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Menstrual Irregularities and Lifestyle Factors in Young Women: A Cross-Sectional Analysis

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ABSTRACT

Background: Menstrual irregularities are common among young women and are affected by modifiable lifestyle factors, including diet, physical activity, stress, and sleep quality. These disorders can indicate underlying endocrine dysregulation and affect reproductive and overall health. The purpose of this study was to estimate the prevalence of menstrual irregularities and their association with important lifestyle factors in young women.

Methods: In this cross-sectional study (January and June 2022) stratified random sampling was used to recruit 400 female students. Menstrual irregularity was a cycle length of <21 days, >35 days, or >7 days change in the preceding six months. Sociodemographic, menstrual history, eating patterns, physical activity, sleep, and perceived stress data were recorded through a validated structured questionnaire. Independent t-test, chi-square, and multivariate logistic regression were used for data analysis. P< 0.05 was considered statistically significant.

Results: Menstrual irregularities were observed at the rate of 146 (36.5%). Disrupted cycles had a significant relation with increased stress (68 (46.6%) vs. 62 (24.4%), p < 0.001; AOR = 2.16, CI: 1.46-3.19), lack of physical activity (85 (58.2%) vs. 98 (38.6%), p < 0.001; AOR = 1.73, CI: 1.16-2.58), and inadequate sleep (72 (49.3%) vs. 89 (35.0%), p = 0.006; AOR = 1.61, CI:1.07-2.43). There was no significant association of breakfast skipping, fast-food intake, BMI, and chronic illness.

Conclusion: Menstrual irregularities are common in young women and are linked to stress, physical inactivity, and sleep disturbances. Addressing these factors may improve menstrual and reproductive outcomes.

Keywords: Menstruation Disturbances, Stress, Psychological, Exercise, Sleep Deprivation, Menstrual Cycle.
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INTRODUCTION

Menstrual irregularities are frequent in adolescents and are a major cause of gynecological visits and reduced quality of life [1]. These disruptions are dependent on numerous changeable lifestyle factors, including psychosocial stress, physical activity, sleep, and eating habits, which interact with endocrine and metabolic pathways and reshape the timing of cycles and ovulation [2]. The effect of psychological stress on the hypothalamus-pituitary-gonadal axis occurs in quantifiable measures and is reliably linked to ovulatory dysfunction and abnormal menstrual patterns [3].

There is a complex association between physical activity and menstrual regularity, with both low and high levels of activity being associated with cycle disturbances in recent cohort studies [4]. The duration and quality of sleep are relevant factors for reproductive hormones and have been correlated with changes in cycle characteristics [5]. The impact on irregular menses, especially among young females, can be attributed to adiposity due to insulin resistance and androgenicity [6].

However, only a few recent studies have comprehensively evaluated multiple lifestyle exposures with sufficient multivariable adjustment in well-powered samples [7]. Evidence on cohorts of South Asian students is scarce despite regional variations in diet, stressors, and health services that may alter relationships [8]. The investigation of modifiable factors in this population is actionable, as lifestyle interventions are promising in menstrual symptoms regulation and associated outcomes [9]. These relationships also affect long-term reproductive health and risk of subfertility, emphasizing the public-health significance of early prevention [10].

The purpose of this study was to determine the prevalence of menstrual irregularities among young women. Additionally, it aimed to investigate the individual associations between stress, physical activity, sleep, dietary habits, and irregular cycles.

METHODS

This cross-sectional study (January and June 2022) aimed to identify the determinants of menstrual irregularities and their associations with modifiable lifestyle factors in young women at SIMS Lahore (135-P-I/SIMS/SHL). A multistage stratified random sampling was used to select the female students proportionally, and written informed consent was obtained from all participants. OpenEpi version 3.0.0 (released 2013, Atlanta, GA, USA) was used to determine the sample size of 400 students based on the expected prevalence of 36.9%, a 95% confidence level, and a 5% margin of error, with a 10% addition for non-response [11]. The inclusion criteria were female students aged between 18 and 25 years, currently enrolled, and capable of completing the questionnaire in English. The exclusion

criteria involved pregnancy, lactation, hormonal contraceptive or therapeutic usage in the three months, and diagnosed polycystic ovary syndrome (PCOS) or thyroid disease under active treatment.

