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Original Research

Association Between Stress Levels, BMI, and Menstrual Cycle Regularity Among Female University Students

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ABSTRACT

Background: *The menstrual cycle functions through a coordinated balance of reproductive hormones. An imbalance in these reproductive hormones can disrupt the menstrual cycle. Aspects that can impact the menstrual cycle include stress and BMI. This study aimed to assess the association between stress levels and BMI on the menstrual cycle among female university students*

Methods: *This research used a cross-sectional study conducted at Dhyana Pura University from April 2025 to May 2025. A total of 40 respondents participated in this study with purposive sampling. Data collection of stress level using the PSS-10 questionnaire, BMI using Staturemeter and digital scales, and menstrual cycle with tracking application (FLO). Pearson correlation test for stress and menstrual cycle variables, Spearman's Rho for BMI and menstrual cycle variables, and multiple linear regression test. A Significance level of $p<0.05$ was used.*

Results: *The association between stress levels and menstrual cycle showed a p-value of 0.13 ($p < 0.05$). The relationship between BMI and menstrual cycle showed a p-value of 0.411 ($p>0.05$). The relationship between stress level and BMI on menstrual cycle showed a p-value of 0.44 ($p < 0.05$) with an R-squared value of 0.395. This indicates a weak-to-moderate correlation between stress level and BMI on the menstrual cycle.*

Conclusion: *This demonstrates a relationship between stress level and BMI on the menstrual cycle, with a weak-to-moderate strength. Based on these findings, students are encouraged to manage their stress levels and maintain a healthy BMI to support regular menstrual cycles.*

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INTRODUCTION

The menstrual cycle is largely governed by the regulation and equilibrium of reproductive hormones. It has been established that a large number of women

experience menstrual disorders that occur in conjunction with menstrual cycle regulation. Menstrual cycle disorders have the potential to exert a substantial influence on individual health, manifesting in both physical and psychological domains. Poor management of these conditions can lead to a range of adverse consequences, including fertility problems (infertility), an elevated risk of reproductive diseases, osteoporosis, and the development of psychological disorders (Fadillah et al., 2022).

A typical menstrual cycle lasts approximately 21 to 35 days, calculated from the initial day of menstrual bleeding to the beginning of the subsequent cycle. However, a considerable number of women also experience irregular menstrual cycles. This phenomenon can be considered an indication of menstrual disorders. Several menstrual disorders have been identified, including polymenorrhea (having an interval of less than 21 days), oligomenorrhea (having an interval exceeding 35 days), and amenorrhea (absence of menstruation in a woman for a period of three months or more) (Song et al., 2022).

Several studies show the high prevalence of menstrual irregularities among adolescent and young adult for example (Miraturrofi'ah. M, 2020). Research found that 93.2% of adolescent girls aged 10-19 years experienced menstrual irregularities. Meanwhile, (Salmawati et al., 2022). Found that 53 (53.5%) of 99 nursing students in their 7th semester at the National University of Jakarta experienced irregular menstrual cycles. The study identified factors contributing to these disorders, including physical activity, hormonal influences, unhealthy lifestyles such as diet and sleep patterns, Body Mass Index (BMI), and stress levels (Salmawati et al., 2022).

Stress represents one of the risk factors affecting female students due to academic stress, self-expectation, and transition to independent living. Academic stress is a type of stress that students frequently experience. It is defined as a condition or state in which individuals feel pressured or distressed due to their perceptions of demands related to science and education (Yuda et al., 2023). The body mass index (BMI) is considered a contributing factor in the emergence of menstrual irregularities.

A body mass index (BMI) that is too low (underweight) or too high (overweight/obesity) has been demonstrated to be a contributing factor to the development of menstrual disorders. This condition arises from hormonal imbalances caused by excessive or deficient body fat, which in turn affects the ovulation process (Chen et al., 2020). Recent observations at Dhyana Pura University indicate that many female students experience irregularities in their menstrual cycles alongside varying degrees of stress.

Although international studies have explored similar issues, the evidence remains inconclusive regarding the extent to which stress and BMI independently or in combination influence menstrual irregularities. Furthermore, no prior study has specifically examined this relationship within the context of the cultural and lifestyle characteristics of female university students in Bali, creating a gap in localised evidence. This study seeks to elucidate the correlations between stress levels and BMI, as well as their connection to menstrual cycle irregularities among female university students, thereby offering context-specific data to address discrepancies noted in prior global research.

MATERIALS AND METHODS

Within this journal, quantitative research is being used as the method. The method used in this research is a cross-sectional study. A quantitative research design was

selected for this study because the primary objective was to investigate quantifiable associations between stress levels, BMI, and menstrual cycle irregularities characteristics among female university students. A cross-sectional design was selected because data on stress, BMI, and menstrual cycle patterns needed to be collected simultaneously within the same observational window (Norlina, 2022).

