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Description Of Ferritin Levels In Pregnant Women With Anemia

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ABSTRACT

Anemia is a condition in which the body experiences a decrease in the amount of hemoglobin (Hb), leading to insufficient red blood cells to meet physiological needs. Anemia during pregnancy is a condition in which the hemoglobin (Hb) level in the body is less than 11 g/dL. Anemia during pregnancy can be caused by a deficiency of iron, a lack of folic acid, and a deficiency of vitamin B12 in the body. Iron Deficiency Anemia (IDA) is the most common cause of anemia during pregnancy because pregnant women experience an increase in iron demand. Iron Deficiency Anemia (IDA) occurring in pregnant women can have negative impacts on both the mother and the fetus, posing a risk of mortality for both. In the first trimester of pregnancy, the iron required tends to be lower because the amount of iron transferred to the fetus is still low. In the second and third trimesters of pregnancy, the iron in pregnant women increases due to the growth of the fetus and placenta. Ferritin levels examination has proven to have the best sensitivity and specificity compared to other tests for diagnosing IDA. Ferritin is the storage form of iron in the body; Thus, its' levels decrease when the body is experiencing iron deficiency. To understand the description of ferritin levels in pregnant women with anemia. This research is classified as a descriptive observational study using a cross-sectional research design. Ferritin levels in pregnant women with anemia, among the 20 subjects studied, revealed that 13 subjects had normal ferritin levels, accounting for a percentage of 65%, while 7 pregnant women with anemia had low ferritin levels, representing a percentage of 35%. The number of pregnant women with anemia who have normal ferritin levels is higher than those with anemia and low ferritin levels.

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1. INTRODUCTION

Anemia is the most common hematological disorder. Anemia is a condition where there is a decrease in the levels of hemoglobin (Hb), hematocrit or erythrocytes in the body. Symptoms that often occur can include less obvious symptoms such as weakness, tiredness, lethargy and tiredness. Other symptoms that can accompany are dizziness, dizzy eyes, paleness in several areas such as the tongue, lips, skin and hands (Turner, 2022). Riskesdas in 2018 stated that the prevalence of anemia cases in Indonesia reached 23.7%. The 15-24 year age group contributed an anemia rate of 32.0% and the 25-34 year age group contributed a rate of 15.1%. Women tend to suffer from anemia more often than men. Anemia in pregnant women has a higher prevalence rate compared to non-pregnant women, namely 48.9%, with the 15-24 year age group at 84.6% and the 25-34 year age group at a lower figure, namely 33. 7%. The incidence of anemia in pregnant women increased from 2013 to 2018 by 11.8% (Riskesdas, 2018).

It is predicted that there will be 41 cases of anemia in Indonesia every day. This figure is quite high and requires treatment. The prevalence of anemia in East Java Province in 2019 averaged 5.8%, which is considered still below the national target of 28% (Ministry of Health, 2019). Iron deficiency anemia (IDA) is the most common cause of anemia in the world. Symptoms complained of by ADB patients can include non-specific complaints such as dyspnea to fatigue when carrying out activities. ADB often occurs in women and children but it does not rule out the possibility of men experiencing

this condition. ADB is often caused by excessive blood loss during menstruation, gastrointestinal bleeding, decreased intake and absorption of iron and pregnancy. Pregnant women need iron to support the growth and development of the fetus in the womb. IDA in pregnancy is a health problem that can cause negative effects on the fetus and mother (Garzon et al., 2020; Kumar and Brookes, 2020; Warner and Kamran, 2021).

