The Relationship between Physical Activity and Other Factors During a Pandemic Covid-19 with Menstrual Cycles in FKM UI Students in 2022

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Keywords	Abstract
Menstrual Cycles, Physical Activity, Stress Levels, Lecture Stressors, Eating Patterns, College Student	The menstrual cycle is the time from the first day of menstruation until the arrival of the next menstrual period. WHO 2018 states that 80% of women in the world experience irregular menstruation. According to Basic Health Research Data (Kemenkes, 2018) where as many as 11.7% of adolescents in Indonesia experience irregular menstruation. This study aims to determine physical activity, stress levels and other factors during the Covid-19 pandemic with menstrual cycles in final year students S1 Regular FKM UI in 2022. This study is a quantitative study with a cross-sectional study design. Data collection was done by distributing online questionnaires using Google Forms. The independent variables used in this study were physical activity, stress levels, lecture stressors, age at menarche, diet, deviant eating behavior, sleep quality, and exposure to cigarette smoke. The results showed that (60.4%) of female students experienced irregular menstrual cycles. The factors that affect the menstrual cycle in final year undergraduate students of FKM UI Regular in 2022 are stress levels and diet as confounding variables. Diet is the most dominant factor affecting the menstrual cycle. It is recommended that female students pay more attention to diet because diet is the dominant factor that affects the menstrual cycle.

1. Introduction

Menstrual cycles that occur outside of normal circumstances or in other words are not within menstrual pattern intervals with a span of less than 21 days or more than 35 days with normal uterine bleeding for less than 3 or more than 7 days are called irregular menstrual cycles (Hilmiati & Saparwati, 2019). Irregular menstrual cycle disorders that are continuous and not treated immediately need to be watched out for because they can indicate a disease that can occur such as affecting fertility levels, problems with ovulation or infertility, uterine polyps, uterine cancer, polycystic ovary syndrome, ovarian cysts, and anemia (Lestari & Amal, 2019).

WHO 2018 stated that 80% of women in the world experience irregular menstruation. According to Basic Health Research Data (Ministry of Health RI, 2018) where as many as 11.7% of adolescents in Indonesia experience irregular menstruation and as many as 14.9% of adolescents in urban areas in Indonesia experience menstrual

irregularities, where irregular presentations reach 15.8% in the DIY region (Purwati & Muslikhah, 2020). The change in situation that occurred due to the Coronavirus Disease 2019 (COVID-19) pandemic caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS CoV-2) resulted in students having to adapt to the latest learning system. With the Public Health Emergency regulations (KKM), the government stipulates health quarantine and physical distancing. In implementing health quarantine in the regions, Indonesia adopts a policy to implement Large-Scale Social Restrictions (PSBB) (Ministry of Health, 2020). The impact of changes experienced by students during the Covid-19 pandemic can be at risk of causing mental health problems. The mental health problems that are increasing during this pandemic are stress, anxiety, and depression (Fauziyyah et al., 2021).

Stress and physical activity are one of the factors that cause menstrual cycle irregularities. Stress can trigger the release of the hormone cortisol, where the hormone cortisol is used as a benchmark to see a person's degree of stress. The hormone cortisol is regulated by the brain, the hypothalamus and the pituitary gland, with the start of the activity of the hypothalamus and pituitary which secrete Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH), as well as the ovarian stimulus process which will produce estrogen (Lee et al., 2016). If there is a disturbance in FSH, it can affect the production of estrogen and progesterone which causes menstrual cycle irregularities (Sirait, 2019). Meanwhile, other factors that can cause menstrual cycle irregularities are physical activity. Physical activity is defined as any physical movement produced by skeletal muscles that requires energy expenditure (WHO,   2018).

2. Materials and Methods

The research design used a cross-sectional design. The dependent variable studied was the menstrual cycle, while the independent variables consisted of physical activity, stress levels, course stressors, age at menarche, eating patterns, eating disorders, sleep quality, and exposure to cigarette smoke. The population in this study were all active female students at the Faculty of Public Health, University of Indonesia. The number of research samples was taken using the Lemeshow formula with a total sample of 154 respondents. The sampling technique used in this research is the accidental sampling technique. The instrument used to measure the primary data needed in this study was a self-administered questionnaire. Data analysis was carried out univariately, bivariate using the chi-square test to prove the existence of a significant relationship between the two variables, and multivariate using multiple logistic regression tests to determine which independent variable is the dominant factor in the studied variable.

