RESEARCH PAPER

Correlation Between Screen Time and Menstrual Irregularities in Women of Reproductive Age

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ABSTRACT

Background: Menstrual regularity reflects the functional integrity of the hypothalamic–pituitary–ovarian axis and serves as an important indicator of reproductive health. With increasing digital engagement and prolonged daily screen exposure, concerns have been raised regarding possible associations between screen time, stress, sleep patterns, metabolic status, and menstrual function. However, data examining cumulative screen exposure in relation to menstrual irregularity remain limited in Indian settings.

Methods: A hospital-based cross-sectional observational study was conducted among 105 women aged 18–40 years attending a tertiary care center in South India. Data were collected using a pretested structured questionnaire capturing sociodemographic characteristics, lifestyle factors, perceived stress, sleep duration, screen exposure patterns, and menstrual history. Screen time was categorized as <2 hours, 2–4 hours, and >4 hours per day. Menstrual irregularity was defined as cycle length <24 days or >38 days, cycle variation ≥8 days (<25 years) or ≥10 days (≥25 years), or bleeding duration >8 days. Associations were assessed using Chi-square testing and univariate logistic regression. Variables significant in univariate analysis were entered into multivariate logistic regression to estimate adjusted odds ratios (AORs). A p-value <0.05 was considered statistically significant.

Results: The mean age at menarche was 12.9 ± 1.3 years. Menstrual irregularity was reported by 35.2% of participants, with delayed cycles being the most frequent pattern (48.6%). Screen exposure exceeding four hours per day was reported by 38.1% of participants and showed a significant association with menstrual irregularity in univariate analysis (OR 4.50; 95% CI 1.60–12.6; p = 0.004). After adjustment, screen time >4 hours remained statistically associated (AOR 3.80; 95% CI 1.20–12.0; p = 0.021). High perceived stress demonstrated the strongest independent association (AOR 4.60; 95% CI 1.40–15.0; p = 0.012). Overweight/obesity showed a borderline but statistically significant association (AOR 2.40; 95% CI 1.00–6.10; p = 0.048). Short sleep duration and bedtime device use did not retain significance in multivariate analysis.

Conclusion: Menstrual irregularity was common in this hospital-based cohort and was statistically associated with prolonged daily screen exposure, high perceived stress, and overweight status. Given the cross-sectional design, these findings indicate associations rather than causation. Larger longitudinal studies incorporating objective exposure assessment and hormonal evaluation are warranted to clarify temporal relationships and underlying mechanisms.

MeSH Keywords: Menstrual Cycle Disorders, Screen Time, Stress, Psychological, Body Mass Index, Reproductive Health, Women

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INTRODUCTION

The menstrual cycle is a precisely coordinated physiological process reflecting the integrity of the hypothalamic–pituitary–ovarian (HPO) axis. Pulsatile secretion of gonadotropin-releasing hormone from the hypothalamus stimulates pituitary release of luteinizing hormone and follicle-stimulating hormone, thereby regulating follicular maturation, ovulation, and cyclical endometrial transformation [1]. Established gynecological literature describes menstrual regularity as a key clinical indicator of endocrine balance and reproductive function [2,3]. At a population level, reproductive health has been identified as a public health priority, with the World Health Organization (WHO) emphasizing that menstrual disturbances may reflect broader physiological or psychosocial influences [4]. The WHO guideline on self-care interventions further highlights the importance of lifestyle awareness in safeguarding reproductive well-being [5]. According to the International Federation of Gynecology and Obstetrics (FIGO), normal menstrual cycles range between 24 and 38 days with bleeding lasting 3–8 days, and deviations beyond these parameters are categorized under abnormal uterine bleeding classifications such as oligomenorrhea, polymenorrhea, and irregular cycle variation [6].

Global reproductive trends are evolving in parallel with demographic transitions. Data from the International Agency for Research on Cancer (IARC) indicate shifts in reproductive patterns, including delayed childbearing and altered hormonal exposure profiles in developing regions [7]. In India, findings from the National Family Health Survey-5 (NFHS-5) document increasing urbanization, improved education, and changing lifestyle behaviors among women aged 15–49 years [8]. These changes coincide with rapid technological expansion. The Telecom Regulatory Authority of India (TRAI) reported substantial growth in broadband connectivity and smartphone penetration across urban populations [9]. International digital usage surveys similarly demonstrate prolonged daily internet engagement, particularly among young adults [10]. Women of reproductive age represent a significant proportion of this digitally active demographic.

