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THE RELATIONSHIP BETWEEN PROTEIN AND IRON INTAKE AND HEMOGLOBIN LEVELS AMONG PREGNANT WOMEN IN THE WORKING AREA OF TAMALATE PUBLIC HEALTH CENTER

HUBUNGAN ASUPAN PROTEIN, ZAT BESI DENGAN KADAR HEMOGLOBIN PADA IBU HAMIL DI WILAYAH PUSKESMAS TAMALATE

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Abstract

Anemia in pregnant women remains a serious public health problem. The main causes of anemia during pregnancy are generally associated with inadequate nutritional intake, particularly iron, folate, and protein. This study aimed to determine the relationship between protein and iron intake and hemoglobin levels among pregnant women in the working area of Tamalate Public Health Center. This study employed a quantitative observational analytic design with a cross-sectional approach. The study population consisted of all pregnant women who underwent antenatal care examinations in June, totaling 114 pregnant women. The samples were selected using purposive sampling, with a total of 52 respondents determined using the Lemeshow formula, based on the inclusion criteria of pregnant women who underwent antenatal care (ANC) and hemoglobin examinations. Hemoglobin levels were obtained through measurements using the NubioN LifeCheck device, a digital hemoglobin testing device commonly used at the public health center. Data on protein and iron intake were collected through direct interviews using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), which were subsequently converted into nutrient intake values. Data were analyzed using bivariate analysis with the Chi-Square test to determine the relationship between protein intake and iron intake and hemoglobin levels among pregnant women. The results showed a significant relationship between protein intake, iron intake, and hemoglobin levels among pregnant women, with a p-value of <0.000. The odds ratio (OR) analysis showed that pregnant women with inadequate protein intake had 65.625 times higher odds of experiencing anemia (95% CI: 10.915–394.550), while those with inadequate iron intake had 345.57 times higher odds of experiencing anemia (95% CI: 16.93–7,055.47) compared with those with adequate intake.

Keywords : Protein, Zat Besi, Kadar Hemoglobin, Ibu Hamil.

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Abstrak

Anemia pada ibu hamil hingga saat ini masih tetap menjadi masalah kesehatan yang serius, penyebab utama anemia pada ibu hamil umumnya berasal dari kurangnya asupan gizi seperti zat besi, folat dan protein. Penelitian ini bertujuan untuk mengetahui hubungan asupan protein, zat besi dengan kadar hemoglobin pada ibu hamil di wilayah puskesmas Tamalate. Metode yang digunakan adalah kuantitatif desain analitik observasional dengan pendekatan *cross-sectional***.** Total populasi dalam penelitian ini adalah seluruh ibu hamil yang memeriksakan kehamilan bulan juni diperoleh 114 ibu hamil, sampel diambil dengan teknik *purposive sampling* dengan besar sampel sebanyak 52 responden yang ditentukan menggunakan rumus Lemeshow, sesuai dengan kriteria inklusi yaitu ibu hamil yang melakukan pemeriksaan (ANC) dan ibu hamil yang melakukan pemeriksaan kadar hemoglobin. Data kadar hemoglobin ibu hamil diperoleh dari pemeriksaan menggunakan alat Nubion LifeCheck atau alat pemeriksaan Hb digital yang biasa digunakan di puskesmas. Data asupan protein dan zat besi diperoleh dari hasil wawancara secara langsung dengan menggunakan kuesioner sq-ffq yang kemudian dikonversi menjadi zat gizi. Analisis data dilakukan secara bivariat menggunakan uji *Chi-Square* untuk menguji hubungan antara asupan protein dan asupan zat besi dengan kadar hemoglobin pada ibu hamil. Hasil penelitian ini menunjukkan bahwa terdapat hubungan antara asupan protein, zat besi, dengan kadar hemoglobin pada ibu hamil nilai *p-value* <0.000. Hasil uji OR menunjukkan bahwa ibu hamil dengan asupan protein kurang memiliki odds mengalami anemia 65,625 kali (95% CI: 10,915–394,550), sedangkan asupan zat besi kurang memiliki odds mengalami anemia 345,57 kali (95% CI: 16,93–7.055,47) dibanding dengan asupan yang cukup.

Kata Kunci : Protein, Zat Besi, Kadar Hemoglobin, Ibu Hamil.

1. INTRODUCTION

Anemia in pregnant women remains a relatively serious health problem. Various prevention and control programs have been implemented, including iron (Fe) tablet supplementation to improve the adequacy of nutritional intake among pregnant women. Nevertheless, anemia remains common because many cases are caused by inadequate intake of nutrients involved in red blood cell formation, such as iron, vitamin B1, and folate. In addition to nutritional deficiencies, anemia during pregnancy may also be triggered by other conditions, including bleeding, genetic disorders, chronic diseases, drug toxicity, and other health problems.

