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IRON DEFICIENCY ANEMIA AND BODY MASS INDEX IN ADOLESCENT MENSTRUAL CYCLE

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Abstract

The prevalence of anemia in the world is 46% according to WHO and 68% of women based on Basic Health Research experience irregular menstruation. Menstrual cycle disorders increase the risk of cancer and cardiovascular disease. Anemia and nutritional status are factors that can influence menstruation. The research aims to determine the effect of anemia and Body Mass Index (BMI) on the menstrual cycle of adolescent girls. This type of research is observational analytic with a cohort research design. This research uses primary data. Initial data collection includes measuring body weight and height, taking blood samples and questionnaires. Determining anemia is done by examining a blood sample with Hb Sahli. Determining the menstrual cycle by filling out a questionnaire about menstruation for 3 months. Data analysis uses a computer program with a confidence level of 95%. Bivariate analysis uses chi square with α 0.05. Multiple logistic regression was used to perform multivariate analysis. The research results showed that 15% of young women experienced anemia, 48.3% had abnormal body mass index and 46.7% had abnormal menstrual cycles. There is no influence of anemia and body mass index on adolescent girls' menstruation. Based on the research results, young women need to check their Hb levels regularly to prevent anemia early and consume nutritious food which is really needed during menstruation.

Keywords: Anemia; Body mass index; Menstrual Cycle

Abstract

The prevalence of anemia in the world is 46% according to WHO and 68% of women based on Riset Kesehatan Dasar experience irregular menstruation. Menstrual cycle disorders have an increased risk of cancer and cardiovascular disease. Anemia and nutritional status is one of the factors that can affect menstruation. The study was to determine the effect of anemia and Body Mass Index (BMI) on the menstrual cycle of young women. This type of research is observational analytic with a cohort study design. This study uses primary data. Initial data collection included measurements of body weight and height, blood sampling and questionnaires. The determination of anemia was carried out by examining blood samples with Hb Sahli. Determination of the menstrual cycle by filling out a questionnaire about menstruation for 3 months. Data analysis using a computer program with a 95% confidence level. Bivariate analysis using chi square with α 0.05. Multiple logistic regression is used to conduct multivariate analysis. The results showed 15% of female adolescents had anemia, 48.3% of body mass index was abnormal and 46.7% of menstrual cycle was abnormal. There is no influence of anemia and body mass index on menstruation for young women. Based on the results of the study, young women

need to check Hb levels regularly to prevent anemia early and consume nutritious foods that are needed during menstruation.

Keywords: Anemia; Body Mass Index; Menstrual

INTRODUCTION

Women throughout their lives will experience menstrual cycles that occur periodically from menarche to menopause. The normal menstrual cycle lasts between 21 – 35 days with an average cycle of 28 days. The duration of menstruation is usually 3 – 5 days. The length of menstruation for each woman is usually constant (Wiknjosastro, 2012). Based on data from Basic Health Research (Rikesdas) in 2010, it was found that as many as 68% of women aged 10-
59 years old experienced irregular menstruation (BASIC HEALTH RESEARCH, 2010). The results of research conducted by Santi on patients who came for treatment at the UIN Sunan Ampel Clinic from 2015-2017 showed that as many as 192 female patients experienced menstrual disorders. Menstrual disorders include disturbances in the menstrual cycle/pattern, length of menstruation, and other disorders (Santi & Pribadi, 2018).

The normal menstrual cycle lasts between 21 – 35 days with an average cycle of 28 days. The duration of menstruation is usually 3 – 5 days. The length of menstruation for each woman is usually constant (Wiknjosastro, 2012). A normal menstrual cycle shows that the woman's reproductive organs and hormonal system are normal and not experiencing problems. However, in reality, quite a few women experience disturbances in their menstrual cycles.