Emerging evidence suggests that digital device use, especially during evening and night hours, is associated with altered sleep patterns and circadian rhythm disruption. A population-based study utilizing objectively tracked smartphone data demonstrated that frequent night-time use was associated with shorter sleep duration and poorer sleep quality among young adult women [11]. Longitudinal findings have further shown that bedtime electronic device use predicts persistent sleep disturbances over time [12]. Sleep duration has been linked with menstrual characteristics; observational research among Korean adolescents reported that shorter sleep duration was associated with increased menstrual cycle irregularity [13].

Psychological stress is another factor linked with menstrual variation. Research conducted among young Indian women demonstrated that higher perceived stress scores were associated with alterations in menstrual characteristics, including delayed cycles and variability in bleeding duration [14]. Experimental studies examining light exposure have shown that blue-wavelength light suppresses nocturnal melatonin secretion, a hormone involved in circadian entrainment and ovarian function [15]. Melatonin interacts with granulosa cell steroidogenesis, and disruption of circadian signaling has been hypothesized to influence reproductive hormonal rhythms.

Menstrual irregularities have implications for quality of life, productivity, and long-term reproductive outcomes. In rapidly urbanizing Indian settings where digital engagement is widespread, examining behavioral exposures such as cumulative daily screen time in relation to menstrual patterns is increasingly relevant. While prior studies have explored associations between sleep, stress, and menstrual disturbances, direct evaluation of total daily screen exposure as a behavioral correlate of menstrual irregularity remains limited in Indian tertiary care contexts.

Therefore, the present study was undertaken to assess the association between total daily screen time and menstrual irregularities among women aged 18–40 years attending a tertiary care center in South India. This investigation seeks to contribute context-specific evidence regarding digital lifestyle patterns and menstrual health within a contemporary urban cohort.

Materials and Methods

This hospital-based cross-sectional observational study was conducted in the Department of Obstetrics and Gynaecology of a tertiary care teaching hospital in South India over a period of three months. The study was designed to examine the association between total daily screen time and menstrual irregularities among women aged 18–40 years attending the outpatient department during the study period.

Women were screened consecutively and recruited after obtaining written informed consent. Eligible participants were those within the reproductive age group who reported natural menstrual cycles and were neither pregnant nor lactating at the time of enrollment. Women using hormonal contraception or intrauterine devices were excluded. Additional exclusion criteria included a prior diagnosis of polycystic ovarian syndrome, thyroid disorders, diabetes mellitus, other endocrine conditions, chronic systemic illnesses, or use of hormonal medications within the preceding three months. Exclusion was based on documented medical history and self-report; biochemical testing or ultrasonography to detect subclinical endocrine disorders was not performed.

The required sample size was estimated using the formula for a single population proportion, $n = Z^2p(1-p)/d^2$, where Z was 1.96 corresponding to a 95% confidence level, p was assumed to be 25% based on previously reported prevalence of menstrual irregularities, and the allowable absolute precision (d) was 8%. The minimum calculated sample size was 113 participants. During the defined study period, 105 eligible women consented and were enrolled consecutively. While slightly below the calculated estimate, the achieved sample size provided reasonable precision for estimating prevalence and detecting moderate associations, though it may have influenced the breadth of confidence intervals in multivariable analysis.

Data were collected using a pretested structured questionnaire administered in person. Information obtained included sociodemographic characteristics such as age, education, occupation, and residence. Lifestyle variables comprised physical activity pattern, dietary habits, caffeine intake, perceived stress level, and average sleep duration. Screen exposure characteristics included primary device used, average daily screen time categorized as less than two hours, two to four hours, and more than four hours, purpose and timing of use, use of devices before sleep, and duration of digital exposure in years. Screen time was operationally defined as the self-reported average number of hours per day spent on digital devices; weekday and weekend usage patterns were not analyzed separately.

Menstrual history included age at menarche, usual cycle length, duration of bleeding, regularity, type of irregularity, intermenstrual spotting, history of reproductive disorders, and use of hormonal therapy. Menstrual irregularity was defined as a cycle length shorter than 24 days or longer than 38 days, cycle variation of eight days or more in women younger than 25 years or ten days or more in women aged 25 years and above, or bleeding lasting longer than eight days. Age-specific criteria were applied during classification; however, stratified analysis by age category was not performed due to the limited sample size.

