WHAT CAUSED IRREGULAR MENSTRUAL PATTERN AMONG SPORT SCIENCE FACULTY STUDENTS AT UNIVERSITAS NEGERI MALANG?

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Abstract. Menstruation is a physiological change involving the woman's hormones and it influences stress, sleep quality, physical activity, and body mass index (BMI). Abnormal menstrual patterns can have an impact on a woman's fertility and cause issues in the future. This study aimed to determine the impact of stress, sleep quality, physical activity, and BMI on menstrual patterns of female students. Data was collected during April-May 2023 using the Perceived Stress Scale (PSS), Pittsburgh Sleep Quality Index (PSQI), Recommended Dietary Allowances (RDA) profile, weight and height, and menstrual patterns questionnaires and Google form was used as a data collection instrument. The total sample of this study comprised 43 active female undergraduate students who were in the 6th semester of their study from all departments within the Faculty of Sports Science at the Universitas Negeri Malang. Inclusion criteria were being currently active and in good health, with no current need for hospital treatment. The univariate analysis revealed that 24 participants (55.8%) had severe stress, 7 participants (16.3%) had very poor sleep quality, 13 participants (30.2%) had sedentary activity levels, and 19 participants (44.2%) were overweight. The Spearman-rho test results revealed a significant relationship between menstrual patterns and stress levels, sleep quality, and body mass index (p-values = 0.038, 0.043, and 0.044 respectively). Physical activity was not significantly related to menstrual patterns in research participants (p = 0.347). Internal and external factors such as stress, sleep quality, and body mass index can all impact menstruation. Female students are expected to be able to manage stress, sleep quality, and BMI to avoid menstrual pattern disruptions.

Keywords: stress level, sleep quality, physical activity, BMI, menstrual pattern

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INTRODUCTION

Menstrual disorders are one of the most dominant gynecological problems in reproductive health. While some women have periods without complaint or minor discomfort, others experience severe physical and emotional symptoms before and during menstruation, ranging from heavy menstruation to late menstruation, mood swings, and menstrual pain, which interfere with a woman's life (Parker, n.d.). The prevalence of menstrual disorders can vary between 5-35% depending on country of origin, age, and occupation (Kwak *et al*, 2019). It was noted that as many as 45% of women experienced menstrual disorders in the first two years after menarche and four to five years after menarche decreased, but the incidence of menstrual disorders persisted in 20% of women (Anindita *et al*, 2016).

Disruption of the menstrual cycle can be influenced by factors such as stress levels, sleep quality, physical activity, and body mass index (BMI) (Genin *et al*, 2021; Ozimek *et al*, 2022; Poston and Foreyt, 2000; Seif *et al*, 2015; Xing *et al*, 2020). Women with high-stress levels can experience several complaints in the menstrual cycle, such as long cycles, prolonged menstrual duration, and changes in premenstrual complaints (Ozimek *et al*, 2022). Furthermore, previous investigations found that women with

a perceived stress scale (PSS) score of more than 20 were associated with heavy menstrual bleeding, irregular menstrual cycles, and dysmenorrhea (Nagma *et al*, 2015; Vannuccini *et al*, 2020). Kennedy *et al* (2022) added that there was a relationship between short sleep duration, poor sleep quality, fatigue, stress, and depression with more bleeding and irregular menstrual cycles. Increased stress levels and poor sleep quality in women are often associated with the incidence of overweight and obesity, categorized as BMI (Bidulescu *et al*, 2010; Tom and Berenson, 2013).

Menstrual disorders that are not handled properly can cause several problems that can interfere with a woman's quality of life (Iacovides *et al*, 2014; Karlsson *et al*, 2014; Nur Azurah *et al*, 2013). Menstruation usually strains a woman, interferes with work at school and home, and prevents her from attending school for at least one day in the last six months. Girls with irregular menstrual patterns are 1.4, 1.8, and 1.6 times more likely to feel depressed, disrupted schoolwork, and disrupted household chores (Adebimpe *et al*., 2016).

Female student groups are also not free from the potential for menstrual disorders. Furthermore, in the previous study, it was found that 72.22% of the students of the Faculty of Sports Science, Universitas Negeri Malang, experienced menstrual disorders (Hapsari *et al*, 2023). The lack of knowledge about the causes of this disorder became the background for this research to analyze the factors that cause menstrual disorders in the Faculty of Sports Science, Universitas Negeri Malang.

