Relationship Between Characteristics of the Third-Trimester Pregnant Women and Incidence of Anemia in Malaria-Endemic Regions in Bengkulu City

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Abstract:

Background: Pregnant women who live in malaria-endemic regions are highly vulnerable to the incidence of anemia. The presence of malarial infections and pregnancy are two major causes that worsen the incidence of anemia in most women. The purpose of this study was to find out the relationship between characteristics and incidence of anemia in the third-trimester pregnant women living in malaria-endemic regions in Bengkulu city.

Methods: This was a cross-sectional study conducting in working areas of five puskesmas (community health centers) in Bengkulu city. The primary data of this study were the characteristics of 107 women in the third-trimester of pregnancy coming to puskesmas for antenatal care (ANC). The characteristic data collected from the participants were the size of mid-upper arm circumference (MUAC), hemoglobin level, body weight and height, clinical history of malarial infection, knowledge, attitude, action, and routine iron supplementation. All these data were then analyzed statistically using the Chi-square test.

Results: Based on the results of study, among the pregnant women investigated, it was found that 22.4% of them had MUAC of less than 23.5 cm, 31.8% of them revealed hemoglobin level of less than 11 g%, 79.4% of the pregnant women had clinical history of malarial infections, 57% of the pregnant women had poor knowledge about iron tablets, 89% of them showed supporting attitude on iron-tablet intake, 73% of them showed good action in taking iron tablets, and 89.7% of them were routinely taking iron tablets. There was a significant relationship ($p < 0.05$) among nutritional status, routine iron supplementation, and clinical history of malarial infections, and the incidence of anemia in the third-trimester of pregnant women living in malaria-endemic regions in Bengkulu city. Besides, the pregnant women with nutritional status of risky to CED had an opportunity of 2.707 times of developing anemia, those who were routinely taking iron tablets had a risk of 6.211 times of developing anemia, and those with the clinical history of malarial infection were at risk of 3.200 times of developing anemia.

Conclusions: Nutritional status, routine iron supplementation and clinical history of malarial infection were significantly correlated with the incidence of anemia in the third-trimester pregnant women living in malaria-endemic regions in Bengkulu city.

Keywords: ***pregnant women, malaria-endemic regions, mother's characteristics, anemia***

I. INTRODUCTION

Anemia is a common health problem occurring during pregnancy. The lower level of hemoglobin decreases oxygen transport to body tissues and lead to various health complications. In developing countries, about 40-80% of the pregnant women were anemic and 20% of them were reported dead [1]. Apart from causing death in pregnant women, anemia can also cause delayed growth of fetuses resulting in low birth weight (LBW) [2].

In Indonesia, the prevalence of anemia in pregnancy is about 20-80% [3]. The survey of Riskesdas (the basic health research) in 2013 reported that the incidence rate of anemia in pregnant women is 37.1 nearly similar to the proportion of pregnant women in cities (36.4%) and villages (37.8%) [4]. The major cause of anemia in pregnancy (gestational anemia) is iron deficiency [5].

During pregnancy, the overall iron requirements are twice greater than in the nonpregnant state. Iron requirements increase because more iron is needed for the growing fetus, the placental structures, and the expansion of hemoglobin mass. Consuming diets of low iron bioavailability, iron mal-absorption, and the presence of parasitic infections increase iron deficiency in pregnancy [6]. In malaria-endemic regions, malarial infections will worsen the status of anemia. One of the malaria-endemic regions in Indonesia is Bengkulu city. A study of Flora stated that 87.3% of pregnant women in five uskesmas in Bengkulu city were anemic [7]. Based on these data, the purpose of this study was to find out the relationship between mother's characteristics and the incidence of anemia in third-trimester pregnant women in malaria-endemic regions in Bengkulu city.

II. METHOD

The design of this study was cross sectional. This study was conducted in malaria-endemic regions in Bengkulu city. The subject of this study was pregnant women in trimester III coming to five puskesmas in Bengkulu city for antenatal care (ANC). Based on the data of patient visits, the five puskesmas involved in this study had the most patients of malaria. Those five puskesmas were as follows: Puskesmas Suka Merindu, Puskesmas Padang Serai, Puskesmas Jembatan Kecil, Puskesmas Pasar Ikan, and Puskesmas Kandang. The sample of this study was the third-trimester pregnant women collected for two weeks from 18 to 29 of December 2017. During the study, 107 pregnant women in the third-trimester had been collected and selected based on the inclusion criteria. The data collected in terms of characteristics included the measurement of mid-upper arm circumference (MUAC), hemoglobin level, body weight and height, clinical history of malarial infection, knowledge, attitude, action, and discipline in taking iron tablets. Then these all data were analyzed using the Chi-square test.

