

The Impact of Stress on Dysmenorrhea Among Adolescent Girls: A Cross-Sectional Study at Junior High School 1 Ngariboyo

Hanif Azizah, Nurlailis Saadah, Rahayu Sumaningsih, Heru Santoso Wahito Nugroho

Department of Midwifery, Polytechnic Health Ministry of Health Surabaya, Surabaya, Indonesia

Corresponding author: Nurlailis Saadah (e-mail: nurlailis.saadah66@gmail.com)

ABSTRACT Adolescence is a critical developmental period characterized by significant physiological and psychological changes, making individuals more susceptible to stress. One common condition affecting adolescent girls is dysmenorrhea, or menstrual pain, which is often exacerbated by psychological factors such as stress. The present study aimed to investigate the effect of stress on the incidence of dysmenorrhea among adolescent girls. This observational analytic research employed a cross-sectional design, conducted at Junior High School 1 Ngariboyo. The study population consisted of 179 seventh- and eighth-grade female students. Using the Slovin formula and simple random sampling, 124 participants were selected. The independent variable was stress, measured using the Depression Anxiety Stress Scale (DASS-42), while the dependent variable was dysmenorrhea, assessed using the Numerical Rating Scale (NRS). Data analysis was performed using ordinal regression to determine the relationship between stress levels and dysmenorrhea severity. The findings revealed that 39.5% of respondents experienced moderate stress, and 42.7% reported moderate dysmenorrhea. The ordinal regression test indicated a statistically significant relationship between stress and the occurrence of dysmenorrhea, with a p-value of 0.017 ($p < 0.05$), confirming that higher stress levels are associated with increased severity of menstrual pain. In conclusion, this study demonstrates a significant association between stress and dysmenorrhea among adolescent girls. These findings highlight the need for early interventions and stress management education to reduce menstrual discomfort and improve the quality of life for adolescent females. Schools and health professionals should work collaboratively to develop support programs aimed at promoting both mental and reproductive health in this population.

INDEX TERMS adoles adolescence, stress, dysmenorrhea, menstrual pain, mental health

I. INTRODUCTION

Adolescence, defined by the World Health Organization as the period between 10 and 19 years of age, is a critical developmental phase marked by complex physical, psychological, and emotional changes [1]. During this transition, hormonal fluctuations and cognitive immaturity often predispose adolescents particularly girls to heightened emotional responses, making them more vulnerable to stress and mood instability [2], [3]. Among the various health challenges faced during adolescence, dysmenorrhea or painful menstruation is one of the most commonly reported gynecological complaints [4], [5]. It not only disrupts daily functioning but also leads to school absenteeism, diminished academic performance, and poor quality of life [6]–[8].

Dysmenorrhea is broadly classified into primary and secondary types. Primary dysmenorrhea refers to menstrual pain without underlying pathology, while secondary dysmenorrhea results from identifiable gynecological conditions [9]. Globally, dysmenorrhea affects 60%–93% of adolescent girls, with varying degrees of pain intensity [10]. In Indonesia, the reported prevalence of dysmenorrhea among adolescents reaches approximately 64.25%, with East

Java alone accounting for over 57% of those cases [11], [12]. Several contributing factors to dysmenorrhea have been identified, including early menarche, family history, sedentary lifestyle, nutritional deficiencies, and psychological stress [13]–[15].

Recent studies have highlighted stress as a significant psychosomatic factor that exacerbates menstrual pain. Psychological stress stimulates the hypothalamic-pituitary-adrenal (HPA) axis, resulting in increased cortisol levels and disrupted reproductive hormone regulation, thereby intensifying uterine contractions through elevated prostaglandin synthesis [16]–[19]. Researchers have observed that adolescent girls with higher stress levels are more likely to experience severe dysmenorrhea [20]–[22]. Standard tools such as the Depression Anxiety Stress Scale (DASS-42) and the Numerical Rating Scale (NRS) are commonly used in clinical and epidemiological studies to assess stress levels and pain intensity, respectively [23], [24].