Height and weight were measured using standardized procedures, and body mass index was calculated as weight in kilograms divided by the square of height in meters. Participants were categorized as normal or overweight/obese according to standard body mass index cut-offs.

Data were entered into Microsoft Excel and analyzed using SPSS version 25. Continuous variables were summarized as mean ± standard deviation, and categorical variables were presented as frequencies and percentages. Associations between independent variables and menstrual irregularity were initially examined using the Chi-square test. Univariate logistic regression analysis was subsequently performed to estimate crude odds ratios with 95% confidence intervals. To reduce the risk of model overfitting given the number of outcome events, only variables that demonstrated statistical significance in univariate analysis were entered into the multivariate logistic regression model. Adjusted odds ratios with corresponding 95% confidence intervals were calculated to identify independent associations. Because of the cross-sectional design, temporal relationships between exposures and outcome could not be established, and certain variables such as stress or sleep may represent intermediary pathways rather than true confounders. A p-value less than 0.05 was considered statistically significant.

Ethical approval for the study was obtained from the Institutional Ethics Committee prior to commencement. Written informed consent was obtained from all participants, and confidentiality of collected information was strictly maintained throughout the study.

Results :

A total of 105 women aged 18–40 years were included in the analysis. The study population was predominantly urban and well educated, with a considerable proportion reporting prolonged daily screen exposure. More than one-third of participants experienced menstrual irregularities, with delayed cycles being the most common pattern. Logistic regression analysis demonstrated significant associations between high screen time, elevated stress levels, overweight/obesity, and menstrual irregularity.

Table 1. Distribution of Sociodemographic Characteristics of the Study Participants (N = 105)

Category	n (%) (n=105)

Age (in years)	
18–24	30 (28.6)
25–30	45 (42.9)
31–40	30 (28.6)
Marital Status	
Unmarried	47 (44.8)
Married	55 (52.4)
Others	3 (2.9)
Education	
School	15 (14.3)
Undergraduate	50 (47.6)
Postgraduate	28 (26.7)
Professional	12 (11.4)
Occupation	
Student	38 (36.2)
Employed	40 (38.1)
Homemaker	27 (25.7)
Residence	
Urban	80 (76.2)
Rural	25 (23.8)
BMI	
Normal	60 (57.1)
Overweight/Obese	45 (42.9)

Table 1 presents the sociodemographic characteristics of the 105 women included in the study. The age distribution was fairly balanced, with the largest proportion of participants belonging to the 25–30 years age group (42.9%), while equal proportions were observed in the 18–24 years (28.6%) and 31–40 years (28.6%) categories.

More than half of the participants were married (52.4%), whereas 44.8% were unmarried and 2.9% fell into other marital categories. With regard to educational status, nearly half of the participants had completed undergraduate education (47.6%), followed by postgraduate education (26.7%). A smaller proportion had school-level education (14.3%) or professional qualifications (11.4%). In terms of occupation, employed women constituted the largest group (38.1%), closely followed by students (36.2%), while homemakers accounted for 25.7% of the study population. A clear predominance of urban residence was observed, with 76.2% residing in urban areas compared to 23.8% from rural areas. Based on body mass index (BMI) classification, 57.1% of participants had a normal BMI, whereas 42.9% were categorized as overweight or obese.

Overall, the study population predominantly comprised young to early middle-aged women, largely urban, relatively well educated, and with a substantial proportion classified as overweight or obese.

Table 2. Distribution of Lifestyle and General Health Characteristics of the Study Participants (N = 105)

Category	**n (%) (n=105)**
Physical Activity	
Regular	35 (33.3)
Occasional	45 (42.9)
None	25 (23.8)
Diet Pattern	
Vegetarian	40 (38.1)
Mixed	65 (61.9)
Caffeine Intake	
None	35 (33.3)
Occasional	48 (45.7)
Daily	22 (21.0)
Stress Level	
Low	28 (26.7)
Moderate	50 (47.6)
High	27 (25.7)
Sleep Duration	
<6 hours	30 (28.6)
6–8 hours	55 (52.4)
>8 hours	20 (19.0)

Table 2 describes the lifestyle and general health characteristics of the 105 study participants. With respect to physical activity, less than one-third of participants reported engaging in regular exercise (33.3%), while 42.9% reported occasional activity and 23.8% reported no physical activity. This indicates that a considerable proportion of women were either insufficiently active or sedentary.