III. RESULTS

1. Characteristics of Research Subjects

The subject of this study was the third-trimester pregnant women. The characteristic data of research subjects included age, education, body height, body weight, parity, size of mid-upper arm circumference, BMI, blood pressure, and hemoglobin level. For more details, the characteristic data are explained in the following table:

Table 1. Characteristics of The third-trimester pregnant women in Five Puskesmas of Bengkulu city

No.	Mother's Characteristics	N	%
1.	Age		
	a. ≤ 30 years old	72	67.3
	b. > 30 years old	35	32.7
2.	Education		
	a. Elementary School	11	10.3
	b. Junior High School	24	22.4
	c. Senior High School	57	53.3
	d. College	15	14.0
3.	Parity		
	e. Primigravida	50	46.7
	f. Multigravida	57	53.3

4.	Basal Metabolism Index:		
	a. Underweight	4	3.7
	b. Normal	47	43.9
	c. Overweight	40	37.4
	d. Obesity	16	15.0
5.	Body height:		
	a. < 145 cm	2	1.8
	b. ≥ 145 cm	105	98.2
6.	Mid-upper arm circumference		
	a. < 23.5 cm	24	22.4
	b. ≥ 23.5 cm	83	77.6
7.	Blood pressure		
	a. Normal	95	88.8
	b. Hypertension	12	11.2
8.	Hemoglobin level		
	a. < 11 gr%	33	30.8
	b. ≥ 11 gr%	74	69.2
9.	Iron supplementation		
	a. Routine	87	81.3
	b. Not Routine	20	18.7

Table 1 showed that majority (67.3%) of the pregnant women aged less than 30 years old, 57% of them graduated from senior high school, 53.3% of them with multigravida pregnancy, 43.9% of them had normal BMI, 98.2% of them had body height of ≥145 cm, 77.6% of them had MUAC of ≥ 25 cm, 88.8% of them had normal blood pressure, 69.2% of them had haemoglobin levels of ≥ 11 gr%, and 81.3% of them routinely took the iron tablets.

2. Relationship between the mother's characteristics and the hemoglobin levels of third-trimester pregnant women living in malaria-endemic regions in Bengkulu city

To find out whether there was a relationship or not between the mother's characteristics and incidence of anemia in the third-trimester of pregnancy, the Chi-square test was applied. The results of the statistical analysis are shown in Table 2.

Table 2. Relationship between the mother's characteristics and the incidence of anemia in the third-trimester pregnant women

Variable	Anemia		Not Anemia		Total	p *value*	PR (CI 95%)
	n	f(%)	n	f (%)	n	f(%)	
MUAC							
< 23.5 cm	7	58.3	5	41.7	12	100	0.03 3.715 (1.083-12.75)
≥ 23.5 cm	26	27.3	69	72.7	95	100	
Iron Supplementation							
Routine	20	22.9	67	77.1	87	100	0.00 6.211 (2.186-17.704)

Not routine	13	65.0	7	35.0	20	100		
Knowledge								
Good	17	36.2	30	63.8	47	100	0.29	0.642 (0.281-1.465)
Poor	16	26.7	44	73.3	60	100		
Attitude								
Supporting	5	20.8	19	79.2	24	100	0.22	0.517 (0.175-1.530)
Not Supporting	28	33.7	55	66.3	83	100		
Action								
Good	24	33.8	52	73.2	76	100	0.79	0.886 (0.355-2.211)
Poor	9	29.0	22	71.0	31	100		
Clinical History of Malarial Infections								
Yes	11	52.4	10	47.6	21	100	0.01	3.200 (1.196 – 8.559)
No	22	25.6	64	74.4	86	100		

Based on Table 2, it was indicated that there was a significant relationship ($p < 0.05$) between mid-upper arm circumference, routine iron supplementation and clinical history of malarial infections and the incidence of anemia in the third-trimester pregnant women in malaria-endemic regions in Bengkulu city. This study showed that pregnant women with MUAC < 23.5 cm were 2.707 times at risk of developing anemia. Those who did not routinely take iron were 6.211 times at risk of developing anemia, and those who had a clinical history of malarial infection were at risk of 3.200 times of developing anemia.

IV. DISCUSSION

The results of this study showed that 30.8% of the third-trimester pregnant women in five puskesmas in Bengkulu city were anemic. This was in line with the World Health Organization (WHO) in which there was 52% of pregnant women in developing countries were suffering from anemia. Anemia in pregnancy (gestational anemia) might lead to the death of the fetus, abortion, congenital defects, low birth weight, depleted iron store, or iron deficiency anemia. Besides, gestational anemia can also cause prolonged bleeding when giving birth and becomes a major cause (28%) of death in pregnant women in Indonesia. 8,9 40% of woman's death in developing countries are closely correlated to gestational anemia.