3. Results and Discussions

Univariate analysis

The univariate analysis included all variables used, which consisted of menstrual cycles, age at menarche, physical activity, stress levels, course stressors, eating patterns, eating disorder behavior, sleep quality, and exposure to cigarette smoke.

Table 1. Description of the Distribution of Respondents Based on Variables

Variable	Frequency	Percent (%)
Age		
20 years	2	1.3
21 years	66	42.9
22 years	75	48.7
23 years	11	7.1
Total	154	100
Menstrual Cycle		
Regular	93	60.4
Irregular	61	39.6
Total	154	100

Menstrual Cycle Irregularities		
Polimenorrhea	28	18.2
Oligomenorrhea	55	35.7
Polimenorrhea and Oligomenorrhea	10	6.5
Total	93	60.4
Menarche age		
Abnormal	43	27.9
Normal	111	72.1
Total	154	100
Physical Activity		
Light	89	57.8
Heavy	65	42.2
Total	154	100
Stress Level		
Heavy	109	70.8
Light	45	29.2
Total	154	100
Dietary habit		
Not good	143	92.9
Good	11	7.1
Total	154	100
Deviant Eating Behavior		
Experiencing PMM	9	5.8
Not suffering from PMM	145	94.2
Total	154	100
Sleep Quality		
Bad	143	92.9
Good	11	7.1
Total	154	100
Cigarette Smoke Exposure		
Often	30	19.5
Seldom	124	80.5
Total	154	100

Source: Data Primer

Bivariate Analysis

The bivariate analysis used is test*who squares.*Test*who squares*used to see the relationship between groups of categorical variables. The independent variables in this study will be analyzed by test*who squares*namely age of menarche, physical activity, stress level, diet, deviant eating behavior, quality of sleep, and exposure to cigarette smoke (Fitri, 2018).

Table 2. Results of Bivariate Analysis

Variable	Siklus Menstruasi				P-value	OR
	Teratur		Tidak Teratur			
	N	%	N	%		
Usia menarche						
Tidak normal	23	53.5	20	46.5	0.277	**0.674 (0.330-1.373**
Normal	70	63	41	37		
Total	93	60.4	61	39.6		
Aktifitas Fisik						
Ringan	53	59.6	36	40.4	0.803	**1.087 (0.565- 2.092)**
Berat	40	61.5	25	38.5		
Total	93	60.4	61	39.6		
Tingkat stres						
Berat	72	66.1	37	33.9	**0.027***	**2.224 (1.096- 4.511)**
Ringan	21	46.7	24	53.3		
Total	93	60.4	61	39.6		
Pola Makan						
Kurang Baik	90	62.9	53	37.1	**0.031***	**4.528 (1.151-17.814)**
Baik	3	27.3	8	72.7		
Total	93	60.4	61	39.6		
PMM						
Mengalami PMM	4	44.4	5	55.6	0.321	**0.503 (0.130- 1955)**
Tidak mengalami PMM	89	61.4	56	38.6		
Total	93	60.4	61	39.6		
Kualitas Tidur						
Buruk	88	61.5	55	38.5	0.300	**1.920 (0.559- 6.593)**
Baik	5	45.5	6	54.5		
Total	93	60.4	61	39.6		
Paparan Asap Rokok						
Sering	16	53.3	14	46.7	0.380	**0.698 (0.312-1.558)**
Jarang	77	62.1	47	37.9		
Total	93	60.4	61	39.6		

Multivariate Analysis

    Multivariate analysis in this study was carried out using multiple logistic regression tests to determine the most dominant factor influencing the pattern of the menstrual cycle.