The research site used in this study was located at Dhyana Pura University. This research uses a non-probability sampling method, employing a purposive sampling approach. The sample size was determined using Slovin's formula for a finite population (N = 83), yielding a minimum requirement of 45 participants (e = 1%). After eligibility screening according to predefined inclusion and exclusion criteria, 40 participants were included in the final analysis. Consistent with previous studies, a minimum of 40 female students met the established criteria and were selected for inclusion (Norlina, 2022).

As for the settled inclusion and exclusion criteria, individuals have been enlisted to be part of it. Dhyana Pura University students, as inclusion criteria, who are still active, 19-25 years old, have normal menstrual duration (3-5 days), are willing to use the menstrual tracking application, and are willing to become research participants. Exclusion criteria applied to women with a confirmed medical history of reproductive health problems, the presence of secondary dysmenorrhea disorders, taking birth control pills regularly or using contraceptives.

The dependent variable in this study was the regularity of the menstrual cycle in female students. The independent variables included stress levels and Body Mass Index (BMI). These three variables were analysed to examine the relationship between stress and BMI on the regularity of the menstrual cycle. Materials utilized in this study are a questionnaire PSS-10 for measuring stress, a staturemeter and digital scale for measuring IMT, and a tracking application (FLO) for cycle menstruation.

Data were obtained through a structured, self-administered questionnaire that was distributed directly to the participants. Respondents completed the Perceived Stress Scale-10 (PSS-10), provided anthropometric information through direct measurement using a staturemeter and digital scale, and recorded menstrual cycle data through the FLO tracking application. The Indonesian version of the PSS-10 has been validated by Hakim et al., (2024) and has been reported to have acceptable psychometric properties.

The AVE (The Convergent validity) values were 0.38 for students and 0.58 for employees, while the CR (Construct reliability) values were 0.85 and 0.93. FLO is a widely used menstrual-tracking application; its menstrual cycle logging features have not yet undergone formal psychometric validation. Therefore, its data are treated as participant-reported cycle records and acknowledged as such in the study limitation. In this study, the independent variables are stress level and Body Mass Index (BMI), while the dependent variable is the menstrual cycle regularity.

Ethical authorization was issued by the Research Ethics Committee of Dhyana Pura University, under approval number 000901/KEP Universitas Dhyana Pura/2025, issued on 07 April 2025. Informed consent was obtained from all participants, guaranteeing the protection of their confidential and anonymous data. In SPSS data analysis, which uses descriptive statistical methods to create a framework of demographic profiles and standard characteristics, the ordinary test is used to determine whether the sample data are normally distributed or not.

To evaluate whether the independent and dependent variables are linearly related, a linearity test is used. The correlation test, on the other hand, determines how strong

the relationship is and in which direction it occurs, and regression test is an analytical method used to see the influence between two or more variables.

RESULTS

Table 1. Descriptive Analysis of Sample Characteristics (n = 40)

Characteristic	Mean ± SD	Min	Max
Age (years)	20.4 ± 1.2	19	24
Stress Level	20.25 ± 4.31	12	29
Body Mass Index (kg/m²)	23.02 ± 6.07	15.6	45.3
Menstrual Cycle (days)	33.02 ± 4.41	25	45

Note: SD = standard deviation

Table 1 shows that the average age of respondents was 20.4 years, indicating that respondents were in the young adult group. The average stress level was in the moderate category (mean 20.25), while the body mass index showed variations in nutritional status with an average value of 23.02 kg/m². The average menstrual cycle was 33 days, which illustrates the variation in cycle regularity among respondents and is an important context in analysing the relationship between the research variables.

The Shapiro-Wilk test was used to assess normality for the sample of 40 participants. The results showed that stress level ($p = 0.337$) and menstrual cycle ($p = 0.091$) were normally distributed ($p > 0.05$), whereas BMI was not ($p < 0.05$). Accordingly, Pearson's correlation was used to analyze the relationship between stress level and menstrual cycle, while Spearman's Rho was used to analyze the relationship between BMI and menstrual cycle. In addition, a residual normality test was conducted as a prerequisite for multiple linear regression. The residual met the normality assumption ($p = 0.586$), indicating that the regression analysis could be performed appropriately.

Linearity test between menstrual cycle and stress level. Linearity p-value 0.019 ($p < 0.05$) and Deviation from Linearity p-value 0.599 ($p > 0.05$), these findings indicate that stress level and menstrual cycle demonstrate a significant linear relationship. Linearity test between menstrual cycle and BMI. Linearity value of p=0.050, which is precisely at the threshold of significance. However, the deviation from linearity value demonstrated a statistically significant result, $p = 0.006$ ($p < 0.05$), suggesting a deviation from a substantial linear correlation. This discovery indicates that the connection between BMI and the menstrual cycle does not follow a linear pattern but rather exhibits a tendency towards a non-linear relationship.