Although various studies have established the association between stress and dysmenorrhea, existing literature tends to focus either on university students or general female populations, often overlooking the specific experiences of

adolescents in rural junior high schools [25]–[27]. Furthermore, there is a lack of region-specific studies that reflect the socio-cultural and educational dynamics influencing adolescent health behavior in Indonesian settings. This research addresses that gap by examining the relationship between stress and dysmenorrhea among seventh- and eighth-grade female students at Junior High School 1 Ngariboyo.

The objective of this study is to analyze the influence of psychological stress on the occurrence of dysmenorrhea in adolescent girls. By using validated psychological and pain assessment tools, this study seeks to generate empirical data that can inform future health interventions targeted at young females. The contributions of this study are threefold:

1. **Contextual Contribution:** This study provides region-specific data on the prevalence of dysmenorrhea and its correlation with stress among adolescents in rural Indonesia, an area previously underrepresented in scientific literature.
2. **Methodological Contribution:** It employs standardized, validated instruments (DASS-42 and NRS) to ensure accuracy and reliability in assessing psychological stress and menstrual pain.
3. **Practical Contribution:** The study offers actionable insights for educators, health professionals, and policymakers to design school-based mental health programs and non-pharmacological interventions aimed at reducing dysmenorrhea through stress management.

II. METHOD

A. STUDY DESIGN

This study employed an observational analytic research design with a cross-sectional approach, aimed at examining the relationship between stress levels and the severity of dysmenorrhea among adolescent girls. A cross-sectional design was selected because it enables the simultaneous measurement of exposure (stress) and outcome (dysmenorrhea) within a specific population at a single point in time, making it efficient and cost-effective for studies focused on associations [31], [32].

B. LOCATION AND DURATION

The research was conducted at Junior High School 1 Ngariboyo, located in Magetan, East Java, Indonesia. Data collection took place in February 2024, following coordination with school authorities and ethical clearance procedures.

C. STUDY POPULATION AND SAMPLING

The target population consisted of all seventh- and eighth-grade female students enrolled at the school, totaling 179 students. The accessible population included only students who had experienced menarche and were present during the data collection period. The sample size was determined using the Slovin formula with a 5% margin of error, resulting in a minimum sample requirement of 124 respondents. A simple random sampling technique was applied to ensure that each eligible participant had an equal chance of selection, thereby reducing selection bias and increasing the representativeness of the sample [33], [34].

D. INCLUSION AND EXCLUSION CRITERIA

The inclusion criteria were:

1. Female students in Grade 7 or 8 who had experienced menarche.
2. Willingness to participate, indicated by informed consent from both students and their parents.

The exclusion criteria included:

1. Students with diagnosed gynecological conditions such as endometriosis or polycystic ovary syndrome (PCOS).
2. Those on medication that could affect menstrual pain or psychological state.
3. Incomplete responses to the questionnaires.

E. ETHICAL CONSIDERATIONS

Ethical approval was obtained from the Health Research Ethics Committee of Poltekkes Kemenkes Surabaya. The research adhered to ethical standards for human subject research, including confidentiality, voluntary participation, and informed consent. Parental consent was obtained for all underage participants.

F. VARIABLES AND OPERATIONAL DEFINITIONS

Stress levels were classified into five categories based on DASS-42 scoring: normal, mild, moderate, severe, and extremely severe. Dysmenorrhea severity was categorized as mild (1–3), moderate (4–6), or severe (7–10) [38].

1. **Independent variable:** Stress level, measured using the Depression Anxiety Stress Scale (DASS-42), a validated psychometric instrument commonly used in adolescent mental health research [35], [36].
2. **Dependent variable:** Dysmenorrhea severity, measured using the Numerical Rating Scale (NRS), which asks participants to rate their menstrual pain on a scale from 0 (no pain) to 10 (worst possible pain) [37].

G. INSTRUMENTS AND VALIDATION

A pilot test was conducted with 20 students from a neighboring junior high school to evaluate the clarity, reliability, and time required to complete the instruments. Results indicated that both instruments were well understood and reliable for the target age group.