Table 3. Multivariate Final Modeling

Variabel	B	S.E.	P-value	OR (95% CI)
Tingkat stres	0.748	0.367	0.042	2.113 (1.029- 4.340)
Pola makan	1.424	0.708	0.044	4.152 (1.036- 16.640)

    Irregularities in the body's metabolic and hormonal systems in a woman can be characterized by short or long menstrual cycles. The impact of an abnormal menstrual cycle is that it will be difficult for women to get pregnant or

infertile. In this study, it was found that some female students had an abnormal menarche age, namely 53.5%, while respondents who had a normal menarche age with irregular menstrual cycles, namely 63%. The results of the statistical test obtained p-value = 0.277, meaning that there is no significant relationship between the age of menarche and the menstrual cycle in female students at the end of the regular undergraduate program at FKM UI in 2022 (Bavil et al., 2016). This is because the respondents are aged 20-23 years, indicating that reproductive hormones respondents have been perfectly formed so that the menstrual cycle becomes regular, generally two years after experiencing menarche. However, this research is not in line with the research of (Karout et al., 2012) in Lebanon which states that there is a significant difference between menstrual cycle irregularities and the age of menarche. The age of menarche can affect the menstrual cycle during the first 2 to 4 years after menarche because there is a significant increase in weight, height, and body fat so late menarche can cause anovulation. Menarche age can be associated with decreased secretion of luteinizing hormone (LH) and/or increased frequency of anovulation caused by obesity-related hyperandrogenemia and hyperinsulinemia (Dossus et al., 2012).

Physical activity is body movement carried out by skeletal muscles that result in energy expenditure. Inadequate physical activity can cause irregular menstrual cycles because excess fat cells in the body will disrupt the balance of menstrual hormones (Brown, 2016). The results of research conducted on regular undergraduate students at FKM UI in 2022 found that 59.6% of respondents had light physical activity and experienced irregular menstrual cycles and 61.5% of respondents had heavy physical activity and experienced irregular menstrual cycles. Based on the results of the statistical test analysis, it was found that p-value = 0.803, meaning that there is no significant relationship between physical activity and menstrual cycle patterns in female students at the end of the regular undergraduate program at FKM UI in 2022. This is in line with research conducted by (Herlina, 2020) which stated that there is no significant relationship between physical activity and menstrual cycle patterns. Strenuous physical activity can affect reproductive hormones in women. Strenuous physical activity can cause disturbances in GnRH secretion due to hypothalamic dysfunction due to fatigue. When carrying out strenuous physical activity, the body will experience an energy deficit (hypermetabolic) which will suppress the menstrual cycle, inhibit GnRH, and reduce LH pulsatility which can affect the menstrual cycle (Wade, 2004). Meanwhile, inadequate or light physical activity can cause irregular menstrual cycles because excess fat cells in the body will disrupt the balance of menstrual hormones (Brown, 2016).

Stress is an individual's inability to overcome problems faced by emotional, spiritual, physical, and mental, and can affect physical health (Ramdani et al., 2017). In this study, stress levels were categorized into mild stress and severe stress which were seen based on scores from completing the Perceived Stress Scale questionnaire developed by Cohen (1983). Something that can cause stress is called a stressor. Stressors that affect stress levels in FKM UI regular undergraduate final-year students are environmental factors such as where to live which makes respondents feel stressed. This stressor is experienced by almost all FKM UI Regular undergraduate female students in 2022, namely 107 people (69.5%) (Chen et al., 2000). Furthermore, problems that become stressors for most female students are mental and physical health problems including autoimmune diseases, stomach ulcers, allergies, and vertigo which are also stressors for some final year students of the FKM UI Regular Undergraduate Program in 2022, namely 100 people (64.9%). In this study, it can also be seen that the description of respondents who have high-stress levels with irregular menstrual cycles is higher than respondents who have mild stress levels with irregular menstrual cycles. As many as 66.1% of respondents stated that they had high levels of stress with irregular menstrual cycles, and 46.7% of respondents experienced mild levels of stress with irregular menstrual cycles. Statistical test results also showed that there was a significant relationship between stress levels and menstrual cycle patterns (p-value 0.027).

