



FACTORS RELATED TO DYSMENORRHEA AMONG ADOLESCENTS

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Abstract

Background: Dysmenorrhea is a brief pain before or during menstruation that often complain by women. Dysmenorrhea that occurs in adolescents has an impact on decreasing learning activity and concentration thus induced them to absent from school. **Method:** This cross-sectional study used proportional random sampling of 128 senior high school students. Data collection was conducted using a self-administered questionnaire via Google Forms April - Mei 2022. Data analysis used multiple logistic regression. **Results:** The proportion of dysmenorrhea is 66.4% and there was a significant relationship between physical activity (POR: 2.42; 95% CI: 1.06 – 5.49), menstrual duration (POR: 3.01; 95% CI: 1.32 – 6.85) and stress (POR: 5.15; 95 % CI: 1.89 – 14.04) with the incidence of dysmenorrhea among adolescents at SMA Negeri 4 Bekasi City with stress as the dominant factor to the incidence of dysmenorrhea, meaning that girls who experienced stress were 5.15 more likely to experienced dysmenorrhea compared to girls who do not experience stress. **Conclusion:** The factors associated with the occurrence of dysmenorrhea includes physical activity, menstrual duration and stress.

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INTRODUCTION

The United Nations launched the Sustainable Development Goals (SDGS) in early 2016, which consisted of 17 goals. One of the goals is good health and well-being for everyone, including adolescents, where, during adolescence, there is a process of physical and psychological maturation towards adulthood. In adolescent girls, physical maturation, especially sexual function, is marked by menstruation¹, which indeed affects the quality of good health and well-being of female students. Menstruation is a process of shedding the endometrium, which thickens, followed by blood spots. It occurs after puberty every month and lasts until menopause.² During the menstrual cycle, several

teenagers experience physical and emotional changes and stomach cramps.³ On the first day of menstruation, teenagers generally experience menstrual pain without complaints. However, some young women experience menstrual pain with several complaints, causing discomfort called dysmenorrhea.

Dysmenorrhea is a gynaecological complaint that occurs due to an imbalance of the hormone progesterone in the blood, causing recurring pain in women.⁴ The symptoms felt by women during dysmenorrhea are headache, cramps in stomach, which can spread to the pelvis and legs, backache, mood disturbance, and change in appetite.³ Menstrual pain can appear irregularly, where the pain can occur before or during menstruation until it peaks within 24 hours, and after 2 days, the pain will disappear.⁵

Dysmenorrhea is divided into two types, namely primary dysmenorrhea and secondary dysmenorrhea. Increased levels of prostaglandins cause primary dysmenorrhea, and there are no gynaecological abnormalities, while secondary dysmenorrhea is due to gynaecological abnormalities. Dysmenorrhea is caused by several factors that cause young women to experience menstrual pain. Factors that influence primary dysmenorrhea are early age at menarche, nutritional status, physical activity/exercise habits, family history, length of menstruation and cycle length.⁵

The prevalence of dysmenorrhea reported in the literature varies widely. Based on the results of a study in Ethiopia using a systematic review and final meta-analysis with 12 studies, the combined prevalence of dysmenorrhea among female students is 71.69% (66.82%-76.56%).⁶ The incidence of dysmenorrhea in the world is substantial; on average, almost 50% of women experience dysmenorrhea.⁷

The high prevalence rate of dysmenorrhea has a significant impact on the quality of life of young women, as a person will have limitations in daily activities, especially learning activities at school. Dysmenorrhea is the leading cause of morbidity, which results in limitations in daily activities and repeated absences of female students from school.⁸ Adolescent girls who suffer from dysmenorrhea but insist on studying at school have the potential to impact learning activities, such as decreasing concentration and enthusiasm for learning, so that they cannot study very well. Young girls who do not attend school may also be influenced by their academic and non-academic achievements.⁹

In Indonesia, the prevalence of dysmenorrhea reaches 60-70%, with primary dysmenorrhea at 54.89% and secondary dysmenorrhea at 45.11%. In West Java, women who experience dysmenorrhea are 51.86%, consisting of 21.80% with mild dysmenorrhea, 19.34% with moderate dysmenorrhea, and 10.72% with severe dysmenorrhea.¹⁰

