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The Role of Nutrient Intake and Social Determinants in Anemia among Pregnant Women at Lampung Malaria Endemic Areas

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ABSTRACT
Anemia in pregnancy is a serious health problem associated with an increased risk of morbidity and mortality during pregnancy and childbirth. This study aimed to determine the role of nutrient intake and social determinants in anemia among pregnant women in Pesawaran district. This analytic observational study was conducted using a cross-sectional design in malaria-endemic areas, of Pesawaran district, Lampung, from June to Desember 2021. The sample was 75 pregnant women in their second trimester, enrolled by purposive sampling techniques. Anemia was measured by examining hemoglobin, while the data on education, family income, age, and parity were obtained from interviews, maternal knowledge using questionnaires, and food intake using a 2x24-hour food recall questionnaire. Results from univariate, bivariate, and multivariate analyses showed anemia in pregnancy was 42.7%. Most of the pregnant women are poorly educated (50.7%), have poor knowledge (64%), sufficient income (53.3%), multiparous (68%), good age (64%), inadequate energy intake (72%), inadequate protein intake (58.7%), and inadequate iron intake (56%). The results showed education (p=0.003), knowledge (p=0.015), income (p=0.009), parity (p=0.004), age (p=0.004), energy intake (p=0.02), protein intake (p=0.025), and iron intake (p=0.031) have significant roles in anemia in pregnancy. The most influential factors are education, income, parity, and iron intake.

Keywords: *anemia, endemic of malaria, nutrient intakes, pregnant women, social determinants*

BACKGROUND

Anemia in pregnant women is the biggest and most difficult micronutrient problem to overcome worldwide. According to the World Health Organization (WHO) definition, anemia in pregnancy is when the hemoglobin (Hb) level is less than 11 g/dl. Anemia is a serious public health problem because it is associated with an increased risk of morbidity and mortality during childbirth[1]. Pregnant women who suffer from anemia have the added risk of experiencing hemorrhaging and excessive bleeding during childbirth which can result in death[2].

Anemia not only affects the mother, but also the babies born to mothers who suffer from iron deficiency or anemia are likely to have little or no iron reserves in their bodies even though they do not suffer from anemia. This can lead to impaired cognitive function during adolescence and adulthood[3]. Severe iron deficiency in pregnant women can result in decreased iron stores in the fetus and newborn, which predisposes them to iron deficiency anemia in infancy[2].
Anemia due to malaria occurs due to the rupture of infected and uninfected erythrocytes. Rupture of uninfected erythrocytes occurs due to increased osmotic fragility resulting in autohemolysis. In falciparum malaria, severe anemia can occur because erythrocytes of all ages can be attacked. Pregnant women are more susceptible to malaria than non-pregnant women. This susceptibility is higher in the first and second pregnancies. Susceptibility to malaria is closely related to immunological processes and hormonal changes during pregnancy. Concentrations of parasite-infected erythrocytes were found in the placental intervillous area. This situation is related to the suppression of both humoral and cellular immune systems during pregnancy due to the presence of the fetus as a "foreign body" in the mother's body. Suppression of the immune system during pregnancy also occurs due to hormonal changes, especially the hormones progesterone and cortisol. The increased concentration of the hormone progesterone during pregnancy has the effect of inhibiting the activation of T lymphocytes against antigen stimulation[4].

According to the findings of the 2018 Basic Health Research (*Riskesdas*), anemia prevalence among pregnant women in Indonesia reached 16.4%, whereas it was only 1.1% in the province of Lampung. Anemia is prevalent in pregnant women between the ages of 15 and 19 (8.2%),

20 to 24 (6.4%), and 25 to 29 (9.4%); these numbers are still significant, necessitating additional intervention.[5] Meanwhile, the prevalence of malnutrition, such as anemia in women of childbearing age, both pregnant and non-pregnant, has decreased in Indonesia, which is one sign that efforts to promote nutrition are being made there.[6]