WHO in 2018 said that ADB is the most nutritional deficiency in the world with a percentage of 30%. Research by Warner and Kamran in 2021 stated that the United States has a lower anemia prevalence rate compared to developing countries. Womanin agereproduction contributes the largest figure, namely 10% due to bleeding during menstruation. Men under 50 years have a small prevalence rate, namely only 1% of the total (Kumar and Brookes, 2020; Warner and Kamran, 2021). ADB in pregnancy is the main cause of world health problems with a prevalence rate of 20% in 80% of countries in the world. Garzon et al.'s research in 2020 stated that the specific figure for the prevalence of ADB in pregnancy was 41.8%, which is a high figure. IDA in pregnancy needs to be diagnosed with certainty and managed so that there is no increase in the incidence rate (Garzon et al., 2020). IDA in pregnant women in the first trimester can cause the fetus to become Small for Gestational Age (SGA), macrosomia in the second trimester and neurocognitive disorders in the fetus in the third trimester. ADB in the third trimester is the most common cause because it is a manifestation of severe iron deficiency that occurs during pregnancy and this condition indicates the absence of iron reserves in the body. The impact of ADB on pregnant women includes cordial decompensation, in-partum or post-partum shock, which can cause post-partum hemorrhage. The negative impact of pregnant women who experience iron deficiency anemia also occurs on pregnancy outcomes, namely that newborn babies can experience itintrauterinegrowth retardation (IUGR), premature birth or even miscarriage, babies born with low birth weight (LBW) and death of babies before or after delivery (Fauzianty and Sulistyaningsih, 2022).

Ferritin levels are one of the supporting examinations required in primary and secondary care from ADB. Ferritin is a store of iron in the body whose levels will decrease if the body shows an iron deficiency condition. A ferritin level of less than 30 µg/mL is considered a diagnosis of iron deficiency, while a value of less than 10 µg/mL is considered 99% specific for IDA. Recent research in the United States has proven that iron deficiency conditions with low serum ferritin levels (<15 µg/L) show a drastic reduction in iron stores in the body (Cullis et al., 2018; Barney and Moosavi, 2022; Santosa et al., 2022). Anemia has a high prevalence rate, especially in pregnant women with iron deficiency anemia which can have negative effects on the mother and fetus, so researchers want to look for an overview of ferritin levels in pregnant women with anemia at the Made Community Health Center to determine the levels of body iron reserves in pregnant women who experience anemia. Therefore, the author is interested in writing a journal article entitled "OVERVIEW OF FERRITIN LEVELS IN PREGNANT WOMEN WITH ANEMIA".

2. METHOD

Types and Research Design

This research is included in the type of descriptive observational research using a cross sectional research design. Cross sectional studies are a type of epidemiological research that makes observations at a certain point in time to analyze the prevalence, distribution, and relationship between disease and exposure. This study used descriptive observational research with the aim of knowing the description of ferritin levels in pregnant women with anemia.

Population and Sample

The population of this study were pregnant women who experienced anemia at Made Community Health Center and Jeruk Community Health Center, Surabaya on the date July 1 to September 30 2023. The sample for this study was pregnant women who experienced anemia at Made Community Health Center and Jeruk Surabaya Community Health Center from July 1 to September 30 2023 who met the inclusion and exclusion criteria.

1. **Inclusion Criteria**
   - The samples in this study were pregnant women with anemia who had been recorded at Made Community Health Center and Jeruk Community Health Center, Surabaya.

- The samples in this study were pregnant women in the first and third trimesters with Hb levels below 11 g/dL, as well as pregnant women in the second trimester with Hb levels below 10.5 g/dL.

2. Exclusion Criteria

- In this research sample, pregnant women were not experiencing inflammatory conditions.
- In this research sample, pregnant women were not suffering from malignancy.

Research Sample Size

In calculating the minimum sample used, it is calculated using a numerical descriptive observational formula. Formula :

$$n = \left(\frac{Z\alpha \; x \; s}{d}\right)^2$$

Information :

n = Minimum number of samples required
Zα =Alpha standard derivative
s = Standard deviation
d = Research precision

Number of samples:

$$n = n = \left(\frac{1{,}96 \; x \; 4{,}25}{1{,}5}\right)^2 = 30{,}83\left(\frac{1{,}96 \; x \; 4{,}25}{1{,}5}\right)^2 = 30{,}83$$

Information :

Based on the numerical descriptive observational formula and calculations above, the sample size is 31 samples.

Sampling technique

The sampling technique in this study used random sampling, namely that the researcher examined all members of the population who met the inclusion and exclusion criteria based on primary data and patient availability as written in the informed consent.

Research variable

1. Classification of Research Variables

In this study the main variable was ferritin levels.