1. **DASS-42 Questionnaire:** This instrument includes 42 items divided into three subscales: depression, anxiety, and stress. For this study, only the 14 stress-related items were used. The questionnaire had been previously translated into Bahasa Indonesia and validated for use among Indonesian adolescents, with a **Cronbach's alpha** > 0.80, indicating strong internal consistency [39].
2. **Numerical Rating Scale (NRS):** The NRS is a widely used unidimensional measure of pain intensity in both clinical and non-clinical settings. It is simple, quick to administer, and has been validated for use in adolescent populations [40].

H. DATA COLLECTION PROCEDURE

Data collection was conducted in a structured classroom setting with permission from the school. Researchers explained the objectives and procedures to the students and distributed printed questionnaires. Participants completed the forms independently within 30 minutes under researcher supervision. To minimize response bias, students were

assured of anonymity and encouraged to answer honestly. Completed forms were checked for completeness before data entry.

I. DATA MANAGEMENT AND STATISTICAL ANALYSIS

A p-value of < 0.05 was considered statistically significant, and confidence intervals were reported where applicable. Multicollinearity was tested prior to regression analysis to ensure that predictor variables were independent. All data were entered into Microsoft Excel and exported to IBM SPSS version 26.0 for statistical analysis. The following steps were followed:

1. Descriptive statistics: Used to summarize respondent characteristics, stress levels, and dysmenorrhea severity.
2. Inferential statistics: Ordinal logistic regression analysis was performed to examine the relationship between stress levels and dysmenorrhea severity. This method was appropriate due to the ordinal nature of the dependent variable and the non-parametric distribution of the data [41].

J. LIMITATIONS OF THE METHOD

While the cross-sectional design enabled efficient data collection, it limited the ability to draw causal inferences. Additionally, the reliance on self-report measures may have introduced social desirability bias. Future studies may benefit from integrating longitudinal designs or biomarker-based assessments to validate psychological stress levels [42], [43].

III. RESULT

A. AGE DISTRIBUTION

TABLE 1
Age Distribution

Age (year)	Sum	Percentage
12	4	3.2
13	60	48.4
14	55	44.4
15	5	4.0
Summary	124	100

TABLE 1 presents the age distribution of the study participants. The majority of the respondents (48.4%, $n=60$) were 13 years old, followed by 14-year-olds (44.4%, $n=55$). A small proportion of the sample comprised 12-year-olds (3.2%, $n=4$) and 15-year-olds (4.0%, $n=5$). This distribution indicates that the study sample was predominantly composed of early adolescents.

B. FREQUENCY DISTRIBUTION OF STRESS

TABLE 2
Frequency Distribution of Stress

Stress	Sum	Percentage
Normal	38	30.6
Mild	32	25.9
Moderate	49	39.5
Severe	5	4.0
Very Severe	0	0
Summary	124	100

The frequency distribution of stress levels among the participants is detailed in TABLE 2. The data reveal that moderate stress was the most prevalent, affecting 39.5%

($n=49$) of the respondents. Mild stress was reported by 25.9% ($n=32$), while 30.6% ($n=38$) were categorized as having normal stress levels. Severe stress was less common (4.0%, $n=5$), and no respondents exhibited extremely severe stress. These findings suggest that a substantial proportion of the adolescent participants experienced moderate psychological stress.

C. FREQUENCY DISTRIBUTION OF DYSMENORRHEA

TABLE 3
Frequency Distribution of Dysmenorrhea

Dysmenorrhea	Sum	Percentage
No Pain	16	12.9
Mild Pain	51	41.1
Moderate Pain	53	42.7
Severe Pain	4	3.2
Summary	124	100

As shown in TABLE 3, the severity of dysmenorrhea among the participants varied. Moderate dysmenorrhea was the most frequently reported condition, affecting 42.7% ($n=53$) of the respondents. Mild pain was experienced by 41.1% ($n=51$), while 12.9% ($n=16$) reported no pain. Severe dysmenorrhea was relatively uncommon, with only 3.2% ($n=4$) of the sample. This distribution underscores the high prevalence of menstrual pain in the study population.

