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Short Communication

Role of stress and physical activity on primary dysmenorrhea: A cross-sectional study

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Abstract

The initial physiological change in adolescent girls is the onset of menstruation. The most prevalent challenge they face regarding menstruation is primary dysmenorrhea, characterized by persistent or intermittent pelvic pain in the lower abdomen. The aim of this study was to investigate the influences of stress levels and physical activities on primary dysmenorrhea. A cross-sectional was conducted in Cirebon, Indonesia, in 2023 included young women who had never given birth (nullipara), aged 17–25 years old, had menstruated, and had no history of smoking and alcohol. The data were collected using a set of questionnaires consisting of the Numeric Rating Scale (NRS) to determine primary dysmenorrhea pain, the Depression Anxiety Stress Scales 42 (DASS 42) to determine the level of stress and the International Physical Activity Questionnaire (IPAQ) to determine physical activity. Pearson's correlation test was used to assess the correlation between the variables (stress levels, physical activity, and dysmenorrhea). A total of 150 young women were included in the study. Moderate stress levels (23.3%) and high physical activity (90.7%) were the most prevalent category observed among studied participants. Approximately 42% of them experienced mild dysmenorrhea pain. Our analysis indicated that stress levels and physical activities had strong positive and negative correlations with dysmenorrhea pain levels, with r=0.782 and r=-0.748, respectively, with both had p<0.001. This highlights that controlling stress could be beneficial in preventing dysmenorrhea pain among young women.

Keywords: Primary dysmenorrhea, menstrual pain, stress level, physical activity, young women

Introduction

Menstruation is the primary physiological change that occurs in adolescent girls characterized by cyclic bleeding that occurs from the uterine corpus, usually beginning at the age of 9–12 years [1,2]. The most frequently encountered problem related to menstruation is primary dysmenorrhea, referring to pelvic pain that occurs continuously or recurrent in the lower abdomen due to uterus' muscle contractions [3,4]. Dysmenorrhea manifests on the first day of menstruation and lasts for approximately 8–72 hours [5,6]. Primary dysmenorrhea is associated with the ovulatory cycle and involves pain mechanisms mediated by the activity of prostaglandin (PGF2α) [7-11]. The pain level is determined by the increased level of PGF2α in the endometrial fluid [12].

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Nearly 90% of adolescent girls experience primary dysmenorrhea [13]. Globally, the prevalence of primary dysmenorrhea in adolescent girls is very high, with an average of more than 50% [14]. Dysmenorrhea in adolescent girls can result in decreased health and productivity in school or work. Studies showed that primary dysmenorrhea was associated with 21.5% of the students to be absent from schools [15], 51.7% experienced problems concentrating in class; 50.2% had limited their social activities; and 12% had a decrease in academic achievement [16]. In general, dysmenorrhea causes a decrease in the quality of life of adolescent girls [5,7-11]. Factors that cause dysmenorrhea are nutritional status, physical activity and the age of menarche [17]. Nutritional status has the potential to influence prostaglandin levels in the body, thereby potentially causing dysmenorrhea [17]. A study found that a higher prevalence of dysmenorrhea in non-athletes (61.6%) compared to athletes (38.4%) [18]. Dysmenorrhea is associated with a higher risk in women who experience menarche at an earlier age [10,15,19]. The aim of this study was to investigate the influences of stress levels and physical activities on primary dysmenorrhea.

Methods

Study design and respondents

A cross-sectional study was conducted at the College of Health Sciences (STIKes) Muhammadiyah Cirebon, Cirebon, Indonesia, in 2023. A total sampling method was employed based on inclusion and exclusion criteria. This study included young women who had never given birth (nullipara), aged 17–25 years old, had menstruated, and had no history of smoking and alcohol. Respondents with a history of reproductive disease or chronic disease, primary dysmenorrhea with severe uncontrolled pain, asthma, and cancer were excluded from the study.