Based on data from Basic Health Research (Rikesdas), it was found that as many as 68% of women aged 10-59 years experienced irregular menstruation (BASIC HEALTH RESEARCH, 2013). The results of research conducted by Santi (2017) on patients who came for treatment at the UIN Sunan Ampel Clinic from 2015-2017 showed that as many as 192 female patients experienced menstrual disorders (Santi & Pribadi, 2018). These menstrual disorders include disorders of the menstrual cycle/pattern, length of menstruation, and other disorders. Menstrual cycle disorders can include polymenorrhoea, oligomenorrhea, amenorrhea, hypominorrhoea and hyperminorrhoea. In polymenorrhea there is a short menstrual cycle, less than 21 days, while in oligomenorrhea there is a long menstrual cycle of more than 35 days. Amenorrhea menstrual disorders, the menstrual cycle lengthens until menstruation does not occur for at least 3 consecutive months. In hypomenorrhoea, there is less menstrual bleeding than usual, while in hypermenorrhea there is bleeding that is heavier and lasts longer than normal (Wiknjosastro, 2012).

Research conducted by Santi during 2015-2017 at the Pratama UIN Sunan Ampel Surabaya clinic showed that there were 192 people who experienced menstrual disorders. The most common menstrual disorders are hypermenorrhoea/menorrhagia and dysmenorrhoea. (Santi & Pribadi, 2018).

These menstrual cycle disorders can be an indicator to describe physiological changes in ovarian and hormonal function, and have been associated with

increased risk of diseases such as breast cancer, ovarian cancer, cardiovascular disease, diabetes and fractures. Menstrual disorders can have an impact on reducing a person's quality of life and cause financial burdens. Menstrual disorders can be influenced by body weight, frequency of exercise, physical activity, diet, environmental exposure, working conditions, synchronization of the menstrual process, and endocrine disorders (Mahitala, 2015).

According to Kusmiran E. (2011), menstrual disorders can be influenced by body weight, frequency of exercise, physical activity, diet, environmental exposure, working conditions, synchronization of the menstrual process, and endocrine disorders (Mahitala, 2015). Research conducted by Puspita D shows that women's nutritional status can cause hormonal changes that are associated with impaired hypothalamic function. These hormonal changes affect the menstrual cycle in women (Puspita, 2014). According to Basri Aramiko, who researched the relationship between the menstrual cycle and the nutritional status of female students, it was found that students with normal menstruation had normal nutritional status. The hormonal system is related to nutritional status. It is not uncommon for women to have normal nutritional status but have abnormal menstrual cycles. This can be caused by polycystic ovary syndrome, uterine abnormalities, contraception, chronic diseases and psychological factors (Aramico, Siketang, & Nur, 2016). Based on research by Rakhmawati (2013), the incidence of menstrual cycle disorders in women who are obese is 1.89 times greater than in women with normal nutritional status, while women who experience stress are 2 times greater than subjects who do not experience stress. The disorder that most often occurs in obesity is oligomenorrhea, while the disorder that often occurs due to stress is polymenorrhea. (Rakhmawati & Dieny, 2013).

Anemia due to iron deficiency is the most common nutritional problem experienced by women, especially adolescent girls. According to WHO (2011), adolescent girls are a high risk group for experiencing anemia compared to adolescent boys, where the need for iron peaks at the age of 14-15 years, while for adolescent boys one or two years later (Silalahi, Aritonang, & Ashar, 2016). According to Briawan in Yunarsih (2014), the prevalence of anemia in the world is estimated at 46%, while according to the Ministry of Health report, the prevalence of anemia in adolescent girls in Indonesia is 30% and in adolescent boys 21%. According to Permaesih, the prevalence of anemia in adolescents is 25.5%, found in 21% of adolescent boys and 30% of girls. As many as 27.1% of teenagers suffering from anemia live in rural areas and 2.6% in urban areas.

Kristianti's research (2014) shows that anemia can affect women's menstrual cycles. Having sufficient hemoglobin levels or not having anemia will help regularize the menstrual cycle. On the other hand, if there is a lack of iron in the body it can cause low hemoglobin levels, which can cause many complications in women. This occurs because low levels of hemoglobin in the body result in a lack of oxygen supply to the hypothalamus. However, overall, the influence of anemia and body mass index on the menstrual cycle has not been fully studied. (Kristianti & Wibowo, 2014).

