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Relationship of Menstrual Patterns with Serum Ferritin Levels in Brides-to-Be in Padang City

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ABSTRACT

Background: Among the causes of high Maternal Mortality Rate (MMR) in Indonesia is anemia. Iron deficiency anemia, the most common type of anemia, frequently occurs in women of childbearing age because they experience menstruation each month. To diagnose iron deficiency, serum ferritin level could be used as one of the indicators. This study aims to know whether there is an association between menstruation patterns and serum ferritin level in brides-to-be in Padang.
Method: This study was conducted using an analytic observational method with a cross-sectional design. A Total of seventy samples of brides-to-be aged 20-30 years were gathered using a consecutive sampling technique. This study was conducted from November 2019 until April 2020. Data on menstruation patterns were collected through a questionnaire. Data of serum ferritin levels were acquired from venous blood sampling and measurement of serum ferritin levels with The Electro Chemiluminescence Immuno Assay (ECLIA) method. Bivariate analysis of this study used Independent T-test.
Results: This study showed sixty-eight point six percent of respondents were experiencing abnormal menstruation patterns while the mean of serum ferritin levels was normal (sixty-two point zero seven ± thirty-nine point forty-five ng/ml). The Independent T-test showed p-value = 0,921.
Conclusion: There was no significant association between menstruation pattern and serum ferritin level in brides-to-be in Padang.

Keywords: iron deficiency anemia, women of childbearing age, menstruation patterns, serum ferritin levels

INTRODUCTION

The degree of health of a nation can be assessed through the maternal mortality rate (MMR).[1] In Indonesia, MMR is still relatively high compared to other countries. MMR in Indonesia in 2015 was recorded at 305 per 100,000 live births.[2] While in Padang City, MMR in the same year amounted to 17 per 100,000 live births which then increased in 2016 to 20 per 100,000 live births. In 2017, MMR in Padang City had decreased to 16 per 100 thousand live births but increased again in 2018 to 17 per 100,000 live births.[1] One of the health problems that contribute to MMR is anemia. Anemia contributes to 20% of all maternal deaths worldwide.[3] The average death caused by anemia in Indonesia and Asia is estimated at 7.26%.[4]

Anemia is one of the health problems around the world, especially in developing countries. As many as 30% of the world's population is estimated to have anemia.[3] Anemia is often suffered by women of childbearing age, one of whom is a bride-to-be as a mother-to-be. This is because women of childbearing age experience menstrual cycles every month.[2] Women of childbearing age are women who

are still in reproductive age (from getting the first menstruation until the cessation of menstruation), which is between the ages of 15-49 years, with the status of unmarried, married, or widowed, who still have the potential to have children.[5] Age 20-30 years is a healthy reproductive age and ideal for achieving good quality pregnancy and childbirth.[6] Globally, the prevalence of anemia in women of childbearing age reaches 32.8%. While in Indonesia, the prevalence of anemia in women of childbearing age is 29%.[7] If not treated properly immediately, then the incidence of anemia in women of childbearing age can continue during pregnancy.

The prevalence of anemia in pregnant women aged 15-49 years globally is 38%.[8] While in Indonesia based on the results of Riskesdas (2018), as many as 48.9% of pregnant women have anemia. The prevalence of anemia in pregnant women increased compared to 37.1% in 2013. The prevalence of anemia in pregnant women most occurred at the age of 15-24 years by 84.6% and the age of 25-34 years by 33.7%, followed by the age of 35-44 years by 33.6%, and the age of 45-54 years by 24%.[9] In contrast to national achievements, the prevalence of anemia in pregnant women in Padang City reached 7.72% in 2018.[1] When anemia occurs during pregnancy can cause complications in pregnancy such as the risk of maternal death at the time of delivery, giving birth to low birth weight (LBW) baby, the fetus and mother are susceptible to infection, miscarriage, and increase the risk of premature birth.[2] In addition, anemia can also increase the risk of antepartum and postpartum bleeding.[10]

Anemia that often occurs is iron deficiency anemia.[10] Iron deficiency is a condition of iron absence that can be mobilized, resulting in an iron imbalance in the long term and eventually leads to disruption of iron to body tissues.[11] Iron deficiency anemia is anemia caused by a lack of iron needed for hemoglobin synthesis so that the concentration of hemoglobin decreases below 95% of the average hemoglobin value at the same age and sex.