There were 278 pregnant women with chronic energy deficiencies (CED) in 2018 and 1,922 pregnant women with malaria in the Pesawaran district of Lampung province.[7] Consumption of food and viral diseases both affect pregnant women's nutritional state. A person who has malaria may get anemia and malnutrition.[8] One of the malaria-endemic regions is the Pesawaran district. According to information on the Pesawaran district's health in 2016, there were 1,915 cases of malaria. The Hanura Health Center's operating area had the highest distribution, followed by the Padang Cermin and Pedada Health Centers and Gedongtaan.[9]

Malnutrition, particularly in pregnant women, and parasite infections are serious issues that develop together in malaria-endemic areas. Anemia and other nutritional deficiencies can result from the parasitic infection that causes malaria. A lack of micronutrients can raise the chance of illness, which will be harmful to the developing child.[10]

RESEARCH METHODS

This observational analytical study used cross-sectional research methods. From June to December 2021, the study was conducted in the Hanura and Gedongtaan Health Centers in the Pesawaran district. The study's sample consisted of pregnant women in the Pesawaran district. The sample computation yielded a minimum sample size of 75 individuals, which must be met. With the power of the test of 80%, the sample size estimate is based on the sample size formula for unpaired categorical comparative analytics. Purposive sampling was used to enroll samples.
The inclusion criteria for this study population were: pregnant women between the ages of 18 and 35, gestational age in the second trimester, and willingness to engage in the research procedure. Pregnant women with malignancies, diabetes mellitus, and tuberculosis were excluded from participating.
Social factors (education, knowledge, income, parity, and age) and nutritional consumption served as the study's independent variables (energy, protein and iron intake). Anemia was the dependent variable in this investigation. Data on education level, family income, parity, and age were gathered from interviews. Data on maternal knowledge were collected from interviews using a questionnaire. Nutrient intake data were measured using a 2x24h food recall questionnaire, to assess consumption of energy, protein, and iron per day. The results were then compared with the recommended daily allowances (RDA), so that the results could be used to determine maternal knowledge.
The researchers collected data with the aid of two enumerators who had received prior instruction and training. The data were then statistically evaluated with a 95% confidence interval (CI) and significance set as p <0.05 for univariate, bivariate, and p<0.025 for the multivariate logistic regression analyses. This research was conducted after receiving an approval letter with the reference number 228/UN26.18/PP.05.02.00/2021 from the Ethics Committee of the Faculty of Medicine, University of Lampung,.

RESULTS

The results showed that pregnant women who suffered from anemia were 32 people (42.7%) and 43 people (57.3%) were not anemic, while 38 people (50.7) were poorly educated and 37 people (49.3%) had a good education. Insufficient family income was found in 35 people (46,7%) and 40 people (53.3%) had sufficient family income, while there were 48 people (64%) with poor knowledge of pregnancy and there were 27 people (36%) with good knowledge, high parity was 51 people (68%) and low parity was 24 people (32%). There were 27 people (36%) at risky age and 48 people (64%) not at the risk age. Additionally, 54 people (72%) had less energy intake and 21 people (28%) had adequate energy intake. Also, there was a lack of protein intake in 44 people (58,7%) and adequate protein intake in 31 people (413%), while 42 people (56%) had a lack of iron intake and 33 people (44%) had adequate iron intake.

Table 1. Frequency Distribution of Research Results

Variable	n	%
Anemia		
a. Yes	32	42.7
b. No	43	57.3
Education		
a. Poor	38	50.7
b. Good	37	49.3
Family income		
a. Insufficient	35	46.7
b. Sufficient	40	53.3
Maternal knowledge		
a. Poor	48	64
b. Good	27	36
Parity		
a. Multiparous	51	68
b. Nulli/Primiparous	24	32
Age		
a. Risk	27	36
b. Not risk	48	64
Energy intake		
a. Inadequate	54	72
b. Adequate	21	28
Protein intake		
a. Inadequate	44	58.7
b. Adequate	31	41.3
Iron intake		
a. Inadequate	42	56
b. Adequate	33	44

The results of cross tabulation of pregnant women with poor education who suffer from anemia indicated 60.5%, which were significantly more than those with good education and suffering from anemia, which were 24.3%. The results showed that education played a significant role in the incidence of anemia in pregnant women (p=0.003) and poor education was a risk factor for anemia in pregnant women with OR = 4.7 (95% CI: 1.76 - 12.88), which means

the pregnant women with poor education will have a 4.7 times greater risk of suffering from anemia of pregnancy than those with good education.