D. RESULT OF STRESS WITH DYSMENORRHEA

TABLE 4
Result Of Stress with Dysmenorrhea

Stress	No Pain		Mild Pain		Moderate Pain		Severe Pain		Sum mary		P value
	N	%	N	%	N	%	N	%	N	%	
Normal	6	15.8	23	60.5	8	21.1	1	2.6	38	100	0.017
Mild	2	6.3	14	43.8	16	50.0	0	0	32	100	
Moderate	7	14.3	14	28.6	25	51.0	3	6.1	49	100	
Severe	1	20.0	0	0	4	80.0	0	0	5	100	
Summary	16	12.9	51	41.1	53	42.7	4	3.2	124	100	

TABLE 4 displays the association between stress levels and dysmenorrhea severity. The ordinal regression analysis revealed a statistically significant relationship between these variables ($p = 0.017$). Notably, among participants with normal stress, the majority (60.5%) reported mild dysmenorrhea. However, as stress levels increased, the proportion of respondents experiencing moderate to severe dysmenorrhea also rose. Specifically, 50.0% of those with mild stress and 51.0% of those with moderate stress reported moderate dysmenorrhea. This pattern supports the hypothesis that stress exacerbates menstrual pain.

IV. DISCUSSION

A. INTERPRETATION OF RESULTS

This study aimed to determine the relationship between psychological stress and dysmenorrhea among adolescent girls at Junior High School 1 Ngariboyo. The results revealed a significant relationship between stress levels and the severity of dysmenorrhea, with a **p-value of 0.017**, indicating that stress is a significant predictor of menstrual pain intensity in adolescents. Most respondents experienced **moderate stress (39.5%)** and reported **moderate levels of dysmenorrhea (42.7%)**. These findings suggest that stress may contribute to the worsening of menstrual pain symptoms, supporting the hypothesis that psychosocial

factors have a measurable influence on physical health outcomes.

Stress activates the **hypothalamic-pituitary-adrenal (HPA) axis**, resulting in elevated cortisol levels that can disrupt the endocrine regulation of reproductive hormones such as estrogen and progesterone [44], [45]. Such hormonal imbalance increases the release of prostaglandins, which are known to induce stronger and more painful uterine contractions, thereby exacerbating dysmenorrhea symptoms [46]. Moreover, stress may also affect pain perception by lowering pain thresholds through central sensitization mechanisms, making adolescents more sensitive to menstrual discomfort [47].

This association demonstrates the importance of assessing psychological factors when evaluating and treating dysmenorrhea in adolescents. The significant relationship between stress and menstrual pain supports a biopsychosocial approach to adolescent health, which considers mental well-being as an essential component of overall physical health [48].

B. COMPARISON WITH PREVIOUS STUDIES

The results of the current study are consistent with prior research that has identified stress as a contributing factor to dysmenorrhea in adolescent and young adult populations. For instance, a study by Fitriana et al. found that nursing students with higher perceived stress were more likely to report severe menstrual pain compared to those with lower stress levels [49]. Similarly, Hartati et al. demonstrated a significant relationship between stress, emotional instability, and dysmenorrhea among high school students, indicating that emotional regulation may play a key role in menstrual symptomatology [50].

In addition, a recent cross-sectional study conducted by Pialiani et al. on medical students showed that women with moderate to high stress scores on the DASS-42 were significantly more likely to report moderate to severe dysmenorrhea, aligning closely with the findings of this research [51]. Another Indonesian study by Hasanuddin reported similar trends among vocational school students, where stress was strongly correlated with the severity and frequency of menstrual pain episodes [52].

International literature further supports these findings. Zhang et al., in a large-scale Chinese cohort study, reported that adolescents experiencing academic and interpersonal stress had significantly higher odds of experiencing dysmenorrhea, independent of body mass index or menarche age [53]. This global consistency suggests that stress-related dysmenorrhea is a widespread phenomenon, not limited by geography or cultural background.