Serum ferritin is a laboratory examination indicator that is often used to diagnose ADB. Ferritin is a protein that plays an important role in the storage of iron in the body. Ferritin represents about 20% of the total iron in the body which has been widely used as a real indicator to assess the status of iron in the body and it is known that serum ferritin levels better describe the body's iron reserves.[12]

One of the factors that affect the incidence of iron deficiency anemia is blood loss due to menstruation in women of childbearing age every month. If a woman experiences abnormal menstrual patterns, the woman can lose a lot of iron that can cause anemia.[10] Menstrual patterns consist of menstrual cycles, menstrual length, and the volume (number) of menstruation. The menstrual cycle is the distance between the first day of menstruation and the first day of the next menstruation. Short menstrual cycles can cause the blood that comes out to be more, causing anemia.[13] While the length of menstruation is the length of the menstrual process in women of childbearing age. Menstruation that is too long can cause the blood that comes out to be more which can eventually lead to anemia.[14]

If the blood that comes out during menstruation is quite a lot, it means that the iron lost in the body is also large enough that the balance of iron in the body can be disturbed. This can cause anemia.[14] Based on Herlinadiyaningsih research (2019) found that there is a relationship between menstrual patterns and the incidence of anemia in adolescent girls.[15] In a study conducted by Saranani (2018) also obtained the same result that there is a significant relationship between menstrual patterns and the incidence of anemia in adolescent girls.[16] However, there have been no further studies examining the relationship of menstrual patterns with serum ferritin levels.

Improving maternal health before pregnancy is an important indicator to reduce maternal mortality (MMR).[2] Therefore, the bride-to-be who is a mother-to-be becomes the main target in efforts to improve the health of the mother before becoming pregnant. One of the health improvement efforts that can be done is early detection by checking serum ferritin levels. Examination of serum ferritin levels can be used as an indicator of decreased iron reserves in the body which later this condition can cause anemia and have an impact on maternal death. Padang Timur District, Lubuk Begalung, Nanggalo, Pauh, and Kuranji are the districts with the highest Maternal Mortality Rate (MMR) in Padang City, so the investigation on the bride-to-be will be conducted in five Religious Affairs Offices (Kantor Urusan Agama / KUA) in the sub-district, namely KUA Kuranji, KUA Pauh, KUA Padang Timur, KUA Lubuk Begalung, and KUA Nanggalo.

Based on the background description above, the author is interested in researching further about the relationship of menstrual patterns with serum ferritin levels in prospective brides in Padang City.

METHOD

The study used analytical observational methods with cross-sectional research designs. The research was conducted from November 2019 to April 2020 at five Religious Affairs Offices (KUA) in Padang City namely KUA Padang Timur, KUA Lubuk Begalung, KUA Nanggalo, KUA Pauh, and KUA Kuranji and UPTD Regional Health Laboratory of West Sumatra Province.

The population of this study is a bride-to-be aged 20-30 years who has registered in KUA Padang Timur, KUA Lubuk Begalung, KUA Nanggalo, KUA Pauh, and KUA Kuranji. The research sample was selected by meeting the inclusion criteria and having no exclusion criteria. The inclusion criteria of this study are: respondents are willing to be the subject of research by signing informed consent. The sampling technique in this study used consecutive sampling techniques.

Menstrual pattern data was obtained by interview using questionnaires obtained from previous research conducted by Pratiwi to find out the factors that affect anemia in MTs Ciwan and Cilegon Banten students in 2015.[17] Serum ferritin level data is obtained through venous blood sampling and serum ferritin levels measured using the ECLIA (Electro Chemiluminescence Immuno Assay) method.

Data is analyzed statistically using computerized systems i.e. univariate and bivariate analysis. Univariate analysis is performed to look at the frequency distribution of each independent variable (free) and dependent variable (bound). The univariately analyzed variables in the study were menstrual patterns and serum ferritin levels. Bivariate analysis is done to find out if there is a relationship between independent variables (free) that is menstrual patterns with dependent variables (bound) namely serum ferritin levels. The test used is the Independent T-test. The meaningful limit of 0.05 is used to determine the results of statistical calculations. If the p-value is $\leq$ 0.05 then there is a significant relationship, while if the p-value is > 0.05 then there is no significant relationship.

This research has passed the ethics test by the Ethics Committee Team of the Faculty of Medicine, Andalas University, and has an ethical clearance with number 626/KEP/FK/2018.

RESULT

This study was conducted on 70 brides-to-be aged 20-30 years by the sample formula used with a 90% confidence level.

