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Original Article

Stress levels and menstrual cycles in high school adolescents

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Abstract

Background Around 15.5 million (34.9%) adolescents in Indonesia experience stress. Most of the stress in adolescents comes from internal and external academic demands. One of the negative impacts of stress is the disruption of hormonal mechanisms in the female reproductive system, which can affect the menstrual cycle.

Objective To analyze the relationship between stress level and menstrual cycle in adolescent girls aged 15-17 years who have menses ≥2 years.

Methods This study used primary data from instruments such as the *Depression Anxiety Stress Scale 42* (DASS 42) questionnaire modified by Damanik and the menstrual cycle questionnaire by Aldiba filled on Google forms by 1,565 adolescents from four high schools in Palembang City. We also excluded adolescents with conditions that could potentially bias the study, such as endocrine diseases (pituitary tumors and Cushing's syndrome), athletes with intensive physical activity, use of hormonal drugs, and abnormalities in nutritional status.

Results A total of 281 of 961 respondents who met the inclusion criteria were randomly selected through a stratified proportional random sampling method. Of those who reported experiencing stress, 27% experienced moderate stress. The majority of subjects experienced menstrual cycle disorders (55.5%). Adolescents with moderate stress level and above had a greater percentage of menstrual cycle disorders compared to adolescents who did not experience stress (P=0.039). Severe levels of stress were significantly associated with menstrual cycle irregularities (P=0.025)

Conclusion Stress levels are significantly associated with menstrual cycle irregularities among high school adolescents in Palembang City. **[Paediatr Indones. 2025;65:325-30; DOI: https://doi.org/10.14238/pi65.4.2025.325-30].**

Keywords: *menstrual cycle disorders; adolescents; stress levels*

Stress is a physiological, psychological, and behavioral reaction in individuals due to an imbalance between abilities and internal and external demands.[1,2] The prevalence of stress worldwide ranges from 38 to 71%. The Asian continent also recorded similar prevalence rates of 39.6 to 61.3%.[3] The phenomenon of stress can be found in various age groups, including adolescents.[3] In Indonesia, 15.5 million (34.9%) adolescents experienced stress.[4]

The storm and stress period that occurs during the adolescent transition greatly affects physical and mental health, especially the reproductive system.[5,6] Some factors that can cause stress include intrapersonal, interpersonal, academic, work and environmental problems.[7,8] Internal and external academic demands are often sources of stress for adolescents.[8] Generally, in the first years, adolescents experience menstrual cycle irregularities due to the ovulatory phase.[9] However, after this initial irregularity menstrual cycle disorders can be caused

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by various factors such as weight, physical activity, sleep duration, and stress levels.[10]

Stress levels are influenced by the complexity of the problems faced and the coping mechanisms of each individual. The frequency of repeated stressful events can trigger a gradual increase in stress levels.[11] Stress can be divided into four levels: mild, moderate, severe, and very severe.[12] Stress that occurs over a long period of time can cause physiological and/or psychological disorders, as well as produce pathological effects on the activation of body systems such as immune function, neuroendocrine function, and hormonal imbalances that trigger menstrual cycle disorders.[1,10,13] Activation of the amygdala in the limbic system due to stress stimulates the hypothalamus to release corticotrophin, which can trigger the production of cortisol. Cortisol secretion that suppresses the release of gonadotropin releasing hormone (GnRH) disrupts luteinizing hormone (LH) secretion, resulting in fluctuations in estrogen and progesterone.[14-16] Thus, women and girls with previously normal menstrual cycles might experience oligomenorrhea, polymenorrhea, or secondary amenorrhea.[14]

Several studies suggested strong evidence of a statistical correlation between stress levels and menstrual cycle disorders.[15,17] In Indonesia, study on the relationship of stress levels to the menstrual cycle has been conducted in Bali, where 55% of adolescents with severe stress experienced irregular menstrual cycles.[18] Given the higher levels of stress in adolescents today,[3] we aimed to evaluate the relationship between stress levels and menstrual cycles in high school adolescents in Palembang City.

Methods

This study involved adolescent girls aged 15-17 years who had experienced menarche ≥2 years prior to the study. Subjects were obtained from four high schools in Palembang City, namely SMAN 1, SMAN 3, SMAN 10, and SMAN 17. The selection of schools was done by stratified proportional random sampling of all public high schools in Palembang City.