MATERIALS AND METHODS

Study design and setting

An observational analysis with a quantitative approach and a cross

sectional design. This study aimed to discover how stress and sleep quality affected menstruation cycles in female students at the Faculty of Sports Science, Universitas Negeri Malang. It was conducted between April and May 2023 at the Faculty of Sport Science, Universitas Negeri Malang.

Study participants

Web employed purposive sampling technique. The inclusion criteria were active female students of all undergraduate departments at the Faculty of Sport Science, Universitas Negeri Malang, currently actively enrolled in 6th-semester courses, and not currently unwell or needing hospital treatment. Due to limitations in resources or time, this sample was chosen for its accessibility, enabling us to conduct the research efficiently.

Study tools and data collection

This study was conducted at Faculty of Sports Science, Universitas Negeri Malang from April to May 2023, using Google Form as a data-collecting tool. The dependent variables in this study were stress, sleep quality, physical activity, and BMI, while the independent variables were menstrual patterns. The Google form collected data from the perceived stress scale (PSS) questionnaire, the Pittsburgh Sleep Quality Index (PSQI), Recommended Dietary Allowances (RDA) profile, weight and height for BMI calculation, and the menstrual patterns questionnaire. All the questionnaires are in Indonesian and have been validated for validity and reliability.

Data management and analysis

The collected data were scored, coded, tabulated and then subjected to bivariate analysis to determine which factor influences menstrual patterns among the Faculty of Sport Science 6th semester female students. After we finished the steps, we discussed the results to reach a conclusion.

Ethical statement

This study was awarded ethical approval by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia, in February 2023 (reference no. 268/EC/KEPK/12/2022).

RESULTS

Table 1 presents the frequency of participant's characteristics. A total of 43 participants completed the survey; most participants were in the Public Health Sciences and Physical Education, Health, and Recreation Departments with 39.5% and 34.9%, respectively.

Table 1
Distribution of research respondents' demographic characteristics (N = 43)

Department	Frequency *n* (%)
Physical Education, Health, and Recreation	15 (34.9)
Public Health Sciences	17 (39.5)
Sports Science	8 (18.6)
Sports Coaching Education	3 (7.0)

Table 2 shows the frequency of stress level, sleep quality, physical activity, body mass index and menstrual pattern of the students. Most of student experienced severe stress (55.8%) and had poor sleep quality (34.9%). Even though most of them were moderately active in daily activities (34.9%), 44.2% students were overweight. Surprisingly, most of the students were also experienced secondary amenorrhea (34.9%) and other menstrual problems.

Table 3 shows the correlation between stress level, sleep quality, physical activity, and BMI to the students' menstrual pattern. It shows that stress level, sleep quality, and BMI were significantly correlated with the menstrual pattern with *p*-values of 0.038, 0.043 and 0.044, respectively. A little over a quarter of students (25.6%) had severe stress level related to secondary amenorrhea, and 16.3% correlated to polymenorrhea. Students with moderate stress level (14%) most often experienced eumenorrhea. On the other hand, 18.6% students who had poor sleep quality encountered secondary amenorrhea. In addition, overweight female students (23.3%) were found to have a higher prevalence of secondary amenorrhea compared to other categories. Then, physical activity was not significantly related to menstrual patterns in research participants (*p*-values = 0.347).

DISCUSSION

Effects of stress on menstrual patterns

Stress is a general pattern of reactions and adaptations in that the pattern of reactions to stressors, which might come from within or outside the individual concerned, can be real or unreal. Eustress and distress are kinds of stress. Eustress is a healthy, good, constructive stress response (constructive). Any stress that surpasses coping capacity loads the body,

Table 2

Stress level, sleep quality, physical activity, BMI, and menstrual pattern of research respondents (N = 43)

Variable	Frequency *n* (%)
Stress level[1]	
Mild	2 (4.7)
Moderate	17 (39.5)
Severe	24 (55.8)
Sleep quality[2]	
Good	9 (20.9)
Fairly good	12 (27.9)
Poor	15 (34.9)
Very poor	7 (16.3)
Physical activity[3]	
Sedentary	13 (30.2)
Light active	13 (30.2)
Moderately active	15 (34.9)
Very active	2 (4.7)
BMI[4]	
Underweight	6 (14.0)
Normal	15 (34.9)
Overweight	19 (44.1)
Obesity	3 (7.0)

Table 2 (cont)

Variable	Frequency *n* (%)
Menstrual pattern[5]	
Eumenorrhea	8 (18.6)
Polymenorrhea	9 (20.9)
Oligomenorrhea	11 (25.6)
Secondary amenorrhea	15 (34.9)