1. Characteristics of Respondents

Table 1. Average Age Of Respondents

Variable	Average	SD	Minimum	Maximum
Age (Year)	24,80	2,42	20	30

Table 1 showed the average age of respondents was 24.80 ± 2.42 years.

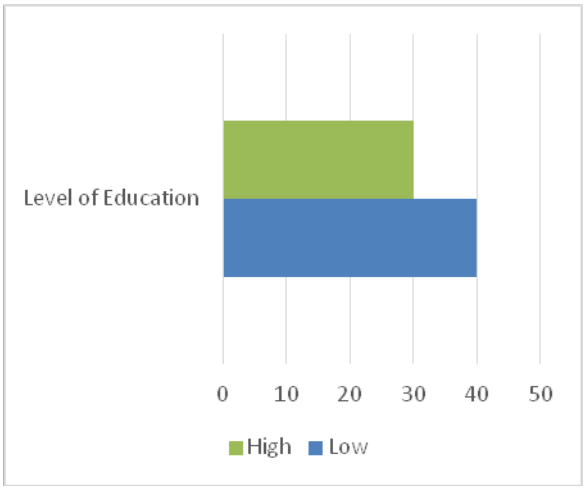

Figure 1. Distribution of Respondents' Education Level Frequency

Figure 1 shows most respondents have a low level of education of 40 people (57.1%).

2. Menstrual Patterns

In this study, most respondents (68.6%) experienced abnormal menstrual patterns.

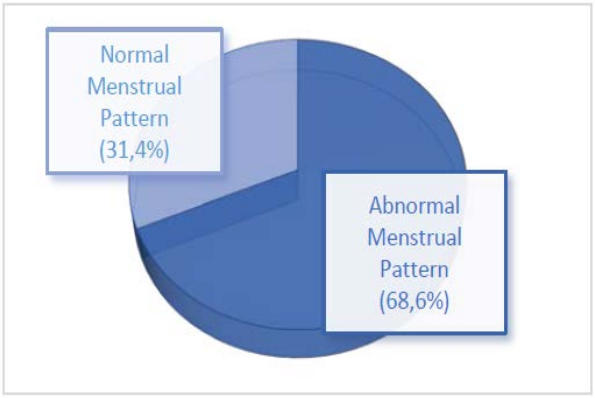

Figure 1. Frequency Distribution of Menstrual Patterns of Respondents

3. Serum Ferritin Rate

Table 2. Average Overview of Respondents' Serum Ferritin Levels

Variable	Average	SD	Minimum	Maximum
Serum Ferritin Level (ng/ml)	62,07	39,45	4,82	169,90

Table 2 showed the average serum ferritin rate of respondents was 62.07 ± 39.45 ng/ml.

4. Relationship of Menstrual Patterns with Serum Ferritin Levels

Based on the Independent T-test, the relationship of menstrual patterns with the serum ferritin levels of respondents can be seen in Table 3.

Table 3. Relationship of Menstrual Patterns with Responders Serum Ferritin Levels

Variable	Average ± SD		p
	Abnormal Menstrual Pattern (n=48)	Normal Menstrual Pattern (n=22)	
Serum Ferritin Level (ng/ml)	62,39 ± 43,35	61,37 ± 30,14	0,921

Table 3 showed the average serum ferritin levels of respondents with abnormal menstrual patterns were higher than normal menstrual patterns. The results of statistical tests obtained a value of p = 0.921 (p > 0.05) which showed that there was no significant difference in the average serum ferritin levels of respondents who had normal menstrual patterns with abnormal.

DISCUSSION

Menstrual Patterns

Based on the results of research on the distribution of menstrual patterns respondents found that most respondents experienced abnormal menstrual patterns that are as many as 48 people (68.6%). Based on the theory, menstruation is a series of menstrual processes consisting of the menstrual cycle, the length of menstruation, and the number (volume) of menstruation. Menstrual patterns are said to be normal if the menstrual cycle occurs once a month, the length of menstruation ≤ 7 days, and change pads ≤ 3 times per day. While the menstrual pattern is said to be abnormal if the menstrual cycle occurs outside once a month, and/or the length of menstruation > 7 days, and/or change pads > 3 times per day.[17]

Research conducted by Amini (2017) at Aisyiyah Midwifery dormitory students in Pontianak found that most respondents experienced abnormal menstrual patterns of 30 people (57.7%).[18] When this study and Amini's study were

compared, it was seen that the incidence of abnormal menstrual patterns in Amini's study was lower. This is due to differences in the number of research samples and the characteristics of menstrual patterns used. In Amini's study, the number of samples used was less than in this study, which was 52 respondents. The characteristics of menstrual patterns used by Amini's research are also different, namely the menstrual cycle and menstrual length. While in this study, the characteristics of menstrual patterns were assessed based on the menstrual cycle, length of menstruation, and number (volume) of menstruation.

