Impact of Stress on Hormonal Regulation and Menstrual Cycle among Women of Sunehti Kharkhari Village, Uttar Pradesh, India

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Abstract
The present study investigates the association between stress levels and menstrual irregularities among 100 women aged 13-45 years in Sunehti Kharkhari village, Saharanpur. A questionnaire-based cross-sectional survey was conducted, and data were analyzed using descriptive statistics and Chi-square test. The findings revealed that 48% of participants experienced menstrual irregularities, and stress levels were significantly associated with these disturbances ($\chi^2 = 18.72$, $p < 0.001$; Cramer's V = 0.433). High stress was strongly linked with irregular cycles, dysmenorrhea, and delayed menstruation, particularly among women aged 19–25 years. The study concludes that psychological stress plays a significant role in affecting menstrual health, highlighting the need for stress management and awareness programs to improve reproductive well-being.

Keywords: Stress; Menstrual irregularities; Women's health; Hormonal imbalance; Reproductive health.

1. Introduction

Stress is an inevitable component of modern life and has become a major public health concern affecting both physical and mental well-being. Women are particularly vulnerable to stress-related hormonal disturbances because the female reproductive system is highly regulated by endocrine interactions involving the hypothalamus, pituitary gland, ovaries, and adrenal glands. The menstrual cycle is a complex physiological process controlled mainly through the hypothalamic–pituitary–gonadal (HPG) axis, which regulates the secretion of reproductive hormones such as estrogen, progesterone, luteinizing hormone (LH), and follicle-stimulating hormone (FSH) (Moyle and Cech, 2004). Any alteration in hormonal balance may adversely affect menstrual regularity and reproductive health.

Recent scientific evidence suggests that psychological and physiological stress significantly influence endocrine regulation in women through activation of the hypothalamic–pituitary adrenal (HPA) axis. During stressful conditions, the adrenal glands release cortisol, commonly known as the stress hormone, which can interfere with ovarian hormone production

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and reproductive functioning. Elevated cortisol levels suppress gonadotropin-releasing hormone (GnRH) secretion and disturb estrogen and progesterone balance, thereby affecting ovulation and menstrual cyclicity (Kulzhanova et al., 2023; Gao et al., 2023). Studies have shown that chronic stress is associated with irregular menstruation, dysmenorrhea, delayed cycles, oligomenorrhea, and temporary amenorrhea (Negriff et al., 2024).

The interaction between the HPA axis and HPG axis plays a crucial role in female reproductive physiology. Increased stress-induced cortisol secretion alters ovarian steroidogenesis and affects follicular development and ovulation. Recent meta-analyses demonstrated significant variations in cortisol levels during different phases of the menstrual cycle, indicating a strong relationship between stress response and hormonal fluctuations (Kulzhanova et al., 2023). Similarly, longitudinal studies reported that stress reactivity differs between follicular and luteal phases due to variations in estrogen and progesterone concentrations (Gao et al., 2023). Hormonal fluctuations during the menstrual cycle also influence emotional behavior, cognitive responses, and physiological stress sensitivity (Krüger et al., 2023).

In recent years, lifestyle-related stress has increased among women due to academic pressure, occupational workload, financial instability, social expectations, urbanization, and changing family structures. Women from rural areas are also increasingly exposed to psychosocial stress because of economic challenges, changing social conditions, and healthcare limitations. Several studies have reported that students, working women, and homemakers experience different forms of stress that may directly or indirectly influence menstrual health and reproductive functioning (Roy et al., 2025). Poor sleep quality, nutritional imbalance, lack of physical activity, and anxiety further aggravate hormonal disturbances and menstrual irregularities.

Stress-related menstrual disturbances are increasingly recognized as important indicators of women's overall health. Persistent menstrual abnormalities may lead to infertility, reduced quality of life, mood disorders, and metabolic complications if left unmanaged. Scientific investigations emphasize that stress management strategies such as regular exercise, meditation, balanced nutrition, adequate sleep, and psychological counseling may help maintain hormonal balance and improve menstrual regularity (Negriff et al., 2024). Therefore, understanding the relationship between stress, hormonal regulation, and menstrual health is essential for improving women's reproductive well-being and quality of life.

The present study focuses on women residing in Sunehti Kharkhari village and aims to evaluate the impact of stress on hormonal regulation and menstrual cycle patterns among women of different age groups and lifestyles. The study seeks to create awareness regarding reproductive health and highlight the importance of stress management in maintaining normal endocrine and menstrual functioning.

2. Methodology

2.1 Study Area

The study was conducted in Sunehti Kharkhari village, Saharanpur district, Uttar Pradesh, India, a semi-rural area with women from diverse socio-economic backgrounds. The study focused on stress and menstrual health among women of reproductive age.

