

## Original Research Paper

## The relationship of stress levels, nutritional status, and physical activity with menstrual cycle disorders

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### Abstract

Menstrual cycle disorders are abnormal uterine bleeding occurring in women of productive age and impact infertility. This study aims to analyze the relationship between stress levels, nutritional status, and physical activity with menstrual cycle disorders in female students of the Jember University public health study program. This research is quantitative research with a Cross-sectional design. The study population is active female Public Health Study Program students, University of Jember batch 2016-2020. The number of samples was 141 female students. Data collection using questionnaire filling through Google form sent to respondents. The collected data was then analyzed bivariate using Chi-Square and multivariate analysis using logistic regression. The results showed that 53% of female students experience menstrual cycle disorders. Stress level (OR 14.2; CI 5.10-38.77) and physical activity (OR 29.10; CI 9.20-92.10) are factors associated with menstrual cycle disruption in female college students. Female students with heavy stress levels and heavy physical activity can increase the risk of menstrual cycle disorders.

**Keywords:** menstrual cycle disorders; nutritional status; physical activity; stress levels

### 1. Introduction

Adolescence is when a teenager begins puberty and sexual maturation quickly due to hormonal changes so that there can be an acceleration of physical growth and development, both primary and secondary. Adolescence is a stage of a person's life to reach emotional, psychosocial, and sexual maturity, which will be marked by the start of the functioning of the reproductive organs and all its consequences. Menstruation is one indicator of sexual maturity in adolescent girls (Gustiana & Djannah, 2015). Normal menstrual cycles in women occur at 28-35 days, with a menstrual duration of 3 to 7 days. A menstrual cycle of < 21 days or > 40 days can be referred to as an abnormal menstrual cycle and usually indicates a disruption to the menstrual cycle (Tombokan et al., 2017).

Menstrual cycle disorders are abnormal bleeding in the uterus. The incidence of menstrual cycle disorders experienced by women of productive age by 9%-14%. Menstrual cycle disorders need attention because they can impact the quality of life and be an economic burden (Tombokan et al., 2017). The results of RISKESDAS in 2010 showed that 13.7% of women aged 10-59 years in Indonesia experiencing cycle disorders (Kementrian Kesehatan RI, 2010). Three types of menstrual cycle disorders exist polymenorrhoea, oligomenorrhoea, and amenorrhoea. Polymenorrhoea can be interpreted as a menstrual cycle lasting < 21 days with blood volume equal to or even more than normal. Oligomenorrhoea is a menstrual cycle with days exceeding 35 days and blood volume less than normal menstruation (Islamy, A., & Farida., 2019). Amenorrhoea is menstruation that does not occur more than 90 days in a row (Taufiq et al., 2019).



Menstrual cycle disorders are important indicators describing changes in ovarian function and are reassociated with an increased risk of breast and ovarian cancer, diabetes mellitus, cardiovascular disease, and fractures (Tombokan et al., 2017). Menstrual cycle irregularities are a sign of deviation from the normal menstrual cycle. Menstrual cycles longer than their normal limits become an important non-invasive clinical indicator for assessing reproductive function. The increased risk of decreased fertility can also be characterized by the disruption of the menstrual cycle experienced by women of childbearing age (Sunarsih, 2015).

Several factors can affect the occurrence of menstrual cycle disorders, namely stress, nutritional status, weight, abnormalities in the reproductive organs, and physical activity (Prayitno, 2014). When stress occurs in adolescent girls, the hypothalamus-pituitary-adrenal cortex axis is aroused to produce the hormone cortisol, which causes hormonal imbalances in the body, including LH and FSH hormones (reproductive hormones responsible for the growth and maturation of follicles in the ovaries), causing menstrual cycle disorders (Yudha et al., 2017). Several previous studies have proven a relationship between stress levels and menstrual cycle disorders. Research conducted by Islamy, A., & Farida (2019) states that stress levels have the greatest influence on menstrual cycle disorders, as evidenced by the results of the p-value in the study is 0.015. Likewise, Wisniastuti et al. (2018) found a relationship between stress and menstrual cycle disorders in 8<sup>th</sup> semesters students at STIKes Wira Medika Bali. The high level of stress is experienced by many female students in the final semester. The high-stress level in female students is most likely due to many tasks that must be completed and poor time management, which triggers stress that can cause menstrual cycle disorders.