In addition, menstrual patterns are also affected by stress levels. Stress causes Corticotropin-Releasing Hormone (CRH) to activate through activation of the adrenal pituitary hypothalamus axiom which can affect the glucocorticoid adrenal cortex. The presence of the delivery of CRH through the anterior pituitary due to stress causes the activation of ACTH to release the hormone cortisol which can affect the increase in the amount of the hormone progesterone in the blood so that the menstrual cycle can be disrupted. This is following the results of Lovani's research (2019) in female students who stated that the higher a person's stress level, the higher the incidence of menstrual disorders.[19]

Menstrual patterns are also influenced by a person's nutritional status which can be assessed through body mass index (BMI). Poor nutrition in young women can affect sexual maturation, growth of organ function, and impaired reproductive function. This will cause disruptions in menstrual patterns. BMI can affect menstrual patterns. This is because if a person has a fat body then the presence of fat accumulated in the body can affect body temperature that can cause menstruation to be disrupted. This is following the results of research conducted by Susanti and Lestari (2019) which states that young women who have high BMI tend to experience menstrual disorders.[20]

Serum Ferritin Rate

Based on the results of this study analysis, the average serum ferritin level of respondents was 62.07 ± 39.45 ng / ml. These results suggest that the average serum ferritin levels in the study respondents are still within the normal range. The normal range of serum ferritin levels in women is 20-200 ng/ml. Clinically, a threshold value of 20 ng/ml is used for the detection of related iron deficiency. This value is used as a sign of depleted iron reserves that can be mobilized for hemoglobin synthesis. While latent iron deficiency is characterized by a decrease in serum ferritin levels below 12 ng/ml. Both of these values do not require further laboratory examination if they get a picture of the morphology of red blood cells that are still normal. However, if you get a picture of hypochromic microcytic morphology in red blood cells then it can be ascertained that iron deficiency anemia has been found.[21]

The results of serum ferritin levels can be affected by several things, namely acute liver disease, cirrhosis of the liver, acute leukemia, kidney disease, infections, and tumors that can cause an increase in false serum ferritin levels even in people with iron deficiency anemia so that serum ferritin levels that should be low become normal or even increase. The presence of high serum ferritin levels can occur in the states of hereditary hemochromatosis, tissue necrosis, erythropoiesis blockade, HHCS (Hereditary Hyperferritinemia Cataract Syndrome), and benign hyperferritinemia. High serum ferritin levels > 2000 ng/ml indicate excess iron (hemosiderosis). However, acute blood loss (1-2 weeks) or chronic blood loss such as gastrointestinal bleeding and malabsorption syndrome can cause serum ferritin levels to below.[22]

In a study conducted by Rahma (2019) on pregnant women at The Mother and Child Hospital (RSIA), Badrul Aini Medan obtained the average serum ferritin rate of respondents was 28.4 ± 27.16 ng/ml. Rahma's results showed that the average serum ferritin levels of respondents were

within the normal range. There is a difference in the results of this study with Rahma's research due to different research respondents. Respondents to this study were brides-to-be, while in the study Rahma was a pregnant woman. Pregnant women need 1000 mg of iron during pregnancy. If these needs cannot be met with daily intake can cause the mobilization of the body's iron reserves which can be characterized by a decrease in serum ferritin levels. Decreased serum ferritin levels occur between the 12th to 15th weeks of pregnancy. Serum ferritin levels were relatively stable after the 32nd week. Increased serum ferritin levels in third-trimester pregnancies are not always as normal as in pre-eclampsia because excretion by the liver is higher. The addition of plasma volume can lead to an increase in serum ferritin levels.[23]

Relationship of Menstrual Patterns with Serum Ferritin Levels

Based on the results of the analysis on this study obtained a value of p = 0.921 (p > 0.05) which showed that there was no significant difference in average serum ferritin levels between brides-to-be who had normal menstrual patterns with abnormal. From these results, it can be concluded that there is no significant association between menstrual patterns and serum ferritin levels. This is because other factors can affect serum ferritin levels such as iron intake and vitamin C intake that was not further studied by researchers. If a person's iron and vitamin C intake can be fulfilled properly according to needs and can replace iron lost due to abnormal menstrual patterns can cause the person's serum ferritin levels to become normal. In addition, the number of study respondents can also affect the results of the study, where research with a cross-sectional design required a large subject. Researchers have not found another similar study that examines the relationship of menstrual patterns with serum ferritin levels.