Pregnant women are considered a high-risk group for anemia because of significant physiological changes during pregnancy, particularly increased nutritional requirements for fetal growth and maternal health (Khoirunisa & Wirjatmadi, 2023). Pregnant women with inadequate nutritional intake and poor dietary patterns are more likely to experience symptoms or health problems such as anemia during the first, second, and third trimesters because their iron requirements are not adequately met.

Anemia during pregnancy remains a serious health problem because it can increase the risk of complications for both the mother and fetus. The main causes of anemia in pregnant women are generally related to inadequate intake of nutrients such as iron, folate, vitamins, and protein, which are required for red blood cell synthesis. Non-nutritional factors, such as infection or chronic health conditions, also contribute to some cases (Doriana & Aritonang, 2024).

Based on data from the 2023 Indonesian Health Survey (SKI), the prevalence of anemia among pregnant women in South Sulawesi Province was 7.7%. Although this figure was lower than the national prevalence of anemia among pregnant women, which was 27.7%, it still indicates a nutritional problem that requires attention. This finding indicates that the problem falls within the category of a serious public health problem. Initial data collected at Tamalate Public Health Center through direct observation showed that, during the previous two months (November–December), the number of

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pregnant women experiencing anemia initially reached 6, then increased to 11, and increased again in January to 18 cases.

Anemia during pregnancy occurs when hemoglobin levels fall below the normal threshold for each trimester; operationally, thresholds of <11.0 g/dL in the first and third trimesters and <10.5 g/dL in the second trimester are commonly used (Yosef et al., 2024). Hemoglobin is the major protein in red blood cells and contains iron (Moustarah F., 2024). Therefore, a decrease in hemoglobin quantity or function due to iron deficiency is directly associated with the occurrence of anemia.

Protein plays an important role in the transportation of iron in the body. Inadequate protein intake can impair the body's ability to transport iron, which is a key component of hemoglobin, through carriers such as transferrin. Consequently, iron may not be optimally available for hemoglobin formation. This condition can increase the risk of iron deficiency, which may subsequently lead to decreased hemoglobin levels and anemia (Awalinda et al., 2025).

Previous studies have largely been conducted in other regions with different characteristics, whereas in Makassar City, particularly at Tamalate Public Health Center, anemia among pregnant women remains a concern and requires more specific scientific evidence regarding the nutritional factors involved. Therefore, a research gap exists in the limited number of studies assessing the relationship between protein and iron intake simultaneously and hemoglobin levels among pregnant women at Tamalate Public Health Center.

This study is important because it can provide a more accurate local description while strengthening the basis for nutritional interventions aimed at reducing anemia among pregnant women. Based on the background described above, the researchers were interested in conducting a study entitled “The Relationship between Protein and Iron Intake and Hemoglobin Levels among Pregnant Women in the Working Area of Tamalate Public Health Center.

2. RESEARCH METHOD

This was a quantitative study using an observational analytic design with a cross-sectional approach, conducted from June 1 to July 1, 2026, in the working area of Tamalate Public Health Center, Makassar City. The study population consisted of 114 pregnant women, with a sample of 52 respondents determined using the Lemeshow formula with a margin of error (d) of 10% and selected through purposive sampling. Protein and iron intake data were collected using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) and categorized as adequate or inadequate based on the 2019 Indonesian Recommended Dietary Allowance (AKG). Hemoglobin levels were measured using the NubioN LifeCheck device, a digital hemoglobin testing device commonly used at public health centers. Hemoglobin examinations were performed by health professionals in the laboratory of Tamalate Public Health Center. Data were analyzed using univariate and bivariate analyses, with the Chi-Square test used to analyze the relationship between protein and iron intake and hemoglobin levels among pregnant women.

3. RESULT AND DISCCUSSION

1. Respondent Characteristics

Table 4.1 Respondent Characteristics

Respondent Characteristics	n	%
Maternal age		
At risk: <20 or >35 years	5	9.6
Not at risk: 20–35 years	47	90.4
Nutritional status		
Normal (MUAC ≥23.5 cm)	35	67.3
Chronic Energy Deficiency (MUAC ≤23.5 cm)	17	32.7
Highest educational level		

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Elementary school	5	9.6
Junior high school	13	25.0
Senior high school	26	50.0
Diploma	2	3.8
Bachelor's degree	6	11.5
Occupation		
Housewife	46	88.5
Civil servant/P3K	3	5.8
Honorary employee	2	1.9
Employee	2	3.8
Gestational age		
First trimester (first 12 weeks)	10	19.2
Second trimester (13–28 weeks	20	38.5
Third trimester (>28 weeks)	22	42.3

