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Relationship Between Serum Ferritin Levels and Patient Characteristics in Pregnant Women

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Abstract: ***Ferritin is an iron storage protein and is found extracellularly in serum. Serum ferritin functions as a clinical marker of the status of body iron stores. Low ferritin levels illustrate low iron stores that lead to iron deficiency conditions that result in anemia in pregnant women. Several maternal characteristics affect ferritin levels in pregnant women. This study aims to determine the relationship between characteristics and ferritin levels in third trimester pregnant women. Taking the research location, TGK Chiek Ditiro Sigli Regional General Hospital, Aceh, Indonesia with a total sample of 45 respondents who have met the inclusion and exclusion criteria. The research method is observational analytic by taking maternal venous blood to check ferritin levels and then looking for its relationship with the characteristics of pregnant women and analyzed using chi square. More than half (83%) of the respondents had ferritin levels <30 pg/ml. The results of the analysis using chi square (p value = <0.05) showed that there was a relationship between age (0.04) and parity (0.01) with ferritin levels in third trimester pregnant women. And there is no relationship between education (0.71) and occupation (0.23) with ferritin levels in third trimester pregnant women. Age and parity are related to ferritin levels in third trimester pregnant women. While education and work are not related to ferritin levels in third trimester pregnant women. It is expected that pregnant women increase the consumption of foods that contain lots of iron to prevent anemia and health workers provide socialization of types of foods that contain lots of iron.***

Keywords: characteristics; pregnant mother; ferritin levels

I. INTRODUCTION

Iron deficiency anemia is a nutritional problem that often occurs in pregnant women, which is the biggest and most difficult micronutrient problem in the world. The World Health Organization (WHO) report shows that there are 52% of pregnant women experiencing anemia in developing countries. In Indonesia, it is reported that of about 4 million pregnant women, half suffer from nutritional anemia and one million others experience chronic energy deficiency1Pregnant women need 1000 mg of iron per day to increase maternal blood volume and fetal red blood cell mass. Although the absorption rate is quite high, anemia often persists, usually iron deficiency anemia occurs. So the transfer of iron will be disrupted due to the deficiency. The transfer of iron is initiated and regulated by the placenta. [2]

Examination of serum ferritin proved to be the earliest indicator of decline in iron stores depletion and has a less invasive procedure. Ferritin is an iron storage protein and is found extracellularly in serum. Ferritin serves as a clinical marker of the body's iron storage status [3]. Serum ferritin (serum ferritin, SF) is a test parameter used to assess iron stores in the body. SF examination has limitations, the level is influenced by the presence of inflammation because ferritin is an acute phase protein. [4]

Pregnant women need 1000 mg of iron per day to increase maternal blood volume and fetal red blood cell mass. Although the absorption rate is quite high, anemia still occurs, generally iron deficiency anemia. Iron transfer will be impaired due to this deficiency. The transfer is regulated by the placenta. Ferritin is an important protein in iron metabolism. Under normal conditions, ferritin stores iron which can be recovered for use as needed. In a state of iron overload, the body's iron stores are greatly increased and much more ferritin is found in tissues, such as the liver and spleen [2].

Free iron exists in two forms, namely ferrous (Fe2+) and ferric (Fe3+). Conversion of the two forms is relatively easy. At high oxygen concentrations, iron is generally in the form of ferric because it is bound to hemoglobin, while in the process of transmembrane transport, deposition is in the form of ferritin and in heme synthesis, iron is in the form of ferrous[5]. In the body, iron is needed for the formation of iron-sulfur and heme complexes. Iron-sulfur complexes are required in enzyme complexes that play a role in energy metabolism. Heme is composed of a porphyrin ring with an iron atom in the center of the ring which plays a role in transporting oxygen to hemoglobin in erythrocytes and myoglobin in muscle [6]

Serum ferritin level is the most useful, straightforward parameter, and is considered the best indirect marker of iron stores available for assess iron deficiency. Levels below 15 pg/L can confirm the diagnosis of iron deficiency.