Data collection was conducted from July 15-19, 2024. Participation in this study was voluntary; parents/guardians provided written consent before the study began. Inclusion criteria were adolescent girls aged 15-17 years, adolescent girls who have had menarche ≥2 years, are willing to sign a consent form to become research respondents. Adolescent girls with a history of chronic diseases such as pituitary tumors or Cushing's syndrome, female athletes with intensive physical activity, those using medications that can cause hormonal disorders, and students with abnormal nutritional status were excluded because these conditions could bias the study outcomes.

Stress level assessments were carried out by the researcher and research assistants. The data collection process was carried out in two stages. In the first stage, the height and weight of the respondents were measured. This anthropometric data was then processed using the *CDC* growth calculator for 2-20 years[19] to analyze the nutritional status of respondents. In the next stage respondents filled online questionnaires on *Google forms*. This questionnaire consisted of screening questions, the *Depression Anxiety Stress Scale 42* (DASS 42) questionnaire modified by Damanik into 14 items related to stress,[20] and a questionnaire regarding the menstrual cycle which contained 4 questions.[21] We classified adolescent stress levels into five categories, namely, normal (score 0-14), mild (score 15-18), moderate (score 19-25), severe (score 26-33), and very severe (score >34). For analysis of our study, we classified the stress level into normal and abnormal based on the DASS 42. In addition, the respondents' menstrual cycles were evaluated based on the menstrual patterns of the three months prior to the study and categorized into normal (menstrual cycle range of 21-35 days), polymenorrhea (cycle range <21 days), oligomenorrhea (cycle range >35 days), and secondary amenorrhea (if no menstruation occurs >3 months). We also classified menstrual cycle into normal and abnormal based on the menstrual pattern to analyze the data.

Primary data was processed and analyzed using the *Statistical Product Service Solution* (SPSS) *version 27* program by univariate data analysis methods to obtain an overview, as well as bivariate analysis. Study variables were analyzed by Chi-square test. Results with P values <0.05 were considered to be statistically significant. The Ethics Committee of the Faculty of Medicine, Universitas Sriwijaya, Palembang, approved this study.

Results

The data collection process in the four high schools resulted in a total of 1,565 respondents, but only 961 adolescents met the inclusion criteria. A total of 604 adolescents were excluded for the following reasons: athletes who trained with intensive physical activity, those taking hormonal drugs, or those with abnormal nutritional status. Of the 961 adolescents who met the inclusion criteria, 281 were randomly selected from the four high schools, in which each population had an equal chance of being selected.

In order to avoid bias of the research findings, we eliminated a few respondents based on specific criteria. Exclusion criteria included female adolescents with a history of chronic illness such as pituitary tumors or Cushing's syndrome, female athletes with intensive physical activity, users of drugs that affect hormones (eg, cortisone, prednisone, and antidepressants), and female students with underweight, overweight, or obesity nutritional status. We didn't use all of the data we received because participants with these illnesses can have a major impact on the menstrual cycle. The minimum required sample size was determined by the one proportion hypothesis test formula, resulting in 63 adolescents from SMAN 3, 80 adolescents from SMAN 6, 42 adolescents from SMAN 10, and 96 adolescents from SMAN 17.

Table 1 shows the characteristics of subjects in terms of age, class, age at menarche, stress level, and menstrual cycle status. Subjects' mean age was 16.01 years, with 63 respondents (22.4%) aged 15 years, 150 respondents (53.4%) aged 16 years, and 68 respondents (24.2%) aged 17 years. There were 129 (45.9%) respondents from grade XI and 152 (54.1%) from grade XII. Menarche occurred in 109 (61.2%) respondents at the age of ≥12 years and in 172 (38.8%) at the age of <12 years. Menstrual cycle status was distributed as follows: normal menstrual cycle (125; 44.5%), polymenorrhea (122; 43.4%), oligomenorrhea (23; 8.2%), and secondary amenorrhea (11; 3.9%). Respondents' stress levels were normal (73; 26.0%), mild (50; 17.8%), moderate (83; 29.5%), severe (59; 21.0%), and very severe (16; 5.7%). Compared to those who had regular periods (44.5%), the majority of adolescence (55.5%) had menstrual cycle abnormalities. Furthermore, the majority of respondents showed abnormal stress when compared to normal stress.

Klik atau ketuk di sini untuk memasukkan teks. **Table 2** shows that there was difference prevalence between stress events and menstrual cycle. Subjects who were classified have abnormal stress level has higher prevalence of abnormal menstrual cyscle (59.1% *vs.* 40.9%). respondents experienced higher than normal stress and abnormal menstrual cycles, while 85 (40.9%) respondents had higher than normal stress and normal menstrual cycles, indicating a significant association between higher than normal stress and menstrual cycle disorders (P=0.039) .This paragraph is confusing. There are no normal stress.