Allah SWT said through a letter in Surat Thaha verse 81 about food from good sustenance and the prohibition not to exceed the limit. In that verse Allah SWT

instructs us to choose food that is good, not excessive and balanced so that diseases do not arise, including diseases related to reproductive health. Research conducted by Puspita D shows that women's nutritional status can cause hormonal changes that are associated with impaired hypothalamic function. These hormonal changes affect the menstrual cycle in women. According to Anggarini and Chayaningrum in 2012 in Puspita, a woman who experiences deficient or excess nutrition will have an impact on decreasing the function of the hypothalamus which does not stimulate the anterior pituitary to produce follicle stimulating hormone (FSH) which functions to stimulate the growth of follicles in egg cells, while luteinizing hormone (LH) functions to mature the egg cells that will be fertilized. If FSH and LH production is disrupted, the menstrual cycle will be disrupted (Puspita, 2014). According to research conducted by Kaimudin, there is a relationship between nutritional status and the incidence of anemia in adolescent girls. This is due to consumption of food that does not meet the principles of balanced nutrition, so that the required nutritional intake is not met (Nur Ia Kaimudin et al., 2017).

One way to assess a person's nutritional status is to measure their body mass index (BMI). Measurement and assessment of nutritional status using BMI is carried out using the mathematical formula of body weight (in kilograms) divided by the square of body height (in meters). The results of BMI measurements can be used to determine whether there is a deficiency or excess in a person's nutritional status. This BMI formula can only be applied to someone aged 19 – 70 years, not pregnant or breastfeeding women. The measurement can be used especially if skinfold thickness measurements cannot be made or standard values are not available.

Based on this background, researchers are interested in conducting research on the influence of iron deficiency anemia and body mass index on the menstrual cycle in adolescent girls. The aim of this study was to determine the effect of iron deficiency anemia and body mass index on the menstrual cycle of adolescent girls

RESEARCH METHODOLOGY

This type of research is observational analytic with a cohort research design. This research was conducted in the integrated laboratory at UIN Sunan Ampel Surabaya. This research was carried out in July - October 2018. This research used primary data. Initial data collection includes measuring body weight and height, taking blood samples and questionnaires. Primary data for determining Body Mass Index (BMI) is carried out by converting body weight measurements and height measurement results. Determining anemia is done by examining a blood sample with Hb Sahli. If the Hb level obtained is <12 mmHg then it is categorized as anemia, but if the Hb level is ≥ 12 mmHg then it is categorized as not anemic or normal. Determining the menstrual cycle by filling out a questionnaire about menstruation for the next 3 months.

The research instrument used easy touch, scales, height measuring and questionnaire sheets. Wide questionnaire to determine the menstrual cycle in adolescent girls. The population in this study were students from the biology study program, Faculty of Science and Technology. The sampling technique used in this research was purposive sampling, namely teenagers

daughter who is already menstruating. The number of samples used in this research was 60 samples. The variables in this research consist of independent variables and dependent variables. The independent variables in this study are iron deficiency anemia and body mass index, while the dependent variable in this study is the menstrual cycle.

Data analysis uses a computer program with a confidence level of 95%. Bivariate analysis uses chi square with α 0.05. Multiple logistic regression was used to perform multivariate analysis. Before statistical tests are carried out, prerequisite tests are carried out, namely normality, homogeneity, linearity and multicollinearity tests.

The data obtained will be analyzed using the chi square test to see whether there is a relationship between anemia status and the menstrual cycle and a relationship between BMI and the menstrual cycle of young women. Next, it will be tested again using multiple logistic regression to see whether there is an influence of two independent variables simultaneously on the dependent variable. In this case, a multiple logistic regression test was carried out on anemia status and BMI on the menstrual cycle of adolescent girls.

RESULTS AND DISCUSSION

The results of this study aim to determine the influence of anemia status on the menstrual cycle of adolescent girls and the influence of Body Mass Index (BMI) on the menstrual cycle of adolescent girls. The results are as follows:

a. Status Anemia

Table 1 Results of Hemoglobin Levels

up to Hb	N	%
<12 mmHg	9	15,0
≥12 mmHg	51	85,0
Total	60	100

Source: Primary Data, 2018.