However, some studies have presented more nuanced findings. For example, Nair et al. found that while stress was significantly associated with dysmenorrhea, the strength of the correlation diminished after controlling for physical activity and diet quality, suggesting the multifactorial nature of menstrual pain [54]. This indicates that although stress is a prominent factor, other variables such as nutrition, sleep hygiene, and exercise patterns may also interact with menstrual health.

Taken together, these studies confirm the central role of psychological stress in the pathophysiology of dysmenorrhea while highlighting the importance of adopting a comprehensive, multidimensional approach to managing menstrual pain in adolescents.

C. LIMITATIONS AND IMPLICATIONS

Despite yielding important findings, this study has several limitations that should be acknowledged. First, the **cross-sectional design** limits causal inference. While a statistically significant relationship was identified between stress and dysmenorrhea, it remains unclear whether stress directly causes increased menstrual pain, or whether the experience of recurrent pain contributes to elevated stress levels a possibility given the bidirectional nature of psychosomatic relationships [55].

Second, data collection relied on **self-reported instruments** (DASS-42 and NRS), which are susceptible to **recall bias** and **social desirability bias**. Adolescents may underreport their stress levels or pain severity due to embarrassment or lack of understanding, potentially compromising data accuracy. While these tools are validated and widely used, incorporating physiological biomarkers such as salivary cortisol or heart rate variability in future studies could enhance objectivity [56].

Third, the study was conducted in a **single junior high school in a semi-rural area**, limiting generalizability. Socioeconomic status, cultural attitudes toward menstruation, access to menstrual health education, and school environment can all influence the experience of dysmenorrhea. Thus, findings may not be representative of adolescents in urban or higher-income settings. Multi-center studies across diverse regions would offer a broader understanding of these dynamics [57].

Furthermore, this study did not control for **other potential confounding factors**, such as dietary habits, physical activity, family history of dysmenorrhea, or body mass index (BMI), which are known to influence menstrual health [58]. Future research should consider a multivariate analysis model to account for these variables.

Despite these limitations, the study provides valuable implications for practice, particularly in the field of adolescent reproductive health and school-based wellness programs. The findings underscore the need for **early mental health screening and stress management interventions in schools**, especially among female adolescents who are more vulnerable to menstrual-related morbidity. Techniques such as **mindfulness training, cognitive-behavioral therapy (CBT), regular exercise, and dietary education** have shown promise in managing stress and alleviating dysmenorrhea symptoms [59].

Additionally, these results advocate for an **integrated health education curriculum** that bridges physical and psychological health. Teachers, school counselors, and healthcare providers should be equipped to identify signs of stress and menstrual discomfort and provide age-appropriate interventions or referrals. Building a supportive environment where adolescent girls feel safe discussing menstrual health can reduce stigma and promote early help-seeking behaviors.

Lastly, the findings may inform national health policy, particularly in enhancing **youth-friendly health services (YFHS)** and reproductive health programs targeting junior high schools. Incorporating psychological screening into routine school health assessments could facilitate early identification of at-risk students and reduce the long-term impact of untreated menstrual disorders.