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Ferritin is an acute phase protein which may also be elevated during infection. This causes plasma ferritin values to be normal or falsely elevated, so caution must be exercised in interpreting iron deficiency. Pregnant women are very susceptible to iron deficiency anemia because during pregnancy the need for oxygen is higher, which triggers an increase in erythropoietin production. As a result, plasma volume increases and red blood cells (erythrocytes) increase. However, the increase in plasma volume occurs in a greater proportion when compared to the increase in erythrocytes so that the decrease in hemoglobin concentration (Hb) is due to hemodilution.[8]

is very influential in pregnancy because it can be fatal if not treated immediately including can cause abortion, premature labor, uterine inertia, prolonged labor, uterine atony and cause bleeding and shock. While the effect of anemia on the product of conception, among others, can cause fetal death in the womb, fetal death at birth, increased perinatal mortality, prematurity and congenital defects.[9] Preliminary studies show that in 2018 of all pregnant women who visited 38% were anemic. This study aims to examine the relationship between characteristics and serum ferritin levels in third trimester pregnant women.

II. RESEARCH METHOD

This type of research is a descriptive prospective with a cross-sectional design. This research was conducted at the TGK Chiek Ditiro Sigli Regional General Hospital, Aceh, Indonesia in May-June 2020. The sample selection used the simple random sampling method with the inclusion criteria being pregnant women in the third trimester, healthy and willing to be respondents by signing the informed consent that visited. 40 people at the TGK Chiek Ditiro Sigli Regional General Hospital, Aceh, Indonesia during the study period. The characteristics of pregnant women (age, parity, education, occupation) were taken from secondary data using data from maternal and child health books (KIA books). While the primary data for ferritin levels were taken by taking 3 cc of venous blood. Venous blood sampling was performed for serum ferritin measurements carried out at the Clinical Laboratory of the TGK Chiek Ditiro Sigli Regional General Hospital, Aceh, Indonesia. Data were analyzed using computer software.

III. RESULTS

A. Characteristics of Respondents

Table1. Distribution of Respondents Based on Characteristics of Age, Parity, Education and Employment.

Variable		n	Percentage (%)
Age			
	<20 years	2	5
	21-34 years	32	80
	>35 years	6	15
parity			
	Primigravida	15	37.5
	Multigravida	25	62.5
education			
	Junior high school	6	15
	high school	26	65
	College	8	20
Work			
	Work	12	30
	Not working	28	70

From the table above it is known that most of the respondents (80%) were in the age range of 21-34 years and a small proportion (5%) of the respondents were aged <20 years. More than half (62.5%) of the respondents had multigravida parity and less than half (37.5%) were primigravida. It can also be seen that more than half (65%) of the respondents have the last education in high school and only a small part (15 %) of the respondents have the last education in junior high school while the rest (20%) have the last education in tertiary education. More than half of the respondents (70%) work and a small part (30%) of the respondents do not work.

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B. Serum Ferritin Levels

Table2. Serum Ferritin Levels for pregnant women in the third trimester.

Serum ferritin	n	Percentage
< 30 ng/ml	33	82.5
> 30 ng/ml	7	17.5
Total	40	100

From the table above it is known that most (83.3%) respondents have serum ferritin levels <_30 ng/ml and some a small number of respondents (16.7%) had serum ferritin levels >30 pg/ml.

C. The Relationship Between Respondents Characteristics and Ferritin Levels in Third Trimester Pregnant Women

Table3. Relationship Between Respondents Characteristics and Ferritin Levels in Third Trimester Pregnant Women

Variable	Serum Ferritin Levels				Total		p
	< 30 pg/ml		> 30 pg/ml		n	%	
	n	%	n	%			
Age							
< 20 years	2	5.00	0	0.00	2	5	0.004
21-34 years	26	65.00	6	15.00	32	80	
> 35 years	5	12.50	1	2.50	6	15	
Parity		0.00		0.00			
Primigravida	11	27 .50	4	10.00	15	37.5	0.001
Multigravida	22	55.00	3	7.50	25	62.5	
Education							
Junior high school	6	15.00	0	0.00	6	15	0.71
High school	20	50.00	6	15.00	26	65	
College	7	17.50	1	2.50	8	20	
Occupation							
Working	8	20.00	4	10.00	12	30	0.23
Not working	25	62.50	4	10.00	28	70	

1) Relationship between Age and Ferritin Levels of Pregnant Women in the Third Trimester Analysis Results bivariate using chi square, the result is 0.004 (<0.005), meaning that age is related to ferritin levels in third trimester pregnant women.

