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Association Between Stress Levels and Primary Dysmenorrhea Pain Intensity: A Cross-Sectional Study

Agusta Klaudia Wea[1], Luh Putu Ayu Vitalisyawati[2], Ni Made Rininta Adi Putri[3], Ni Luh Made Reny Wahyu Sari[4]

[1-4]Universitas Dhyana Pura, Badung Regency, Bali Province, Indonesia

Corresponding author:
Name: Agusta Klaudia Wea
E-mail: keldawea@gmail.com

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Abstract

Introduction: Primary dysmenorrhea is a common complaint among female university students and may interfere with daily activities. Stress is considered one of the factors that can exacerbate menstrual pain.

Objective: This study aimed to examine the association between stress levels and the intensity of primary dysmenorrhea pain among female students at Dhyana Pura University.

Methods: This cross-sectional quantitative study was conducted at Dhyana Pura University from April to May 2025. A total of 40 female students who met the inclusion criteria were recruited. Stress levels were assessed using the Kessler Psychological Distress Scale (K10), while pain intensity was measured using the Numeric Rating Scale (NRS). Data analysis included descriptive statistics, normality testing, linearity testing, and hypothesis testing. Normality tests showed that both stress levels and pain intensity were not normally distributed ($p=0.001$ for both; $p<0.05$); therefore, Spearman's Rho correlation test was applied.

Results: The analysis demonstrated a strong positive correlation between stress levels and primary dysmenorrhea pain intensity ($r=0.757$; $p<0.01$), indicating that higher stress levels were associated with greater menstrual pain intensity.

Conclusion: Stress levels are significantly and positively associated with the intensity of primary dysmenorrhea pain among female university students.

Keywords
Stress, Psychological; Dysmenorrhea; Students; Cross-Sectional Studies; Pain Measurement

Introduction

Menstruation is a normal physiological response that occurs monthly once a woman reaches reproductive age, typically beginning in adolescence. Adolescence, defined as the transition from childhood to adulthood between the ages of 12 and 19 years, is marked by physical and psychological growth, including the onset of puberty. In adolescent girls, puberty is generally indicated by menarche, or the first menstrual cycle.[1] Menstruation occurs due to the absence of fertilization, leading to the shedding of the endometrial lining of the uterus. During menstruation, women often experience a range of symptoms, one of the most common being dysmenorrhea.[2]

Dysmenorrhea refers to a group of symptoms occurring before and during menstruation, including abdominal and lower back pain, fatigue, nausea, vomiting, and in severe cases, fainting. Dysmenorrhea is classified into primary and secondary types. Primary dysmenorrhea has no clearly identifiable cause but is associated with ovulation and hormonal imbalance, whereas secondary dysmenorrhea results from underlying reproductive organ disorders. Emotional instability during adolescence may further exacerbate the experience of menstrual pain, making it difficult for young women to adapt. In addition, female students often face academic pressure and demanding school activities, with some missing classes due to menstrual pain.

Several factors influence the occurrence of primary dysmenorrhea, including age under 30 years, body mass index (BMI) below 20 kg/m², smoking, early menarche (before age 12 years), menstrual duration, stress levels, family history, nutritional status, anemia, psychological factors, exercise habits, allergies, and hormonal influences.[3] Among these factors, stress is recognized as an important contributor. Stress, defined as the physiological and emotional response to demands, can worsen primary dysmenorrhea if left unmanaged. Cortisol, the primary stress hormone, increases muscle tension, including in the abdominal and pelvic regions, thereby intensifying pain perception. Cortisol also stimulates the sympathetic nervous system, delays muscle recovery, and enhances sensitivity to pain, particularly during prolonged stress.[4] Uncontrolled stress may therefore heighten dysmenorrhea pain intensity and disrupt daily activities.[5]

According to the World Health Organization (WHO), the global prevalence of primary dysmenorrhea is high, with more than 50% of women in every country experiencing it. In Indonesia, approximately 55% of women of reproductive age suffer from dysmenorrhea, with 54.89% of cases classified as primary dysmenorrhea.[6] The highest prevalence is found among women experiencing moderate to severe stress compared with those reporting low stress levels. Dysmenorrhea was observed in 22% of women with low stress, 29% with moderate stress, and 44% with severe stress. In Bali, the prevalence of primary dysmenorrhea among adolescent girls and university students ranges from 74% to 78%, highlighting its significant impact on daily functioning. Research at ITEKES Bali reported a prevalence of 74.42% among 145 female nursing students.[7]