The results of cross tabulation of pregnant women with insufficient family incomes who suffer from anemia indicated 60%, which were significantly more than those with sufficient family incomes who suffer from anemia, which were 27.5%. The results showed that family income significantly contributed to the incidence of anemia in pregnant women (p=0.009) and insufficient family income was a risk factor for anemia in pregnant women with OR=3.9 (95% CI: 1.50 - 10.42), which means that pregnant women who have insufficient family income will have a 3.9 times greater risk of suffering from anemia of pregnancy than those with sufficient family income.

The results of cross tabulation of pregnant women with poor knowledge who suffer from anemia were 54.2%, which were significantly more than those with good knowledge and suffering from anemia, which were 22.2%. The results showed that knowledge played a significant role in the incidence of anemia in pregnant women (p=0.015) and poor knowledge of mothers was a risk factor for the incidence of anemia in pregnant women with OR = 4.1 (95% CI: 1.41 - 12.06), which means that pregnant women with poor knowledge have 4.1 times greater risk to suffer from anemia of pregnancy than those with good knowledge.

The results of cross tabulation of pregnant women with high parity (multiparous) and suffering from anemia were 54.9%, which were significantly more than those with low parity (nulli/primiparous) and suffering from anemia, which were 16.7%. The results showed that parity played a significant role in the incidence of anemia in pregnant women (p=0.004) and multiparous was a risk factor for anemia in pregnant women with OR=6 (95% CI: 1.82 - 20.35), which means that pregnant women with multiparous were six times more likely to suffer from anemia during pregnancy than those with nulli/primiparous.

The results of cross tabulation of pregnant women with age at risk and suffering from anemia were 66.7%, which were significantly more than those not at risk age and suffering from anemia, which were 29.2%. The results showed that age played a significant role in the incidence of anemia in pregnant women (p=0.004) and age at risk was a risk factor for the incidence of anemia in pregnant women with OR = 4.8 (95% CI: 1.76-13.38), which means pregnant women at risky age will have 4.8 times greater risk to suffer from anemia compared to those not at a risky age.

The results of cross tabulation of pregnant women who have inadequate energy intake and suffer from anemia were 51.9%, which were significantly more than those who have sufficient energy intake and suffer from anemia, which were 19%. The results showed that energy intake played a significant role in the incidence of anemia in pregnant women (p=0.02) and inadequate energy intake was a risk factor for anemia in pregnant women with OR=4.5 (95% CI: 1.36 -.15.39), which means that pregnant women who have inadequate energy intake will have a 4.5 times greater risk of suffering from pregnancy anemia than those who have sufficient energy intake.

The results of cross tabulation of pregnant women who have inadequate protein intake and suffer from anemia were 54.5%, which were significantly more than those who have adequate protein intake and suffer from anemia, which were 25.8%. The results showed that protein intake played a significant role in the incidence of anemia in pregnant women (p=0.025) and inadequate protein intake was a risk factor for the incidence of anemia in pregnant women with OR = 3.4 (95% CI: 1.27 – 9.37), which means that pregnant women who have inadequate protein intake will have a 3.4 times greater risk of suffering from pregnancy anemia than those who have sufficient protein intake.