Regarding dietary pattern, the majority of participants followed a mixed diet (61.9%), whereas 38.1% adhered to a vegetarian diet. Caffeine or energy drink consumption was reported by a substantial proportion of participants, with 45.7% consuming these beverages occasionally and 21.0% reporting daily intake. One-third of the participants (33.3%) reported no caffeine consumption.

Assessment of perceived stress revealed that nearly half of the participants experienced moderate stress levels (47.6%). High stress was reported by 25.7%, while 26.7% reported low stress levels. In terms of sleep duration, more than half of the participants (52.4%) reported sleeping 6–8 hours per night. However, 28.6% reported short sleep duration of less than six hours, and 19.0% reported sleeping more than eight hours.

Overall, the findings suggest a moderate prevalence of sedentary behavior, considerable caffeine consumption, and notable levels of psychological stress within the study population, which may have implications for overall health and menstrual patterns.

Table 3. Distribution of Screen Time and Digital Usage Patterns Among the Study Participants (N = 105)

Category	n (%) (n=105)
Primary Device	
Smartphone	70 (66.7)
Laptop	15 (14.3)
Television	10 (9.5)
Tablet	5 (4.8)
Multiple	5 (4.8)
Daily Screen Time	
<2 hours	25 (23.8)
2–4 hours	40 (38.1)
>4 hours	40 (38.1)
Main Purpose	
Work/Study	45 (42.9)
Social media	30 (28.6)
Entertainment	20 (19.0)
Gaming	5 (4.8)
Others	5 (4.8)
Timing of use	
Daytime	30 (28.6)
Evening/Night	35 (33.3)
Throughout Day	40 (38.1)
Device Before Sleep	
Yes	65 (61.9)
No	40 (38.1)
Years of Digital Use	
<5 years	20 (19.0)
5–10 years	55 (52.4)
>10 years	30 (28.6)

Table 3 presents the distribution of screen time and digital usage patterns among the 105 study participants. The majority of participants primarily used smartphones (66.7%) as their main digital device, followed by laptops (14.3%) and televisions (9.5%). A smaller proportion reported using tablets (4.8%) or multiple devices (4.8%) as their primary mode of digital access.

Regarding daily screen exposure, 38.1% of participants reported spending more than four hours per day on digital devices, while an equal proportion (38.1%) reported 2–4 hours of daily use. Only 23.8% reported screen time of less than two hours per day. This indicates that more than three-quarters of participants were exposed to at least two hours of daily screen use.

In terms of the primary purpose of screen usage, work or study-related activities were most common (42.9%), followed by social media use (28.6%) and entertainment (19.0%). Gaming and other purposes each accounted for 4.8% of participants.

With respect to timing of use, 38.1% reported using digital devices throughout the day, while 33.3% predominantly used them during the evening or night, and 28.6% mainly during daytime hours. A substantial proportion of participants (61.9%) reported using digital devices before sleep, which may have potential implications for sleep quality and hormonal regulation.

Finally, more than half of the participants (52.4%) reported 5–10 years of digital device use, while 28.6% reported more than 10 years of use and 19.0% reported less than five years.

Overall, the findings demonstrate high levels of digital engagement, prolonged screen exposure, and frequent pre-sleep device use among the study population.

Table 4. Distribution of Menstrual History and Reproductive Health Characteristics (N = 105)

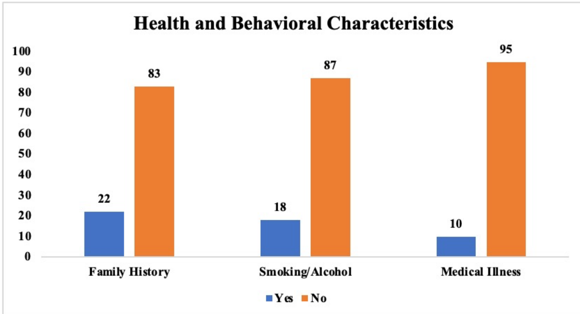
Category	n (%) / Mean ± SD (n=105)
Age at Menarche	12.9 ± 1.3
Cycle Regularity	
Regular	68 (64.8)

Irregular	37 (35.2)
Type of Irregularity (n=37)	
Delayed	18 (48.6)
Frequent	9 (24.3)
Irregular duration	10 (27.0)
Duration of Bleeding	
≤5 days	40 (38.1)
6–8 days	48 (45.7)
>8 days	17 (16.2)
Intermenstrual Spotting	
Yes	20 (19.0)
No	85 (81.0)
Reproductive Disorder	
Yes	15 (14.3)
No	90 (85.7)
Hormonal Therapy	
Yes	12 (11.4)
No	93 (88.6)