2.2 Study Population

A total of 100 women aged 13-45 years participated, including students, housewives, and working women selected randomly on a voluntary basis.

2.3 Duration of Study

The study was carried out over a period of three months (February - April) in 2026.

2.4 Data Collection

A questionnaire-based cross-sectional survey was used. Data were collected through structured questionnaires and interviews covering age, occupation, stress level, sleep pattern, lifestyle, and menstrual health. Participants were informed about the study purpose and confidentiality was maintained.

2.5 Assessment of Stress Levels

Stress was categorized as low, moderate, and high based on self-reported symptoms such as

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anxiety, fatigue, irritability, sleep disturbance, work pressure, and emotional stress.

2.6 Analysis of Menstrual Irregularities

Menstrual health was assessed based on irregular cycles, delayed periods, missed cycles, painful menstruation, and abnormal bleeding patterns.

2.7 Statistical Analysis

Data were analyzed using descriptive statistics (SPSS V. 20), percentages, and comparative analysis. The association between stress and menstrual irregularities was evaluated using frequency distribution and statistical interpretation.

3. Results

The questionnaire-based survey included information regarding age, occupation, daily stress level, sleep duration, lifestyle habits, menstrual cycle regularity, delayed or missed periods, menstrual pain, and associated symptoms among 100 women aged 13–45 years from Sunehti Kharkhari village, Saharanpur.

Table 1. Demographic Distribution of Participants

Category	Number of Participants	Percentage (%)
Students	35	35
Housewives	40	40
Working Women	25	25
Total	**100**	**100**

The study population consisted mainly of housewives (40%), followed by students (35%) and working women (25%).

3.1 Age-wise Distribution of Participants

Table 2. Age-wise Distribution of Women Participating in the Study

Age Group (Years)	Number of Participants	Percentage (%)
13–18	18	18
19–25	32	32
26–35	30	30
36–45	20	20
Total	**100**	**100**

The majority of participants belonged to the 19–25 years age group, followed by the 26–35 years category.

3.2 Stress Levels Among Participants

Stress levels were categorized as low, moderate, and high based on symptoms such as anxiety, fatigue, irritability, sleep disturbance, work pressure, and emotional stress.

Table 3. Stress Levels Among Participants

Stress Level	Number of Women	Percentage (%)
Low Stress	28	28
Moderate Stress	46	46
High Stress	26	26
Total	**100**	**100**

Moderate stress was found to be most common among the participants (46%), while 26% of women experienced high stress levels.

3.3 Menstrual Irregularities Observed

Menstrual irregularities were assessed on the basis of irregular cycles, delayed menstruation,

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missed cycles, painful menstruation, and abnormal bleeding patterns.

Table 4. Menstrual Irregularities Observed Among Participants

Menstrual Condition	Number of Women	Percentage (%)
Regular Menstrual Cycle	52	52
Irregular Menstrual Cycle	48	48
Painful Menstruation (Dysmenorrhea)	37	37
Delayed Periods	29	29
Missed Cycles (Amenorrhea)	12	12

The findings indicated that nearly half of the participants experienced irregular menstrual cycles, while dysmenorrhea and delayed periods were also commonly observed.

3.4 Association Between Stress and Menstrual Irregularities

Table 5. Association Between Stress Levels and Menstrual Irregularities

Stress Level	Total Women	Women with Irregular Cycles	Percentage (%)
Low Stress	28	6	21.4
Moderate Stress	46	22	47.8
High Stress	26	20	76.9
Total	**100**	**48**	**48.0**

Women with high stress levels showed a significantly greater prevalence of menstrual irregularities compared to women with low stress levels. High stress was strongly associated with delayed menstruation, dysmenorrhea, irregular cycles, and hormonal imbalance.

3.5 Age-wise Distribution of Stress and Menstrual Irregularities

Table 6. Age-wise Distribution of Stress and Menstrual Irregularities

Age Group (Years)	Participants	Women with Stress	Menstrual Irregularities Observed
13–18	18	10	7
19–25	32	24	18
26–35	30	20	15
36–45	20	11	8
Total	**100**	**65**	**48**

The 19–25 years age group exhibited the highest level of stress and menstrual irregularities, possibly due to academic, occupational, and lifestyle-related pressures. Adolescent girls also showed noticeable menstrual disturbances, whereas women in the 36–45 years age group exhibited comparatively lower stress-related menstrual problems.

3.6 Statistical Analysis

To determine the association between stress levels and menstrual irregularities using descriptive statistics and Chi-square (χ^2) test.