Study variables and data collection

Primary data was collected using a set of questionnaires. Primary dysmenorrhea pain was assessed using the Numeric Rating Scale (NRS) and was categorized into no pain (0), mild pain (1–3), moderate pain (4–6), and severe pain (7–10) [20-22]. Stress levels were measured by employing the Depression Anxiety Stress Scales 42 (DASS 42) and were classified into normal (0–14), mild (15–18), moderate (19–25), severe (26–33), and extremely severe (>34) [20-23]. The International Physical Activity Questionnaire (IPAQ) was utilized to determine physical activity and its interpretations were divided into moderate activities (600–<1500 metabolic equivalents (MET)-minutes/week) and high activities (1500–3000 MET-minutes/week or more) [24,25].

Data collection was carried out for three days among the respondents. The data collection was assisted by two enumerators who had previously been trained. Respondents were approached and requested to answer the questionnaire directly, accompanied by the study team, facilitating the completion of the questionnaire for respondents who encountered statements they found hard to understand. The questionnaires that had been answered by respondents were examined to ensure that all statements had been filled in completely for data processing.

Statistical analysis

Descriptive data were reported as means and standard deviations (SD) or frequencies and percentages. Pearson's correlation test was used to assess the correlation between the variables (stress levels, physical activity, and dysmenorrhea). The data was analyzed using SPSS software version 20 (SPSS Inc, Chicago, USA).

Results

Characteristics of respondents

A total of 150 young women were included in the study, as presented in **Table 1**. Approximately 45% of the respondents were 19 years and those who aged 20 and 18 years old accounted 28% and 21.3%, respectively. More than 75% of experienced menarche at age between 11 and 14 years old of which more than a quarter (25.3%) experienced menarche at the age of 12 (**Table 1**).

Table 1. Characteristics of the young women included in the study

Characteristics	Frequency	Percentage (%)
Age (year)		
17	2	1.3
18	32	21.3
19	67	44.7
20	42	28.0
21	4	2.7
22	1	0.7
23	1	0.7
25	1	0.7
Age of menarche (year)		
9	3	0.2
10	7	4.2
11	23	15.3
12	38	25.3
13	33	22.0
14	24	16.0
15	16	10.7
16	5	3.3
17	1	0.7

Stress, physical activity and dysmenorrhea pain levels

More than half (52.7%) of the respondents had no stress, while 23.3% and 20% of the respondents had moderate and mild stress (**Table 2**). Among all of them, 136 young women (90.7%) engaged in high-level physical activity. In terms of dysmenorrhea, 42.7% experienced mild pain while moderate pain affecting 40% of young women (**Table 2**).

Table 2. Stress levels, physical activity and pain levels in young women

Variables	Categories	Frequency	Percentage
Stress levels	Normal	79	52.7
	Mild	30	20.0
	Moderate	39	23.3
	Severe	3	2.0
	Extremely severe	3	2.0
Physical activity	Moderate	14	9.3
	High	136	90.7
Dysmenorrhea pain levels	No pain	4	2.7
	Mild pain	64	42.7
	Moderate pain	60	40.0
	Severe pain	22	14.6

Distributions of stress levels, physical activity based on dysmenorrhea pain levels

Out of 79 who had no stress, 48.1%, 36.7 and 12.6% had mild, moderate and severe dysmenorrhea pain, respectively (**Table 3**). Out of the total who had mild stress levels, 40%, 36.6% and 16.% had mild, moderate and severe dysmenorrhea pain, respectively. Those who had severe dysmenorrhea pain was higher among those who had severe level of stress (**Table 3**). Based on physical activities, among young women who engaged in moderate physical activity, 57.1%, 28.5% and 14.2% had mild, moderate and severe dysmenorrhea pain, respectively (**Table 3**). In contrast, those who engaged in high physical activity, 41.1%, 41.1%, and 14.7%, had mild, moderate and severe dysmenorrhea pain, respectively (**Table 3**).

Table 3. Distribution of stress levels, physical activity and dysmenorrhea pain levels among young women

Variables	Total	Dysmenorrhea pain level							
		No pain		Mild pain		Moderate pain		Severe pain	
		n	%	n	%	n	%	n	%
Stress levels									
Normal	79	2	2.5	38	48.1	29	36.7	10	12.6
Mild	30	2	0.6	12	40.0	11	36.6	5	16.6
Moderate	39	0	0.0	11	28.2	18	46.1	6	15.3