[1]Stress level is measured by Perceived Stress Scale (PSS) consisting of 10 questions. Scores ranging from 0-13 would be considered mild stress; scores ranging from 14-26 would be considered moderate stress; and scores ranging from 27-40 would be considered severe stress

[2]The measuring tool for assessing sleep quality is the Pittsburgh Sleep Quality Index (PSQI) questionnaire. This questionnaire consists of 18 questions and consists of 7 components, namely sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disorders, use of sleeping pills and daytime activity dysfunction. Sleep quality is categorized as follow – Good: score 0; Fairly good: score 1; Poor: score 2; Very poor: score 3

[3]Physical activity is categorized as follow – Sedentary: spending 6 hours or more per day sitting or lying down, and lacking physical movement in daily life; Light active: mostly professionals (lawyers, doctors, accountants, architects, *etc*.), office workers, shop workers, teachers, housewives with mechanical equipment, and the unemployed); Moderately active: light industrial workers, agricultural workers, active students, department store workers, inactive soldiers, people involved in commercial fishing, housewives without mechanical household equipment); Very active: full-Time athletes, dancers, unskilled laborers, farmers, forestry workers, army recruits, soldiers in active service, mine workers, and steel workers.

[4]BMI is categorized as follow – Underweight: BMI under 18.5 kg/m^2; Normal weight: BMI greater than or equal to 18.5 to 24.9 kg/m^2; Overweight: BMI greater than or equal to 25 to 29.9 kg/m^2; and Obesity: BMI greater than or equal to 30 kg/m^2.

[5]Menstrual pattern is categorized as follow – Eumenorrhea: normal, regular menstruation that lasts for around the first 5 days of the cycle; Polymenorrhea: (frequent menses) refers to a menstrual interval of less than 21 days; Oligomenorrhea: (infrequent menses) the interval is greater than 37 days but less than 90; Secondary amenorrhea: when a patient who has passed menarche goes six months or longer without menses.

BMI: body mass index; kg/m^2: kilograms per square meter

Table 3

Correlation between menstrual patterns and stress level, sleep quality, physical activity and BMI (N = 43)

Variable	Menstrual pattern[5], *n* (%)					*p*-value
	Eumenorrhea	Polymenorrhea	Oligomenorrhea	Secondary amenorrhea	Total	
Stress level[1]						0.038
Mild	1 (2.3)	0 (0.0)	1 (2.3)	0 (0.0)	2 (4.6)	
Moderate	6 (14.0)	2 (4.7)	5 (11.6)	4 (9.3)	17 (39.6)	
Severe	1 (2.3)	7 (16.3)	5 (11.6)	11 (25.6)	24 (55.8)	
Sleep quality[2]						0.043
Good	4 (9.3)	3 (7)	1 (2.3)	1 (2.3)	9 (20.9)	
Fairly good	1 (2.3)	3 (7)	4 (9.3)	4 (9.3)	12 (27.9)	
Poor	3 (7)	1 (2.3)	3 (7)	8 (18.6)	15 (34.9)	
Very poor	0 (0)	2 (4.7)	3 (7)	2 (4.7)	7 (16.3)	
Physical activity[3]						0.347
Sedentary	3 (7)	1 (2.3)	4 (9.3)	5 (11.6)	13 (30.2)	
Light active	1 (2.3)	3 (7)	3 (7)	6 (14)	13 (30.2)	
Moderately active	4 (9.3)	4 (9.3)	4 (9.3)	3 (7)	15 (34.9)	
Very active	0 (0)	1 (2.3)	0 (0)	1 (2.3)	2 (4.7)	

Table 3 (cont)

Variable	Menstrual pattern[5], *n* (%)					*p*-value
	Eumenorrhea	Polymenorrhea	Oligomenorrhea	Secondary amenorrhea	Total	
BMI[4]						0.044
Underweight	2 (4.7)	1 (2.3)	1 (2.3)	2 (4.7)	6 (14)	
Normal	4 (9.3)	4 (9.3)	5 (11.6)	2 (4.7)	15 (34.9)	
Overweight	2 (4.7)	4 (9.3)	3 (7)	10 (23.3)	19 (44.2)	
Obesity	0 (0)	0 (0)	2 (4.7)	1 (2.3)	3 (7)	

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and creates bodily or psychological difficulties. Stress often disrupts menstruation (Novelia *et al*, 2023). This occurs when stress signals the limbic system in the central nervous system via nerve transmission. The hormonal glands send neurohormonal secretions from the autonomic nerves to the pituitary via the frontal system, resulting in the release of gonadotropins like follicle stimulating hormone (FSH). FSH influences Luteinizing hormone (LH), which are sent from the hypothalamus to the pituitary. The feedback mechanism of estrogen to the brain greatly affects RH release and menstruation. In menstruation disorders, integrated regulatory mechanisms impact biochemical and cellular processes, affecting the brain and psychology (Achmad *et al*, 2021).

