



# Iron intake, dental and gum disease as risk factors of anemia in pregnancy in Bajuin sub-district

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## Abstract

The high incidence of anemia in pregnancy in Bajuin sub-district in 2019 (50,87%) and 2020 (17,25%) and the coverage of first visit antenatal care that does not fulfill the minimum service standards (75%) are one of the problems in the public health center in Bajuin sub-district. The prevalence of anemia in pregnancy affected by several factors, such as iron intake, dental and gum disease (dental caries, gingivitis, periodontitis), and maternal knowledge about iron intake. This study aims to analyze iron intake, dental caries, gingivitis, periodontitis, and knowledge of iron intake as risk factors of anemia pregnancy in Bajuin sub-district Tanah Laut District. This study used an analytical observational method with a cross-sectional design. The research subjects consisted of 42 pregnant women in the working area of the Tirta Jaya Public Health Center and Tanjung Habulu Public Health Center, Bajuin sub-district. Data analysis was performed by descriptive analysis, statistical analysis  $\chi^2$  test, and multinomial logistic regression analysis.  $\chi^2$  test analysis showed the  $p$  - value of the variable iron intake ( $p$  value = 0.000), dental caries ( $p$  value = 0.488), gingivitis ( $p$  value = 1,000), periodontitis ( $p$  = 0.045), and knowledge of iron intake ( $p$  value = 0.035). The analysis results using multiple logistic regression showed the  $p$  - value and Exp B of the variables of iron intake ( $p$  value = 0.001; Exp.B = 42,42). Iron intake, periodontitis, and knowledge of iron intake are related with anemia pregnancy in Bajuin sub-district, Tanah Laut District. Dental caries and gingivitis are not a risk factor of anemia pregnancy in Bajuin sub-district, Tanah Laut District. The most influential risk factor of anemia pregnancy is iron intake. Dental caries, gingivitis, periodontitis, and knowledge of iron intake as confounding factors of anemia pregnancy.

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## I. INTRODUCTION

Anemia is a global public health problem that can occur to all people [1]. The prevalence of anemia is prone to occur in pregnant women where the hemoglobin (Hb) concentration of pregnant women is less than 11 grams per deciliter (g/dl), which can decrease red blood cells' capacity to carry oxygen tissues [1, 2]. In Indonesia, the proportion of anemia pregnancy according to 2013 and 2018 Riskesdas tends to increase (37,1 in 2013 and 48,9 in 2018) [3]. The propor-

tion of anemia pregnancy in Bajuin Sub-district in 2019 and 2020 is 50,87 and 17,25. The standard of health services for pregnant women has not been achieved at the first visit (K1) to health facilities. It is still possible that the incidence of anemia has not been detected in pregnant women.

Management of anemia pregnancy in Indonesia is done by giving iron supplements as many as 90 tablets consumed one tablet per day during pregnancy. Prevention of anemia from an early age is also carried out by giving iron supple-

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ments to adolescents and women of childbearing age who are taken one tablet per week for one year and one tablet per day during menstruation. The provision of additional food in biscuits to pregnant women is also carried out to prevent chronic energy deficiency [4, 5].

Anemia's risk factors, including inadequate of iron intake, low maternal education, maternal age, and other infectious diseases. Inadequate iron intake influence maternal iron metabolism and cause anemia pregnancy. Iron intake is necessary for fetal growth and tissue expansion, including red blood cell mass, placental iron content and preventing blood loss during parturition [6, 7]. Iron intake is obtained from food sources of iron and vitamins such as iron supplements [8, 9, 10]. If people have a higher level of education, it is easier to receive knowledge. With more knowledge, they can prevent anemia pregnancy, fulfill pregnant women's nutrition, and utilize existing health services [11, 12, 13, 14]. Anemia in pregnancy can also caused by oral infections, such as dental caries, gingivitis and periodontitis. Dental caries is a local infectious disease caused by specific bacteria in the oral cavity, such as *Streptococcus mutans* which can cause a decrease in serum ferritin and can trigger anemia [15]. Periodontal disease is a group of inflammatory diseases, usually caused by periodontal pathogens such as *Porphyromonas gingivalis*, *Prevotella nigrescens*, *Prevotella intermedia*, and *Campylobacter rectus*. Periodontal pathogens develop from reversible plaque accumulation and inflammation of the gingival tissue (gingivitis) [16, 17, 18, 19] to irreversible destruction of the supporting tissues of the teeth (periodontitis) [20, 21]. *Porphyromonas gingivalis* has very high infectivity, allowing the degradation of transferrin which can cause inhibition of iron metabolism. It can disturb the production of Hemoglobin and ultimately leads to iron deficiency anemia [22, 23]. The incidence of anemia pregnancy in Bajuin sub-district is high, and there is no research on the risk factors for anemia pregnancy in Bajuin sub-district. In order to avoid anemia pregnancy from an early age, this study sought to understand the risk factors associated with the prevalence of anemia in pregnant women as well as the association between dental and gum illnesses (dental caries, gingivitis, and periodontitis) and the prevalence of anemia.

