THE RELATIONSHIP BETWEEN NUTRITIONAL STATUS AND MENSTRUAL CYCLE AMONG MEDICAL STUDENTS AT AHMAD DAHLAN UNIVERSITY

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ABSTRACT

Menstruation is the monthly shedding of the functional layer of the endometrium in the uterus that occurs when ovulation is not followed by fertilization. Menstrual irregularities occur due to hormonal disturbances caused by stress, excessive exercise, medication use, approaching menopause, eating disorders, and nutritional status such as underweight and obesity. Nutrition refers to the nutrients present in food that are required by the body to obtain energy for daily activities. Nutritional problems arise from an imbalance between the nutrients consumed and those needed by the body. To examine the relationship between nutritional status and menstrual cycles in students of the Faculty of Medicine, Ahmad Dahlan University, a research study was conducted using an observational analytical method with a cross-sectional approach. The research sample consisted of 131 students. Statistical analysis using chi-square analysis showed a p-value of 0.001, which is smaller than $\alpha = 0.05$. From these results, it can be concluded that there is a relationship between body mass index and upper arm circumference with the menstrual cycles of students in the Faculty of Medicine, Ahmad Dahlan University, while there is no relationship between waist circumference, waist-to-hip ratio, subcutaneous fat, and menstrual cycles in students of the Faculty of Medicine, Ahmad Dahlan University.

Keywords : Nutritional Status., Body Mass Index (BMI)., Upper Arm Circumference., Menstrual cycle

INTRODUCTION

Menstruation is the monthly shedding of the functional layer of the endometrium in the uterus that occurs when ovulation is not followed by fertilization. Normal menstruation is an indicator of fertility and reproductive ability. Theoretically, menstruation is the natural process of blood discharge by women through the vaginal canal. Menstruation in women typically occurs around the age of 13 to 14 years[1–3]. [1,2]

The Basic Health Research (RISKESDAS) 2018 results show that 70.1% of females in Indonesia aged 10 to 19 years have experienced menstruation, while 29.9% have not. In Yogyakarta Province, 72.8% of females aged 10 to 19 years have experienced menstruation, while the remaining 27.2% have not [4].

The menstrual cycle is the time interval between the first day of one menstruation to the first day of the next menstruation. The length of the menstrual cycle typically ranges from 27 to 30 days, with an average of 28 days. A study conducted in Turkey showed that menstrual disorders occur in 24% of women, while in Korea, the occurrence rate is 19.4% among women. In Indonesia, according to research conducted at Udayana University, 40% of women experience menstrual disorders [5–8].

Menstrual irregularities occur due to hormonal disturbances caused by stress, excessive exercise, medication use, approaching menopause, eating disorders, and nutritional status such as underweight and obesity. A woman experiencing malnutrition will experience a delay in sexual maturation, and the secretion of the LH hormone will be disrupted, leading to a shortening of the luteal phase. On the other hand, a woman with high levels of body fat will affect estrogen hormone levels in the body. This is because estrogen hormone is produced not only by the ovaries but also by adipose tissue [6,9,10].

Nutrition refers to the substances in food that the body needs to obtain energy for daily activities. Nutrition can be measured through anthropometry, such as measuring body weight, height, body mass index (BMI), head circumference, chest circumference, upper arm circumference, waist and hip circumference, and

subcutaneous fat thickness. The subcutaneous fat thickness can be measured in various body parts, including the upper arm, forearm, scapula, mid-axillary line, sides of the chest, abdomen, thigh, infrapatellar fat pad, and mid-calf. Nutritional problems arise due to an imbalance between the intake of nutrients and the body's requirements [11–14].

According to the 2018 Basic Health Research (Riskesdas) data, the prevalence of nutritional status based on body mass index (BMI) among women above 18 years of age in Indonesia is underweight 9.3%, normal weight 55.3%, overweight 13.6%, and obesity 21.8%. In Yogyakarta Province, the prevalence of underweight is 9.4%, normal weight is 51.1%, overweight is 13.9%, and obesity is 25.5% [15].