In January 2022, researchers held a preliminary study by conducting a mini survey regarding dysmenorrhea among female student councils at SMA Negeri 4 Bekasi City. It was found that 21 female student council members (60%) experienced dysmenorrhea. Based on previous studies, it was

concluded that dysmenorrhea has an impact on the learning quality of female students at school, such as difficulty in concentrating on understanding learning materials, decreased motivation to study and absence in class. Therefore, the researchers are determined to identify the proportion and factors related to dysmenorrhea in female students at SMA Negeri 4 Bekasi City.

METHODS

This is quantitative research with a cross-sectional design. The population in this study were female students in classes X and XI at SMA Negeri 4 Bekasi City. The study sample was 128 female students selected using the proportionate random sampling technique, with the criteria being female students in classes X and XI at SMA Negeri 4 Bekasi City who had already experienced menstruation. Data were collected using an online survey through Google Forms, which was self-administered between April and May 2022. The link to the survey was sent to the WhatsApp group.

Dysmenorrhea in this study is defined as a condition where an adolescent is considered to experience dysmenorrhea if they experience one or more of the following: abdominal pain, groin/pelvic pain, back or thigh pain, or pain before and/or during menstruation for the past year.¹¹ The menstrual cycle is measured from the start of menstruation to the arrival of the next menstrual period.¹² The menstrual cycle is categorised into two groups: irregular (<21 days or >35 days) and regular (21-35 days). Menstrual duration refers to the average number of days a respondent experiences menstruation. The categories of menstrual duration are: abnormal (>7 days) and normal (3-7 days).¹³

Nutritional status is the body's condition resulting from the outcome of food consumption and the use of nutrients.¹⁴ Nutritional status was categorised based on the Body Mass Index for Age (BMI/A) measurement, which consists of undernutrition (-3 SD to <-2 SD), normal nutrition (-1 SD to +1 SD), overweight (+1 SD to +2 SD), and obesity (>+2 SD).¹⁵ Physical activity is any body movement produced by skeletal muscles that requires energy expenditure.¹⁶ The physical activity categorised by using the International Physical Activity Questionnaire-Short Form (IPAQ-short form), which includes light physical activity (<600 MET), moderate physical activity (600-1500 MET), and vigorous physical activity (>1500 MET).

Stress is the inability to cope with threats faced by an individual's physical, mental, spiritual, and emotional well-being, which can affect health. The stress instruments used are the Depression Anxiety Stress Scale 21 (DASS 21), consisting of 21 questions, with seven questions each to assess depression, anxiety, and stress. The answer scores on the questionnaire are categorised into four levels: 0 "never," 1 "sometimes," 2 "often," and 3 "very often." The results of the DASS-21 measurement are in the form of scores, which are then totaled and categorised as follows: very severe (score: >34), severe (score: 26-33), moderate (score: 19-25), mild (score: 15-18), and normal (score: 0-14).¹⁷

This study conducted validity and reliability tests on the DASS-21 and IPAQ-short form instruments with 30 respondents, consisting of female students from grades X and XI at SMA Negeri 10, Bekasi City. The R table was used for the validity test with a sample size of 30 and an alpha of 5%, 0.361. The item is considered valid if the calculated r exceeds the r table. The DASS-21 and IPAQ-short form instruments were valid for each question item. The Cronbach's Alpha method was used with a 90% confidence level for the reliability test. Hence, this study's Cronbach's Alpha value was more significant than 0.60 for the DASS-21 and IPAQ-short form instruments.

The data analysis used in this research is univariate analysis to determine the distribution of research variables, bivariate analysis to determine the relationship between independent and dependent variables using the chi-square test and multivariate analysis to determine the dominant factors using the multiple logistic regression test. This research was approved by the UPN Veteran Jakarta Health Research Ethics Commission (KEPK) in May 2022, Number: 134/V/2022/KEPK.