## II. METHODS

This study is a cross-sectional investigation carried out between November 2021 to January 2022 at Tirta Jaya Health Center and Tanjung Habulu Health Center, located in Bajuin sub-district, Tanah Laut District, South Kalimantan Province. The sample size was calculated based on the prevalence proportion formula with a 95% confidence level.

The prevalence is 90%, which is the proportion of caries incidence in pregnant women in Bajuin sub-district. With a significance level of 5% and a correction factor of 20%, the number of samples obtained was 42 pregnant women. Through direct interviews and oral examinations, respondents were pregnant women doing Ante Natal Care (ANC) in Tanjung Habulu Health Center and Tirta Jaya Health Center. This study did not include pregnant women who had gestational diabetes and were uncooperative with oral examinations. This research has been approved by the Health Research Ethics Commission, Medical Faculty, Lambung Mangkurat University (Surat laik etik No.097/KEPK-FKUNLAM/EC/XII/2021).

Sampling was carried out by direct interviews (Food Frequency Questionnaires and questionnaires), dental and oral examinations to determine the DMFT index, Gingival Index, and Periodontal index, and direct examination of hemoglobin levels with blood samples at the fingertips of fingertips pregnant women using a haemometer. The questionnaires that we made ourselves were in Indonesian. The questionnaire consists of 10 questions about the meaning of iron, the role of iron during pregnancy, the state of iron deficiency, the impact of iron deficiency during pregnancy for pregnant women, the impact of iron deficiency on the fetus, symptoms of iron deficiency, iron source food, meaning and function of blood supplement tablets. The questionnaire has been validated against 37 respondents with valid results (Pearson product-moment test, = 5%,  $R < 0.325$ ) and reliable (Cronbach's alpha  $> 0.6$ ).

Statistical analysis using  $\chi^2$  test and Fisher's exact test to analyze the relationship of risk factors (iron intake, dental caries, gingivitis, periodontitis, and knowledge of iron intake) with the prevalence of anemia pregnancy in Bajuin sub-district. Multiple logistic regression analysis was used to determine the risk factors most closely related to the prevalence of anemia in pregnancy.

## III. RESULTS

Table 1 shows that most pregnant women are aged 20-29 (52.4%) with an elementary level of education (40.5%). The occupation of pregnant women is housewives (83.3%). As many as 45% of pregnant women consume iron tablets irregularly. Pregnant women who experience anemia incidence as much as 50%. Pregnant women who do not get sufficient iron intake as much as 38.1%. Most pregnant women have dental caries (95.2%) and gingivitis (92.9%). Only 19% of pregnant women have periodontitis. Pregnant women who have low knowledge about iron intake are 73.8%.

TABLE 1  
SOCIODEMOGRAPHIC AND CLINICAL  
CHARACTERISTICS OF RESPONDENTS

Characteristic	n	%
Age (years old)		
11-19	6	14.3
20-29	22	52.4
30-39	14	33.3
Education		
Elementary school	17	40.5
Junior high school	11	26.2
High school	10	23.8
Diploma III	2	4.8
Bachelor degrees	1	2.4
Occupation		
Housewives	35	83.3
Government employees	3	7.2
Entrepreneur	4	9.5
Iron supplement consumption		
Regularly	23	55
Irregularly	19	45
Oral hygiene level		
Good	4	9
Fair	26	62
Poor	12	29
Incidence of anemia pregnancy	21	50
Iron intake		
Adequate	16	38.1
Inadequate	26	61.9
Dental caries	40	95.2
Gingivitis	39	92.9
Periodontitis	8	19
Knowledge of iron intake		
Sufficient	31	73.8
Insufficient	11	26.2

Table 2 shows a relationship between iron intake and the prevalence of anemia in pregnancy ( $p = 0.00$ ), with the percentage of pregnant women experiencing anemia with insufficient iron intake at 93.8%. The lower iron intake in pregnancy, the chance of 15 times increases in anemia of pregnant women ( $PR = 15.00$ ).