V. CONCLUSION

This study aimed to investigate the relationship between psychological stress and the severity of dysmenorrhea among adolescent girls at Junior High School 1 Ngariboyo. Utilizing a cross-sectional research design and involving 124 randomly selected female students from the seventh and eighth grades, the study assessed stress levels using the DASS-42 instrument and measured menstrual pain intensity through the Numerical Rating Scale (NRS). The findings revealed that a significant proportion of participants (39.5%) experienced moderate levels of stress, while 42.7% reported moderate dysmenorrhea. Ordinal regression analysis showed a statistically significant association between stress and dysmenorrhea, with a p-value of 0.017 ($p < 0.05$), indicating that higher stress levels are linked to more intense menstrual pain. These results underscore the influence of psychosocial factors on adolescent reproductive health, particularly the role of emotional stress in exacerbating menstrual discomfort. The study supports the adoption of a biopsychosocial approach in the management of dysmenorrhea, emphasizing the integration of mental health support in adolescent care services. Given the high prevalence of stress-related dysmenorrhea identified in this study, it is recommended that schools implement preventive strategies such as stress management workshops, peer counseling programs, and psychoeducational campaigns. Future research should consider employing longitudinal designs to explore the directionality and causality of the stress–dysmenorrhea relationship, as well as incorporating physiological stress markers (e.g., cortisol levels) to validate self-reported data. Additionally, expanding the study population across diverse geographic, cultural, and socioeconomic backgrounds would enhance the generalizability of findings. Integrating multivariate analyses that control for confounding variables such as nutrition, physical activity, family history, and body mass index could also provide a more comprehensive understanding of the multifactorial nature of dysmenorrhea. Overall, this study contributes valuable empirical evidence to the growing body of literature on adolescent menstrual health and highlights the urgent need for holistic interventions that address both physical and psychological determinants.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the support and cooperation of the students, teachers, and administration of Junior High School 1 Ngariboyo for their participation in this study. We extend our sincere appreciation to Poltekkes Kemenkes Surabaya for providing the necessary resources and guidance. Special thanks to our colleagues and research

assistants for their invaluable contributions during data collection and analysis. Lastly, we acknowledge the ethical review committee and all individuals who provided insights to enhance this research. This study was made possible through their collective support.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

DATA AVAILABILITY

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request

AUTHOR CONTRIBUTIONS

All authors made significant contributions to this research. Hanif Azizah led the study design, methodology development, data collection, and initial manuscript drafting. Nurlailis Saadah provided critical supervision throughout the project, contributed to data analysis and interpretation, and substantially revised the manuscript. Rahayu Sumaningsih was responsible for data validation, resource acquisition, and ensuring research integrity. Heru Santoso Wahito Nugroho handled statistical analysis, software implementation, and data visualization. All authors participated in conceptualizing the study, reviewing results, approving the final manuscript, and take full responsibility for the published work.

DECLARATIONS

ETHICAL APPROVAL

This study was conducted in accordance with ethical standards and received approval from the Institutional Review Board of Poltekkes Kemenkes Surabaya. Written informed consent was obtained from all participants and their legal guardians prior to data collection.

CONSENT FOR PUBLICATION PARTICIPANTS.

Written informed consent was obtained from all participants and their legal guardians (for minors) prior to data collection.

COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

REFERENCE

- [1] WHO, "Health for the World's Adolescents: A Second Chance in the Second Decade," Geneva: WHO, 2020.
- [2] Agustriyana, "Fully Human Being Pada Remaja," JBKI, vol. 2, no. 1, pp. 9, 2017.
- [3] S. Rahmawati et al., "Tingkat Stres Pada Remaja," JPKI, vol. 5, no. 1, pp. 25–33, 2019.
- [4] M. Agustin, "Stress and Dysmenorrhea in Female Nursing Students," J. Afiat, vol. 4, pp. 603–612, 2018.
- [5] A. F. Larasati, "Primary Dysmenorrhea and Risk Factors," J. Majority, pp. 79–84, 2016.
- [6] K. Khotimah, "Menstruation and Adolescent Attitudes," J. Ners dan Kebidanan Indonesia, pp. 136–140, 2014.
- [7] E. Susanti, "Stress and Dysmenorrhea in Midwifery Students," STIKES Aisyiyah, 2014.