Table 4 presents the menstrual history and reproductive health characteristics of the 105 participants.
The mean age at menarche was 12.9 ± 1.3 years, indicating that most participants attained menarche during early adolescence.
With regard to menstrual cycle regularity, 64.8% of participants reported having regular cycles, while 35.2% experienced menstrual irregularities. Among those with irregular cycles (n = 37), delayed cycles were the most commonly reported pattern (48.6%), followed by irregular duration of bleeding (27.0%) and frequent cycles (24.3%). In terms of duration of menstrual bleeding, the majority of participants (45.7%) reported bleeding lasting 6–8 days. A total of 38.1% reported bleeding for five days or less, while 16.2% experienced prolonged bleeding lasting more than eight days.

Intermenstrual spotting was reported by 19.0% of participants, whereas the majority (81.0%) did not report spotting between cycles. Regarding reproductive health conditions, 14.3% of participants reported having a diagnosed reproductive disorder, while 85.7% did not report any such condition. Additionally, 11.4% of participants were on hormonal therapy or contraception at the time of the study.
Overall, more than one-third of the participants reported menstrual irregularities, with delayed cycles being the predominant pattern, while a smaller proportion reported underlying reproductive disorders or hormonal therapy use.

Fig 1. Distribution of Additional Health and Behavioral Characteristics of the Study Participants (N = 105)



The distribution of additional health and behavioral characteristics among the study participants shows that 21.0% reported a positive family history of menstrual or hormonal disorders, while the majority (79.0%) did not report any such history. Regarding lifestyle risk behaviors, 17.1% of participants reported smoking or alcohol consumption, whereas 82.9% denied these habits.
A small proportion of participants (9.5%) reported having a significant medical illness, while 90.5% reported no known medical conditions.
Overall, the findings indicate that most participants did not report major medical comorbidities or high-risk behaviors, although a notable proportion had a positive family history of hormonal or menstrual disorders, which may have implications for menstrual health outcomes.

Table 6. Univariate Logistic Regression Analysis of Factors Associated with Menstrual Irregularity Among Study Participants (N = 105)

Category	Menstrual Regular n (%) (n=68)	Menstrual Irregular n (%)	Crude OR (95	p-value

		(n=37)	% CI)	
Screen Time				
<2 hours	22 (88.0)	3 (12.0)	Ref	—
2–4 hours	28 (70.0)	12 (30.0)	1.80 (0.60 – 5.20)	0.28
>4 hours	18 (45.0)	22 (55.0)	4.50 (1.60 – 12.6)	0.004
Stress Level				
Low	23 (82.1)	5 (17.9)	Ref	—
Moderate	35 (70.0)	15 (30.0)	2.20 (0.70 – 6.80)	0.16
High	10 (37.0)	17 (63.0)	5.80 (1.90 – 17.7)	0.002
BMI				
Normal	45 (75.0)	15 (25.0)	Ref	—
Overweight/Obese	23 (51.1)	22 (48.9)	2.90 (1.20 – 6.90)	0.016
Physical Activity				
Regular	28 (80.0)	7 (20.0)	Ref	—
Occasional/None	40 (57.1)	30 (42.9)	2.40 (0.95 – 6.00)	0.065
Sleep Duration				
6–8 hrs	38 (69.1)	17 (30.9)	Ref	—
<6 hrs	16 (53.3)	14 (46.7)	2.10 (0.85 – 5.20)	0.110
>8 hrs	14 (70.0)	6 (30.0)	1.30 (0.40 – 4.10)	0.650
Device Before Sleep				
No	30 (75.0)	10 (25.0)	Ref	—
Yes	38 (58.5)	27 (41.5)	2.70 (1.10 – 6.50)	0.029
Family History				
No	58 (69.9)	25 (30.1)	Ref	—
Yes	10 (45.5)	12 (54.5)	2.50 (1.00 – 6.20)	0.049

Table 6 presents the results of univariate logistic regression analysis examining the association between selected factors and menstrual irregularity.