Research conducted by Islamy, A., & Farida (2019) states that there is a significant relationship between nutritional status and the menstrual cycle. This is in line with the research of Kurniasari et al. (2018), which states that a significant relationship exists between nutritional status and menstrual cycle irregularities in MAN 1 Samarinda students. In addition, it is also stated by research conducted by Rachmawati., & Murbawani (2015) states that there is a significant relationship between physical activity and menstrual cycle disorders. Another supporting research by Usman (2015) stated a significant relationship between physical activity and menstrual cycle disorders in adolescent girls at the Pelita Ibu Kendari Midwifery Academy in 2018.

Several previous studies have provided evidence of the relationship between each variable stress level, nutritional status, and physical activity with menstrual cycle disorders. This study aims to analyze the relationship between stress levels, nutritional status, and physical activity with menstrual cycle disorders simultaneously using multivariable analysis so that the determinants of menstrual cycle disorders can be obtained and can be formulated prevention and handling of adverse effects through modification of learning activities both curricular, co-curricular and extracurricular at the Public Health Study Program, Jember University.

## **2. Research Methods**

This research includes analytical, observational research with a cross-sectional design. There were 141 students as samples taken by stratified random sampling from 800 female student populations of the Public Health Study Program, University of Jember class of 2016-2020, who were still active. The study's stress, nutrition, and physical activity level were independent variables, and a dependent variable was menstrual cycle disorders.

The stress level variable was measured using the Depression Anxiety Stress Scales questionnaire (DASS 42) containing 14 question items from Lovibond (1995), which had a validity and reliability value of 0.91 processed based on Cronbach's Alpha assessment. The measurement results are classified into 1) No stress if the total score (0-14), 2) mild stress if the total score (15-18), 3) moderate stress if the total score (19-25), 4) severe stress if the total score (26-33) and 5) very severe stress if the total

score is  $>34$ . Nutritional status variables are determined using the Body Mass Index (BMI) of respondents, which are classified into 1) undernutrition if BMI ( $< 18.5$ ), 2) normal if BMI ( $18.5 - < 24.9$ ), 3) more body density and obesity (BMI  $25.0 - > 27$ ). The physical activity variable was measured using a Physical Activity Level (PAL) questionnaire with a predetermined fixed value multiplied by the length of activity carried out by respondents in units of hours. The PAL questionnaire has a validity and reliability value of 0.71 which is processed based on Cronbach's Alpha assessment. The measurement results are classified into three categories, namely 1) light activity if (PAL value 1.40-1.69), 2) moderate activity if (PAL value 1.70-1.99), and 3) heavy activity if (PAL value 2.00-2.40). The variable menstrual disorder was identified by filling out a questionnaire to respondents about the menstrual cycle experienced for 4 consecutive months. Respondents were identified as having menstrual cycle disruption if they reported their cycle  $<21$  days (polymenorrhoea) or  $>35$  days (oligomenorrhoea) or not menstruating for 90 consecutive days (amenorrhea).

The data collection technique sends a link instrument to selected respondents in the Google form application. The collected data is analyzed univariately to describe the frequency distribution of each variable, bivariate analysis using Chi-Square, and multivariate analysis using logistic regression. This research has obtained ethical clearance from the research ethics committee Fakultas Kedokteran Gigi Universitas Jember with Number 1163/UN25.8/KEPK/DL/2021.

### 3. Results and Discussion

#### 3.1. Result

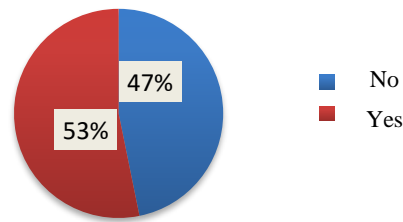
The subjects of this study were 141 active female students of the Public Health Study Program, University of Jember, batch 2016-2020. Primary data was obtained through filling out an online questionnaire using a Google form sent to each selected respondent. An overview of respondents' stress levels, nutritional status, and physical activity is described in detail in Table 1.