2. Operational Definition of Variables

No.	Variable	Definition	Gauge	Measuring instrument	Measuring Scale
1.	Ferritin	Ferritin is a level of iron reserves which is useful as an indicator of iron reserves in the body. The reference value for ferritin is 10.0 – 125.0 µg/mL for women and 16.0 – 220.0 µg/mL for men.	Researcher	*Ferritin Rapid Quantitative Test*	Numerical
2.	Anemia	Anemia is defined as a lower concentration of hemoglobin, erythrocytes and hematocrit than normal values. Pregnant women in the first and third trimesters are said to be anemic if the hemoglobin level is <11 g/dL and pregnant women in the second trimester are said to be anemic if the hemoglobin level is <10.5 g/dL.	Laboratory Officer UC Faculty of Medicine	*Quick-Check Hb*	Nominal

Research Materials

The materials used in this study were venous blood from which 50 µl of serum was taken, test cartridge, detector buffer, SD card, instructions for use, Biotime FIA analyzer.

Research Instrument

Primary data from patients is needed as a research instrument. The instruments used in this research were non-sterile gloves, sterile cotton, antiseptic and disinfectant, 70% alcohol swab, plaster, tourniquet, 23 G syringe, 3 cc syringe, transfer pipette, EDTA tube, timer, centrifuge, abroban paper , specimen label and needle disposal area.

Place and time of research

This research will be carried out at the Made Community Health Center, Jeruk Community Health Center, Surabaya and the Clinical Pathology Laboratory, Faculty of Medicine, Ciputra University, Surabaya. This research will be conducted from July 1 to September 30 2023.

Research procedure

1. Licensing
   The researcher obtained a cover letter from the Faculty of Medicine, Ciputra University and asked permission from the Made Community Health Center and the Jeruk Surabaya Community Health Center to conduct research.
2. Informed Consent
   Researchers provide an explanation of the aims and objectives of the research to pregnant women with anemia. Then the patient signs the informed consent sheet provided by the researcher as proof of willingness to take part in the research.
3. Data Collection
   The data required is data on pregnant women with anemia where data collection can be carried out in several stages, namely:
   1. Identifying pregnant women who experience anemia at Made Community Health Center and Jeruk Community Health Center, Surabaya.
   2. Provide informed consent to pregnant women with anemia who will have blood drawn.
   3. Collect primary research data.
   4. Carry out the process of taking venous blood from pregnant women with anemia to then take the serum and check the patient's ferritin level.

3. DISCUSSION RESULT

Results

This study obtained 39 research subjects from pregnant women who, when examined, resulted in 20 pregnant women with anemia, namely hemoglobin levels <11 g/dL. Blood samples from pregnant women who have anemia will be examined to determine the ferritin levels.

Demographic Characteristics of Pregnant Women with Anemia

An overview of the demographic characteristics of pregnant women with anemia who are research subjects will be described using a table with the following results:

Table 1 Demographic Characteristics of Pregnant Women with Anemia

Variable	Frequency	Percentage	Minimum	Maximum	Mean	Median
Age	**20**	**100%**				
<20 years	2	10%	16	39	25.5	24.5
20-35 years	17	85%				
>35 years	1	5%				
Trimester	**20**	**100%**				
I	5	25%	8	38	23.8	26
II	5	25%				
III	10	50%				
Height	**20**	**100%**				
<150cm	4	20%	144	160	152.5	152.5
>150 cm	16	80%				

Variable	Frequency	Percentage	Minimum	Maximum	Mean	Median
Weight	**20**	**100%**				
<50kg	13	65%	38	65	47.1	43
>50 kg	7	35%				
LILA	**20**	**100%**				
<23.5cm	2	10%	21.5	29	24.5	24
>23.5 cm	18	90%				
Hb	**20**	**100%**	8.3	10.9	10	10.2
<11 g/dL	20	100%				