The participants were categorized into two groups based on regular cycles (n = 254) and irregular cycles (n = 146) as per the International Federation of Gynecology and Obstetrics (FIGO) [12]. Measured variables included socio-demographics (age, BMI, family background, chronic disease) and lifestyle factors (stress, physical activity, sleep duration, breakfast omission, fast-food consumption). A structured, self-administered survey was used to collect data by trained research assistants.

SPSS version 26.0 (released 2019, IBM Corp., Armonk, NY) was utilized to analyze the data. Chi-square tests compared categorical variables and independent-samples t-tests compared continuous ones. In bivariate analysis, variables with $p < 0.10$ were subjected to multivariable logistic regression to estimate adjusted odds ratios (AOR) with 95% confidence intervals. The statistical significance was defined as $p < 0.05$.

RESULTS

This study aimed to determine the prevalence of menstrual irregularities in 400 females (18-25 years). High stress, physical inactivity, and insufficient sleep were important predictors. These findings highlight the central role of modifiable lifestyle factors in menstrual health. Stress control, increased physical activity, and improved sleep may prevent these irregularities. Demographic and clinical characteristics of study participants are presented in **Table 1.**

Table 1: Demographic and Clinical Characteristics of Study Participants

Characteristic	Menstrual Regular (n = 254)	Menstrual Irregular (n = 146)	Test Value	p-value
Age (years), mean ± SD	20.8 ± 1.9	21.0 ± 2.0	t = 0.92	0.358
BMI (kg/m²), mean ± SD	22.3 ± 3.4	22.7 ± 3.6	t = 1.09	0.276
Underweight (<18.5)	26 (10.2%)	16 (11.0%)	χ^2 = 0.06	0.805
Normal weight (18.5–24.9)	175 (68.9%)	97 (66.4%)		
Overweight/Obese (≥25)	53 (20.9%)	33 (22.6%)		
Family history of menstrual issues	41 (16.1%)	33 (22.6%)	χ^2 = 2.57	0.109

*n = Number of Participants, BMI = Basal Metabolic Index, SD = Standard Deviation, % = Percentage, * = Significance at p<0.05*

There were no significant differences in mean age (20.8 ± 1.9 vs. 21.0 ± 2.0 years) or mean BMI (22.3 ± 3.4 vs. 22.7 ± 3.6) between the two groups. The distribution of weight categories and family history of menstrual disorders did not differ significantly, indicating that the baseline demographics were similar. **Table 2** indicates the lifestyle and potential confounding factors associated with menstrual irregularities.

Table 2: Lifestyle and Confounding Factors

Variable	Menstrual Regular (n = 254)	Menstrual Irregular (n = 146)	Test Value	p-value
High perceived stress	62 (24.4%)	68 (46.6%)	χ^2 = 21.94	<0.001*
Insufficient physical activity (<150 min/week)	98 (38.6%)	85 (58.2%)	χ^2 = 14.50	<0.001*
Sleep <7 hours/night	89 (35.0%)	72 (49.3%)	χ^2 = 7.54	0.006*
Skips breakfast ≥3 times/week	104 (40.9%)	70 (47.9%)	χ^2 = 1.87	0.171
High fast-food intake (>3 times/week)	58 (22.8%)	40 (27.4%)	χ^2 = 1.02	0.313
BMI ≥25 kg/m²	53 (20.9%)	33 (22.6%)	χ^2 = 0.14	0.708
History of chronic illness	15 (5.9%)	13 (8.9%)	χ^2 = 1.13	0.288

*n = Number of Participants, BMI = Basal Metabolic Index, % = Percentage, * = Significance at p<0.05*

Menstrual irregularities were significantly high in women reporting (68 (46.6%) vs. 62 (24.4%), $p < 0.001$), lack of physical activity (85 (58.2%) vs. 98 (38.6%), $p < 0.001$), and <7 h of sleep (72 (49.3%) vs. 89 (35.0%), $p = 0.006$). Breakfast skipping, fast-food intake, BMI, and chronic illness were not significant, suggesting that lifestyle is a stronger determinant of menstrual irregularities. Multivariate regression analysis of factors is illustrated in **Table 3.**