A statistically significant association was observed between daily screen time and menstrual irregularity. Participants reporting more than four hours of daily screen time had a markedly higher proportion of menstrual irregularity (55.0%) compared to those reporting less than two hours (12.0%). The odds of menstrual irregularity were 4.5 times higher among women with screen time exceeding four hours per day (OR = 4.50; 95% CI: 1.60–12.6; p = 0.004). However, screen time of 2–4 hours did not show a statistically significant association.

Perceived stress demonstrated a strong association with menstrual irregularity. Women reporting high stress levels had the highest proportion of irregular cycles (63.0%), with significantly increased odds compared to those with low stress (OR = 5.80; 95% CI: 1.90–17.7; p = 0.002). Moderate stress was not statistically significant. Body mass index (BMI) was also significantly associated with menstrual irregularity. Overweight or obese participants had a higher prevalence of irregular cycles (48.9%) compared to those with normal BMI (25.0%), with nearly threefold increased odds (OR = 2.90; 95% CI: 1.20–6.90; p = 0.016).

Although women with occasional or no physical activity had higher odds of menstrual irregularity compared to those engaging in regular exercise (OR = 2.40), this association did not reach statistical significance (p = 0.065). Similarly, short sleep duration (<6 hours) was associated with higher odds of menstrual irregularity (OR = 2.10), but the association was not statistically significant (p = 0.110).

Device use before sleep was significantly associated with menstrual irregularity. Participants who used devices before bedtime had higher odds of irregular cycles (OR = 2.70; 95% CI: 1.10–6.50; p = 0.029). Finally, a positive family history of menstrual or hormonal disorders was significantly associated with menstrual irregularity (OR = 2.50; 95% CI: 1.00–6.20; p = 0.049).

Overall, the univariate analysis identified high screen time (>4 hours/day), high perceived stress, overweight/obesity, device use before sleep, and positive family history as factors significantly associated with menstrual irregularity.

Table 7. Multivariate Logistic Regression Analysis of Independent Predictors of Menstrual Irregularity (N = 105)

Category	**Adjusted OR (95% CI)**	**p-value**
Screen Time		
<2 hours	Ref	—
2-4 hours	1.45 (0.48-4.38)	0.510
>4 hours	3.80 (1.20–12.0)	0.021
Stress Level		
Low	Ref	—
High	4.60 (1.40–15.0)	0.012
BMI		
Normal	Ref	—
Overweight/Obese	2.40 (1.00–6.10)	0.048
Device Before Sleep		
No	Ref	—
Yes	1.60 (0.60–4.20)	0.320

Table 7 presents the results of multivariate logistic regression analysis performed to identify independent predictors of menstrual irregularity after adjusting for potential confounding factors.

After adjustment, screen time remained significantly associated with menstrual irregularity. Participants reporting more than four hours of daily screen time had 3.8 times higher odds of experiencing menstrual irregularity compared to those with less than two hours of screen time (Adjusted OR = 3.80; 95% CI: 1.20–12.0; p = 0.021). However, screen time of 2–4 hours was not significantly associated with menstrual irregularity (p = 0.510).

High perceived stress emerged as a strong independent predictor. Women reporting high stress levels had 4.6 times higher odds of menstrual irregularity compared to those with low stress (Adjusted OR = 4.60; 95% CI: 1.40–15.0; p = 0.012). Body mass index also remained independently associated with menstrual irregularity. Overweight or obese participants had 2.4 times higher odds of irregular cycles compared to those with normal BMI (Adjusted OR = 2.40; 95% CI: 1.00–6.10; p = 0.048).

In contrast, device use before sleep, although significant in univariate analysis, did not retain statistical significance after adjustment (Adjusted OR = 1.60; 95% CI: 0.60–4.20; p = 0.320), suggesting that its effect may be confounded by other factors such as screen time or stress level. Overall, the multivariate analysis identified prolonged screen time (>4 hours/day), high perceived stress, and overweight/obesity as independent predictors of menstrual irregularity among the study participants.

Discussion

In the present study, menstrual irregularity was observed in 35.2% of participants, with delayed cycles accounting for 48.6% of irregular cases. Women reporting more than four hours of daily screen time had a higher prevalence of irregular cycles (55.0%) compared with those reporting less than two hours (12.0%). In multivariate analysis, screen exposure exceeding four hours per day remained statistically associated with menstrual irregularity (AOR 3.8; 95% CI 1.20–12.0; p = 0.021). High perceived stress demonstrated the strongest independent association (AOR 4.6; 95% CI 1.40–15.0; p = 0.012). Overweight/obesity showed a borderline but statistically significant association (AOR 2.4; 95% CI 1.00–6.10; p = 0.048). Although short sleep duration and bedtime device use showed elevated crude odds, these variables did not retain statistical significance after adjustment.