Based on table 1, it shows that there are 9 (15.0%) samples that have Hb levels <12 mmHg so that anemia status means they have anemia and there are 51 (85.0%) samples that have Hb levels ≥12 mmHg so anemia status means they don't have anemia. .

b. Body Mass Index (BMI)

Table 2 Body Mass Index (BMI) Variables

IMT	N	%
Normal	31	51,7
Abnormal	29	48,3
Total	60	100

Source: Primary Data, 2018.

Based on table 2, it shows that there are 31 samples who have a normal BMI (51.7%) and there are 29 samples (48.3%) who have an abnormal BMI.

C. Menstrual Cycle

Table 3 Menstrual Cycle Variables

Menstrual Cycle	N	%
Normal	32	53,3
Abnormal	28	46,7
Total	60	100

Source: Primary Data, 2018.

Based on table 3, it shows that there are 32 samples who have a normal menstrual cycle (53.3%) and there are 28 samples (46.7%) who have an abnormal menstrual cycle.

d. The research results based on the variables anemia status and menstrual cycle can be seen from the following table:

Table 4 Bivariate Analysis based on Anemia Status and Menstrual Cycle

Status Anemia	Menstrual Cycle				Amount		P value
	Abnormal		Normal				
	N	%	N	%	N	%	
Of	5	55,6	4	44,4	9	15,0	0,721
No	23	45,1	28	54,9	51	85,0	
Amount	28	46,7	32	53,3	60	100,0	

Source: Primary Data, 2018.

Table 4 shows that of the 9 samples who experienced anemia, there were 5 people (55.6%) who had abnormal menstrual cycles and 4 people (44.4%) had normal menstrual cycles. Meanwhile, samples that did not experience anemia. Meanwhile, of the 51 samples who did not experience anemia, there were 23 people (45.1%) who had abnormal menstrual cycles, and 28 people (54.9%) who had normal menstrual cycles. The results of statistical analysis obtained a value of $p = 0.721$ ($\alpha > 0.05$), this means that Ho is accepted so there is no relationship between anemia status and menstrual cycle.

e. The research results based on the research variables Body Mass Index and menstrual cycle can be seen from the following table:

Table 5 Bivariate analysis based on Body Mass Index and Menstrual Cycle

IMT	Menstrual Cycle				Amount		P value
	Abnormal		Normal				
	N	%	N	%	N	%	
Less	13	44,8	16	55,2	29	48,3	
Normal	15	48,4	16	51,6	31	51,7	0,986
Amount	28	46,7	32	53,3	60	100,0	

Source: Primary Data, 2018.

Table 5 shows that of the 29 samples including low BMI, 13 people (44.8%) had abnormal menstrual cycles and 16 people (55.2%) had normal menstrual cycles. Meanwhile, of the 31 samples who did not experience anemia, there were 15 people (48.4%) who had abnormal menstrual cycles, and as many as 16 people (51.6%) who

have a normal menstrual cycle. The results of statistical analysis obtained a p value = 0.986 ($\alpha > 0.05$), this means that Ho is accepted so there is no relationship between BMI and the menstrual cycle.

f. Logistic Regression Analysis

Regression analysis is used to study the influence of independent variables on dependent variables. From this analysis, the best (fit) model will also be obtained which can describe the influence of the independent and dependent variables. In this research, the influence of anemia status and BMI variables on the menstrual cycle (multivariate case) or what is usually called Multiple Logistic Regression can be determined.

From the results of the logistic regression analysis, a significant value of p value = 0.563>0.05 was obtained for the anemia status variable and a significant value of p value =0.948>0.05 for the BMI variable, so it can be concluded that Ho is accepted or Ha is rejected, meaning that these two variables do not exist. influence on the menstrual cycle of adolescent girls.