Yunianti investigated stress levels and dysmenorrhea severity among high school students and found a significant relationship between these variables. Most students experienced moderate dysmenorrhea (47.8%), followed by mild (33.3%) and severe (18.8%). The cross-tabulation showed that students without stress reported mild dysmenorrhea (55.6%), whereas those with severe stress frequently experienced severe dysmenorrhea (60%).[8] Conversely, another study concluded that no significant association existed between stress levels and primary dysmenorrhea among first-year university students, attributing the result to reliance on subjective recall.[9] Similarly, research on high school students in Bekasi also reported no relationship.[10]

The present study offers methodological improvements compared with earlier research. Unlike previous studies involving high school students or non-health science students, this study recruited physiotherapy students with basic health knowledge, allowing them to provide more valid and objective responses regarding stress and pain symptoms. This approach is supported by research conducted among medical students, who demonstrated greater validity in reporting due to their medical understanding and familiarity with research instruments.[11] Furthermore, a study among female students in Medan reported a significant association between stress and primary dysmenorrhea, although data collection inconsistencies across different menstrual days weakened its findings.[12]

To date, no study has specifically examined the relationship between stress and the intensity of primary dysmenorrhea pain among female students at Dhyana Pura University using standardized instruments and controlled timing of assessment. This study introduces methodological innovations, including the use of menstrual tracking applications to obtain real-time and more accurate data, in contrast to prior research that relied solely on memory. The inconsistent findings across previous studies may reflect differences in sample size, respondent characteristics, measurement methods, and control of confounding variables. By addressing these limitations, including a sufficient sample size, strict inclusion and exclusion criteria, and validated instruments such as the Kessler Psychological Distress Scale (K10) for stress and the Numeric Rating Scale (NRS) for pain, this study seeks to provide more accurate evidence. Confounding factors such as age, menstrual patterns, and general health were also considered to better capture the true relationship between stress levels and the intensity of primary dysmenorrhea pain.

The aim of this study was to determine the association between stress levels and primary dysmenorrhea pain intensity among female students at Dhyana Pura University, thereby addressing the limited empirical evidence on the psychological contribution to menstrual pain in this population.

Methods

This study was an observational analytic investigation with a cross-sectional design conducted to assess the association between stress levels and the intensity of primary dysmenorrhea pain. The research was carried out at the Physiotherapy Laboratory, Dhyana Pura University, Bali, from April to May 2025. Pain intensity was measured on the first to third days of menstruation to ensure uniformity in assessment timing. The target population consisted of female undergraduate students in the Physiotherapy Study Program, Faculty of Medicine, Dhyana Pura University.

Inclusion criteria were: (1) active students of Dhyana Pura University, (2) aged 19–25 years, (3) regular menstrual cycles lasting 3–5 days, (4) willingness to use a menstrual tracking application, and (5) willingness to participate in the study. Exclusion criteria included: (1) a history of reproductive health disorders, (2) secondary dysmenorrhea, and (3) routine use of oral contraceptive pills or contraceptive devices. Sampling was conducted using purposive sampling, a non-probability method in which participants were selected based on the inclusion and exclusion criteria.

Primary data were collected using validated self-administered questionnaires. Stress levels were assessed with the Kessler Psychological Distress Scale (K10), which consists of 10 items rated on a 5-point Likert scale (1 = never, 2 = sometimes, 3 = fairly often, 4 = often, 5 = always). Total scores were categorized as follows: <20 = no stress, 20–24 = mild stress, 25–29 = moderate stress, and ≥30 = severe stress. Pain intensity was measured using the Numeric Rating Scale (NRS), with scores ranging from 0–10 (0 = no pain, 1–3 = mild pain, 4–6 = moderate pain, 7–10 = severe pain).

Both instruments have demonstrated strong psychometric properties in previous research. The K10 showed high internal consistency with Cronbach's alpha values ranging from 0.84 to 0.93, while the NRS demonstrated excellent reliability with an intraclass correlation coefficient (ICC) of 0.96. Thus, both tools were deemed valid and reliable for use in this study.

Participants completed the questionnaires independently after receiving standardized instructions from the researcher regarding the study's objectives and the completion process. Data collection was conducted in the physiotherapy laboratory, which provided a calm and conducive environment. Seating arrangements ensured privacy of responses. To minimize bias, all assessments were carried out on the same menstrual cycle days (day 1–3), guided by a visual NRS scale.

Sample size requirements were calculated using Fisher's z transformation based on prior effect size estimates. For a moderate correlation (r = 0.30), approximately 85 participants were required. However, the 40 participants in this study were sufficient to detect a strong correlation with adequate statistical power (80%). For statistical analysis, K10 and NRS scores were treated as continuous variables to maximize data variation and precision. For descriptive analysis, scores were also categorized into groups (stress: none, mild, moderate, severe; pain: mild, moderate, severe) to aid interpretation and presentation of frequency distributions.

All analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize participant characteristics. The Shapiro–Wilk test was used to assess normality, followed by linearity testing. Correlation analysis was conducted using Pearson's correlation for normally distributed data and Spearman's Rho for non-normally distributed data. The level of significance was set at $\alpha = 0.05$ (two-tailed). Missing data were handled using listwise deletion, including only participants with complete data in the final analysis. The independent variable was stress level, while the dependent variable was the intensity of primary dysmenorrhea pain. This study was approved by the Research Ethics Committee of Dhyana Pura University (Approval No. 000919/2025).

Results

From a total population of 83 students, 48 were invited to participate, 47 met the inclusion criteria, 7 declined participation, and 40 were included in the final analysis (n = 40). No missing data were identified for any variables. The study results are presented in frequency distribution tables, descriptive statistics, and inferential analyses including normality, linearity, and correlation tests. The distribution of participants' stress levels is presented in Table 1, providing an overview of how stress was categorized across the study population.

Table 1. Frequency Distribution of Stress Levels

Stress Category	Frequency	Percentage
No Stress	9	22.5%
Mild Stress	7	17.5%
Moderate Stress	15	37.5%
Severe Stress	9	22.5%
Total	40	100%

As shown in Table 1, the majority of participants experienced moderate stress (n = 15, 37.5%), while the fewest reported mild stress (n = 7, 17.5%). Table 2 illustrates the distribution of dysmenorrhea pain intensity among respondents, highlighting the proportion of participants within each pain category.

Table 2. Frequency Distribution of Dysmenorrhea Pain Intensity

Pain Category	Frequency	Percentage
No Pain	1	2.5%
Mild Pain	12	30.0%
Moderate Pain	21	52.5%
Severe Pain	6	15.0%
Total	40	100%

Table 2 demonstrates that most respondents reported moderate pain (n = 21, 52.5%), while only one respondent (2.5%) reported no pain. The descriptive statistics of the study variables, including measures of central tendency and variability, are summarized in Table 3.

Table 3. Descriptive Statistics

Variable	Minimum	Maximum	Mean	SD
Age (years)	19	24	20.48	1.198
Stress Score (K10)	13	40	26.62	6.460
Pain Score (NRS)	0	9	4.18	1.866

Table 3 shows that the mean age of participants was 20.48 years. The mean Kessler Psychological Distress Scale (K10) score was 26.62, indicating moderate stress, while the mean Numeric Rating Scale (NRS) score was 4.18, indicating moderate dysmenorrhea pain. Standard deviation (SD) values indicate the variability of responses across participants. Table 4 presents the results of the linearity test, which was performed to examine the relationship assumptions between stress levels and dysmenorrhea pain intensity.

Table 4. Linearity Test

Variable	p-value
Combined	0.001
Linearity	0.001
Deviation from Linearity	0.769

Table 5 shows that the relationship between stress levels and pain intensity was linear ($p < 0.05$), with no significant deviation from linearity ($p = 0.769$). The correlation between stress levels and dysmenorrhea pain intensity was analyzed using Spearman's Rho, and the results are shown in Table 5.

Table 5. Spearman's Rho Correlation Test

Variable	n	Spearman's rho	p-value
Stress vs. Pain	40	0.757	0.001

As shown in Table 6, Spearman's correlation analysis revealed a strong positive association between stress levels and pain intensity ($r = 0.757$, 95% CI [0.58–0.87], $p < 0.001$). Subgroup analysis confirmed that this correlation remained significant across all age groups (< 21 years: $r = 0.742$, $p < 0.001$; ≥ 21 years: $r = 0.768$, $p < 0.001$). The strongest association was found among participants with moderate-to-severe stress ($r = 0.801$, $p < 0.001$), compared to those with no stress or mild stress ($r = 0.512$, $p = 0.021$).

Discussion

The findings of this study demonstrate a strong positive correlation between stress levels and the intensity of primary dysmenorrhea, with $r = 0.757$ ($p < 0.01$). According to Sugiyono's classification, this value falls within the strong correlation category.[13] This result is higher than the moderate correlation ($r = 0.540$) reported by Yunianti, representing an approximately 40% stronger proportional association. Similarly, Noviary also identified a relationship between these variables, although the correlation value was not as high.14,[15] Paseno et al. reported that respondents with high stress were 2.3 times more likely to experience severe dysmenorrhea, which is consistent with the present findings, despite employing a different measure of association.[16] Taken together, this study provides stronger quantitative evidence that, among female university students, stress plays a significant role in the severity of primary dysmenorrhea compared to several previous studies.