The table here shows that the subjects examined had a minimum age of 16 years and a maximum age of 39 years with an average age of 25.5 years. Pregnant women with anemia in the age group between 20-35 years have the largest number, namely 17 out of 20 total pregnant women with a percentage of 85%. The minimum gestational age for the subjects examined was 8 weeks, which was included in the first trimester category, and the maximum gestational age for pregnant women with anemia was 38 weeks, which was included in the third trimester category, with an average age of 23.8 weeks. Pregnant women with anemia in the third trimester gestational age group have the largest number, namely 10 out of 20 total pregnant women with a percentage of 50%. The height of the subjects examined had a minimum height of 144 cm and a maximum height of 160 cm with an average height of 152.5 cm. Pregnant women with anemia in the height group of more than 150 cm had the highest number, namely 16 out of 20 total pregnant women with a percentage of 80%. The body weight of the subjects examined had a minimum body weight of 38 kg and a maximum body weight of 65 kg with an average body weight of 47.1 kg. Pregnant women with anemia in the group weighing less than 50 kg have the largest number, namely 13 out of 20 total pregnant women with a percentage of 65%. The upper arm circumference (LILA) of the subjects examined had a minimum height of 21.5 cm and a maximum upper arm circumference of 29 cm with an average upper arm circumference of 24.5 cm. Pregnant women with anemia in the LILA group of more than 23.5 cm had the highest number, namely 18 out of 20 total pregnant women with a percentage of 90%. The hemoglobin (Hb) of the subjects examined had a minimum hemoglobin of 8.3 and a maximum hemoglobin of 10.9 with an averagehemoglobinof 10.9 cm and a percentage of 100% of the total pregnant women.

Results of Hemoglobin Analysis in Pregnant Women

The results of the analysis of hemoglobin frequency distribution in pregnant women who were the sample for this study will be described using a table with the following results:

Table 2. Frequency Distribution of Hemoglobin in Pregnant Women

Variable	Frequency (n=39)	Percentage (%)
Hemoglobin		
No anemia (>11 g/dL)	19	48.7%
Mild Anemia (9 -10.9 g/dL)	17	43.5%
Moderate Anemia (7 - 8.9 g/dL)	3	7.8%
Severe Anemia (<7 g/dL)	0	0

The table here shows that the hemoglobin in pregnant women, namely the 39 subjects studied, produced normal hemoglobin in 19 subjects with a percentage of 48.7% and pregnant women who had hemoglobin below 11 g/dL could be said to be anemic. Pregnant women with anemia can be categorized into 3 groups, namely mild anemia, moderate anemia and severe anemia. There were 17 subjects of pregnant women with mild anemia with a percentage of 43.5%, 3 pregnant women with moderate anemia with a percentage of 7.8% and in this study there were no pregnant women with severe anemia.

Results of analysis of ferritin levels in pregnant women with anemia

The results of the analysis of the frequency distribution of ferritin levels in pregnant women with anemia who are the samples of this study will be described using a table with the following results:

Table 3. Frequency Distribution of Ferritin Levels in Pregnant Women with Anemia

Variable	Frequency (n=20)	Percentage (%)
Ferritin levels		
Normal (10.0-125.0 µg/mL	13	65
Abnormal (<10.0 µg/mL)	7	35

The table here shows that the ferritin levels in pregnant women with anemia, namely 20 subjects studied, produced normal ferritin levels in 13 subjects with a percentage of 65% and pregnant women with anemia who had abnormal ferritin levels were 7 subjects with a percentage of 35%. Pregnant women with anemia have more normal ferritin levels than pregnant women with anemia who have abnormal ferritin levels. Pregnant women with anemia who had ferritin levels of less than 10.0 µg/mL were most often in the third trimester with the number being 5 out of 7 subjects and the least in the first and second trimesters of pregnancy, each producing only 1 subject. The results of ferritin levels in pregnant women with anemia at the Made health center and Jeruk health center are based on the mean, min, max, standard deviation (std. deviation), variance, skewness and kurtosis values as follows:

Table 4 Characteristics of Ferritin Levels in Pregnant Women with Anemia

Variable	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*	*Variance*	*Skewness*	*Kurtosis*
Ferritin levels	4.25	42.55	16.47	9.74	94.89	0.955	1,086

This table shows that ferritin levels in pregnant women with anemia have a minimum value of 4.25 µg/mL where this value is said to be abnormal because this value is less than the normal value for ferritin levels, namely 10.0 – 125.0 µg/mL with a maximum value in pregnant women with anemia it is 42.55 µg/mL where this value is said to be normal because it is at a value of 10.0 – 125.0 µg/mL. Pregnant women with anemia have an average of 16.47 µg/mL, where this value is said to be normal because it is within the normal value of ferritin levels, namely 10.0 – 125.0 µg/mL. The distribution of ferritin levels tends to be high where the distribution tends to be far from the average of 94.89, which shows that ferritin levels in pregnant women with anemia have high variance so they tend to be unstable. The skewness of the ferritin level is 0.955 which indicates a positive value, so that the majority of pregnant women with anemia have ferritin levels on the right side of the curve or tend to be below the average of all pregnant women with anemia. The majority of pregnant women with anemia have ferritin levels below 16.47 µg/mL. A kurtosis value of 1.086 shows a positive value which indicates that the data is spread higher and peaks, so that a steep/high curve is formed, which means the number of pregnant women with anemia who have normal ferritin levels is much higher than those who are abnormal.