The results of the study showed that hemoglobin levels were based on examination of hemoglobin levels with Easy Touch, namely 9 samples (15.0%) had Hb levels $\leq$ 11.5 gr% and there were 51 samples (85.0%) who had Hb levels > 11. 5 gr%. This shows that the incidence of anemia in adolescents is still quite high.

Anemia in adolescent girls is a condition where the hemoglobin level in the blood is less than normal with a normal Hb value according to WHO of 12 gr/dl. Adolescent nutritional problems are a continuation of nutritional problems in childhood, even though calorie and protein intake is met, other elements such as iron, calcium and several vitamins are still deficient. According to Aramico (2016) there is a relationship between the menstrual cycle and the nutritional status of female students. Female students with normal menstruation will have normal nutritional status. The hormonal system is related to nutritional status. It is not uncommon for women to have normal nutritional status but have abnormal menstrual cycles. This can be caused by polycystic ovary syndrome, uterine abnormalities, contraception, chronic diseases and psychological factors (Aramico et al., 2016). According to Tita (2012), the average Hb level of adolescent girls who have normal menstrual cycles is higher than the Hb level of adolescent girls with abnormal menstrual cycle patterns. Vegetable protein in the body needs vitamin B 12 to prevent anemia, weakness, gout disorders and decreased brain function. Apart from that, vitamin B 12 helps the absorption of iron content in the body which can cause anemia. Anemia often occurs in teenagers, teenagers tend to maintain their appearance by avoiding excessive weight gain. Body conditions that do not meet expectations make teenagers go on a diet. Teenagers nowadays are doing more diets by reducing carbohydrate intake. The problem is, teenagers only think about losing weight without paying attention to whether they are living a healthy lifestyle or not. For a long time, many people in society still think that a beautiful face and a slim body will have more attractiveness than those with a large body. Ultimately, this causes teenagers, especially girls, to compete in dieting. As a result, nutritional intake is not met and anemia is easy. Apart from that, young women who have entered puberty will experience menstruation every month which makes them susceptible to anemia.

Based on the research results, it shows that of the 9 samples who experienced anemia, there were 5 people (55.6%) who had abnormal menstrual cycles and 4 people (44.4%) had normal menstrual cycles. Meanwhile, samples that did not experience anemia. Meanwhile, of the 51 samples who did not experience anemia, there were 23 people (45.1%) who had abnormal menstrual cycles, and 28 people (54.9%) who had normal menstrual cycles. The results of statistical analysis obtained a p value = 0.721 ($\alpha > 0.05$), this means that Ho is accepted so there is no relationship between anemia status and the menstrual cycle.

This is not in accordance with research conducted by Tita in 2012 which stated that the average Hb level of adolescent girls who had normal menstrual cycles was higher than the Hb level of adolescent girls with abnormal menstrual cycle patterns. Vegetable protein in the body needs vitamin B 12 to prevent anemia, weakness, gout disorders and decreased brain function. Apart from that, vitamin B 12 helps the absorption of iron content in the body which can cause anemia.

In Sayes's (2011) research, the prevalence of deficiency anemia at university level among female students at King Abdul Aziz University found that 23.9% of female students experienced iron deficiency anemia among students who appeared healthy. It was also found that there was a significant correlation between anemia and nutritional intake and exercise (Sayes, 2011).

According to Grooms et al (2013) Adolescents are at increased risk of anemia due to rapid growth and increased muscle mass. Female students with heavy menstrual bleeding are at greater risk of experiencing anemia. Adolescent girls have a need for iron to compensate for menstrual blood loss and increased growth (Grooms et al., 2013). Based on research by Rakhmawati (2013), the incidence of menstrual cycle disorders in women who are obese is 1.89 times greater than in women with normal nutritional status, while women who experience stress are 2 times greater than subjects who do not experience stress. The disorder that most often occurs in obesity is Oligomenorrhea, while the disorder that often occurs due to stress is polymenorrhea. (Rakhmawati & Dieny, 2013).

