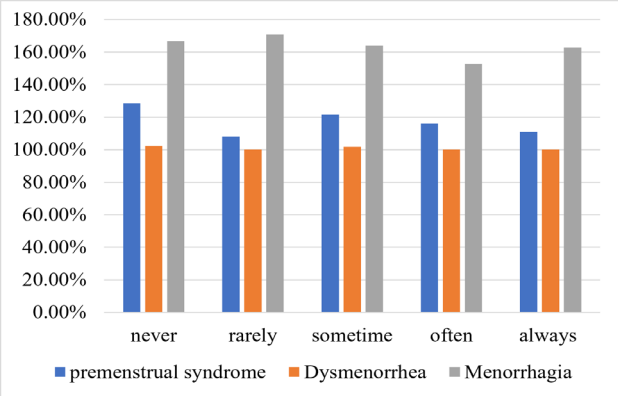

Figure 6: Relation of difficult falling in sleep with menstrual irregularities.

The data disclosed notable association between lifestyle factors and menstrual irregularities. Individuals who scarcely exercised reported higher prevalence of PMS (110.90%) and dysmenorrhea (101.17%), with chi-square values showing significant relationships (p = .008, p = .008, respectively) (see figure 7).

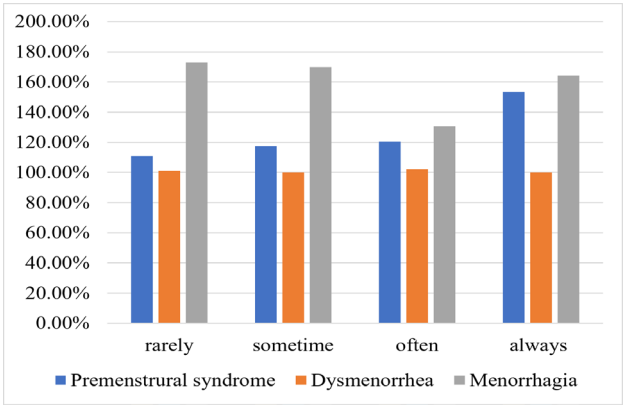

Figure 7: Relation of regular exercise with menstrual irregularities.

Discussion

The present study found significant associations between dietary patterns and menstrual irregularities. Breakfast and dinner frequency were significantly associated with PMS, dysmenorrhea, and menorrhagia, while the number of meals per day was associated with PMS. Plant-protein intake was significantly associated with all three menstrual outcomes. Fast-food consumption was associated with PMS, whereas junk-food consumption was associated with dysmenorrhea and menorrhagia. These findings are partly consistent with a study that demonstrated that although ultra-processed food consumption was not significantly associated with menstrual irregularities, but higher consumption was related to greater visceral fat.[13] Another cross-sectional study of 432 female university students reported that higher ultra-processed food consumption was significantly associated with greater PMS symptom severity. The differences may reflect variations in dietary assessment, food categories, and study populations.[14]

The significant association between breakfast frequency and menstrual outcomes in the present study is supported by a previous study that revealed that breakfast skipping was common among university students and was associated with several lifestyle and sociodemographic characteristics.[15] More directly, the research found among 3,110 female college students that breakfast skipping was significantly associated with menstrual pain and menstrual-related problems. Although this study was published before 2025, its population closely resembles the present study and provides relevant evidence for comparison.[16]

Sleep disturbances were significantly associated with menstrual symptoms in the present study. Difficulty falling asleep was

associated with PMS, waking during sleep was associated with PMS and dysmenorrhea, and perceived insufficient sleep was significantly associated with PMS, dysmenorrhea, and menorrhagia. These findings are strongly supported by a study conducted on 254 female undergraduate students in the UAE that found moderate and severe sleep problems were significantly associated with severe dysmenorrhea after adjustment for age, BMI, socioeconomic status, and stress. Their findings particularly identified sleep disturbance as an independent predictor of severe dysmenorrhea.[17]

Physical activity was significantly associated with PMS and dysmenorrhea in the present study, while no significant association was observed with menorrhagia. The negative correlation between exercise and PMS symptoms ($r = -0.213$, $p < .01$) further suggests that participants reporting more regular exercise tended to have fewer PMS symptoms. This is consistent with the randomized clinical trial, which compared aerobic exercise and yoga among women with primary dysmenorrhea and evaluated menstrual pain, uterine blood flow, psychological symptoms, and quality of life. Their findings support exercise as a potentially beneficial non-pharmacological approach to dysmenorrhea.[18]

Smoking was significantly associated with PMS and menorrhagia but not dysmenorrhea in the present study. Although recent original research specifically examining smoking and these three outcomes among university students is limited, previous observational research has reported associations between cigarette smoking and menstrual symptoms. The difference in the dysmenorrhea finding may be related to the small number of smokers in the present sample and differences in smoking exposure and population characteristics. Therefore, the present findings should be interpreted as associations rather than causal effects.

The correlation analysis also showed a strong positive correlation between weight and BMI ($r = 0.725$, $p < .01$). Weak but significant associations were observed between plant-protein intake and BMI ($r = 0.141$, $p < .01$), caffeine intake and medication use during menstruation ($r = -0.185$, $p < .01$), and exercise and PMS symptoms ($r = -0.213$, $p < .01$). These findings indicate that lifestyle factors may be interrelated and should be considered collectively when addressing menstrual health.

Overall, the present findings suggest that dietary behaviors, sleep quality, physical activity, and smoking are associated with menstrual symptoms among university students. However, because the study was cross-sectional, temporal relationships and causality cannot be established. Further longitudinal and intervention studies are needed to determine whether modification of these lifestyle factors can improve menstrual health.

Recommendations

Recommendations for the Health Directorates:

- Provide continuous training for healthcare providers on menstrual health and evidence-based management of menstrual irregularities.
- Expand telehealth services to improve access to menstrual health consultations, particularly in underserved areas.

Recommendations for Female Students:

- Encourage menstrual tracking through diaries or digital applications.
- Promote stress-management activities, including mindfulness, relaxation, meditation, and peer support.
- Encourage regular health check-ups and healthy lifestyle practices, including proper nutrition, adequate sleep, and regular physical activity.

Recommendations for Further Research:

- Conduct longitudinal or prospective studies to establish causal relationships between stress, lifestyle factors, and menstrual irregularities.
- Include larger and more diverse samples and assess factors such as stress, hormonal levels, sleep, nutrition, and BMI.
- Use qualitative research to explore students' experiences and perceptions of menstrual health.

Conclusion

The findings of this study concluded that, the most common menstrual irregularities among female students were dysmenorrhea and PMS. The unhealthy lifestyle such as eating habits, poor sleep quality, lack of physical activity and smoking are significantly associated with menstrual irregularities among university going female 18 to 26 years. Encouraging female students to follow the balanced diet, practice regular exercise and obtaining adequate sleep can help to promote the hormonal balance and reduce PMS symptoms.

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