RESULTS

This research was conducted to 128 respondents and found that 66.4% of female students at SMAN 4 Bekasi were experiencing dysmenorrhea. Most menarche age distribution is normal (12 – 13 years) among 58.6% of students, as stated in Table 1.

Around 82% of students experienced regular menstrual cycles (21 – 35 days). Regarding the duration of menstruation, most respondents experienced a period of >7 days. There were 62.5% female students who had no family history of dysmenorrhea. Furthermore, in the nutritional status through BMI/U calculations, it was found that the majority of respondents, 72.7%, were classified as well-nourished. The physical activity of female students is dominated by the light category (62.5%). The most significant stress type for the stress variable was in the moderate category (25.8%), followed by the severe and very severe categories.

Table 2 shows four factors related to dysmenorrhea among adolescents at SMA Negeri 4 Bekasi City in 2022: age of menarche, length of menstruation, stress and physical activity, while menstrual cycle, family history and nutritional status shows no associations to dysmenorrhea.

Based on Table 3, it is known that in the final model, variables that significantly related to the incidence of dysmenorrhea are stress (POR= 5.155; 95% CI= 1.893 – 14.042), length of menstruation (POR= 3.014; 95% CI= 1.326 – 6.85) and physical activity (POR: 2.418; 95% CI: 1.065 – 5.489). The dominant variable is stress, with the highest POR value of 5.155 (95% CI: 1.893 – 14.042). This means that girls who experience stress are 5.155 times more likely to experience dysmenorrhea compared to girls who do not experience stress.

Table 1 Respondents Characteristics

Variable	Total (n = 128)	%
Dysmenorrhea		
Yes	85	66.4
No	43	33.6
Menarche Age		
Early (<12 years)	35	27.3
Normal (12-13 years)	75	58.6
Late (>13 years)	18	14.1
Menstrual Cycle		
Irregular	23	18
Regular	105	82
Length of Menstruation		
Abnormal	71	55.5
Normal	57	44.5
Family History		
Yes	48	37.5
No	80	62.5
Nutritional status		
Undernutrition	11	8.6
Well nourished	93	72.7
Overnutrition	19	14.8
Obese	5	3.9
Physical Activity		
Light	80	62.5
Moderate	39	30.5
Heavy	9	7
Stress		
Very severe	31	24.2
Severe	31	24.2
Moderate	33	25.8
Light	10	7.8
Normal	23	18
Total	128	100

DISCUSSION

The results of this study show a significant relationship between the duration of menstruation and dysmenorrhea in adolescents. This aligns with a survey of 10th-grade students at SMK Kesehatan Bhakti Kencana Subang, which found a relationship between menstruation duration and dysmenorrhea incidence.¹⁸ According to the study, uncontrolled estrogen production leads to instability in the endometrial lining, which results in disruptions to vasoconstriction and myocardial contractility, causing prolonged menstruation.¹⁹ In this study, it was explained that women experiencing long periods of menstruation can have excessive contractions in the uterus, resulting in increased production of prostaglandins, which can cause dysmenorrhea.²⁰

The results of statistical tests showed that there was a significant relationship between physical activity and the incidence of dysmenorrhea in adolescents. This aligns with a study in Tincep Village, Minahasa Regency, which found a relationship between physical activity and dysmenorrhea.²¹ The decrease in dysmenorrhea occurs when adolescent girls exercise regularly; they can provide oxygen twice as much per minute, which results in vasoconstriction and a reduction in dysmenorrhea.

Regular physical activities such as walking, jogging, aerobics, cycling, and yoga can improve overall health and help maintain a regular menstrual cycle.²²

Table 2: The Relationship Between Age at Menarche, Menstrual Cycle, Duration of Menstruation, Family History, Nutritional Status, Physical Activity, and Stress with the Incidence of Dysmenorrhea in Adolescents