A person's hemoglobin levels are influenced by gender, age, physical activity, lifestyle and body composition which are related to nutritional status (Zufrianingrum, 2016). Iron adequacy in the body is an important indicator that determines hemoglobin levels in the blood. Iron is used as a raw material to produce hemoglobin, so iron nutritional anemia will cause the formation of smaller red blood cells and low hemoglobin content. The recommended iron adequacy is the minimum amount of iron from food that can provide enough iron for every healthy individual in 95% of the population, so as to avoid the possibility of iron deficiency anemia (Zarianis, 2006). Apart from that, the use of tools to measure anemia also affects the results of Hb levels. Based on the research results of Kusumawati et al. (2018) showed that there were differences in the results of measuring Hb levels using Hb sahli and easy touch. In this study, an easy touch tool was used which has higher sensitivity (Kusumawati, Lusiana, Mustika, Hidayati, & Andyarini, 2018).

Table 5 shows that of the 29 samples that included less BMI, there were 13 people (44.8%) who had abnormal menstrual cycles and as many as normal menstrual cycles.

16 people (55.2%). Meanwhile, of the 31 samples who did not experience anemia, there were 15 people (48.4%) who had abnormal menstrual cycles, and 16 people (51.6%) who had normal menstrual cycles. The results of statistical analysis obtained a p value = 0.986 ($\alpha > 0.05$), this means that Ho is accepted so there is no relationship between BMI and the menstrual cycle.

The results of research conducted by Yana Aurora Pradhita stated that there was no significant relationship between the menstrual cycle and BMI and body fat percentage. The results of research using the chi-square test showed that the majority of respondents had a normal body mass index (BMI) and body fat percentage, namely 72.15% with a BMI of less than 23 kg/m2 and 64.6% a fat percentage of less than 22 .1 % (Prathita, Lipoeto, n.t.).

The results of the research indeed show that there is no difference between BMI and menstruation in young women. This has the same pattern as Olaf Sianifar's research which stated that there was no significant relationship between BMI and the menstrual cycle and the factors that influence menstruation are age, class and physical activity. (Olaf Sianifar , 2009) Obesity and stress are factors that can cause menstrual disorders, in accordance with Rakhmawati's research which states that stress can cause menstrual disorders (OR = 1) and obesity affects menstrual cycle disorders (OR = 2.8) (Rakhmawati & Dieny, 2013). Actually, the 28 day menstrual cycle is not very common. only about 10-15% of women have a 28 day cycle. (Wiknjosastro, 2012).

Based on the research results, it is known that there is no influence of iron deficiency anemia and Body Mass Index on the menstrual cycle of adolescent girls, either partially or simultaneously. The overall percentage value before the independent variables are included in the model is: 28/60 = 46.7%, meaning that there is less than a 50 percent chance that young women who have anemia and abnormal BMI will experience menstrual cycle disorders. This can be caused by factors that influence the menstrual cycle, not only anemia status and body mass index.

Factors that influence the menstrual cycle include physical activity, stress, smoking, drug consumption and disease. The results of research conducted by Baiq show that there is a relationship between diet and anemia and menstrual patterns with anemia (Utami & Mardiyaningsih, 2015).

According to research conducted by Nurul, there is a relationship between physical activity and the menstrual cycle in athletes from the PON XIX contingent at KONI South Sulawesi (Yani, n.t.). Apart from physical activity, the menstrual cycle is also influenced by stress. According to research conducted by Toduho et al, the results showed that psychological stress was related to the menstrual cycle (Toduho, Kundre, & Malara, 2014).

Research conducted by Andriana et al shows that there is a relationship between menstrual age, BMI and the menstrual cycle, while physical activity does not have a significant relationship with the menstrual cycle. Adolescent girls who experience menarche at the age of <12 years are more likely to experience menstrual cycle disorders

compared to teenage girls who experience menarche at the age of 12-14 years (Andriana, Aldriana, & Andria, 2018)

CONCLUSION

Based on the results of the research that has been carried out, it can be concluded that there is no influence of anemia and body mass index on the menstrual cycle of young women. However, it is necessary to study further the influence of anemia and body mass index on the menstrual cycle with a larger sample size and it is necessary to study other factors that influence the menstrual cycle in young women.

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