A distinctive feature of this study lies in its focus on young adult women—specifically university students—who face unique psychosocial pressures compared to high school students, including academic demands at the tertiary level, social expectations, and adaptation to adult roles. Moreover, the use of the Kessler Psychological Distress Scale (K10) to assess stress and the Numeric Rating Scale (NRS) to assess pain enhanced the accuracy and reliability of measuring both variables. Another point of distinction is the cultural and contextual setting of the study, conducted at Dhyana Pura University in Bali, which has its own academic and social dynamics. Thus, the study not only strengthens existing empirical evidence but also contributes new insights within a distinct sociocultural population of Indonesian university students.

The study involved 40 respondents aged 19–25 years. As shown in Table 5.1, the majority were 20 years old (n = 14, 35%), while the minority were 24 years old (n = 1, 2.5%). This group represents late adolescence to early adulthood, a developmental stage in which reproductive organs remain in the maturation process. Late adolescence to early adulthood is recognized as a transitional phase in which individuals begin to assume responsibility for career planning and adult roles. Academic obligations such as coursework and examinations form an essential part of this preparation.[17]

At this age, hormonal fluctuations are common, particularly involving cortisol, which may become imbalanced under prolonged psychosocial pressure. Continuous stress activates the hypothalamic–pituitary–adrenal (HPA) axis, increasing cortisol secretion and disrupting circadian regulation.[18] Alongside cortisol imbalance, increased levels of prostaglandins occur during this stage, linked to fluctuations of estrogen and progesterone. Declining progesterone levels stimulate excessive prostaglandin production, leading to uterine contractions and menstrual pain.[19]

The present study showed that most respondents aged 20 reported moderate pain intensity (52.5%). This aligns with prior findings that dysmenorrhea incidence is highest among women aged 15–25 years and tends to decline thereafter.[20] Similarly, another study confirmed that women aged 15–25 have significantly higher risk of dysmenorrhea compared to those aged 26–30.[21]

Stress levels were categorized into four groups: none, mild, moderate, and severe.[22] As presented in Table 5.2, most respondents reported moderate stress (n = 15, 37.5%), while the fewest reported mild stress (n = 7, 17.5%). This is consistent with findings among students at Al-Azhar University in Mataram, where the majority reported moderate stress.[23] Similarly, a study among Klabat University students found that moderate stress was the most common level reported.[24]

Stress exacerbates dysmenorrhea through biological and psychological mechanisms. Biologically, stress triggers neuroendocrine responses that increase prostaglandin production, leading to stronger uterine contractions, vasoconstriction, ischemia, and intensified pain. Psychologically, stress-related conditions such as anxiety and depression reduce pain thresholds, amplifying the perception of menstrual pain.[25]

Several factors influence stress among university students, including living environment, family economic status, social relationships, unexpected life events, and lifestyle habits.[26] For instance, poor housing conditions or family conflict may act as stressors.[27] Financial difficulties can also contribute to psychological distress, as students from low-income families may feel disadvantaged compared to peers.[28] Furthermore, interpersonal conflicts with friends, partners, or family members often heighten stress levels.[27] Unexpected events, such as bereavement, are additional significant triggers. Academic procrastination is another relevant factor; delaying assignments or studying can accumulate stress over time.[29] Prolonged stress manifests as irritability, fatigue, poor concentration, and difficulty relaxing.[30]

At Dhyana Pura University, most respondents experienced moderate dysmenorrhea. Similar findings were reported by Luh et al., where 48.5% of female students experienced moderate menstrual pain, and by Suherman et al., among biology students at Padang State University.31,32 Globally, dysmenorrhea prevalence ranges widely between 16.8% and 81%, particularly high in adolescents whose reproductive systems are still developing.[32]

Primary dysmenorrhea is mainly attributed to excessive prostaglandin production, particularly PGF2α and PGE2, which induce uterine hypercontraction and ischemia.[33] The mechanism of pain involves nociceptor activation and transmission via spinal segments T10–L1 and S2–S4, explaining the referred pain to the lower back, pelvis, and thighs.[19] Dysmenorrhea impairs daily functioning by reducing concentration, academic performance, and social interactions, while chronic cases may affect reproductive health, fertility, and quality of life.[35,34]

Risk factors include age under 25, low body mass index (BMI), smoking, early menarche, high stress, family history, and poor nutritional status.[35] Smoking contributes through vasoconstriction and increased PGF2α production.[36] Early menarche reflects immature reproductive organs and increases susceptibility to menstrual pain.[37] Consistent with Triwahyuningsih et al., the present study confirmed a strong positive correlation ($r = 0.782$, $p < 0.001$) between stress and dysmenorrhea severity.[38] Higher stress levels corresponded with greater pain intensity, underscoring the multifactorial pathways linking psychological and physiological processes.