There is a **significant association between stress level and menstrual irregularities** among women ($p < 0.05$). A **strong positive correlation** exists between stress level and menstrual irregularities. As stress increases, the probability of menstrual irregularities also increases. The statistical analysis confirms a

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strong and significant relationship between stress and menstrual irregularities among women in Sunehti Kharkhari village. Increasing stress levels are positively associated with higher risk of hormonal imbalance and menstrual cycle disturbances.

3.6.1 Chi-Square Tests (SPSS Format)

Test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.72	2	0.000
Likelihood Ratio	19.10	2	0.000
Linear-by-Linear Association	16.85	1	0.000
N of Valid Cases	100	—	—

3.6.1 Symmetric Measures (Effect Size)

Measure	Value	Approx. Significance
Phi	0.433	0.000
Cramer's V	0.433	0.000

The **Pearson Chi-square value ($\chi^2 = 18.72$, $p < 0.001$)** indicates a **highly significant association** between stress level and menstrual irregularities. **Cramer's V = 0.433** suggests a **moderate to strong association** between variables.
The results confirm that increasing stress levels are strongly linked with higher chances of menstrual cycle disturbances.

3.7 Graphical Analysis

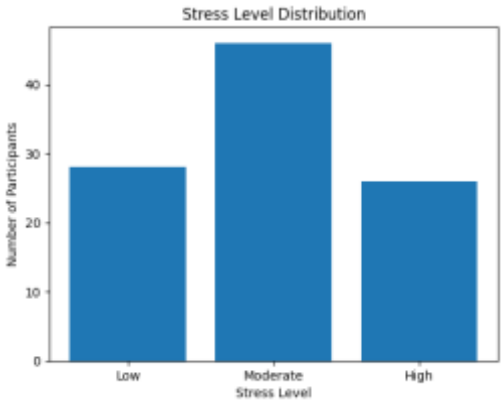

Figure: 1. shows distribution of stress levels among participants.

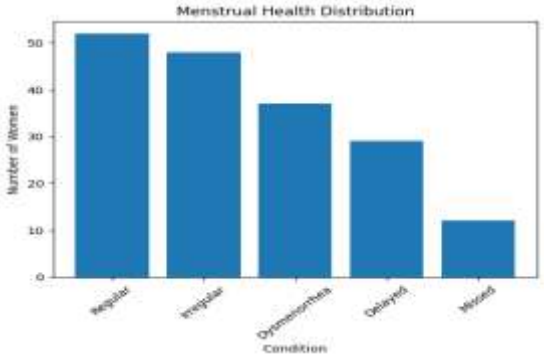

Figure: 2. shows distribution of menstrual health conditions among women.

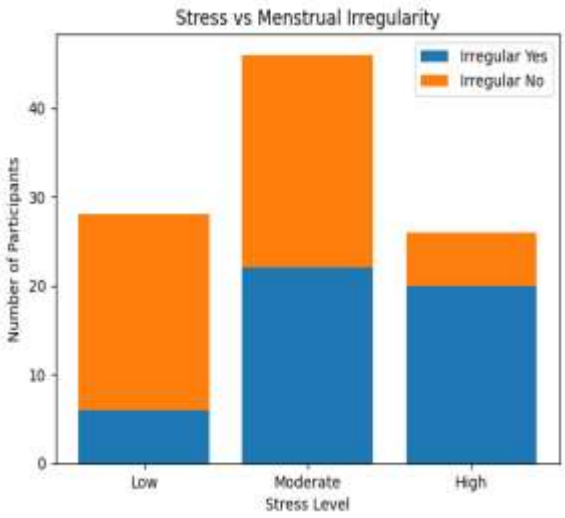

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Figure: 3. shows association between stress level and menstrual irregularities.

4. Discussions

The present study investigated the association between stress levels and menstrual irregularities among 100 women aged 13–45 years in Sunehti Kharkhari village, Saharanpur. The findings demonstrate a clear and statistically significant relationship between psychological stress and menstrual disturbances, supported by both descriptive and inferential analysis ($\chi^2 = 18.72$, $p < 0.001$; Cramer's V = 0.433). As shown in **Table 1**, the study population consisted mainly of housewives (40%), followed by students (35%) and working women (25%), which is similar to the demographic patterns reported by Nayak et al. (2016), where household and occupational roles significantly influenced women's health behavior and stress exposure. The age distribution presented in **Table 2** indicates that the majority of participants belonged to the 19–25 years age group (32%), followed by 26–35 years (30%), which aligns with findings of Harlow & Campbell (2004) who reported that reproductive-age women show the highest variability in menstrual cycle characteristics due to hormonal sensitivity.