According to this study, pregnant women with periodontitis are more likely to get anemia ( $p = 0.04$ ), which was indicated by the percentage of pregnant women experiencing anemia and suffering from periodontitis of 87.5%. Periodontitis

will increase the risk of anemia in pregnant women seven times ( $PR = 7.00$ ). This study also showed knowledge about iron intake as risk factor of anemia pregnancy ( $p = 0.03$ ). The percentage of pregnant women experiencing anemia has insufficient iron intake knowledge at 61.3%. Lacking knowledge about iron intake in pregnancy will raise opportunity anemia pregnancy by 1.5 times ( $PR = 1.58$ ). The two variables of dental caries and gingivitis did not correlate with anemia pregnancy ( $p = 0.45$  and  $p = 1.00$ ).

TABLE 2  
RISK FACTORS OF ANEMIA PREGNANCY

Variables	Prevalence of Anemia Pregnancy						P-value	PR
	Anemia		No Anemia		Jumlah			
	n	%	n	%	n	%		
Iron intake								
Inadequate	15	93,8	1	6,2	16	100	0,00* <sup>^</sup>	15,00
Adequate	6	23,1	20	76,9	26	100		
Dental caries								
Dental caries	21	52,5	19	47,5	40	100	0,49+	-
No Dental caries	0	0	2	100	2	100		
Gingivitis								
Gingivitis	20	51,3	19	48,7	39	100	1,00+	-
No Gingivitis	1	33,3	2	66,7	3	100		
Periodontitis								
Periodontitis	7	87,5	1	12,5	8	100	0,04+ <sup>^</sup>	7,00
No Periodontitis	14	41,2	20	58,8	34	100		
Knowledge of iron intake								
Insufficient	19	61,3	12	38,7	31	100	0,03* <sup>^</sup>	1,58
Sufficient	2	18,2	9	81,8	11	100		

Table 3 shows that iron intake is the most influential risk factor of anemia pregnancy ( $p = 0.002$ ). The strength of the relationship is indicated by the Exponent Beta (Exp B) value of the iron intake of 42.42. The B value is positive for iron intake, which suggests that adequate iron intake in pregnant women is most responsible causing anemia preg-

nancy. Pregnant women with inadequate iron intake will raise opportunity of anemia pregnancy 42.42 times. Table 4 shows that dental caries, gingivitis, periodontitis, and knowledge of iron intake are confounding factors in the prevalence of anemia pregnancy.

TABLE 3  
IRON INTAKE AS A MOST INFLUENTIAL RISK FACTOR FOR THE PREVALENCE OF ANEMIA PREGNANCY

No	Risk Factor	B	Sig.	Exp. B	95% C.I	
					Lower	Upper
1	Iron intake	3,748	0,002	42,421	4,157	432,862
2	Dental caries	19,398	0,999	265639279,546	0,000	
3	Gingivitis	0,743	0,697	2.103	0,050	88.905
4	Periodontitis	2,071	0,124	7,931	0,567	110,891
5	Knowledge of iron intake	0,742	0,505	20,99	0,237	18,588

TABLE 4  
CONFOUNDING FACTORS ON THE INCIDENCE OF ANEMIA IN PREGNANT WOMAN

Risk Factor	Crude PR	Stratum 1 PR	Stratum 2 PR	Change PR (%)	Confounding
Dental caries	265639279,546	306971,145	265639,189	13,46	Yes
Gingivitis	2,103	2,103	1,760	16,31	Yes
Periodontitis	7,931	7,711	8,675	12,50	Yes
Knowledge of iron intake	2,099	1,477	2,252	52,47	Yes

#### IV. DISCUSSION

The incidence of anemia is generally preventable and can be treated early. Prevention of the incidence of anemia re-

quires early identification and reduction of risk factors so that appropriate supplementation can prevent complications of the disease and improve the prognosis of treatment,

including the potential for total recovery [1, 2, 24]. The risk factors studied were iron intake, dental and oral infections, and knowledge about iron intake.

This study shows that inadequate iron intake in pregnancy is a risk for anemia. Inadequate iron intake can increase the prevalence of anemia in pregnancy by 42 times. Insufficient iron intake in pregnant women supported by irregular consumption of iron tablets causes a high prevalence of anemia pregnancy. Based on the characteristics of the respondents according to the consumption of iron supplements in this study, 45% of pregnant women consume iron tablets irregularly. In comparison, 55% of pregnant women consume iron supplements regularly. Consumption of iron supplements regularly can reduce the risk of anemia in pregnant women [25]. Iron binds to immature red blood cells, which will assimilate into heme which then binds to globin, and some globin binds to hemoglobin. Hemoglobin is an oxygen binder found in erythrocytes that transport oxygen from the lungs to the tissues [26, 27].