2) Relationship between Parity and Ferritin Levels in Third Trimester Pregnant Women The results of bivariate analysis with chi square obtained results of 0.001 (<0.005) meaning that there is a relationship between parity and ferritin levels in third trimester pregnant women.

3) The Relationship between Education and Ferritin Levels in Third Trimester Pregnant Women. The results of bivariate analysis using chi square obtained results of 0.71 (<0.05) which means there is no relationship between education and ferritin levels in third trimester pregnant women.

4) The Relationship between Occupation and Ferritin Levels for Pregnant Women in the Third Trimester The results of bivariate analysis using chi square obtained results of 0.23 (<0.05), which means that there is no relationship between work and ferritin levels in third trimester pregnant women.

IV. DISCUSSION

A. The Relationship Between Age and Ferritin Levels in Third Trimester Pregnant Women

Research conducted by Judistiani in 2018 showed that pregnant women who had low serum ferritin levels were in the age range that was not at risk at the age of 20-35 years. Most women with an age range of 20-30 years are known to have not been able to compensate for iron loss due to menstruation by having a low iron intake.[3]

The age of pregnant women ranging from 16-18 years is susceptible to anemia because of the high risk age for pregnancy. Pregnant women aged < 20 years and 20-35 years had a higher prevalence of low serum ferritin levels than the group of pregnant women aged > 35 years.[10] During pregnancy, ferritin levels change with increasing gestation and reach a maximum level at 12-16 weeks of gestation and then decrease to a minimum level in the third trimester. High maternal ferritin levels may be associated with poor infant outcomes. The increase in serum ferritin concentration during the third trimester may be part of the acute-phase response, which suggests an increased risk of pregnancy [11]

Body iron requirements increase during growth and gestation. Iron is needed during pregnancy for the baby, the placenta and an increase in the number of red blood cells. The total iron requirement during pregnancy is about 1000 mg. If iron stores are empty, the total iron requirement during pregnancy must be met from diet and supplementation. In the first trimester of pregnancy does not require additional iron for pregnant women, fetus or placenta. Iron requirements at this time are usually lower than in nonpregnant women because of low erythropoietic activity. In the second trimester of pregnancy, the need for iron is higher and will continue to increase until the end of pregnancy[12]

B. The Relationship Between Parity and Ferritin Levels for Pregnant Women in the Third Trimester

Research conducted in the city of Malang in 2017 showed that knowledge, education and work were not related to ferritin levels inpregnant mother.[13] Pregnant women with parity > 2 had a higher prevalence of low serum ferritin levels than subjects with parity < 2.24. Judistiani also explained that the amount of parity will be related to the short interval between births that allows for depletion of iron reserves and if iron intake cannot keep up with the mother's needs, it can experience iron deficiency[3]

This is not in line with research conducted by Rahma and Lubis in 2019 which states that there is no relationship between parity and ferritin levels in pregnant women. Low ferritin levels describe low iron stores that lead to iron deficiency conditions that result in anemia in pregnant women, but the large number of pregnancies is not related to ferritin levels[14] c. The Relationship between Education and Ferritin Levels in Third Trimester Pregnant Women .

Educational levels cannot be compared with low serum ferritin levels. In Judistiani's research, et al. showed that at low serum ferritin levels subjects with low levels of education had significantly lower levels of [3]

C. The Relationship between Occupation and Ferritin Levels for Pregnant Women in the Third Trimester

Research conducted in the city of Malang in 2017 showed that knowledge, education and work were not related to ferritin levels in pregnant women.[13]Types of work cannot be compared with low serum ferritin levels in pregnant women because in this study, low ferritin levels in respondents who worked had significantly not high levels.[3] The value of serum ferritin levels that exceed the maximum upper limit can indicate an iron overload condition. Conversely, a serum ferritin level lower than 10 ng/mL may indicate a decrease in iron stores in the body.[15] Ferritin is an iron storage protein and is found extracellularly in serum. Ferritin serves as a clinical marker of the body's iron storage status. Mobilization of body iron reserves can be estimated by serum ferritin concentration, which in healthy people is a good biomarker for iron status [2]