Ferritin is a scattered iron storage protein that can be found in body tissues. Serum ferritin is a good indicator for measuring iron reserves because its levels are almost balanced with the levels of ferritin tissue. The normal range of serum ferritin levels is 20-200 ng/ml.[21] In general, serum ferritin levels are affected by iron intake, iron absorption, and iron loss due to blood loss both occurring physiologically such as menstruation and pathologies such as gastrointestinal bleeding disorders and worm infections.[24]

In women in the Prague mill period, there is an increase in the body's iron needs due to increased erythropoietic activity. If the body's iron needs cannot be met from iron intake, there will be the use of the body's iron reserves. This can disrupt the body's iron balance ranging from the occurrence of body iron depletion, iron reserves become depleted, to iron deficiency anemia (ADB). This is following research by Idaman (2019) which found that most (54%) of newlywed couples in Bali have low ferritin levels. This is due to a lack of iron intake which causes the respondents' ferritin levels to be below.[25]

The absorption of iron is affected by the quality of iron (bioavailability) consumed from the daily diet. Based on the form of iron found in food, iron is sourced from non-heme iron, while iron in the form of heme is more abundant in meat and fish. Heme iron has a high bioavailability and is easier to absorb by the body. Heme iron is absorbed about 25-30% while non-heme iron is only about 1-7%. Inadequate absorption of iron can cause serum ferritin levels to decrease. This is following Young's research (2018) in women aged 18-35 years in Australia who found that heme iron intake has a stronger correlation with serum ferritin levels compared to non-heme iron intake. This suggests that iron bioavailability affects iron absorption which impacts serum ferritin levels.[26]

In addition, iron absorption is also influenced by other micronutrients, namely vitamin C. Vitamin C or ascorbic acid is a driving factor in food that can increase the absorption power of non-heme iron. In a

study by Alzaheb and Al-Amer (2017) in Saudi Arabia, it was found that 50% of students aged 19-25 years have low levels of ferritin which is < 15 ng / ml. This is due to the lack of vitamin C intake which acts as a driving factor in increasing the absorption of non-heme iron.[27]

The body maintains iron efficiently. Normally, the amount of iron lost is about 1 mg in men and 2 mg in women. Iron lost in normal amounts can be restored if intake and iron are adequate. When entering the reproductive period, women experience more iron loss compared to men because of the menstrual cycle in women every month. The menstrual cycle experienced by women normally results in additional iron loss of about 1.4 mg per day. The amount of blood lost during menstruation can affect the body's iron reserves which are characterized by a decrease in serum ferritin levels. This is following a study conducted by Mayer (2019) that there is a negatively correlated relationship between blood loss due to menstruation and serum ferritin levels. The more blood lost due to menstruation, the lower the serum ferritin. Increased iron loss due to menstruation of 1 mg/day was associated with a decrease in serum ferritin levels of 6.9 µg/L.28

Serum ferritin which is an active protein can increase in the event of inflammation. A person who is obese can experience iron deficiency due to inflammation in fat tissues of obese people resulting in trapping iron in the reticuloendothelial system which can cause iron levels to below. Research by Syari (2019) found that there is a positive relationship between viscera fat and waist circumference with serum ferritin levels in obesity. This is due to an increase in levels of hepcidin due to inflammation that causes iron absorption in the intestines to be reduced and inhibited the release of iron by macrophages.[29]

In addition to these factors, the genetic role can also cause an increase in serum ferritin levels, namely hemochromatosis (excess iron in the body). Hemochromatosis can occur due to gene mutations, excessive iron intake, and excessive production and transfusion of red blood cells. This can lead to an increase in serum ferritin levels.[30]

Limitations of Research

This study uses a cross-sectional research design, namely observation and measurement of independent and dependent variables carried out together so that the weakness of this research design is the conclusion of causal relationships become less strong. Researchers did not examine other factors that influence menstrual patterns and serum ferritin levels.

CONCLUSION

Based on the results of this study, it was concluded that most brides-to-be in Padang City experienced abnormal menstrual patterns with average serum ferritin levels within the normal range. There is no relationship between menstrual patterns and serum ferritin levels in brides-to-be in Padang City.

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Ethical Approval: Approved

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