Variable	Dysmenorrhea				Total		P Value	POR (95% CI)
	Yes		No		N	%		
	n	%	n	%				
Menarche Age								
Early/Late	41	77.4	12	22.6	53	100	0.044*	2.407 (1.092 – 5.307)
Normal	44	58.7	31	41.3	75	100		
Menstrual Cycle								
Irregular	14	60.9	9	39.1	23	100	0.706	0.745 (0.293 – 1.891)
Regular	71	67.6	34	32.4	105	100		
Length of Menstruation								
Abnormal	54	76.1	17	23.9	71	100	0.017*	2.664 (1.253 – 5.664)
Normal	31	54.4	26	45.6	57	100		
Family History								
Yes	33	68.8	15	31.3	48	100	0.809	1.185 (0.552 – 2.543)
No	52	65	28	35	80	100		
Nutritional status								
Abnormal	25	71.4	10	28.6	35	100	0.597	1.375 (0.589 – 3.209)
Normal	60	64.5	33	35.5	93	100		
Stress								
Stress	77	73.3	28	26.7	105	100	0.001*	5.156 (1.972 – 13.479)
No stress	8	34.8	15	65.2	23	100		
Physical Activity								
Insufficient	59	73.8	21	26.3	80	100	0.038*	2.377 (1.117 – 5.059)
Sufficient	26	54.2	22	45.8	48	100		

Table 3: The Dominant Factor among Stress, Menstrual Duration, and Physical Activity in the Incidence of Dysmenorrhea in Adolescents

Variable	B	P value	POR	95%CI	
				Lower	Upper
Stress					
Stress	1.640	0.001	5.155	1.893	14.042
No stress	-	-	-	-	-
Length of Menstruation					
Abnormal	1.103	0.008	3.014	1.326	6.85
Normal	-	-	-	-	-
Physical Activity					
Insufficient	0.883	0.035	2.418	1.065	5.489
Sufficient	-	-	-	-	-

The results of this study show that there is a significant relationship between stress and dysmenorrhea in adolescents. Based on the results of multivariate analysis, it was found that the dominant factor was stress, with the highest POR value of 5.155 (95% CI: 1.893 – 14.042). This means that women who experience stress are 5.155 times more likely to experience dysmenorrhea than women who do not experience stress. This is similar to study in Cirebon that stress was significantly influenced dysmenorrhea pain.²³

Currently, many adolescents experience stress, especially high school students. This is because the stress factors experienced by each individual are different and are influenced by personality factors, stressor characteristics and the individual's ability to adapt to stress.²⁴ The stress level of high school students is caused by the burden of exams they receive, school assignments that pile up and must be completed immediately and very dense study duration.

A person experiencing stress pushes their body to secrete Adreno cortico tropic hormone (ACTH) from the neuroendocrine, which is produced by the Corticotropin-Releasing Hormone (CRH). This hypothalamic regulator results in an increase in adrenal cortisol secretion.²⁵ This can disrupt the secretion of FSH and LH in the body, impairing follicle development. If follicle development is disrupted, it will change the synthesis and release of progesterone, which can affect the production of prostaglandins, increased vessel permeability; and tissue breakdown. This inflammatory event manifests as menstrual bleeding and pain.²⁶

The study's limitation was its cross-sectional design, which could not show cause-and-effect relationships. There was a possibility of recall bias on menarche age and menstrual duration variables, as respondents were asked to recall past events. Additionally, information bias may have occurred because the questionnaire was filled out through Google Forms, which was not less sensitive, as it relied on a symptom questionnaire instead of a medical test, which only detected one person.

CONCLUSION

Factors that were significantly associated with the incidence of dysmenorrhea were physical activity, length of menstruation, and stress. Stress is the dominant factor in the incidence of dysmenorrhea. Therefore, it seems that interventions considering health-promoting lifestyles can help manage dysmenorrhea among adolescent girls.

RECOMMENDATION

For respondents experiencing dysmenorrhea, it is suggested that adolescent girls engage in regular light physical activity such as walking, running, aerobic or yoga to help menstrual pain. In addition, stress management is essential and can be addressed through meditation, writing a journal or counselling with school counsellors. Schools are expected to provide reproductive health education and supportive policies, such as rest areas or flexibility in assignments, to help adolescent girls cope with dysmenorrhea without disrupting their learning process. For further research, it is recommended that the limitations faced in the current study be addressed, including aspects such as measurement tools, data collection, and the design of other studies.