Sedentary behavior has been examined in relation to menstrual disturbances in Asian populations. Shi et al. [16], in a large cohort of Chinese female college students, reported that prolonged sedentary time was significantly associated with moderate-to-severe premenstrual syndrome, while regular physical activity appeared protective. Although their outcome focused on symptom severity rather than cycle irregularity, the behavioral exposure is comparable. In our study, women reporting occasional or no physical activity had higher crude odds of irregular cycles (OR 2.4), but this association did not reach statistical significance (p = 0.065). Differences in outcome definition and age distribution may partly explain the variation in statistical strength.

Objective digital tracking has provided additional insight into reproductive health patterns. Severinsen et al. [17] demonstrated that frequent night-time smartphone activation was associated with shorter sleep duration and increased reporting of menstrual disturbances. Women in the highest night-time activation category showed greater likelihood of irregular cycles. Similarly, in our cohort, cumulative daily exposure exceeding four hours was independently associated with menstrual irregularity. However, given the cross-sectional design of the present study, directionality between screen exposure and menstrual changes cannot be established.

Circadian mechanisms provide biological plausibility for these associations. Touitou et al. [18] described how exposure to artificial light at night suppresses melatonin secretion and disrupts circadian synchronization, potentially influencing endocrine rhythmicity. In our cohort, 61.9% reported device use before sleep. Although bedtime device use was significant in univariate analysis (OR 2.7), it did not retain independent significance after multivariate adjustment (AOR 1.6; p = 0.320), suggesting that total duration of exposure or coexisting stress may have stronger associations than timing alone.

Sleep duration has been reported as an independent correlate of menstrual irregularity in adolescent populations. Nam et al. [19] observed that sleeping fewer than six hours significantly increased the likelihood of cycle irregularity among Korean adolescents. In contrast, short sleep in our study was associated with increased crude odds (OR 2.10) but did not achieve statistical significance (p = 0.110). The broader age range (18–40 years) and possible residual confounding may explain this difference.

Psychological stress consistently emerges in literature examining menstrual variability. Barsom et al. [20] reported associations between elevated stress levels and menstrual cycle variability among perimenopausal women. Similarly, findings from the BioCycle Study by Gollenberg et al. [21] demonstrated that higher perceived stress scores correlated with increased perimenstrual symptom severity. In the present study, high perceived stress showed the strongest independent association with menstrual irregularity (AOR 4.6; 95% CI 1.40–15.0; p = 0.012). While the magnitude of association appears substantial, the wide confidence interval suggests limited precision and warrants cautious interpretation.

Mechanistically, chronic stress activates the hypothalamic–pituitary–adrenal axis and may suppress gonadotropin-releasing hormone pulsatility, thereby influencing ovulatory function, as reviewed by Hu et al. [22]. Although hormonal parameters were not directly measured in our study, the observed statistical association is consistent with established endocrine pathways.

Metabolic factors also play a role in menstrual regulation. Attia et al. [23] summarized evidence linking irregular menstruation with metabolic and endocrine disturbances. In our cohort, 42.9% of participants were overweight or obese, and this group had increased odds of menstrual irregularity (AOR 2.4; 95% CI 1.00–6.10; p = 0.048). Given that the lower bound of the confidence interval approached unity, this finding should be interpreted as borderline and requires confirmation in larger studies.

Digital behavior has been linked to sleep quality in adult populations. Exelmans and Van den Bulck [24] reported that bedtime mobile phone use was associated with poorer sleep outcomes, and Carter et al. [25] confirmed adverse sleep associations in their meta-analysis of portable screen-based media use. Although bedtime device use showed elevated crude odds in our study, its loss of significance after adjustment suggests that stress or cumulative exposure duration may better explain the observed associations.

Lifestyle influences on ovulatory function have also been described beyond established endocrine disorders. Zhang et al. [26] demonstrated that environmental and behavioral factors were associated with ovulatory dysfunction in women with polycystic ovary syndrome. Although women with diagnosed PCOS were excluded in our study, subclinical endocrine conditions cannot be entirely ruled out. The observed association between overweight/obesity and menstrual irregularity supports the broader concept of metabolic influence on ovarian function.