Normality Test of Ferritin Levels in Pregnant Women with Anemia

The normality test is used to determine whether ferritin levels in pregnant women with anemia have a normal distribution or not. The results of the analysis of the normality test for ferritin levels in pregnant women with anemia are as follows.

Hypothesis:

H0: Ferritin levels in pregnant women with anemia are normally distributed

H1: Ferritin levels in pregnant women with anemia are not normally distributed

The significant level α is set at 0.05 with a rejection area, namely Reject H0 if$P_{value} < \alpha$ $P_{value} < \alpha$

Table.5 Shappiro Wilk test

SWcalculate	*P-value*
0.927	0.134

The table here shows that the SW value is 0.927 and is reinforced by the P-value of 0.134 which is greater than$\boldsymbol{\alpha}$0.05 so it was decided to fail to reject H0, which means that the distribution of ferritin levels in pregnant women with anemia has a normal distribution. The normality test can also

be seen through histogram visualization, QQ plot and boxplot.The following is a histogram, QQ plot, and boxplot of the profile of ferritin levels in pregnant women with anemia.

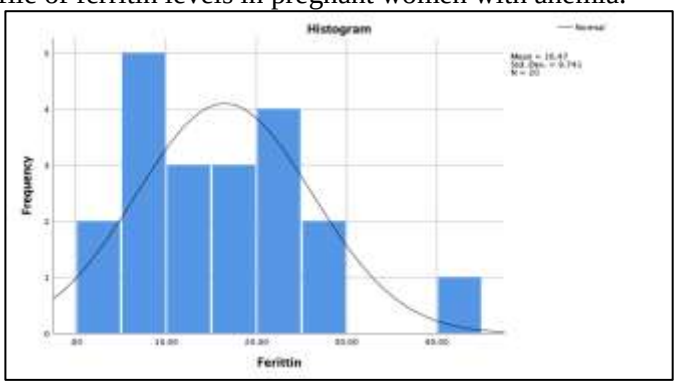

Figure 3. Histogram of ferritin levels in pregnant women with anemia

This image shows that the histogram curve of ferritin levels in anemic pregnant women has a curve shapetends to the right but still has abnormal ferritin levels or below 10 µg/mL. Amountpregnant women with anemia who have ferritin levels of 4.23 – 9.36µg/mLa total of 7 pregnant women.