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REFERENCES

1. Wirenviona R, Riris IDC. Adolescent Reproductive Health Education. Airlangga University Press. 2020.
2. Lacroix AE, Gondal H, Shumway KR, Langaker MD. Physiology, Menarche [Internet]. StatPearls Publishing; 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK470216/>
3. Pouraliroudbaneh S, Marino J, Riggs E, Saber A, Jayasinghe Y, Peate M. Heavy menstrual bleeding and dysmenorrhea in adolescents: A systematic review of self-management strategies, quality of life, and unmet needs. *Int J Gynecol Obstet.* 2024;(April):16–41. Available from: <https://doi.org/10.1002/ijgo.15554>
4. Nagy H, Carlson K, Khan MA. Dysmenorrhea [Internet]. StatPearls Publishing; 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK560834/>
5. Huda AI, Ningtyias FW, Sulistiyani. The relationship between nutritional status, age of menarche and the incidence of primary dysmenorrhea in young women at SMPN 3 Jember. *Heal Lit E-Journal.* 2020;8(2):123–30. Available from: <https://doi.org/10.19184/pk.v8i2.12007>
6. Molla A, Duko B, Girma B, Madoro D, Nigussie J, Belayneh Z, et al. Prevalence of dysmenorrhea and associated factors among students in Ethiopia: A systematic review and meta-analysis. *Women's Heal.* 2022;18. Available from: <https://doi.org/10.1177/17455057221079443>
7. Katib Y, Almeahmadi M, Alhajaji F, Alqorashi S, Almajnooni F, Alshinawi MA, et al. Prevalence of Primary Dysmenorrhea and Its Effect on the Quality of Life Among Female Students at Umm Al-Qura University. *Cureus.* 2024 Oct;16(10):e72136. Available from: <https://doi.org/10.7759/cureus.72136>
8. Esan DT, Ariyo SA, Akinlolu EF, Akingbade O, Olabisi OI, Olawade DB, et al. Prevalence of dysmenorrhea and its effect on the quality of life of female undergraduate students in Nigeria. *J Endometr Uterine Disord* [Internet]. 2024;5:100059. Available from: <https://www.sciencedirect.com/science/article/pii/S294983842400001X>
9. Meliani V, Syahrias L, Silalahi RD. The relationship between dysmenorrhea and learning activities in students. *Zo Keperawatan* [Internet]. 2024;15(1):52–60. Available from: <https://doi.org/10.37776/zk.v15i1.1616>
10. Marisa DE, Kasnad, Purbaningsih ES. Emosi Remaja Putri yang Mengalami Dismenore di Wilayah Desa Rajawetan Kecamatan Pancalang Kabupaten Kuningan. *Cerdika.* 2022;7(2):638–42. Available from: <https://cerdika.publikasiindonesia.id/index.php/cerdika/article/view/413>
11. Sachedina A, Todd N. Dysmenorrhea, Endometriosis and Chronic Pelvic Pain in Adolescents. *J Clin Res Pediatr Endocrinol.* 2020 Feb;12(Suppl 1):7–17. Available from: <https://doi.org/10.4274/jcrpe.galenos.2019.2019.S0217>
12. Juliana I, Rompas S, Onibala F. Hubungan Dismenore dengan Gangguan Siklus Haid pada Remaja di SMA N 1 Manado. *J Keperawatan.* 2019;7(1):1–8. Available from: <https://doi.org/10.35790/jkp.v7i1.22895>
13. Hatmanti NM, Septianingrum Y, Riah A. Early menarche , menstrual duration with dysmenorrhea in adolescents in Surabaya. *Bali Med J.* 2022;11(1):306–9. Available from: <https://doi.org/10.15562/bmj.v11i1.3109>
14. Nuzula F. Faktor-Faktor yang Mempengaruhi Kejadian Dismenore Primer pada Mahasiswi Akademi Kesehatan Rustida Banyuwangi. *J Ilm Kesehat Rustida.* 2019;06(01):1–13. Available from: <https://doi.org/10.55500/jikr.v6i1.67>
15. Ministry of Health Republic Indonesia. Regulation of the Minister of Health of the Republic of Indonesia Number 2 of 2020 concerning Child Anthropometric Standards. 2 Indonesia; 2020 p. 1–78.