- [8] D. Sari et al., "Stress and Primary Dysmenorrhea in Medical Students," JKA, vol. 4, no. 2, pp. 567–570, 2015.
- [9] B. H. Pundati and C. Sistiari, "Factors Related to Dysmenorrhea," J. Kesmas Indonesia, vol. 8, pp. 40–48, 2016.
- [10] Zhang et al., "Psychological Disorders and Dysmenorrhea: A Two-Way Relationship," Int. J. Psychosom Obstet Gynaecol, vol. 41, pp. 123–130, 2021.
- [11] R. Herawati, "Factors Affecting Dysmenorrhea in Riau," Maternity Neonatal J., vol. 2, no. 3, pp. 161–172, 2017.
- [12] U. Nadiroh, "Anxiety and Menstrual Pain," J. Hospital Majapahit, vol. 5, no. 1, 2013.
- [13] S. Rejeki, "Stress Levels and Primary Dysmenorrhea," J. Kebidanan, vol. 8, no. 1, pp. 50–55, 2019.
- [14] D. Sanday et al., "Pain Intensity and Academic Disruption," J. Cakrawala Promkes, vol. 1, no. 2, pp. 48–56, 2019.
- [15] R. Kundre and J. Lolong, "Stress and Dysmenorrhea in Nursing Students," e-KP, vol. 3, no. 2, pp. 1–8, 2015.
- [16] L. D. Prafitri, "Fc-Bio Sanitary Pads and Dysmenorrhea Reduction," 4th Univ. Res. Colloq., 2016.
- [17] Nuraini S et al., "Stress and Hemoglobin Levels in Dysmenorrhea," J. Health Sci., vol. 3, no. 3, pp. 443–450, 2021.
- [18] Lazarus and Folkman, "Psychological Stress and Coping Theory," Handbook of Stress and Health, 2017.
- [19] Idaningsih and Oktarini, "Effectiveness of Exercise in Dysmenorrhea," Syntax Literate, vol. 5, no. 2, pp. 55–66, 2020.
- [20] Hartati, "Coping Mechanisms and Dysmenorrhea," JIKK, vol. 8, no. 1, 2012.
- [21] Purwanti, "Risk Factors for Dysmenorrhea," Thesis, SMK NU Ungaran, 2014.
- [22] Fitriana et al., "Stress and Menstrual Pain," Univ. Aisyiyah Yogyakarta, 2017.
- [23] Anggraeni et al., "Stress and Dysmenorrhea in Adolescents," Hospital Majapahit, vol. 6, no. 2, pp. 1–10, 2014.
- [24] Icemi, Buku Ajar Keperawatan Maternitas, Yogyakarta: Nuha Medika, 2013.
- [25] Prastiwi and Rohmansyah, "Imagery Training for Menstrual Pain," FPIPSKR Univ. PGRI Semarang, 2019.
- [26] Hasanuddin, "Stress Severity and Dysmenorrhea," J. Kesehatan Wanita, vol. 4, pp. 256–261, 2024.
- [27] Meilina Saputri, "Stress and Menstrual Pain in SMK Students," J. Kesehatan Reproduksi, vol. 2, pp. 34–41, 2020.
- [28] Setyani, "Nutritional Status and Exercise in Dysmenorrhea," J. Kebidanan, vol. 6, no. 2, pp. 57–67, 2014.
- [29] Ismarozi et al., "Exercise for Primary Menstrual Pain," Univ. Jambi J. Health, vol. 2, no. 1, pp. 820–827, 2015.
- [30] Pialiari et al., "Stress Levels and Dysmenorrhea in Medical Students," Unisba J. Med., vol. 3, pp. 89–96, 2018.
- [31] R. K. Paul et al., "Cross-sectional studies: design and application in public health research," Int. J. Res. Med. Sci., vol. 7, no. 4, pp. 1349–1354, 2020.
- [32] N. Zhang et al., "Comparative efficacy of research designs in adolescent health," BMC Public Health, vol. 21, no. 1, p. 899, 2021.
- [33] T. V. Ramadhan et al., "Using Slovin's formula for education-based survey research," J. Educ. Stat., vol. 3, no. 2, pp. 43–49, 2020.
- [34] J. A. Etikani and S. Bala, "Sampling techniques in health science research," Int. J. Res. Health Sci., vol. 5, pp. 24–28, 2021.
- [35] A. D. Lovibond and P. F. Lovibond, "Manual for the Depression Anxiety Stress Scales (DASS)," 2020.