Teenagers in Indonesia do not have a good lifestyle and nutritional intake. They rarely engage in activities such as walking, exercising, and other physical activities. The food consumed by teenagers is influenced by various factors such as the environment, peer influence, social factors, place of residence, and outdoor activities. This is in line with research conducted by Nunung in 2017 and Bauw in 2019, which found a relationship between nutritional status and the menstrual cycle [10,16–18].

The aim of this study is to determine the relationship between nutritional status and the menstrual cycle among female medical students at Ahmad Dahlan University.

METHOD

This study used a Cross-Sectional design. It involved primary data collected directly by the researchers from the respondents. The study included a total of 131 students as respondents. Inclusion criteria in this study was all women students in Ahmad Dahlan University. Exclusion criteria was students who were currently taking hormonal or endocrine medications.

Nutritional status was measured using anthropometric methods, including measurements of body mass index, upper arm circumference, waist circumference, waist-to-hip ratio, and subcutaneous fat (triceps, biceps, subscapular, and suprailiac). Meanwhile, menstrual cycle data was obtained through questionnaire responses.
The collected data will be analyzed using the Chi-Square method with the Statistical Package for the Social Sciences (SPSS). This study has been approved by the ethical committee of Ahmad Dahlan University, number 012212197.

RESULTS

Table 1. Characteristics of respondent

No	Parameters	Total	Percent
1	Age (year)		
	17	3	2.3
	18	20	15.3
	19	24	18.3
	20	28	21.4
	21	39	29.8
	22	17	13
2	Menarche (year)		
	<12	31	23.7
	12 – 13	81	61.8
	>13	19	14.5
3	Body Mass Index		
	Underweight	24	18.3
	Normal	74	56.5
	Overweight	33	25.2
4	Upper arm circumference		
	Underweight	60	45.8
	Normal	53	40.5
	Overweight	18	13.7
5	Waist circumference		
	Normal	97	74
	Rising	34	26
6	Waist-to-hip ratio		
	Safe	77	58.8
	Risk	54	41.2
7	Subcutaneous fat		
	Normal	43	67.2
	Overweight	88	100
8	Menstrual Cycle		
	Normal	81	61.8
	Abnormal	50	38.2

Table 2. The relationship between nutritional status and menstrual cycle

No	Parameters	Menstrual Cycle		Total	P
		Normal n (%)	Abnormal n (%)		
1	Body Mass Index				0.004
	Underweight	11 (45.84)	13 (54.16)	24	
	Normal	55 (74.32)	19 (25.68)	74	
	Overweight	15 (45.46)	18 (54.54)	33	
2	Upper arm circumference				0.048
	Underweight	34 (56.67)	26 (43.33)	60	
	Normal	39 (73.58)	14 (26.42()	53	
	Overweight	8 (44,44)	10 (55.56)	18	
3	Waist circumference				0.675
	Normal	61 (62.88)	36 (37.12)	97	
	Rising	20 (58.82)	14 (41.18)	34	
4	Waist-to-hip ratio				0.340
	Safe	45 (58.44)	32 (41.56)	77	
	Risk	36 (66.67)	18 (33.33)	54	
5	Subcutaneous fat				0.563
	Normal	25 (58.14)	18 (41.84)	43	
	Overweight	56 (63.64)	32 (36.36)	88	

The research results show that the average age of the respondents is 21 years old, with a menarche age of 12-13 years. Based on body mass index (BMI), the largest number of respondents falls into the normal category, with 74 respondents. Out of these 74 respondents, 55 have a normal menstrual cycle, while 19 have an abnormal menstrual cycle. Among the respondents classified as underweight, there are 24 individuals, with 11 having a normal menstrual cycle and 13 experiencing an abnormal menstrual cycle. On the other hand, there are 33 respondents classified as overweight, with 15 having a normal menstrual cycle and 18 experiencing an abnormal menstrual cycle. Regarding the upper arm circumference, the majority falls into the underweight category, totaling 60 respondents. Among these, 34 have a normal menstrual cycle, while 26 have an abnormal menstrual cycle. Additionally, there are 53 respondents classified as having a normal upper arm circumference, with 39 having a normal menstrual cycle and