The hypothalamic-pituitary-adrenal axis (HPA-axis) is stimulated by stress, and the hypothalamus releases corticotropin-releasing factor (CRF) hormone, which stimulates the pituitary to release adrenocorticotropic hormone (ACTH) into the blood. The ACTH activates the adrenal glands, causing them to release cortisol. These hormones regulate the body's stress response and can inhibit the production of normal quantities of reproductive hormones, resulting in irregular ovulation, anovulation, or amenorrhea, depending on the degree of gonadotrophin-releasing hormone (GnRH) suppression (Hamid *et al*, 2022).

Based on the findings of the stress level variables, more than half of the respondents had severe stress, ie 24 respondents (55.8%). According to Achmad *et al* (2021), stress is a shift in the body's reaction to a new threat, pressure, or condition. When the body is under stress, cortisol and adrenaline are released. In such circumstances, the heart rate and blood pressure rise, causing breathing to become quicker and muscles to stiffen. When stressed, the hypothalamus, the brain region that governs the menstrual cycle, is disrupted. The hormones that regulate the menstrual cycle are not generated in balance in this illness, causing

menstruation to become irregular (Achmad *et al*, 2021).

Effect of sleep quality on menstrual patterns

Based on the findings of the sleep quality variables, the percentage of respondents undergoing very poor sleep quality was 16.3%. Female students at the Faculty of Sports Science, Universitas Negeri Malang, may experience sleep disturbances due to practical and written exams and fatigue after excessive exercise. Table 2 shows that 15 students were moderately active, and two students were very active; those who were moderately active and very active were detected as athletes. Good sleep quality includes a latency of ≤15 minutes, a duration of >7 hours, 85% of total sleep time spent in bed, no waking up more than once per night, no sleep disturbances in the past month, no sleeping pills, and no attention disturbances during the day (Pangestika *et al*, 2018). On the other hand, nine respondents had good sleep quality, and 12 respondents had good sleep quality. Based on the questionnaires that we had, the students had no sleeping pills to help.

Effect of physical activity on menstrual patterns

In this study, female sport science student with light physical activity experienced secondary amenorrhea, in line to a study from Negi *et al* (2018) which reported that female nurse aged 20-45 years with low physical activity had irregular menstrual cycle. A theory about physical activity can restore ovulation by enhancing insulin sensitivity, which helps to restore normal levels of steroidogenesis, is the first step in the mechanism (Hakimi and Cameron, 2017) According to another study, women with polycystic ovary syndrome (PCOS) may experience

spontaneous ovulation when their levels of sex hormone-binding globulin increase and their levels of free androgens fall due to improved insulin sensitivity (Froment and Touraine, 2006). Two studies mentioned physical activity could enhance slightly, but not significantly, menstrual patterns (Karimzadeh and Javedani, 2010; Palomba *et al*, 2010).

Effect of body mass index (BMI) on menstrual patterns

Low levels of sex hormone-binding globulin, insulin resistance/ hyperinsulinemia, and changes to the hypothalamic-pituitary-ovarian axis may all contribute to menstrual disorder in obese women (Klenov and Jungheim, 2014; Wei *et al*, 2009). In the present study, young female students who with BMI ≥25 kg/m^2 experienced secondary amenorrhea. Stress, exercise, and weight loss have all been linked to functional hypothalamic amenorrhea, which is defined by the suppression of the pulsatile release of the gonadotropin (Gordon, 2010).

This cross-sectional study was unable to explain the definite causes of irregular menstrual pattern factors in sport science students. In addition, purposively recruiting the 6th semester female students was considered a bias as it is known that they were facing some stress at this stage of study; therefore, future studies should use randomized sampling to avoid this issue. Furthermore, to address the limitations of this study, additional samples and alternative methodologies such as mixed-methods approach and longitudinal studies research may be useful for future research, allowing more in-depth exploration of causal relationship and contextual understanding.

In conclusion, stress, poor sleep quality, and body mass index are a few examples of internal and external factors that might affect menstruation. To prevent disturbances to their menstrual cycles, female

students must be able to control their stress levels, sleep patterns, and BMI.

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CONFLICT OF INTEREST DISCLOSURE

The authors declare no conflict of interest

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