**Table 1.** Frequency distribution of stress levels, nutritional status, and physical activity in female students of the Public Health Study Program, University of Jember

Variable	Total (n)	Percentage (%)
<b>Stress Level</b>		
No Stress	33	23.4
Mild	21	14.9
Moderate	11	7.8
Severe	61	43.3
Very severe	15	10.6
<b>Nutritional Status</b>		
Normal	88	62.4
Thin	31	22.0
Overweight and Obesity	22	15.6
<b>Physical Activity</b>		
Light	30	21.3
Moderate	42	29.8
Heavy	69	48.9

Table 1 explains that most respondents experienced stress (76.6%) with mild stress category of 14.9% and 7.8% experienced moderate stress. The most category is severe stress (43.3%). Some even experience severe stress (10.6%). Based on nutritional status, most respondents had normal nutritional conditions (62.4%), but 22% of respondents were underweight, and some were overnourished and obese (15.6%). Most respondents had strenuous physical activity (48.9%), and only a few had light physical

activity (21.3%). More respondents experienced menstrual cycle disruptions than those who did not (53% and 47%, respectively), for an overview of menstrual cycle disorders described in Figure 1.



**Figure 1.** Frequency distribution of the number of students of the Public Health Study Program, University of Jember

**Table 2.** Frequency distribution of menstruation cycle disorders of female students of the Public Health Study Program, University of Jember by batch

Batch	Menstrual cycle disorders		Total n(%)
	Yes n(%)	No n(%)	
2016	15(10.6)	15(10.6)	30(21.3)
2017	21(14.9)	9(6.4)	30(21.3)
2018	10(7.1)	13(9.2)	23(16.3)
2019	16(11.3)	12(8.5)	28(19.8)
2020	13(9.2)	17(12.1)	30(21.3)
<b>Total</b>	<b>75(53.2)</b>	<b>66(46.8)</b>	<b>141(100)</b>

Table 2 shows that the respondents who experienced the most menstrual cycle disorders were female students of the class of 2017, which was 14.9%, followed by the class of 2019, as much as 11.3%. The fewest who experience menstrual cycle disorders are female students of the class of 2018 (7.1%). Several factors, including stress levels, nutritional status, and physical activity, cause menstrual cycle disorders. The analysis of the relationship between stress levels, nutritional status, and physical activity with menstrual cycle disorders bivariable using the chi-square test can be seen in Table 3.

**Table 3.** Proportion, p-value, and Odds Ratio menstruation cycle disorders based on stress level, nutritional status, and physical activity in female students of the Public Health Study Program, University of Jember

Variable	Menstrual cycle disorders				p-value	OR (95% CI)
	Yes		No			
	n	%	n	%		
<b>Stress Level</b>						
No stres	8	5.7	25	17.7	<0,0001*	1
Mild	4	2.8	17	12.1		0.74 (0.20–2.83)
Moderate	3	2,1	8	5.7		1.20 (0.25–5.51)
Severe	50	35.5	11	7.8		14.21 (5.10–38.77)
Very severe	10	7.1	5	3.6		6.30 (1.64 – 23.80)
<b>Nutritional Status</b>						
Normal	48	34.0	40	28.4	0.911	1
Thin	16	11.4	15	10.6		0.89 (0.39–2.02)
Overweight and Obesity	11	7.8	11	7.8		0.83 (0.33–2.12)
<b>Physical Activity</b>						

Light	7	5.0	23	16.3		1
Moderate	6	4.3	36	26.0	<0.0001*	0.60 (0.16–1.84)
Heavy	62	44.0	7	5.0		29.10 (9.20–92.10)