Evidence from Indian settings further contextualizes these findings. Nagma et al. [27] reported significantly higher perceived stress scores among women with menstrual disturbances, supporting a stress-related association. Similarly, Negi et al. [28] observed higher prevalence of menstrual abnormalities among adolescent girls with sedentary lifestyles. Singh et al. [29] documented menstrual disorders among medical and nursing students, highlighting stress and lifestyle imbalance as associated factors. During the COVID-19 lockdown period, Ramesh et al. [30] reported increased menstrual disturbances coinciding with elevated screen exposure and stress among healthcare students. These studies collectively demonstrate that lifestyle and psychosocial variables are consistently associated with menstrual patterns in Indian populations.

In the present study, prolonged screen exposure exceeding four hours per day and high perceived stress were independently associated with menstrual irregularity after adjustment. However, given the cross-sectional design, self-reported exposure assessment, and modest sample size, these associations should be interpreted as correlational rather than causal. Wide confidence intervals indicate limited precision, and residual confounding cannot be excluded.

Although short sleep duration did not retain statistical significance in multivariate analysis, the elevated crude odds (OR 2.10) suggest a potential contributory role. It is possible that sleep operates within a broader behavioral cluster linking digital exposure and stress to menstrual variability rather than acting as an isolated independent factor.

Limitations

This study has certain limitations. The cross-sectional design prevents establishing temporal or causal relationships between screen exposure and menstrual irregularity. Screen time and stress levels were self-reported, which may introduce recall bias or reporting inaccuracies. Hormonal assays were not performed, limiting direct physiological validation of proposed mechanisms. Additionally, the study was conducted in a single tertiary care setting, which may affect generalizability to broader community populations. Despite these limitations, the study provides clinically relevant insight into emerging lifestyle determinants of menstrual health.

Conclusion

The present study demonstrates that menstrual irregularity is common among women of reproductive age, affecting over one-third of participants. Prolonged screen time exceeding four hours per day, high perceived stress, and overweight or obesity were independently associated with irregular menstrual cycles. Among these, psychological stress showed the strongest relationship, highlighting the significant role of psychosocial factors in menstrual regulation. While short sleep duration and bedtime device use showed elevated crude associations, their effects were attenuated after multivariate adjustment, suggesting that total digital exposure and stress may exert more direct influence. These findings indicate that modern digital lifestyle patterns, combined with metabolic and psychological factors, may contribute meaningfully to reproductive health disturbances. Addressing modifiable behaviors such as excessive screen exposure, stress management, and weight control may therefore support improved menstrual health in this population.

Conclusion

The findings of this study should be interpreted in light of several methodological limitations. The cross-sectional design precludes establishing temporal sequence or causality between screen exposure and menstrual irregularity. It remains unclear whether prolonged screen use preceded menstrual changes or whether women with irregular cycles differed in behavioral patterns due to underlying physiological or psychosocial factors. Screen time, stress levels, and sleep duration were self-reported and therefore subject to recall bias and potential misclassification. Objective digital tracking and validated stress assessment tools may have improved exposure precision. Additionally, hormonal assays and ultrasonographic evaluation were not performed; hence, subclinical endocrine conditions such as undiagnosed polycystic ovarian syndrome or thyroid dysfunction could not be fully excluded. The study was conducted in a single tertiary care outpatient setting using consecutive sampling, which may limit generalizability to community populations. The modest sample size and number of outcome events may also have contributed to wide confidence intervals, particularly for multivariable estimates, indicating limited statistical precision.

Despite these limitations, the study provides context-specific evidence regarding behavioral correlates of menstrual irregularity in a contemporary urban cohort. Menstrual irregularity was observed in 35.2% of participants. Screen exposure exceeding four hours per day was independently associated with irregular cycles (AOR 3.8; 95% CI 1.20–12.0), and high perceived stress demonstrated the strongest independent association (AOR 4.6; 95% CI 1.40–15.0). Overweight or obesity showed a borderline statistically significant association (AOR 2.4; 95% CI 1.00–6.10). Although short sleep duration and bedtime device use showed elevated crude odds, these factors did not retain independent significance after adjustment.

Overall, the results suggest that prolonged digital exposure, psychological stress, and metabolic status are statistically associated with menstrual irregularity within this hospital-based population. Given the observational design, these findings should be considered associative rather than causal. Larger longitudinal studies incorporating objective exposure assessment and hormonal profiling are warranted to clarify underlying pathways and temporal relationships.

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