Relationship Between Stress and Primary Dysmenorrhea

Correlation testing using Spearman's rho produced $r = 0.757$ with $p = 0.001$, indicating a strong, statistically significant positive relationship between stress and dysmenorrhea intensity. Similar findings were reported by Thasmara et al. among medical students at Tanjungpura University, where stress and pain scores were positively correlated.[16] Shintya and Tandungan also observed a significant moderate association ($r = 0.449$, $p < 0.05$) among female students at Klabat University.[20]

In the present study, the mean stress score was 24.62, classified as moderate, consistent with Rafique et al., who identified moderate stress as most common among students.[38] Academic workload, transitional adaptation, and personal factors such as fatigue and anxiety are key contributors. Stress is a natural physiological response but may adversely affect mental and physical health, particularly reproductive health through dysregulation of the hypothalamic–pituitary–adrenal axis and prostaglandin synthesis.[39,40,41]

Although this study found a robust correlation, contrasting findings exist. For example, Sriwati and Isrona found no association between stress and dysmenorrhea among first-year medical students at Andalas University.[42] A study in high school students also reported no significant relationship.[10] Such discrepancies may stem from methodological differences, including reliance on subjective recall rather than standardized instruments. The present study improved on these limitations by using validated measures (K10 and NRS) and involving health science students, who are more familiar with medical terminology and symptom reporting.[11]

Another strength is the contextual consideration of menstrual tracking applications, allowing more accurate data collection. Nonetheless, limitations remain: the cross-sectional design precludes causal inference; the sample size (n = 40) is relatively small and confined to one program and one university; data collection occurred within a short timeframe, not accounting for inter-cycle variability; and potential confounders such as sleep, physical activity, and reproductive history were not fully controlled.

Therefore, while these findings highlight a significant and strong association, generalization must be approached cautiously. Cultural, academic, and social contexts likely influence the stress–dysmenorrhea relationship, limiting applicability to other populations. Future studies should employ larger, more diverse samples and longitudinal designs to confirm and expand these findings. From a practical standpoint, this study suggests that stress management strategies may serve as effective non-pharmacological interventions to reduce dysmenorrhea among female university students. By addressing both physiological and psychological mechanisms, stress management could improve menstrual health and academic performance.

This study is not without limitations. The relatively small sample size, the use of a cross-sectional design, and the restriction to a single university program limit the robustness of the findings and preclude causal inference. Moreover, the short data collection period did not capture inter-cycle variability, and potential confounding factors such as sleep patterns, physical activity, and reproductive history were not comprehensively controlled. Consequently, the results are most appropriately generalized to female university students in similar cultural and academic contexts, and caution is warranted in applying them to broader or more heterogeneous populations. Despite these limitations, the study provides important practical implications. The strong association between stress and primary dysmenorrhea underscores the potential benefit of incorporating stress management strategies—such as relaxation training, mindfulness-based interventions, and time-management skills—into student health promotion programs. These non-pharmacological approaches may reduce menstrual pain, improve well-being, and enhance academic performance. Future research should employ larger and more diverse samples, longitudinal designs, and comprehensive assessment of potential confounders to confirm and extend the present findings.

Conclusion

Based on the findings of this study involving female students at Dhyana Pura University, it can be concluded that there is a significant association between stress levels and the intensity of primary dysmenorrhea pain. The analysis demonstrated that stress has a causal relationship with increased menstrual pain intensity, a result supported by epidemiological evidence. This highlights the importance of stress management as a key therapeutic strategy in the management of dysmenorrhea, while also paving the way for further research into effective interventions.

Author Contribution

Agusta Klaudia Wea contributed to study conceptualization, data collection, data analysis, and manuscript drafting.
Luh Putu Ayu Vitalisyawati contributed to methodology development, statistical analysis, and critical revision of the manuscript.
Ni Made Rininta Adi Putri contributed to data interpretation and manuscript editing.
Ni Luh Made Reny Wahyu Sari contributed to study supervision and final manuscript review.
All authors read and approved the final manuscript.

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Conflict of Interest Statement

The authors declare no conflict of interest related to this study.

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Ethics Statement

This study was approved by the Research Ethics Committee of Dhyana Pura University (Approval No. 000919/2025). Written informed consent was obtained from all participants prior to data collection.

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