Table 3 shows that there was asscociation between severity of stress level and menstrual cycle. Subjects who has higher stress levels had higher prevalence of abnormal menstrual cycle.

Discussion

In our study, 83 (29.5%) high school adolescents in Palembang City experienced a moderate stress level. Similarly, a previous study found moderate stress levels in 40.9% of adolescent subjects in a Palembang

Table 1. Sociodemographic characteristics of subjects (N=281)

Characteristics	(N=281)
Mean age (SD), years	16.01 (0.68)
Age by year, n (%)	
15 years	63 (22.4)
16 years	150 (53.4)
17 years	68 (24.2)
Class, n (%)	
XI	129 (45.9)
XII	152 (54.1)
Age at menarche, n (%)	
≥12 years	109 (38.8)
<12 years	172 (61.2)
Menstrual cycle status, n (%)	
Normal	125 (44.5)
Polymenorrhea	122 (43.4)
Oligomenorrhea	23 (8.2)
Secondary amenorrhea	11 (3.9)
Stress level, n (%)	
Normal	73 (26.0)
Mild	50 (17.8)
Moderate	83 (29.5)
Severe	59 (21.0)
Very severe	16 (5.7)

Table 2. Analysis of stress levels and menstrual cycle status (N=281)

Stress events	Menstrual cycle		P value
	Not normal (n=156)	Normal (n=125)	
Not normal, n(%)	123 (78.9)	85 (68.0)	
Normal, n(%)	33 (21.1)	40 (32.0)	0.039

Table 3. Analysis of stress levels and menstrual cycle status (N=208)

Stress levels	Menstrual cycle		P value
	Not normal (n=123)	Normal (n=85)	
Severe-very severe	52 (42.3)	23 (27.1)	
Moderate-mild	71 (57.7)	62 (72.9)	0.025

City study,[22] while another study reported that 32.6% of Indonesian adolescent subjects experienced moderate stress. A study in Turkey found that 45.2% of adolescent subjects predominantly experienced moderate stress.[23] In contrast, another study reported that 51 (51%) adolescents had high stress, while 49 (49%) subjects had low stress.[24] The difference in a previous study may have been due to the timing of data collection, which took place during the COVID-19 pandemic.[25] During the pandemic, adolescents engaged in few social activities directly with their peers. Stress levels in adolescents can be influenced by several factors such as the fulfillment of emotional developmental tasks, environmental and living conditions, parenting, and internet addiction.[26]

In our study, 162 (57.7%) respondents had abnormal menstrual cycles and 119 respondents (42.3%) had normal menstrual cycles. Other studies' findings varied from 52.5% to 89%, which may have been due to differences in sample sizes or exposure to stress, as the studies were from indonesia and ukraine.[2,17,20,27,28]

Menstrual cycle irregularities need to be watched for, as they can be a sign of disorders and increase the risk of diseases of the reproductive system that impact the quality of life of adolescents in the future. Several factors such as body weight, physical activity, sleep duration and stress levels can affect menstrual cycle irregularities.[15]

We found a significant relationship between stress levels and menstrual cycle disorders in high school adolescents in Palembang City. studies on stress and menstrual cycle in adolescents from Semarang,[29] Surabaya,[2] India,[30] and Ukraine[17] found similar significant associations. In contrast, a study on adolescent girls found no significant relationship between stress level and menstrual cycle.[25] This difference may have been due to their use of 5x2 Chi-square tables while we used 2x2 Chi-square tables.

When women experience stress, the amygdala in the limbic system is stimulated. Hypothalamic pituitary adrenal (HPA) axis activity stimulates the hypothalamus to secrete corticotropic releasing hormone (CRH). CRH also increases and stimulates the release of endorphins to reduce pain and ACTH which stimulates the adrenal cortex to release of blood cortisol. Cortisol inhibits the production of GnRH produced in the arcuate nucleus. A decrease in GnRH levels interferes with LH secretion, resulting in fluctuations in estrogen and progesterone that can affect the menstrual cycle.[16]

Our study had several limitations such as using a cross-sectional design with only one research instrument to evaluate stress levels and one to evaluate menstrual cycles, as well as conducting the study in four high schools in Palembang City. In addition, we did not examine various aspects of menstrual disorders such as pain, duration and volume of blood during menstruation, and other menstrual-related disorders.

In conclusion, there was a statistically significant relationship between severe to very severe stress level and menstrual cycle disorders among high school adolescents in Palembang City. Developing insight into adolescent stress management could reduce the adverse effects of stress on health.

Conflict of interest

None declared.

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