The results of cross tabulation of pregnant women who have inadequate iron intake and suffer from anemia were 54.8%, which were significantly more than those who have sufficient iron intake and suffer from anemia, which were 27.3%. The results showed that iron intake played a significant role in the incidence of anemia in pregnant women (p=0.031) and inadequate iron intake was a risk factor for anemia in pregnant women with OR = 3.2 (95% CI: 1.21 - 8.58), which means that pregnant women who have inadequate iron intake will have a 3.2 times greater risk of suffering from anemia of pregnancy than those who have adequate iron intake.

The independent variables, or variables with a p value <0.25 were chosen as candidates in the multivariate analysis based on the findings of the bivariate analysis using the chi square test. The education level, family income, maternal knowledge, parity, age, energy intake, protein intake, and iron intake were the candidate variables included in the multivariate analysis. Education, income, parity, and iron intake were revealed to have the greatest effects on pregnant women's nutritional status in the multivariate analysis utilizing binary logistic regression and the backward stepwise technique. The Hosmer and Lemeshow test's null hypothesis had a p value of 0.407, meaning that it was accepted. As a result, it may be inferred that the derived equation is accurately calibrated since there is no discrepancy between the observed value and the expected value.

Based on the results of the analysis, we obtained the following equation:
Anemia in Pregnant Women = -8.87 + (1.651*Poor Education) + (1.395*Insufficient Family Income) + (2.064*Multiparous/ High Parity) + (1.399*Inadequate Iron Intake)

Table 2. The Role of Social Determinants and Nutrient Intake on the Incidence of Anemia in Pregnant Women

Variable	Anemia				*p*	OR	95% CI
	Yes		No				
	n	%	n	%			
Education					0.003	4.7	1.76- 12.88
a. Poor	23	60.5	15	39.5			
b. Good	9	24.3	28	75.7			
Family income					0.009	3.9	1.50- 10.42
a. Insufficient	21	60	14	40			
b. Sufficient	11	27.5	29	72.5			
Maternal knowledge					0.015	4.1	1.41- 12.06
a. Poor	26	54.2	22	45.8			
b. Good	6	22.2	21	77.8			
Parity					0.004	6	1.82- 20.35
a. Multiparous	28	54.9	23	45.1			
b. Nulli/Primiparous	4	16.7	20	83.3			
Age					0.004	4.8	1.76- 13.38
a. Risk	18	66.7	9	33.3			
b. Not Risk	14	29.2	34	70.8			
Energy intake					0.02	4.5	1.36- 15.39
a. Inadequate	28	51.9	26	48.1			
b. Adequate	4	19	17	81			
Protein intake					0.025	3.4	1.27- 9.37
a. Inadequate	24	54.5	20	45.5			
b. Adequate	8	25.8	23	74.2			
Iron intake					0.031	3.2	1.21-8.58
a. Inadequate	23	54.8	19	45.2			
b. Adequate	9	27.3	24	72.7			

CI, confidence interval; OR, odds ratio.

Table 3. Initial Model and Final Model of Binary Logistics Regression Analysis Factors that Contribute to the Incidence of Anemia in Pregnant Women

	B	*p*	OR	95% CI
Initial Model				
a. Education	1.997	0.004	7.3	1.89-28.65
b. Family income	0.951	0.187	2.5	0.63-10.61
c. Maternal knowledge	0.586	0.43	1.7	0.41-7.71
d. Parity	1.702	0.039	5.4	1.09-27.59
e. Age	1.174	0.086	3.2	0.84-12.36
f. Energy intake	1.019	0.245	2.7	0.49-15.43
g. Protein intake	0.505	0.489	1.6	0.39-6.93
h. Iron intake	1.015	0.131	2.7	0.73-10.30
Constant	-12.415			
Final Model				
a. Education	1.651	0.007	5.2	1.58-17.15
b. Family income	1.395	0.023	4	1.21-13.41
c. Parity	2.064	0.004	7.8	1.91-32.45
d. Iron intake	1.399	0.026	4	1.18-13.89
Constant	-8.873			

CI, confidence interval; OR, odds ratio.