According to Lokare, approximately 50% of all types of anemia are iron-deficiency anemia. This is because the iron requirements during pregnancy increase twice since blood volume is increased without expansion of plasma volume. The higher demand for iron during pregnancy is needed for mothers and fetal development. Iron deficiency anemia in pregnant women common health problems found in most women throughout the world especially in developing countries [8]. WHO reported that the prevalence of pregnant women having iron deficiency is about 35-75% and it increases along with the progress of the pregnancy [9].

Apart from the higher demand for iron during pregnancy, parasitic infections such as malaria and hookworm can also cause anemia [10]. According to Flora, et. al, in malaria-endemic regions, anemia caused by iron deficiency during pregnancy is frequently overlapping with the one caused by infection during pregnancy. Malarial infection can cause anemia and other micronutrient deficiency, and micronutrient deficiency can increase the risk of infections [11]. The survey of Susenas (the National Socioeconomic Survey) reported that from about 4 million pregnant women in Indonesia, half of them suffered from iron deficiency anemia and one million others had chronic energy deficiency (CED) [12].

This present study also showed a significant relationship ($p < 0.05$) between the measurement of MUAC and the incidence of anemia in the third-trimester of pregnancy in Bengkulu city. Pregnant women with nutritional status of CED were at risk of 2.707 times developing anemia. The results of this present study were in line with the study of Marlapan, et. al. Their study indicated that pregnant women

with poor nutritional status had a three-time risk of developing anemia than those with good nutritional status [13].

According to Katz et al, MUAC can be used to assess the nutritional status of pregnant women associated with chronic energy deficiency (CED). At present, the measurement of MUAC as a risk indicator of CED has been used by many developing countries including Indonesia . The nutritional status of pregnant women can be assessed by the size of MUAC. If MUAC is < 23.5 cm, the nutritional status of the pregnant women is in CED category. This means that these women have been developing malnutrition for long time. If this happens during pregnancy, the nutrient transfer to the growing fetus is delayed and this may lead to LBW. The pregnant women with anemia will have problems in transferring nutrient and uteroplacental oxygenation that cause the delayed growth of conception and resulting in the delayed fetal growth and development [14]. Besides, the pregnant women with poor nutrition will have a risk of 7 times higher of having stunted children, 11 times higher of having underweight children, and 12 times higher of having wasting children compared with those with good nutritional status [15]. The results of this study also revealed that there was 29.7% of the third-trimester pregnant women in malaria-endemic regions of Bengkulu city did not routinely take iron tablets; and 65.0% of them were anemic. There was a significant relationship ($p < 0.05$) between routine iron supplementation and the incidence of anemia in the third-trimester of pregnancy in malaria-endemic regions in Bengkulu city. The pregnant women who did not routinely take iron tablets had a risk of 6.211 times of developing anemia. The results of this present study were in line with that of Wati, et. al, in their study there was 56.8% of pregnant women in Gandus subdistrict were anemic and did not routinely take iron tablets [16].

Based on the results of this present study, it was found that 25.2% of the third-trimester pregnant women in malaria-endemic regions in Bengkulu city had clinical histories of malarial infections, and 52.4% of them developed gestational anemia. The pregnant women with the clinical history of malarial infections were at risk of 3.200 times of developing anemia. The anemia is caused by the plasmodium-infected red blood cells resulting in the suppress of erythropoietin and erythropoesis disorder due to cytokine releases during inflamation. The red blood cells infected with plasmodium will show morphological changes in the form of cell-membrane irregularity. The morphological defects on these red blood cells will lead to anemia, tissue anoxia, and intravascular hemolysis. The highest prevalence of anemia is between 16 to 28 weeks of gestation along with the peak of parasitemia. Non-immune pregnant women will develop anemia significantly in malaria infections. Similar to anemia, maternal complications due to plasmodium are also associated with low birth weight. Low birth weight in malaria-endemic regions ranges in prevalence from 15 %-30 %. Abortion and premature birth can occur from pregnant women with no immunity, intrauterine growth restriction, congenital malaria, and perinatal mortality [11].

A study of Flora, et. al interviewed 40 pregnant women in the third-trimester in Bengkulu city. The results of the study indicated that all pregnant women investigated were infected by malaria before the onset of pregnancy. Bengkulu city is one of the malaria-endemic regions in Indonesia, and *Plasmodium vivax* is the commonest and most widely distributed in those regions. In *Plasmodium vivax* infections, each destruction of one infected red blood cell would be followed by the destruction of other uninfected red blood cells. In pregnant women infected with *Plasmodium vivax*, the level of TNF-α was higher than the infections caused by *Plasmodium falciparum* on the same level of parasitemia. It is assumed that the higher level of TNF-α is associated with the incidence of LBW and anemia in pregnant women who are not infected with *Plasmodium vivax* [11].

V. CONCLUSIONS

Nutritional status, routine iron supplementation, and clinical history of malarial infection were significantly correlated with the incidence of anemia in the third-trimester of pregnant women living in malaria-endemic regions in Bengkulu city.

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