Table 3: Multivariate Regression Analysis of Factors

Predictor Variable	Adjusted Odds Ratio (AOR)	95% CI	Test Value (Wald χ^2)	p-value
High perceived stress	2.16	1.46–3.19	15.54	<0.001*

Insufficient physical activity (<150 min/week)	1.73	1.16–2.58	7.42	0.006*
Sleep <7 hours/night	1.61	1.07–2.43	5.22	0.022*
Skips breakfast ≥3 times/week	1.25	0.83–1.89	1.20	0.273
High fast-food intake (>3 times/week)	1.12	0.70–1.80	0.37	0.545
BMI ≥25 kg/m²	1.05	0.66–1.66	0.06	0.806
History of chronic illness	1.52	0.69-3.34	1.08	0.299

*n = Number of Participants, BMI = Basal Metabolic Index, CI = Confidence Interval, * = Significance at p<0.05*

After adjusting for confounders, high stress (AOR = 2.16), low physical activity (AOR = 1.73), and short sleep (AOR = 1.61) were established as independent predictors. The findings support the importance of interventions for menstrual health improvement in young women through stress reduction, physical activity, and proper sleep.

DISCUSSION

This study aimed to evaluate menstrual irregularity in young women of university age and the impact of lifestyle-modifiable factors that contribute to cycle irregularity. The findings indicated that these parameters are significant contributors to menstrual health, and demographic variables, including age and BMI, are not predictive in this group.

No significant differences were found between groups in terms of age, BMI category, or family history. This is consistent with a study among young women, where BMI was associated with irregular cycles in unadjusted models but not after the inclusion of stress and sleep variables [13]. Similarly, research has indicated that educational level and socioeconomic status may lose predictive value when lifestyle factors are considered [14]. The findings revealed that stress is a significant risk factor for menstrual irregularity. In a group of female students, it was found that women with higher scores in stress were almost twice as likely to have irregular cycles [15,16]. Another major predictor was also physical inactivity. This is consistent with a scoping review indicating that low volumes of moderate-to-vigorous activity are associated with increased menstrual symptoms [17,18]. Another independent predictor was short sleep duration, which aligns with data, indicating that adolescent girls with fewer sleep hours were more likely to experience menstrual irregularity [19,20].

Breakfast skipping and dietary intake of fast foods were not significant following adjustment. This is contrary to studies in young women, where skipping breakfast was a predictor of menstrual irregularity [21]. These disparities may relate to age variations, cultural food patterns, or measurement

methods [22]. These results emphasize that demographic factors have less impact on menstrual health compared to modifiable behaviors. Analogous results were found when stress management practices enhanced menstrual regularity, programmed exercise normalized cycles in functional hypothalamic amenorrhea, and yoga reduced stress-induced menstrual dysfunctions [23,24]. Sleep-targeted interventions such as cognitive behavioral therapy have also proved to be effective in improving menstrual symptoms [25]. Institute-based interventions that embrace these approaches may have long-term impacts on public health [26].

Study limitations include the cross-sectional design, preventing causal inference, and dependence on self-reported menstrual and lifestyle information, which may be subject to recall bias. Confounding of unmeasured factors (e.g., micronutrient deficiencies, subclinical endocrine disorders, or drugs) cannot be ruled out. This sample restriction to university students can limit generalizations about all young women. Multicenter longitudinal studies using objective lifestyle measures and uniform menstrual assessment should be conducted to define the causality and test specific interventions.

CONCLUSION

This study revealed the prevalence of menstrual irregularities among one-third of young women and a high level of stress, physical activity, and inadequate sleep as predictors, with no independent predictive association with socio-demographic factors. These findings support that modifiable lifestyle factors have a significant impact on menstrual health. By managing stress levels, promoting exercise, and improving sleep, health programs among young women may help to improve menstrual regularity and contribute to long-term reproductive health in this group.

LIST OF ABBREVIATIONS

FIGO: International Federation of Gynecology and Obstetrics

HPG: Hypothalamus-Pituitary-Gonadal (Axis)

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CONFLICT OF INTEREST

None

ETHICAL APPROVAL

This cross-sectional study (January and June 2022) aimed to identify the determinants of menstrual irregularities and their associations with modifiable lifestyle factors in young women at SIMS Lahore (135-P-I/SIMS/SHL).

AUTHORS' CONTRIBUTION

All authors contributed equally as per ICMJE.

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