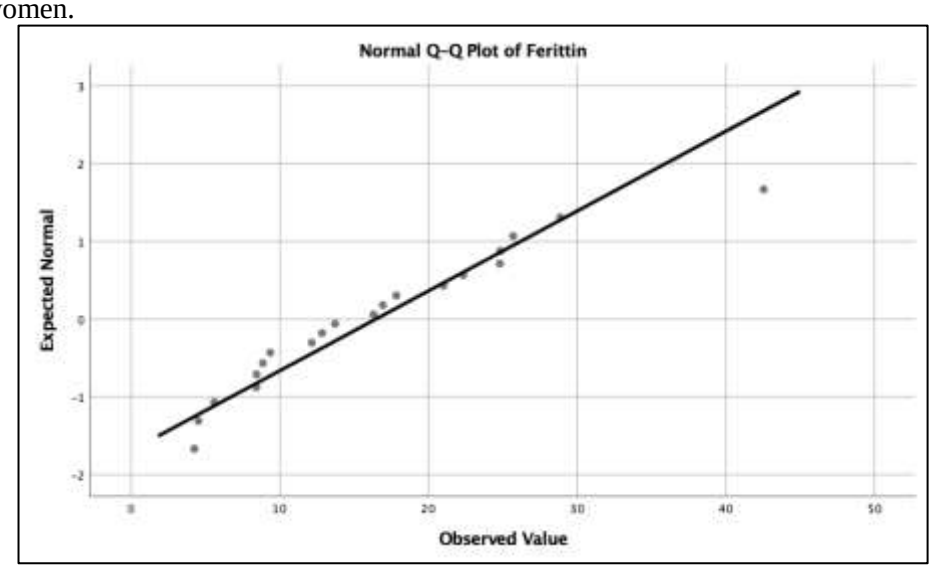

Figure 4. QQ Plot of Ferritin Levels in Pregnant Women with Anemia

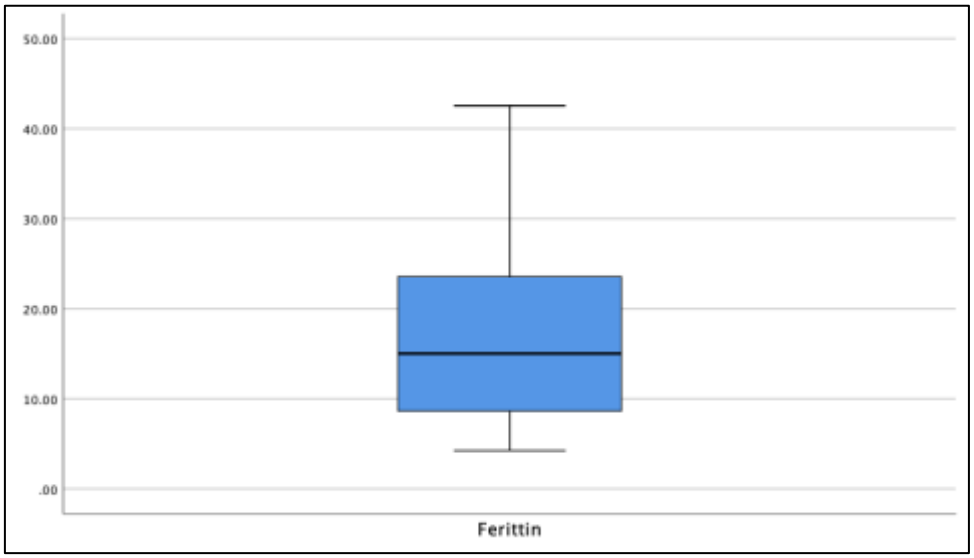

Figure 5 Box Plot of Ferritin Levels in Pregnant Women with Anemia

Based on the Normal QQ Plot Graph in the Figure here, it shows that the data on ferritin levels in pregnant women with anemia has a plot that is on a linear line and a boxplot that does not have outlier values with a center line that tends todownThis means that more patients tend to have ferritin levels above the average, so it can be concluded that by visualizing the ferritin levels in pregnant women with anemia tend to have a normal distribution.

Discussion

This study obtained 20 research subjects from pregnant women in the first to third trimesters who experienced anemia. According to Antari and Nadhira (2021) anemia in pregnancy is a condition where the hemoglobin (Hb) level in the body is less than 11 g/dL. This can be caused by insufficient iron reserves during pregnancy, inadequate nutritional intake, impaired nutrient absorption, or other causes. Anemia caused by iron deficiency is the main cause of anemia in pregnancy because pregnant women experience an increased need for iron during pregnancy (Antari and Nadhira, 2021).

Ferritin is an iron reserve in the body which can be a benchmark for levels of iron stores in the reticuloendothelial system. The normal value for ferritin levels in the body is 10.0-125.0 µg/mL. Ferritin levels can be influenced by several confounding factors such as infection, history of repeated blood transfusions and chronic diseases where these factors can cause a false increase in ferritin levels, so that in conditions of iron deficiency the serum ferritin levels can become normal or increase due to infection. Infection can cause disruption in the release of iron from reticuloendothelial cells so that ferritin levels in the body increase (Bakta, et al., 2015).