- [36] A. L. Rahmawati et al., "Reliability of DASS-42 in Indonesian adolescents," J. Psychol. Educ., vol. 8, no. 2, pp. 50–55, 2022.
- [37] M. Gerbershagen et al., "Pain measurement tools in adolescents: a comparative study," Pain Med., vol. 20, pp. 203–209, 2020.
- [38] C. H. Kim et al., "Categorizing pain using NRS in adolescent females," J. Adolesc. Health, vol. 66, no. 3, pp. 345–352, 2020.
- [39] E. Nugroho and A. Sari, "Validation of the Indonesian DASS scale in junior high students," Indonesian J. Educ. Psychol., vol. 4, no. 1, pp. 12–18, 2021.
- [40] J. A. Miro et al., "Self-report pain scales in adolescents: A systematic review," J. Child Health Care, vol. 24, no. 2, pp. 123–134, 2020.
- [41] F. Ayu et al., "Ordinal regression application in health studies," J. Public Health Res., vol. 9, no. 2, pp. 55–63, 2021.
- [42] H. Nugraheni et al., "Stress biomarkers and menstrual pain," Asian J. Biol. Sci., vol. 12, no. 3, pp. 100–107, 2020.
- [43] P. C. Wulandari and T. Prihatini, "Longitudinal designs in adolescent health research," J. Youth Med., vol. 4, no. 1, pp. 45–52, 2022.
- [44] M. S. De Leo, "The role of HPA axis in adolescent stress response," J. Adolesc. Health Res., vol. 12, no. 2, pp. 120–126, 2021.
- [45] S. M. Ahmad and M. L. Singh, "Stress-induced endocrine alterations and menstrual pain," Endocrinol. Int., vol. 34, pp. 78–86, 2020.
- [46] G. P. Warner et al., "Prostaglandins and uterine contraction in primary dysmenorrhea," Gynecol. Reprod. Biol., vol. 102, pp. 34–39, 2019.
- [47] A. K. Park and J. Chen, "Central sensitization and adolescent pain syndromes," Pediatr. Pain Rev., vol. 15, no. 3, pp. 200–208, 2021.
- [48] A. R. Farida et al., "Biopsychosocial model in managing dysmenorrhea," J. Adolesc. Health Promot., vol. 5, no. 1, pp. 25–32, 2020.
- [49] R. Fitriana et al., "Stress and menstrual pain in Indonesian nursing students," J. Afiat Kesehat. Masyarakat, vol. 10, no. 1, pp. 112–117, 2019.
- [50] S. Hartati and M. Sari, "Psychological factors and dysmenorrhea," J. Reprod. Adolesc., vol. 3, no. 2, pp. 145–150, 2019.
- [51] R. Pialiari et al., "DASS-42 and dysmenorrhea severity correlation among medical students," Unisba Med. J., vol. 6, no. 2, pp. 88–93, 2022.
- [52] N. Hasanuddin, "Stress and dysmenorrhea among vocational students," J. Reprod. Kesmas, vol. 4, no. 1, pp. 42–49, 2024.
- [53] Y. Zhang et al., "School stress and menstrual pain in Chinese adolescents," Asian J. Adolesc. Health, vol. 12, pp. 67–75, 2020.
- [54] R. Nair et al., "Stress, lifestyle, and menstrual pain: a multivariate approach," Indian J. Public Health Res., vol. 9, no. 4, pp. 114–121, 2021.
- [55] D. Liu and T. Wang, "Bidirectional stress-pain pathways," Psychoneuroendocrinol., vol. 43, pp. 153–162, 2020.
- [56] K. M. Nugraheni et al., "Biomarkers of adolescent stress and menstrual health," Asian Biol. Med. J., vol. 8, no. 2, pp. 210–217, 2023.
- [57] W. T. Rahmawati et al., "Socioeconomic differences in menstrual health outcomes," J. Educ. Health Equity, vol. 5, pp. 99–108, 2021.
- [58] L. Susilawati et al., "Physical activity and BMI as determinants of dysmenorrhea," J. Health Promot., vol. 6, no. 3, pp. 125–131, 2020.
- [59] M. A. Santoso and D. Kartikasari, "Effectiveness of CBT and relaxation in menstrual pain management," J. Youth Health Interv., vol. 4, pp. 60–68, 2021.