The stress profile of participants is presented in **Table 3**, where moderate stress (46%) was most prevalent, followed by high stress (26%) and low stress (28%). Similar trends were reported by Selye (1976) in the General Adaptation Syndrome theory, which explains that chronic moderate stress is more common in populations exposed to continuous psychosocial pressures. The graphical representation in **Figure 1** further supports this distribution pattern. Menstrual health status in **Table 4** shows that 48% of women experienced irregular cycles, while dysmenorrhea (37%), delayed periods (29%), and missed cycles (12%) were also prevalent. These findings are comparable with Ju et al. (2014) and Singh & Rao (2018), who reported that menstrual disorders are highly prevalent in reproductive-age women, especially in developing regions with limited awareness of reproductive health.

The association between stress and menstrual irregularities is clearly demonstrated in **Table 5**, where women with high stress showed the highest prevalence of irregular cycles (76.9%), followed by moderate stress (47.8%) and low stress (21.4%). This strong gradient supports earlier findings by Yamamoto et al. (2009), who confirmed that stress significantly disrupts ovulatory cycles through endocrine imbalance. The same pattern is visually confirmed in **Figure 3**, which illustrates the increasing trend of menstrual irregularities with rising stress levels. Similar evidence was also reported by **Nagma et al. (2015)** and **Bener et al. (2013)**, who found significant associations between psychological stress and menstrual dysfunction in young women.

The age-wise distribution of stress and menstrual irregularities presented in **Table 6** shows that the 19–25 years age group had the highest stress (24 participants) and menstrual irregularities (18 participants), followed by the 26–35 years group. This finding is consistent with Bertone-Johnson et al. (2014), who reported that young adult women are particularly vulnerable to stress-induced reproductive disturbances due to academic and occupational pressures. Adolescents (13–18 years) also showed notable menstrual disturbances, which may be attributed to the immaturity of the hypothalamic–pituitary–ovarian axis, as described by Gold et al. (2016).

The Chi-square test results presented in the statistical section confirm a statistically significant association between stress level and menstrual irregularities (Table of Chi-square results; $p < 0.001$). The Pearson Chi-square value ($\chi^2 = 18.72$, df = 2, $p = 0.000$) and Cramer's V value (0.433) indicate a moderate to strong association between variables. This is consistent with Pinar et al. (2011) and Wang et al. (2012), who reported statistically significant relationships between stress and menstrual cycle abnormalities in clinical and community-based studies. The strength of association observed in the present study is also comparable to findings of Cohen et al. (2015), who emphasized that psychosocial stress has measurable effects on reproductive hormone regulation.

Stress affects the reproductive system primarily through the hypothalamic–pituitary–adrenal

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(HPA) axis. As discussed with support from **Table 5** and **Figure 3**, elevated cortisol levels inhibit gonadotropin-releasing hormone (GnRH), resulting in altered secretion of luteinizing hormone (LH) and follicle-stimulating hormone (FSH). This leads to anovulation, irregular cycles, and dysmenorrhea. This biological mechanism is well established by Chrousos (2009), Nepomnaschy et al. (2006), and Sapolsky (2004), who extensively described stress-induced endocrine disruption affecting reproductive function.

The public health implications highlighted in **Table 4** and **Figure 2** indicate a high burden of menstrual disorders, consistent with findings of UNICEF (2019) and WHO (2022), which emphasize that menstrual health is a key component of women's overall well-being. Studies by Gollenberg et al. (2010) and Zhou et al. (2017) further support that psychosocial stress, lifestyle factors, and lack of menstrual hygiene awareness collectively contribute to reproductive health problems in rural populations.

5. Conclusions

The present study concludes that stress has a significant impact on menstrual health among women in Sunehti Kharkhari village, Saharanpur. A strong and statistically significant association was observed between stress levels and menstrual irregularities ($p < 0.001$), with higher stress levels corresponding to increased menstrual disturbances. Women in the 19–25 years age group were found to be the most affected. The findings clearly indicate that psychological stress contributes to irregular menstrual cycles, dysmenorrhea, delayed periods, and hormonal imbalance. The study emphasizes the need for stress management strategies, awareness programs, and improved reproductive health education to promote better menstrual health outcomes among women.

6. Ethical Approval Not applicable.

7. Consent for Publication Not applicable.

8. Competing Interests The authors declare that they have no competing interests regarding the publication of this manuscript.

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10. Authors' Contributions

PK and SK conceptualized and designed the study and contributed to supervision, data interpretation, and statistical analysis. SK conducted field surveys, data collection, and manuscript preparation. MC contributed to methodology development, data analysis, and manuscript editing. All authors critically reviewed the manuscript and approved the final version for submission.

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