DISCUSSION

This study shows that pregnant women in malaria endemic areas, Pesawaran Lampung district, have a high prevalence of anemia in pregnancy with as many as 32 people (42.7%). The results of this study are lower than the prevalence of anemia among the pregnant women in the vivax malaria endemic area of Bengkulu city, which was 50%[11,12]. The causes of anemia are malnutrition, lack of iron, blood loss during the last delivery, and chronic diseases. In pregnancy, the decrease in hemoglobin levels found during pregnancy is caused by the increase in the need for nutrients and the occurrence of changes in the blood. Plasma volume becomes relatively larger than the addition of hemoglobin mass and red blood cell volume[12].

A previous study conducted in a malaria endemic area, Pesawaran district, found that the prevalence of maternal anemia/ pregnancy was 67.3%. Naturally acquired

immunity in malaria can reduce the number of parasites when the person becomes infected. This immunity can reduce the severity of clinical symptoms but requires more repeated infections. Individuals living in malaria endemic areas take a very long time to acquire effective immunity against the parasite. The relationship between the malaria parasite and humans in endemic areas for a very long period can lead to the evolution of host erythrocytes which in turn will protect the host from both infection and clinical symptoms of malaria. This immunity is referred to as innate immunity, which is related to genetic traits[13].

Compared to women who are not pregnant, pregnant women are more likely to get malaria and will experience more severe symptoms if they do. The fetus they carry will be also negatively impacted by malaria. Because pregnancy-related problems such anemia, fever, hypoglycemia, cerebral malaria, pulmonary edema, and sepsis can affect pregnant women, malaria during pregnancy increases the risk of mother, baby, and neonatal mortality. Low birth weight, early birth, stillbirth, congenital malaria, among other birth defects, are caused in the fetus by this pathogenesis.[14] According to studies conducted in India, pregnant women are more likely than non-pregnant women to contract malaria.[15]

Hemoglobin examination is a routine examination that must be done when a woman is declared pregnant, namely in the first and third trimesters. In addition, a peripheral blood smear can be performed on pregnant women who are indicated to have anemia. If pregnant women experience anemia, treatment will be conducted according to their disease. Pregnant women who suffer from mild anemia will be given additional blood-building iron tablets, with education about anemia nutrition and changes in eating behavior. Moderate and severe anemia are managed by administering pharmacological and non-pharmacological therapy and blood transfusions if needed[16].

In malaria endemic areas, regular malaria examinations are done in at risk groups such as pregnant women. Malaria examination consists of examination using a microscope (thick and thin blood preparations), rapid test equipment (immunochromatography/ICT), or biomolecular analyzer (PCR). At the public health centers or *Puskesmas* in the malaria endemic area of Pesawaran district, the tests are done using a microscope examination[16]. Pregnant women suffering from malaria will be treated accordingly. An antimalarial drug that is safe for the first trimester of pregnancy is quinine. Clindamycin is also safe, but must be combined. Quinine is also the drug of choice because it is the most effective and can be used throughout pregnancy. Meanwhile, the artemisinin-based combination therapy (ACT) is given in the 2nd and 3rd trimesters. The artemisinin-based combination therapy (ACT) used in Indonesia is dihydroartemisinin-piperaquine (DHP) and the artesunate-amodiaquine combination. Chloroquine and sulfadoxine-pyrimethamine (SP) are currently ineffective for the treatment of malaria due to increased resistance. Antimalarial drugs that should not be used during pregnancy are tetracycline, doxycycline, and primaquine[17].

The findings in this study indicated that anemia among pregnant women in the malaria-endemic Pesawaran district of Lampung was influenced by education. Pregnant women with poor education have a 4.7 times higher risk of developing anemia than pregnant women with good education. Poor education is a risk factor for anemia in pregnant women. Pregnant women's diets are influenced by educational factors; generally, those with higher levels of education are predicted to have better knowledge and information about nutrition so they can meet their nutritional needs, particularly in relation to energy, protein, and iron intake, which affects the prevalence of anemia in pregnant women. Poor education will result in pregnant women having less nutritional awareness, which will impair their food intake.