16. Rahayu KD, Kartika I, Dayanti R. The Relationships Between Physical Activities and Dysmenorrhea in Adolescent the City of Bandung. *J Matern Care Reprod Heal*. 2019;2(1):1–10. Available from: <https://doi.org/10.36780/jmcrh.v2i1.45>
17. Mangoulia P, Kanellopoulou A, Manta G, Chrysochoou G, Dimitriou E, Kalogerakou T, et al. Exploring the Levels of Stress, Anxiety, Depression, Resilience, Hope, and Spiritual Well-Being Among Greek Dentistry and Nursing Students in Response to Academic Responsibilities Two Years After the COVID-19 Pandemic. *Healthc (Basel, Switzerland)*. 2024 Dec;13(1). Available from: <https://doi.org/10.3390/healthcare13010054>
18. Indarna, A. A., & Lediawati L. Age menarche and the time of menstruation with the primary dismenore events in class X students SMK Kesehatan Bhakti Kencana Subang. *J Nurs Public Heal*. 2021;9(Oktober):1–7. Available from: <https://doi.org/10.37676/jnph.v9i2.1789>
19. Ansong E, Arhin SK, Cai Y, Xu X, Wu X. Menstrual characteristics, disorders and associated risk factors among female international students in Zhejiang Province, China: A cross-sectional survey. *BMC Womens Health*. 2019;19(1):1–10. Available from: <https://doi.org/10.1186/s12905-019-0730-5>
20. Mouliza N. Factors Associated with the Incidence of Dysmenorrhea in Adolescent Girls at MTS Negeri 3 Medan in 2019. *Batanghari Univ Jambi Sci J*. 2020;20(2):545–50. Available from: <https://doi.org/10.33087/jiubj.v20i2.912>
21. Kojo NH, Kaunang TMD, Rattu AJM. Hubungan Faktor-faktor yang Berperan untuk Terjadinya Dismenore pada Remaja Putri di Era Normal Baru. *e-CliniC*. 2021;9(2):429. Available from: <https://doi.org/10.35790/ecl.v9i2.34433>
22. Wildayani D, Keb M, Lestari W, Keb M, Ningsih WL, Keb ST, et al. The Relationship Between Physical Activity Level and Dysmenorrhoea in Young Women. *Med J Malaysia [Internet]*. 2023;78(4):495–9. Available from: <https://www.e-mjm.org/2023/v78n4/dysmenorrhoea.pdf>
23. Triwahyuningsih RY, Rahfiludin MZ, Sulistiyan S, Widjanarko B. Role of stress and physical activity on primary dysmenorrhea: A cross-sectional study. *Narra J*. 2024 Apr;4(1):e685. Available from: <https://doi.org/10.52225/narra.v4i1.685>
24. Sinarning, Tasnim, Banudi L. Risk Factors of Stress and History of Allergy to Dysmenorrhea in Adolescent Students in Public Middle School 1 Pasikolaga. *Indones J Heal Sci Res Dev*. 2021;3(2):46–51. Available from: <https://doi.org/10.36566/ijhsrd/Vol3.Iss3/101>
25. Rahmatanti R, Pradigdo SF, Pangestuti DR. The Relationship between Stress Level and Anemia Status with Primary Dysmenorrhoea in Class XII Female Students at SMAN 1 Nganjuk. *Indones Public Heal Media*. 2020;19(4). Available from: <https://doi.org/10.14710/mkmi.19.4.246-254>
26. Critchley HOD, Maybin JA, Armstrong GM, Williams ARW. Physiology of the Endometrium and Regulation of Menstruation. *Physiol Rev [Internet]*. 2020 Feb 7;100(3):1149–79. Available from: <https://doi.org/10.1152/physrev.00031.2019>

Declarations

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