Source: Secondary Data, 2026

Based on Table 4.1, most respondents were in the non-risk age group, namely 47 women (90.4%), and most had a non-risk nutritional status for chronic energy deficiency (CED) based on mid-upper arm circumference (MUAC), namely 35 women (67.3%). The respondents' highest educational level was predominantly senior high school, with 26 respondents (50.0%). In terms of occupation, the majority were housewives, totaling 46 respondents (88.5%). Most respondents were in the third trimester, totaling 22 women (42.3%), followed by the second trimester with 20 women (38.5%) and the first trimester with 10 women (19.2%). These findings indicate that most respondents were of reproductive age and were not in the high-risk age group, had relatively good nutritional status based on MUAC, and were predominantly housewives with secondary-level education. The predominance of respondents in the second and third trimesters indicates that most participants were at stages of pregnancy when nutritional requirements increase along with fetal growth and development; therefore, adequate nutritional intake during pregnancy is important.

2. Distribution of Protein and Iron Intake

Table 4.2 Distribution of Protein and Iron Intake

Maternal Intake	n	%
Protein intake		
Adequate	25	48.1
Inadequate	27	51.9
Iron intake		
Adequate	20	38.5
Inadequate	32	61.5

Source: Primary Data, 2026

The results showed that 27 pregnant women (51.9%) had inadequate protein intake, while 25 (48.1%) had adequate protein intake. This finding indicates that more than half of the respondents had not met their protein requirements according to the criteria used in this study. This condition requires attention because protein is an essential nutrient during pregnancy and plays various roles, particularly in iron transport required for globin synthesis. The results also showed that most respondents had inadequate iron intake, namely 32 women (61.5%), while 20 women (38.5%) had adequate iron intake. This finding indicates that most pregnant women in the study had not met their iron requirements according to the categories used. This is important because iron requirements increase during pregnancy and iron is required for hemoglobin formation.

3. Responden Distribution of Hemoglobin Levels

Tabel 4.3 Distribution of Respondents' Hemoglobin Levels

Hemoglobin level	n	%

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Normal	23	44.2
Anemia	29	55.8
Total	52	100

Source: Primary Data, 2026

The results showed that 29 pregnant women (55.8%) were categorized as anemic, while 23 (44.2%) had normal hemoglobin levels. This finding indicates that the proportion of pregnant women with anemia was greater than that of pregnant women with normal hemoglobin levels. This condition illustrates that anemia remains a problem requiring attention among pregnant women in the working area of Tamalate Public Health Center; therefore, hemoglobin monitoring during pregnancy and adequate nutritional intake require attention.

4. Relationship between Protein Intake and Hemoglobin Levels

Tabel 4.4 Relationship between Protein Intake and Hemoglobin Levels

Protein intake	Hemoglobin Level (g/dL)				Total		OR (95% CI)	*p-value*
	Normal		Anemia		n	%		
	n	%	n	%				
Inadequate	2	3.8	25	48.1	27	51.9	65.625 (10.915-394.550)	<0.000
Adequate	21	40.4	4	7.7	25	48.1		
Total	23	44.2	29	55.8	52	100		

Source: Primary Data, 2026

The Chi-Square test showed a significant relationship between protein intake and hemoglobin levels among pregnant women ($p < 0.000$). The Odds Ratio (OR) analysis yielded an OR of 65.625 (95% CI: 10.915–394.550), indicating that pregnant women with inadequate protein intake had 65.625 times higher odds of experiencing anemia than those with adequate protein intake. This finding indicates differences in protein intake between pregnant women with normal hemoglobin levels and those with anemia. Therefore, adequate protein intake is an important condition to consider in relation to hemoglobin levels among pregnant women in the working area of Tamalate Public Health Center.

5. Relationship between Iron Intake and Hemoglobin Levels

Tabel 4.5 Relationship between Iron Intake and Hemoglobin Levels

Iron intake	Hemoglobin Level (g/dL)				Total		OR (95% CI)	*p-value*
	Normal		Anemia		n	%		
	n	%	n	%				
Inadequate	3	5.8	29	55.8	32	61.5	345.57 (16.93-7.055,47)	<0.000
Adequate	20	38.5	0	0.0	20	38.5		
Total	23	44.2	29	55.8	52	100		

Source: Primary Data, 2026

The Chi-Square test showed a significant relationship between iron intake and hemoglobin levels among pregnant women ($p < 0.000$). Because the contingency table contained a cell with a value of zero, the Odds Ratio estimation was performed using the Haldane–Anscombe correction by adding 0.5 to each cell before calculating the OR and 95% confidence interval. The resulting OR was 345.57 (95% CI: 16.93–7,055.47), indicating that pregnant women with inadequate iron intake had 345.57 times higher odds of experiencing anemia than those with adequate iron intake. This finding indicates that pregnant women with inadequate iron intake were more frequently categorized as anemic, whereas all pregnant women with adequate iron intake had normal hemoglobin levels.