Income is also impacted by education. A person will have more options to find a better career with a higher pay if they have a good education. Those with poor education, meanwhile, tend to work at low-paying jobs. Family income is one of the elements that affects how much food is accessible to the family, which in turn affects the family's nutritional status.[18]

The results showed that family income played a significant role in the incidence of anemia in pregnant women in malaria endemic areas, Pesawaran district, Lampung. Insufficient family income is a risk factor for anemia in pregnant women, and pregnant women with insufficient family incomes have a 3.9 times greater risk of developing anemia than sufficient family incomes.

Lack of or low family income causes the family to be unable to meet the nutritional standards applied by the government, so that the mothers are unable to buy enough food that meets nutritional standards every day, including pregnant women who also have to share their income for other needs. Insufficient family income can affect the availability of food, particularly for pregnant women in families who have low income, because only their husbands are looking for income for the family which is used not only for consumption purposes but also for fulfilling daily needs[19].

The results showed that maternal knowledge played a significant role in the incidence of anemia in pregnant women in malaria endemic areas, Pesawaran district, Lampung. Poor maternal knowledge is a risk factor for anemia in pregnant women, and pregnant women with poor knowledge have a 4.1 times greater risk of experiencing anemia than mothers with good knowledge.

Knowledge of pregnant women about the importance of nutrition during pregnancy is a factor that causes the behavior of pregnant women in applying nutritious food during pregnancy. Accordingly, someone with poor knowledge will find it difficult to respond or try something new because it is overshadowed by the fear of being wrong and poor knowledge is also an inhibiting factor for accepting a motivation, including in the health sector[20].

The results showed that parity played a significant role in the incidence of anemia in pregnant women in malaria

endemic areas, Pesawaran district, Lampung. Multiparous/ high parity is a risk factor for anemia in pregnant women, and pregnant women who are multiparous have a 6 times greater risk of developing anemia than pregnant women with nulli/primiparous.

The parity number more than 3 is a factor in the occurrence of anemia related to the distance of pregnancy that is too close, namely <2 years, which is caused by becoming pregnant too often, which can deplete the nutritional reserves of the mother's body. In developing countries, especially in rural areas, mothers who come from low socioeconomic levels with a large number of children and close pregnancy intervals and still breastfeeding for a long time without regard to nutrition during lactation will suffer a higher risk of complications which will be very dangerous for their survival and often can cause anemia[21].

The results showed that age played a significant role in the incidence of anemia in pregnant women in malaria endemic areas, Pesawaran district, Lampung. Age at risk (less than 20 years or more than 35 years) is a risk factor for anemia in pregnant women, and pregnant women with age at risk have a 4.8 times greater risk of developing anemia than pregnant women with age not at risk.

Pregnancy in adolescence (less than 20 years) has worse risks such as delayed fetal growth, birth less than 9 months, low baby weight at birth, bleeding and prolonged labor. Other factors such as pregnancy at the age of <20 years is biologically not optimal, due to the emotions of the prospective mother tend to be unstable, and they are mentally not qualified so that they can experience shocks which result in a lack of attention to meeting nutritional needs during pregnancy. During pregnancy, a person needs as much as 1,000 mg of iron. If the needs cannot be met through daily diet, there will be mobilization of body iron reserves. The need for iron during pregnancy is very high, but low iron reserves in pregnant women will result in a void of reserves during pregnancy. Adolescent girls tend to want to have a thin body and ignore healthy eating patterns during pregnancy, which results in anemia, where plant foods that have less iron content than animal foods are consumed more and consequently the iron needed by the body is not met[19].

The results showed that energy intake played a significant role in the incidence of anemia in pregnant women in malaria endemic areas, Pesawaran district, Lampung. Inadequate energy intake is a risk factor for anemia in pregnant women, and pregnant women who have inadequate energy intake have a 4.5 times greater risk of developing anemia than pregnant women who have adequate energy intake.