V. CONCLUSIONS AND RECOMMENDATIONS

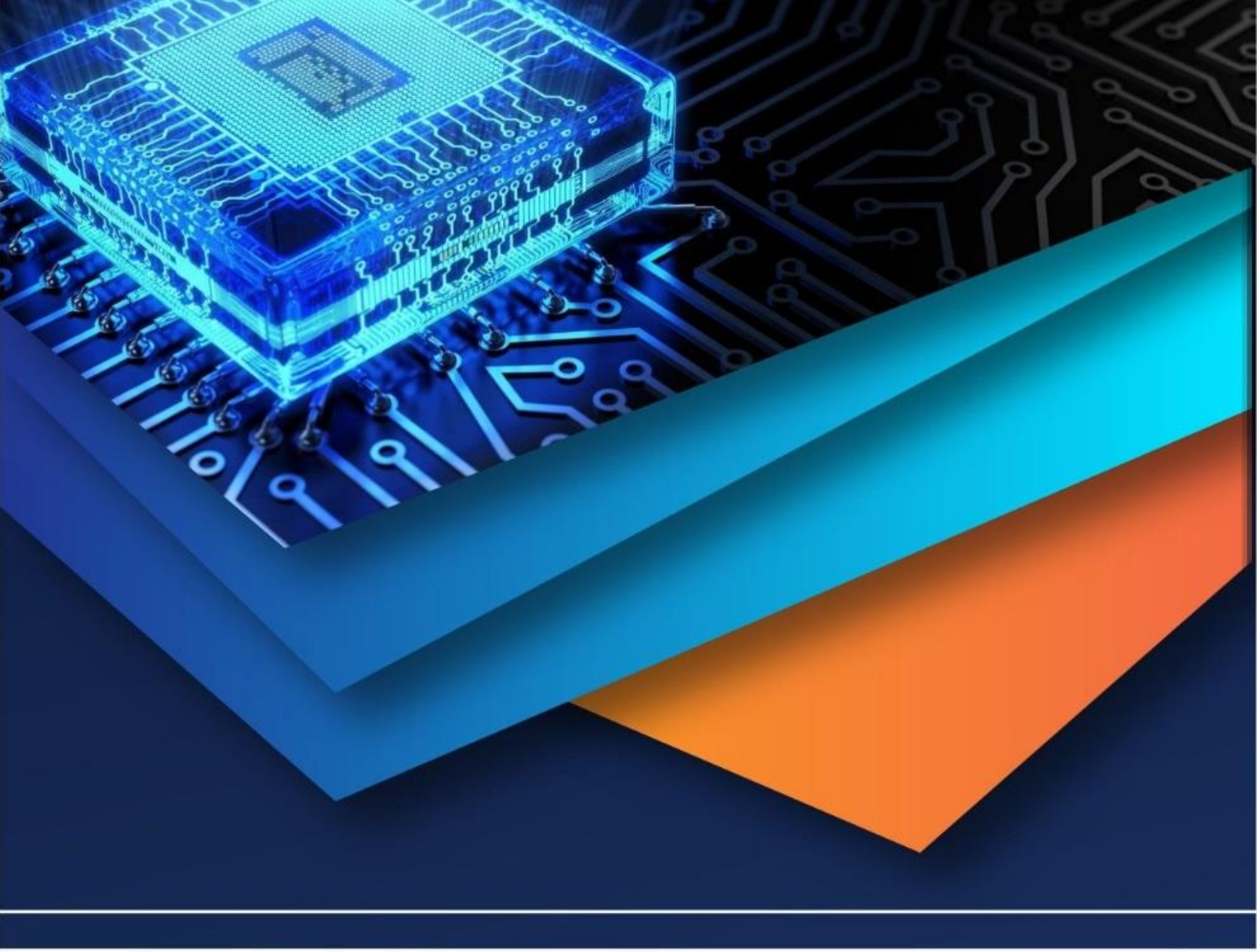
Age and parity are related to ferritin levels in third trimester pregnant women, while education and work are not related to maternal ferritin levels. third trimester of pregnancy. It is expected that pregnant women increase the consumption of foods that contain lots of iron to prevent anemia and health workers provide socialization of types of foods that contain lots of iron.

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