Stress is one of the factors that can cause menstrual cycle irregularities. When women experience stress, their menstrual cycles can be longer or shorter than their normal menstrual cycle. This is caused by the hormone cortisol which is regulated in the brain and pituitary gland and causes hormonal imbalances, including one of which is reproductive hormones which eventually cause menstrual cycle irregularities (Achmad, et al., 2021). Hormonal imbalances including reproductive hormones cause menstrual cycle irregularities due to the cortisol hormone stimulated by the HPA (hypothalamus pituitary adrenal cortex) axis due to stress ((Isnaeni, 2010); (Yudita et al., 2017).

Diet is the amount or amount of food consumed by a person or group that aims to meet their needs. Diet can be influenced by several things such as pleasure habits, culture, religion, economy, environment, and so on (Herlina, 2020). In a study conducted on regular undergraduate students at FKM UI in 2022, it was found that there were more respondents who had a poor diet compared to respondents who had a good diet. The results of a bivariate analysis conducted on regular undergraduate students at FKM UI in 2022 showed that 62.9% of respondents had a poor diet and irregular menstrual cycle patterns, and 27.3% had a good diet with irregular menstrual cycle patterns. Based on the results of the statistical test analysis, it was obtained p-value = 0.031, meaning that there was a significant relationship between diet and menstrual cycle patterns in female students at the end of the regular undergraduate

program at FKM UI in 2022. The results of the analysis obtained OR = 4.528, meaning that female students who have irregular eating patterns are 4.5 times more likely to experience irregular menstrual cycle patterns. Diet is also known as the most dominant factor influencing the menstrual cycle in FKM UI regular undergraduate students in 2022.

According to Purwanti's research (2017) breakfast is good for reducing obesity rates because someone who skips breakfast in the morning is more likely to feel hungry quickly so he will eat large portions when meeting food. Whereas someone who has breakfast in the morning, he will get metabolic stability and tends not to consume many calories throughout the day. In someone who is obese, there will be leptin resistance. Leptin resistance can cause the hypothalamus to be disrupted in releasing GnRH, causing irregular menstrual cycles (Strauss & Barbieri, 2013). The results of this study are in line with research conducted on female students at the Faculty of Dentistry, University of North Sumatra which shows that there is a significant relationship between diet and menstrual cycle patterns (Ahmed, 2017). Deviant eating behavior is a series that starts with mild body dissatisfaction to serious eating disorders (Brown, 2016). In this study, deviant eating behavior was divided into 2 categories, namely not experiencing PPM and experiencing PPM. The questionnaire used in this study used the modified Eating Disorder Diagnostic Scale questionnaire developed by Stice & Rizvi in 2000.

In a study conducted on regular undergraduate students at FKM UI in 2022, it was found that 94.2% of respondents did not experience deviant eating behaviors, and another 5.8% experienced deviant eating behaviors such as binge eating disorders. The results of a bivariate analysis conducted on regular undergraduate students at FKM UI in 2022 showed that 44.4% of respondents experienced deviant eating behaviors and irregular menstrual cycle patterns, and 61.4% of respondents did not experience deviant eating behaviors with irregular menstrual cycle patterns. Based on the results of the statistical test analysis, it was obtained that p-value = 0.321, meaning that there is no significant relationship between deviant eating behavior and menstrual cycle patterns in female FKM UI final-level regular undergraduate students in 2022.

This research is in line with Hikmah's research (2016), which states that there is no significant relationship between deviant eating behavior and the menstrual cycle in female students of SMAN 44 Jakarta, with a p-value of 0.136. However, the results of this study are not in line with the research of (Eittah, 2014) which states that there is a significant difference between eating behavior and the incidence of oligomenorrhea. This study was conducted on 300 adolescents aged 17-22 years at Menoufia University, Egypt. The difference in the results of this study with that of (Eittah, 2014) occurred due to differences in the number of samples used.

This study used the Pittsburgh Sleep Quality Index (PSQI) to measure the sleep quality of female students at the end of the regular undergraduate program at FKM UI in 2022. The sleep quality of female students is seen from various aspects, including subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping pills, and daytime dysfunction. Sleep disorders often occur in students who are working on their thesis, usually due to stress factors. Demands for academic and non-academic values trigger feelings of discomfort for students (Sulana et al., 2020).