Due to the results of the normal distribution data test for stress levels and abnormality for BMI. The significance value in the relationship between stress level and menstrual cycle is 0.13 ($p <0.05$), and Pearson's value $p = 0.389$, or can be said to be weak to moderate strength with a significance level of 0.05. As the connection test has been done, it can be recapitulated that there is a weak to moderate relationship and a positive, significant correlation between stress levels and the menstrual cycle. The results are shown in Table 2.

Table 2. Correlation Analysis Between Variables (n = 40)

Relationship	Statistical Test	Coefficient	p-value	Interpretation
Stress Level vs. Menstrual	Pearson r	0.389	**0.013***	Significant

Relationship	Statistical Test	Coefficient	p-value	Interpretation
Cycle				
BMI vs. Menstrual Cycle	Spearman's rho	0.134	0.411	Not significant
Stress Level vs. BMI	Spearman's rho	0.183	0.257	Not significant

To evaluate the hypothesis, a multiple linear regression test was performed to assess the association correlation between stress level and BMI on the menstrual cycle. The significance value on the correlation between stress level and BMI on menstrual cycle is 0.044 ($p < 0.05$), and the correlation coefficient value is 0.395, or can be said to be weak to moderate strength with a significance level of 0.05. The results can be seen in Table 7

Table 3. Multiple Linear Regression Predicting Menstrual Cycle Length (n = 40)

Variable	β Coefficient	t-value	p-value
Constant	24.026	–	–
Stress Level	0.384	0.200	0.044*
BMI	0.053	0.637	0.527

Model Fit Statistics	Value
R	0.395
Model p-value	0.044*

*Significant at $p < 0.05$

DISCUSSION

The respondents in this research were women enrolled as students from the Faculty of Health and Science, aged 19 to 25. Based on the distribution of stress levels, the data showed that normal stress was the most prevalent, affecting 33 students (83%). Meanwhile, the lowest stress level was mild, reported by 3 female students (8%).

These results are consistent with those of a study by (Mittiku et al., 2022) out of the total respondents, 36% of college students had perceived stress. For students, this can arise from fatigue from completing assignments and organizational activities, as well as anxiety surrounding these activities. Based on The BMI distribution indicates that the majority of participants in this study, precisely 22 individuals, fell within the normal BMI range (18.5–25.0), specifically 22 participants (55%).

Based on the distribution of menstrual cycles, among 40 female students, 30 had a regular menstrual cycle (75%), and 10 had an irregular menstrual cycle (15%). This finding aligns with the research conducted by Norlina, (2022) which examined the correlation between BMI and menstrual cycle in a sample of 40 female students. The analysis showed that most participants in that study had normal menstrual cycle, with 26 respondents (65%). According to the aforementioned description, researchers posit that a multitude of factors have the capacity to exert influence on the menstrual cycle. Among other factors, including stress levels, BMI, physical activity, and sleep patterns, that can affect female students' reproductive hormones(Song et al., 2022)

In examining the relationship between stress levels and the menstrual cycle, the Pearson correlation test produced a significance value of 0.013 ($p < 0.05$). This finding suggests that higher stress levels are linked to an increased likelihood of menstrual

irregularities among female students at Dhyana Pura University. The correlation coefficient is 0.389, indicating a weak to moderate strength at the 0.05 significance level. Although the correlation was weak to moderate, this is likely influenced by the wide variation in stress levels across participants, including differences between final-year students and early-year students.

These findings align with several previous studies that have also identified a significant association between stress and menstrual cycle patterns (Ozimek et al., 2022; Fadila et al., 2024). Their findings showed that participants with moderate and high stress levels experience more menstrual cycle irregularities, indicating that higher stress levels increase the likelihood of menstrual irregularities. According to Saadedine et al. (2025), stress triggers excessive activation of the HPA axis, leading to elevated cortisol levels that disrupt GnRH secretion, the key hormone regulating the menstrual cycle.

Based on the relationship between BMI and the menstrual cycle, the results of the Spearman's Rho correlation test showed a p-value of 0.411 ($p > 0.05$). As such, there is no compelling correlation between BMI and the menstrual cycle among female students at Dhyana Pura University. The findings are consistent with previous studies, which have concluded that BMI is not significantly associated with the menstrual cycle (Sagabulang et al., 2022; Andini, 2022). The lack of significance in this study may be partly explained by the limited variation in BMI: more than half of the respondents (22 out of 40) fell within the normal BMI category, limiting the ability to represent all BMI classifications adequately.