Dental caries is a common chronic infection caused by specific *Streptococcus mutans* bacteria that adhere to teeth by metabolizing sugars to produce acids, which lead to demineralization of tooth structure [28, 29, 30, 31]. The results of this study stated that dental caries is not a risk factor of prevalence of anemia pregnancy. Pregnant women who have adequate iron intake can reduce the incidence of dental caries. Iron is one of the important mineral elements in saliva (saliva). Iron in saliva plays a role in inhibiting the proliferation of mutant *Streptococcus* bacteria by reducing the formation of energy (ATP), thereby reducing its infecting ability [15, 32].

In this study, gingivitis is not a risk factor of prevalence of anemia pregnancy in Bajuin sub-district. The proportion of pregnant women who do not have anemia and have gingivitis is close to the proportion of pregnant women who have anemia and have gingivitis, which means gingivitis can occur in all pregnant women, both those with anemia and those without anemia. These results indicate that gingivitis is not a risk factor for the occurrence of anemia in pregnant women. As many as 62% of pregnant women have a moderate level of oral hygiene, which means that pregnant women can still maintain oral hygiene, thereby reducing bacterial colonies in the oral cavity and reducing the risk of gingivitis infection. Periodontitis can increase the prevalence of anemia pregnancy by seven times. It can say that periodontitis is a risk factor for the incidence of anemia in pregnant women. Periodontal pathogens (particularly *Porphyromonas gingivalis*) can degrade transferrin. Reduced transferrin can inhibit the transport of iron into

cells. As a result, immature red blood cells cannot bind iron. There is no assimilation into heme, so they cannot bind to hemoglobin. Periodontitis can increase serum hepcidin. Hecpidin is a major regulator of iron metabolism in the body, induced by cytokines. The presence of periodontal pathogens will increase proinflammatory cytokines, causing an increase in hepcidin. Increased hepcidin will inhibit iron absorption in the intestine (duodenum). An increase in hepcidin and decrease in transferrin are very implicated in the prevalence of anemia [23].

Knowledge of iron intake is a risk factor for anemia in pregnancy. Insufficient knowledge of pregnant women about iron intake will increase the prevalence of anemia in pregnant women. It can be seen from the education level of pregnant women in Bajuin District, which is dominant at the elementary school level. Knowledge is a predisposing factor of behavioral factors where behavioral factors influence human behavior. The poor level of knowledge will be impacted by the low degree of maternal education. Because mothers with poor levels of education are less likely to take information, there is less awareness about iron [33, 7, 12, 27, 13, 27]. Iron intake plays a direct role in the iron metabolism of pregnant women during pregnancy. Iron intake has a dominant relationship to the prevalence of anemia pregnancy. Dental caries, gingivitis, periodontitis, and knowledge of iron intake have a role that interferes with the prevalence of anemia pregnancy women as confounding factors. Confounding factors can inhibit the absorption of nutrient intake in pregnant women if no control is carried out on these confounding factors. Pregnant women can control dental caries, gingivitis, and periodontitis by checking the condition of their teeth and mouth regularly to prevent these diseases. Knowledge of pregnant women about iron intake can also be increased by providing counseling with illustrated media by midwives and nutrition counseling by nutritionists.

## V. CONCLUSION

Iron intake is the dominant risk factor for anemia in pregnant women. Increasing the diversity of consumption of iron-rich foods during pregnancy can prevent iron deficiency. Dental caries, gingivitis, and periodontitis are dental and oral diseases that can interfere with the absorption of iron intake in the body.

Perform a thorough examination during pregnancy, including ANC and dental and oral examination whenever ANC is needed to prevent anemia in pregnant women. Knowledge about iron intake in pregnant women can be increased by attending regular nutritional counseling. Adolescent girls

and women of childbearing age can prevent anemia early. Respondents of this study were limited to pregnant women in the working area of Tirta Jaya Health Center and Tanjung Habulu Health Center, Bajuin Sub District, Tanah Laut District. Further research on dental and oral care in pregnant women is needed to prevent periodontitis during pregnancy. Educational interventions about iron intake and con-

sumption of foods high in iron that are needed during pregnancy is needed to avoid anemia pregnancy.

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