The results showed that female students with poor sleep quality and experienced irregular menstrual cycles were more numerous than female students who had good sleep quality, namely 61.5% of respondents had poor sleep quality with irregular menstrual cycle patterns, and 45.5 % had good sleep quality with irregular menstrual cycle patterns. Female students with poor sleep quality had a 1.9 times higher chance of experiencing irregular menstrual cycle patterns than female students who had good sleep quality. However, statistically there is no relationship between sleep quality and the menstrual cycle (p-value 0.300).

The factor that dominates the reason for the lack of quality sleep in female students is because female students cannot fall asleep within 30 minutes with a percentage of 31.2%, followed by the frequent awakening of respondents at night or early in the morning with a percentage of 21.4%, and respondents often experience aches or pains in their bodies with the percentage of 16.9%. The results of this study are in line with research by Deviliawati and Sayati (2021) which was conducted on high school students in Banyuasin, which showed that there was no relationship between sleep quality and the menstrual cycle (p-value 1,000). Research on young women in South Tangerang also showed that there was no significant relationship between sleep quality and the menstrual cycle (p-value 0.090) (Fikawati et al., 2016). Research Damayanti, et al. (2022), also showed that sleep quality did not have a significant relationship with the menstrual cycle of Harapan Bangsa University female students during the Covid-19 pandemic. The high percentage of female students with poor sleep quality may be due to the Covid-19 pandemic, which has changed all aspects of society. Among female students, online learning from home has led to increased use of electronic devices. This condition is one of the causes of decreased sleep quality in female students (Syahrul et al., 2022). In addition, a study by Silva et al., (2022) found that almost half of the teenagers studied (47.2%) were more active at

night and 72.2% of these teenagers had poor sleep quality which was also measured using the PSQI instrument (Maharani et al., 2023).

In the study of exposure to cigarette smoke, there are 3 main places studied, namely exposure to cigarette smoke at home, in public places, and on public transportation. Based on the results of the study, it was found that exposure scores to cigarette smoke at home, in public places, and in public transportation were combined and divided into 2 categories. It can be seen that 80.5% of respondents were rarely exposed to cigarette smoke, while the other 19.5% said that they were often exposed to cigarette smoke. The results of the research on exposure to cigarette smoke and menstrual cycles in female students at the end of the regular undergraduate program of FKM UI in 2022, it is known that respondents who are rarely exposed to more cigarette smoke and experience irregular menstrual cycles are higher than respondents who are often exposed to cigarette smoke, with a percentage of 62.1%. rarely exposed to cigarette smoke and experience irregular menstrual cycle patterns.

Meanwhile, the respondents who were frequently exposed to cigarette smoke and experienced irregular menstrual cycle patterns were 53.3%. Based on the results of the statistical test analysis, it was obtained that p-value = 0.380, meaning that there was no significant relationship between exposure to cigarette smoke and the pattern of the menstrual cycle in regular undergraduate students at FKM UI 2022. According to Lestari's research (2010), women who have smoking habits can have menstrual cycles that are not normal or not smooth, pain or cramps during menstruation, and the risk of sudden fetal death (Sudden Infant Death Syndrome) in pregnant women who smoke, skin becomes dull, hair is dry, and causes bad breath. The adverse effects on health that can occur in someone who consumes nicotine are increasing the risk of cancer in the oral cavity, the occurrence of lung cancer, and other cancers that can attack the brain and heart, as well as chronic disorders and lung disease, pregnancy and fetal complications, as well as various other adverse conditions (American Psychiatric Association, 2000).

4. Conclusion

The results showed that (60.4%) female students experienced irregular menstrual cycles. Factors that affect the menstrual cycle in female students at the end of the Regular Undergraduate Program FKM UI in 2022 are stress levels and eating patterns as confounding variables. Diet is the most dominant factor affecting the menstrual cycle. It is recommended that female students pay more attention to diet because diet is the dominant factor that affects the menstrual cycle.

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