Energy in the body is produced by macronutrients which are converted into energy. Energy is also needed to help the process of muscle movement of the digestive tract, so this movement helps the digestive tract to process of absorption of iron in the intestines[22]. Lack of energy in pregnant women can make the movement of the small intestinal microvilli weak so that iron absorption is not perfect and raises the risk of iron deficiency anemia in pregnancy.

The results showed that protein intake played a significant role in the incidence of anemia in pregnant women in malaria endemic areas, Pesawaran district, Lampung. Inadequate of protein intake is a risk factor for anemia in pregnant women, and pregnant women who have inadequate protein intake have a 3.4 times greater risk of developing anemia than pregnant women who have sufficient protein intake. Protein is needed by the body for growth, building body structures, antibodies and as enzymes to break down amino acids. Food material that are used as sources should be 2/3 parts of foods that have high biological value, such as lean meat, fish, eggs, milk and their processed products. For the protein derived from plants, since it has low biological value, then 1/3 part is enough. Inadequate protein intake of pregnant women in this study is caused by consuming small amounts of food sources containing protein nutrients, eating habits that are not good and regular, often consuming carbohydrate-based foods such as noodles, and snack foods that cause pregnant women to feel full, and the tendency to consume vegetable protein more often than consuming animal protein.

Protein plays an important role in the transportation of iron in the body. Absorption mainly occurs in the upper part of the small intestine (duodenum) with the help of special protein transporters. There are two types of protein transporters that help with iron absorption, namely transferrin and ferritin. Transferrin has a central role in iron metabolism because this protein element transports iron into the circulation that requires iron, for example from the intestines to the bone marrow and other organs to form new hemoglobin. Therefore, inadequate protein intake will affect iron transport in the body and cause pregnant women to be at risk of suffering from iron deficiency anemia in pregnancy[22].

The results showed that iron intake played a significant role in the incidence of anemia in pregnant women in malaria endemic areas, Pesawaran district, Lampung. Inadequate iron intake is a risk factor for anemia in pregnant women, and pregnant women who have low iron intake have a 3.2 times greater risk of developing anemia than pregnant women who have adequate iron intake.

Iron is one of the important minerals that the human body needs to form the heme component of hemoglobin, the blood component that carries oxygen from the lungs to all parts of the body and carries carbon dioxide back from the body's tissues to the lungs. Iron is also part of myoglobin, which helps muscles store oxygen, certain enzymes, and other body tissues. Iron is stored in the liver in the form of ferritin, in body tissues in the form of hemosiderin, and in the blood in the form of transferrin[23].

Inadequate iron intake in this study may be due to the less varied diet of pregnant women, especially iron-rich foods. Based on the interviews, it is known that pregnant women prefer vegetable side dishes that are always available and can be purchased at affordable prices. In addition, they often consume sweet tea twice a day which can inhibit iron

absorption. Although tea has many health benefits, it turns out that tea is also known to inhibit the absorption of non-heme iron. In addition, in tea there are compounds called tannins. These tannins can bind some metals such as iron, calcium and aluminum, then form chemically complex bonds. As a result, because they are in a continuously bound position, the iron and calcium compounds found in food are difficult to absorb by the body, causing a decrease in iron (Fe). Pregnant women who have the habit of drinking tea have a 2.785 times greater risk of anemia compared to pregnant women who never drink tea[23].

CONCLUSIONS

The prevalence of anemia in pregnant women in malaria endemic areas, Pesawaran district is still high. Nutrient intake (energy, protein, iron) and social determinants (education, knowledge, family income, maternal age, and parity) contribute to the incidence of anemia in pregnant women. The factors that most contribute to the incidence of anemia in pregnant women in malaria endemic areas of Pesawaran district are education, family income, parity and iron intake. The behavior of eating low-quality protein and drinking tea when eating should be corrected so that anemia in pregnancy can be prevented and managed as well as possible.

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