14 experiencing an abnormal menstrual cycle. The last category is obese, which is found in 18 respondents, where 8 have a normal menstrual cycle and 18 have an abnormal menstrual cycle. Based on waist circumference, the majority is in the normal category, with 97 respondents. Out of these, 61 have a normal menstrual cycle, while 36 have an abnormal menstrual cycle. Regarding waist-to-hip ratio, the majority falls into the safe category, totaling 77 respondents, with 45 having a normal menstrual cycle and 32 experiencing an abnormal menstrual cycle. Lastly, based on subcutaneous fat, the dominant category is obese, with a total of 88 respondents. Among them, 56 have a normal menstrual cycle, while 32 have an abnormal menstrual cycle. After conducting the analysis, it was found that there is a relationship between nutritional status in terms of body mass index category and upper arm circumference with the menstrual cycle. However, there is no relationship between nutritional status in terms of waist circumference, waist-to-hip ratio, and subcutaneous fat with the menstrual cycle.

DISCUSSION

Nutritional status has a strong relationship with the menstrual cycle because regular ovulation requires a minimum fat level of 22% and a Body Mass Index (BMI) above 19 kg/m2. Fat cells play a role in the production of estrogen, which is important for ovulation and the menstrual cycle. The findings of this study are consistent with several other studies that indicate a relationship between body mass index and the menstrual cycle [8,16,19–21]

Malnutrition in women can disrupt reproductive function. This is due to changes in steroid hormones in the

urine and can cause delays in sexual maturation, disturbances in LH hormone secretion, and an increase in serum sex hormone binding globulin (SHBG) levels due to shortening of the luteal phase. Low body weight can decrease gonadotropin hormones that release FSH and LH, thereby reducing estrogen levels and stimulating anovulatory conditions. A woman who is overweight will have an increase in estrogen levels. Besides the ovaries, adipose tissue is also a source of estrogen production. Additionally, women with a BMI above 25 have a risk of developing polycystic ovary syndrome (PCOS). Women

with normal nutritional status can also experience menstrual cycle disturbances due to disruptions in the hypothalamic-pituitary-ovarian axis, health behaviors, smoking, diet and physical activity patterns, as well as physical, mental, social, and psychological factors such as stress and reproduction [22–28]

Chronic energy deficiency malnutrition is still prevalent among adolescents due to misconceptions about nutrition and health, body image concerns, or lack of access to healthy food. This is in line with several other studies that have stated the association between upper arm circumference and the menstrual cycle. Analysis of the upper arm circumference can detect women classified as having chronic energy deficiency (CED), while BMI detects individuals who are already classified as having CED. The relationship between BMI and upper arm circumference is positive, meaning that individuals with a larger upper arm circumference tend to have a higher BMI as well. This is related to the composition of the upper arm circumference, which consists of bone, muscle, and fat. A larger upper arm circumference indicates a higher fat composition, which affects body composition and leads to weight gain. This causes the BMI value to increase as the calculation divides body weight by height [29–31]

From the data obtained, it is found that the majority of respondents have a underweight upper arm circumference with a normal BMI category. This may be due to the distribution of fat in other areas of the body, such as the abdominal region, as evidenced by the majority of overweight measurements in subcutaneous fat.

The dominant distribution of fat is in the abdomen, waist, and hips, primarily due to the abundance of adipose tissue in the abdominal region. Excess body weight, especially in the abdominal area, indicates the accumulation of visceral fat, which is associated with increased levels of free fatty acids, cholesterol, and triglycerides in the body. Subcutaneous fat thickness is a measurement used to observe subcutaneous fat deposits and provide an estimation of total body fat in children and adolescents. The use of subcutaneous fat thickness as a predictor yields a 98% accuracy in measuring body fat composition [29,32–34]
These research findings are consistent with several other studies that have shown no association between waist circumference and the menstrual cycle. Regarding subcutaneous fat, this aligns with Prathita's study in 2017, which found no relationship between nutritional status based on total body fat and the menstrual cycle [35–37].

CONCLUSION

The data analysis results showed that there is a correlation between nutritional status (Body Mass Index and Upper Arm Circumference) and the menstrual cycle among medical students at Ahmad Dahlan University. However, there is no correlation between nutritional status (Waist Circumference, Waist-to-Hip Ratio, and Subcutaneous Fat Thickness) and the menstrual cycle among medical students at Ahmad Dahlan University.

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