Variables	Total	Dysmenorrhea pain level							
		No pain		Mild pain		Moderate pain		Severe pain	
		n	%	n	%	n	%	n	%
Severe	3	0	0.0	2	66.7	0	0.0	1	33.3
Extremely severe	3	0	0.0	1	33.4	2	66.7	0	0.0
Physical activity									
Moderate	14	0	0.0	8	57.1	4	28.5	2	14.2
High	136	4	2.9	56	41.1	56	41.1	20	14.7

Correlation of stress levels, physical activity and dysmenorrhea pain levels

The study revealed that stress levels and physical activities significantly influenced dysmenorrhea pain levels (p<0.001). A strong positive and negative correlation between stress levels and physical activities with dysmenorrhea pain levels was observed, with r=0.782 and r=0.748, respectively (**Table 4**).

Table 4. Correlation between stress levels and physical activities with dysmenorrhea pain levels

Variables	Pearson correlation (r)	p-value
	Pain levels	
Stress levels	0.782	<0.001*
Physical activities	-0.748	<0.001*

* Statistically significant at the 0.001

Discussion

This study found that the incidence of primary dysmenorrhea was observed higher at age 19. The incidence and severity of primary dysmenorrhea tend to decrease with increasing age. The condition often starts within the first 6–12 months after menarche and the pain typically decreases in severity over time as women get older. The reduction in primary dysmenorrhea with age is not due to deterioration of the uterine nerves but rather is thought to be related to changes in the levels of prostaglandins and other inflammatory mediators that contribute to painful uterine contractions. As women age, the production of these pain-inducing substances tends to decrease [27,28].

The stress experienced by a woman can impact the function of the endocrine system, which can ultimately lead to irregular menstruation or dysmenorrhea [29]. This study found that the level of stress was correlated to dysmenorrhea pain levels of which adolescent girls with higher levels of stress have higher pain levels of dysmenorrhea. This aligns with a previous study that reported stress levels in women results were related to the likelihood of dysmenorrhea [30]. Under stressful conditions, the human body produces excessive estrogen and prostaglandin hormones which causes excessive contractions in the uterus, resulting in menstrual pain [31]. Stress triggers a neuroendocrine response, leading to the release of corticotrophin-releasing hormone (CRH), which stimulates the secretion of adrenocorticotrophic hormone (ACTH), resulting in increased adrenal cortisol secretion [32]. These hormones cause the reduced secretion of follicle-stimulating hormone (FSH) and luteinizing hormone (LH), as a result, the release of progesterone is disrupted. Decreased levels of progesterone induce the synthesis of prostaglandin, especially PGF2α [32]. In addition to prostaglandin, the body also produces excess adrenal hormones and estrogen. Elevated estrogen levels lead to excessive uterine contractions [33,34]. Additionally, an increase in adrenaline hormone levels stimulates tension in uterine muscles, leading to constriction of blood vessels by these muscles, thereby reducing oxygen supply and causing ischemia, ultimately resulting in pain. Furthermore, the likelihood of experiencing pain doubles under stress due to the surge activity of sympathetic nerves [33,34].

We also found that there was a correlation between the level of physical activity and dysmenorrhea pain levels, and most young women who experienced mild levels of pain had high levels of physical activity. Intensive physical activity triggers hypothalamic dysfunction, causing disturbances in the secretion of gonadotrophin-releasing hormone (GnRH) [39]. A study has shown that the physical activity significantly reduces pain intensity [5]. This is due to the body producing endorphins when performing physical activities. Endorphins act as a natural sedative, creating a sense of comfort. These hormones are produced by the brain and interact with its receptors to lessen pain perception and induce a positive, euphoric sensation [40,41].

Conclusion

This study showed that the level of stress and physical activity had a significant positive correlation with dysmenorrhea pain levels, with a strong positive correlation. Therefore, incorporating stress-reduction techniques and maintaining an active lifestyle could potentially contribute to reducing the severity of dysmenorrhea symptoms.

Ethics approval

All respondents in this study have provided the informed consent. Ethical permission has been obtained from the Ethics Commission of the Faculty of Public Health, Universitas Diponegoro, Semarang, Indonesia, with number: 237/EA/KEPK-FKM/2020.

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Competing interests

All the authors declare that there are no conflicts of interest.

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Underlying data

Derived data supporting the findings of this study are available from the corresponding author on request.

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