\*Signifikan at  $\alpha=0.05$ ; CI= Confidence Interval

Based on the analysis bivariabel using the chi-square test with  $\alpha=0.05$  as explained in Tabel 3, it can be seen that there is a significant difference in the proportion of menstrual cycle disorders events based on stress levels in female students of the Public Health Study Program, Jember University. This is indicated by the p-value of the variable of  $<0.0001$  ( $\alpha<0.05$ ). The heavier the stress level, the greater the risk of menstrual cycle disorders. The risk of menstrual cycle disruption was greater in female students who experienced severe and very severe stress with odds ratios of 14.2; 95% CI (5.10–38.77) and 6.3; 95% CI (1.64–23.80), respectively. The same is true of physical activity variables. The analysis showed a significant difference in the proportion of menstrual cycle disorders based on physical activity (p-value =  $<0.0001$ ). The risk of menstrual cycle disruption was 29.1 greater in female students with heavy activity than those with light activity (OR 29.10; 95%CI 9.20-92.10). The nutritional status variable did not show a significant difference because p-value = 0.911 ( $\alpha \geq 0.05$ ), so in this study, nutritional status was not a risk factor for menstrual cycle disorders. Based on the results of this bivariable analysis, multivariable analysis was then continued using logistic regression tests to determine the occurrence of menstrual cycle disorders in students of the Public Health Study Program, Jember University. In detail, the results of the analysis can be seen in Table 4.

**Table 4.** Results of multivariable analysis of determinants of menstrual cycle disorders in female students of the Public Health Study Program, University of Jember

Variable	B	Wald	Sig.	OR	95% CI	
					Lower	Upper
<b>Stress Level</b>						
No stress				1		
Mild	-0.288	0.095	0.758	0.8	0.12	4.70
Moderate	-0.269	0.063	0.801	0.8	0.09	6.24
Severe	2.729	12.133	<0.0001*	15.3	3.30	71.17
Very severe	2.123	4.799	0.028*	8.4	1.30	55.80
<b>Nutritional Status</b>						
Normal				1		
Thin	0.366	0.289	0.591	1.4	0.38	5.48
Overweight and Obesity	-0.055	0.004	0.950	1.0	0.17	5.30
<b>Physical Activity</b>						
Light				1		
Moderate	-0.801	1.231	0.267	0.5	0.11	1.85
Heavy	3.303	21.661	<0.0001*	27.2	6.77	109.29
Constant	-2.128					

\*Sig. at p-value  $< \alpha(0.05)$

The results of multivariable analysis using logistic regression, as presented in Table 4, provide information that variable stress levels and physical activity influence menstrual cycle disorders in students of the Public Health Study Program, Jember University. The odd ratio (OR) in the results of the multivariable analysis shows the magnitude of the risk of menstrual cycle disorders in female students of the Public Health Study Program at Jember University. Students who have severe to very severe stress levels accompanied by heavy physical activity have an OR value of  $>1$ , so female students

who have severe to very severe stress levels accompanied by heavy physical activity can increase the risk of menstrual cycle disorders in female students of the Jember University Public Health Study Program. The probability of menstrual cycle disruption in students who experience severe stress accompanied by heavy physical activity can be up to 98%.

## **0.2. Discussion**

### **3.2.1. The Relationship of Stress Levels with Menstrual Cycle Disorders**

This study showed that female students with severe stress levels experienced more menstrual cycle disorders than female students who were not stressed. Students with severe stress levels are 14.21 times more likely to experience menstrual cycle disorders than female students who do not experience stress. The results of this study support the research of Kurniasari et al. (2018), which states that there is a significant relationship between stress levels and menstrual cycles in MAN 1 Samarinda students. This is also in line with Wisniastuti et al. (2018), which found a strong and meaningful relationship between stress levels and menstrual cycles in VIII semester female students at STIKes Wira Medika Bali. This is evidenced by a p-value of  $<0.0001$  and a correlation coefficient of 0.537. The heavier the stress level, the more likely female students are to experience menstrual cycle disorders.

The severe stress that occurs in female students is most likely due to a lot of coursework that must be completed soon, accompanied by the lack of ability of female students to manage time, so it can be a stressor. When female students experience stress, it will stimulate the HPA (hypothalamus-pituitary-adrenal cortex) axis to produce the hormone cortisol. This cortisol hormone causes hormonal imbalances in the body, including LH and FSH hormones (both are reproductive hormones responsible for the growth and maturation of follicles in the ovaries), causing menstrual cycle disorders (Yudha et al., 2017).