The results of this study showed that the average value of ferritin levels in research subjects was 16.47 µg/mL with a minimum value of 4.25 µg/mL and a maximum value of 42.55 µg/mL. The ferritin level value in this study showed a normal value because it was higher than the minimum ferritin level limit, namely more than 10.0 µg/mL. This is not in line with research by Meiriska, et al. in 2022 which stated that serum ferritin levels in pregnant women in the third trimester were below the normal limit in 65 out of 95 pregnant women who were housed at RSI Siti Rahmah Padang in 2018-2019. Research by Meiriska, et al in 2022 stated that the average value of ferritin levels in 95 research subjects was 27.84 µg/mL with a minimum value of 1.56 µg/L and a maximum value of 216.0 µg/L. The discrepancy between these two studies has several possible causes, including the small number of pregnant women with anemia in the city of Surabaya, which is one of the big cities in Indonesia where anemia prevention in Surabaya is quite good. Since the first trimester of pregnancy, all pregnant women are given blood supplements to prevent anemia during pregnancy. In the first trimester of pregnancy, iron requirements tend to be lower because the amount of iron transferred to the fetus is still low. In the second and third trimesters of pregnancy, the need for iron in pregnant women increases due to the growth of the fetus and placenta, so IEC and giving blood supplement tablets are very important to prevent anemia in pregnancy. Another cause is limited research time which causes researchers to get fewer samples than the minimum sample size (Meiriska, et al., 2022).

Meanwhile, in the research of Pontoh, et al. in 2015, it showed that pregnant women with ferritin levels below normal were 26 or around 36.1% and pregnant women with normal ferritin were 46 or around 63.9% of the total number of 72 pregnant women subjects. The results of this research are in line with research conducted by Pontoh, et al. In 2015 in North Boolang Mongondow district, the percentage of ferritin values above the normal limit in pregnant women with anemia was greater than in pregnant women with anemia who had low ferritin levels. In pregnancy, the maximum concentration is at 12-16 weeks of gestation and will decrease with increasing gestational age, reaching the highest point in the third trimester. Not all pregnant women with anemia experience a decrease in ferritin levels because ferritin contains around 23% iron. Each ferritin complex can store approximately 3000-4500 Fe ions in it. Ferritin can be stored in the lymph, muscles and bone marrow. Under normal circumstances, only a small amount of ferritin is found in human plasma. The amount of ferritin in serum describes the amount of iron stored in our body. Prenatal vitamin and mineral supplementation given from the first trimester can maintain ferritin concentrations so that they do not decrease (Pontoh, et al., 2015).

Very high ferritin levels in pregnant women can be associated with poor baby outcomes. Increased ferritin levels during the third trimester may be part of the acute phase response, indicating an increased risk of pregnancy. This can result due to metabolic syndrome, diabetes mellitus,

inflammatory conditions and infections. So, it is necessary to keep iron levels in the body stable during pregnancy so that there is no deficiency or excess of iron which can affect ferritin levels in the body (Pontoh, et al., 2015).

This research has a weakness which causes the target number of samples not to be met with the target number of samples being 31 samples but in this research only 20 samples were obtained due to several possibilities, including:

1. Pregnant women have been given blood supplement tablets since the first trimester to prevent anemia during pregnancy.
2. Pregnant women with low Hb levels have received initial treatment to prevent ongoing anemia.
3. Many pregnant women in the city of Surabaya receive IEC on how to prevent anemia in pregnancy.
4. Limited research time, so that the research subjects obtained were less than the minimum sample.

4. CONCLUSION

Based on the results of research regarding ferritin levels of pregnant women with anemia conducted from July to September 2023, it can be concluded as follows: Pregnant women at Made Surabaya health center and Jeruk Surabaya health center with Hb <11 g/dL were 20 out of 39 pregnant women examined. Pregnant women in the first, second and third trimesters with Hb <11 g/dL at Made Surabaya health center and Jeruk Surabaya health center had 13 subjects or 65% of normal ferritin levels and 7 subjects or 35% of the total had below normal ferritin levels. 20 subjects. Ferritin levels in pregnant women with iron deficiency anemia are 4.25 µg/mL, 4.52 µg/mL, 5.59 µg/mL, 8.43 µg/mL, 8.44 µg/mL, 8.86 µg/ mL and 9.36 so the average is 7.06 µg/mL. Pregnant women with anemia have more normal ferritin levels than pregnant women with anemia who have ferritin levels below normal. Based on the conclusions above, several suggestions that can be given are: The results of the research can be used as input for pregnant women in Surabaya city health centers as well as providing information about serum ferritin levels in the body. Pregnant women who have ferritin levels below normal need to be given treatment to prevent various risks that can occur to the mother and fetus. It is hoped that health workers, especially doctors and midwives at community health centers, will provide IEC to pregnant women as an effort to prevent anemia in order to reduce the increase in anemia during pregnancy. Further research can be carried out to look for other factors that influence serum ferritin levels in the body.

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