Additionally, several students with normal BMI experienced irregular cycles, while some with abnormal BMI had regular cycles, further weakening the overall relationship. Biologically, obesity is characterized by high body fat. Adipose tissue converts androgens into estrogen hormones by aromatization. The aromatization of androgens into estrogen transpires in the granulosa cells of adipose tissue (De Liyis et al., 2024). High estrogen levels disrupt the FSH hormone, preventing it from reaching its peak. This disrupts follicular growth, resulting in an irregular menstrual cycle (Sagabulang et al., 2022).

Several earlier studies have demonstrated a significant association between body fat levels and reproductive hormone function. Therefore, accurately measuring body fat levels is crucial for research and clinical evaluations related to reproductive health. Some studies show that BMI is significantly limited in its ability to assess body fat levels accurately. Research on the advantages and disadvantages of BMI has been conducted. Wu et al., (2024) as well as Sweatt et al., (2024) the researchers asserted that BMI did not directly quantify body fat. BMI is a computation of body weight divided by height in meters squared; however, it cannot differentiate between fat and muscle mass.

Furthermore, BMI is unable to characterise the distribution of body fat. For example, visceral fat in the abdominal area is more prone to metabolic diseases than subcutaneous fat. The study explains that there are other methods of measuring body fat levels, such as waist circumference (WC), waist-to-height ratio (WHtR), and fat mass (FM) (Licenziati et al., 2022). However, this mechanism is not reflected in the current findings as BMI does not reflect variations in fat distribution or metabolic status. Given that the majority of participants were within the normal BMI range, key differences in adiposity that affect estrogen levels were likely overlooked, which may have contributed to the non-significant relationship and constitute a limitation of the study.

According to the findings of the Spearman's Rho test assessing the association between stress levels and BMI. This shows that there is no significant relationship between stress level and BMI. In this study, the absence of a relationship between X1 and X2 may be due to limitations in the distribution of the sample data used. Most of the samples were at moderate stress levels and had relatively normal BMI, due to the limited breadth of the sample, so the data variation is limited.

The multiple linear regression analysis produced a correlation coefficient (R) of 0.395 with a significance value of 0.044 ($F < 0.05$). These findings demonstrate a statistically significant association between stress levels, BMI, and the menstrual cycle among female university students. Although this relationship was statistically significant, it was not very strong. The BMI variable, which was found to have no significant individual relationship with the menstrual cycle, decreased the overall strength of the correlation. This suggests that stress levels play a more dominant role in influencing menstrual cycle changes than BMI does.

This research is substantiated by the findings of Talita et al., (2021), who identified a strong correlation between stress and the menstrual cycle ($p < 0.001$) and no significant correlation between BMI and the menstrual cycle ($p = 0.313$). This research is substantiated by the findings of Talita et al., (2021), who identified a strong correlation between stress and the menstrual cycle ($p < 0.001$) and no significant correlation between BMI and the menstrual cycle ($p = 0.313$). These outcomes support the conclusion that stress is a more dominant factor in influencing the menstrual cycle patterns. A complex interplay of hormones characterizes the menstrual cycle.

These interactions involve dominant hormones such as estrogen, progesterone, prostaglandins, gonadotropin-releasing hormone, follicle-stimulating hormone, and luteinizing hormone (Zheng et al., 2023). Excess stress increases cortisol levels. Excess cortisol disrupts the secretion of the hormone GnRH, affecting the hormones FSH and LH and disturbing the production of estrogen and progesterone (Saadedine et al., 2025). This study presents several limitations that should be recognized to inform enhancements in future studies.

Firstly, the researchers did not control for other risk factors such as physical activity, diet, sleep, hormonal conditions, and chronic illnessin the samples, which can also affect the menstrual cycle. Secondly, researchers did not examine the menstrual cycles of the samples before or after the period, and only measured menstruation in 1 period or a single-cycle menstrual assessment. Thus, this weakens the validity of the conclusion. Third, the lack of strict sample criteria in this study, and fourth, the limitations of BMI as a measure of fat content. Furthermore, the fourth limitation of measurement tools, such as BMI and the FLO application, has not been fully validated.

CONCLUSION

Based on the findings of this study, it can be concluded that a significant association exists between stress levels and the menstrual cycle irregularities among female university students at Dhyana Pura University. There is no significant relationship between BMI and the menstrual cycle among these students. There is no significant relationship between stress levels and BMI. Additionally, a significant relationship was found between stress level, BMI, and the menstrual cycle in students, with a weak to moderate strength of relationship. These results recommend the need for structured stress management and reproductive health education programmes for female

students, in order to help maintain regular menstrual cycles and improve reproductive well-being.

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