### **3.2.2. Relationship of Nutritional Status with Menstrual Cycle Disorders**

The results of this study provide information that female students with a normal nutritional status experience more menstrual cycle disorders as well as more who experience normal menstrual cycles, so the results of the chi-square test do not show a significant difference in the proportion of menstrual cycle disorders based on nutritional status. The value of p-value = 0.911 evidences this. The results of the multivariable analysis showed that the risk of menstrual cycle disruption was 1.4 times greater in female students whose nutritional status was thin than normal. However, this result was not significant in the population, so nutritional status could not be determined as a risk factor. The results of this study are not in line with Andriana., & Aldriana's (2018), which states that less or more nutritional status can affect the growth and development of the reproductive system.

It is theoretically explained that less nutritional status are at greater risk for resulting in menstrual cycle disorders. Menstrual cycle disorders occur due to the inhibition of GnRH (gonadotropin-releasing hormone) secretion, which is influenced by low body weight or sudden weight loss, then results in reduced levels of LH and FSH hormones (both hormones responsible for the growth and maturation of follicles in the ovaries), so that eggs will not be released if there is a lack of hormones, and menstrual cycle disruption occurs. In addition, disruption of the menstrual cycle can also be caused by obesity. It is caused by adipose tissue, which actively affects the ratio of estrogen and androgen hormones. Excess production of the hormone estrogen in obese women can inhibit the release of eggs which then disrupts the menstrual cycle (Sari, 2015).

### **3.2.3. The Relationship of Physical Activity with Menstrual Cycle Disorders**

This study showed that female students with heavy physical activity had more menstrual cycle disorders than those with light physical activity. Students with heavy physical activity have a 29.10

times greater risk of menstrual cycle disorders. This study is in accordance with Rachmawati & Murbawani (2015) research, which states that physical activity is associated with menstrual cycle disorders as evidenced by the value of  $p = 0.022$ . This is also in line with Usman's research (2015) stating that there is a significant relationship between physical activity and menstrual cycle disorders in adolescent girls at the Pelita Ibu Kendari Midwifery Academy in 2018. This is in line with Purwati & Muslikhah (2020) research which states that most female students with heavy physical activity levels accompanied by irregular menstrual cycles are 22 respondents (34.37%).

Female students who experience menstrual cycle disorders tend to have heavy physical activity (Purwati & Muslikhah, 2020). The heavy physical activity carried out by 8<sup>th</sup>-semester students can be caused by a busy lecture schedule and a large number of books carried out every day. In addition, female students must also do activities outside the campus to work on thesis preparation, sports, and other organizational activities to make student activities more dense. This is in line with research by Anindita et al. (2016), stating that women with heavy physical activity are at risk of disrupting their menstrual cycle. This is because the severity of physical activity carried out can result in increased levels of androgen hormones and excessive loss of body fat, causing an imbalance between estrogen and androgen hormones which can result in disruption of the growth and development of eggs in the ovaries resulting in disruption of the menstrual cycle.

Stress level and physical activity are determinants of menstrual cycle disorders in female Faculty of Public Health, Jember University students. Female students with heavy stress levels accompanied by heavy physical activity can increase the risk of menstrual cycle disorders. The results of this research are supported by research by Purwati & Muslikhah (2020), which states that physical activity tends to disrupt the m cycle of instruments with OR results of 6.05. Thus, female students with heavy physical activity have a 6.05 times greater risk for menstrual cycle disorders. This research has limitations in terms of data collection that must be done online using google forms due to the Covid-19 pandemic. In addition, nutritional status data is only based on filling in the Google form by the respondent, who should have measured height and weight directly to the respondent.

#### **4. Conclusion**

The most common stress level among female students is severe stress (43.3%). The nutritional status of female students who were the most respondents was normal nutritional status (62.4%) as well as physical activity owned by female students, whom most respondents had heavy physical activity (48.9%). It is known that female students of the Faculty of Public Health experience menstrual cycle disorders by 53%. The nutrition of female students of the Public Health Study Program, University of Jember, is not significantly related to menstrual cycle disorders. This study shows that female students have the most normal nutritional status but still experience menstrual cycle disorders.

Students with severe stress levels were 14.21 times more at risk of menstrual cycle disorders than female students who were not stressed or normal. Students with heavy physical activity are 29.10 times more likely to experience menstrual cycle disorders than female students with light physical activity. Multivariable analysis showed that female students with severe to very heavy stress levels and heavy and very large physical activity had a greater tendency to experience menstrual cycle disorders.

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