DISCUSSION

1. Respondent Characteristics

Most respondents in this study were in the non-risk age group. This is a relatively favorable finding because pregnancy during a biologically mature reproductive age is generally associated with greater physiological readiness than pregnancy at an excessively young or advanced age. However, pregnant women in the risk age group still require attention because age is one characteristic that may be associated with pregnancy conditions and anemia. Indrifah et al. (2024) showed that anemia can

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occur across different age groups, indicating that anemia is not limited to women in risk age groups. Thus, although most respondents in this study were in the non-risk age group, other factors such as nutritional adequacy, pregnancy conditions, and adherence to health services should also be considered in maintaining maternal hemoglobin levels.

Most respondents were categorized as not at risk for CED based on MUAC measurement, although some respondents were still categorized as being at risk. This indicates that, overall, the respondents' nutritional status based on MUAC was relatively good, but nutritional problems were still present among some pregnant women. MUAC is used as a simple indicator for initial screening of CED risk among pregnant women. Research by Rihadah et al. on pregnant women in the working area of Mamboro Public Health Center in 2024 showed that MUAC can be used as an indicator for nutritional status screening and found a significant relationship between MUAC and hemoglobin levels among pregnant women. These findings indicate that nutritional status monitoring through MUAC remains important during pregnancy because maternal nutritional status is related to meeting nutritional requirements needed to maintain maternal health and support fetal development.

The predominance of respondents with senior high school education indicates that most pregnant women in this study had a secondary educational background. Education may influence an individual's ability to receive, understand, and apply health information, including information regarding nutritional requirements during pregnancy. Bachtiar et al. (2023) explained that education is one external factor that may influence pregnant women's ability to receive and process health information during pregnancy, and their study was conducted among pregnant women at Pampang Public Health Center, Makassar City. Therefore, the educational background of respondents in this study may provide context for understanding health behavior and fulfillment of nutritional requirements during pregnancy, although education cannot be used as a basis for concluding that higher education necessarily results in better nutritional intake.

Most respondents were in the second and third trimesters. This condition is important because physiological requirements increase throughout pregnancy as gestational age advances. This increase is particularly related to fetal growth and changes in maternal blood volume; therefore, nutritional requirements to support hemoglobin formation should also be considered. Qomarasari and Pratiwi (2023) showed that gestational age was one of the characteristics examined among pregnant women with anemia, although their study did not find a significant relationship between gestational age and anemia. This indicates that trimester should be considered as part of the maternal condition, but it cannot directly be used to conclude that a particular trimester causes anemia.

The high proportion of housewives in this study indicates that most respondents did not have formal employment outside the home. Occupational status among pregnant women should be viewed as part of their social circumstances because employment may be related to daily activities, family economic conditions, and the family's ability to meet food needs. However, occupation does not necessarily determine anemia or maternal nutritional status. Indrifah et al. (2024) found that occupation was not significantly associated with anemia among pregnant women. Therefore, the predominance of housewives in this study is more appropriately viewed as a description of the respondents' social conditions, while protein and iron intake are influenced by various other circumstances, including family economic capacity, food availability, and eating habits.

2. Relationship between Protein Intake and Hemoglobin Levels

Based on Table 4.4, the results of the bivariate analysis using the Chi-Square test yielded $p < 0.0000$ ($p < 0.05$), indicating a significant relationship between protein intake and hemoglobin levels among pregnant women in the working area of Tamalate Public Health Center. The cross-tabulation showed that pregnant women with inadequate protein intake were more likely to experience anemia than those with adequate protein intake. These findings indicate that adequate protein intake plays an important role in maintaining hemoglobin levels during pregnancy. This result is consistent with the study by Khoirunisa and Wirjatmadi (2023), which found a relationship between protein consumption levels and anemia among pregnant women. Pregnant women whose protein consumption did not meet

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the Recommended Dietary Allowance (AKG) had a higher risk of anemia than those with adequate protein consumption. This condition indicates that adequate protein intake is an important factor in maintaining hemoglobin levels during pregnancy (Khoirunisa & Wirjatmadi, 2023).

3. Relationship between Iron Intake and Hemoglobin Levels

Based on Table 4.5, the results of the bivariate analysis using the Chi-Square test yielded $p < 0.000$ ($p < 0.05$), indicating a significant relationship between iron intake status and hemoglobin levels among pregnant women in the working area of Tamalate Public Health Center. The cross-tabulation showed that pregnant women with inadequate iron intake were more likely to experience anemia than those with adequate iron intake. These results indicate that adequate iron intake plays an important role in maintaining hemoglobin levels during pregnancy. This finding is consistent with the study by Finasari et al. (2023), which found a significant relationship between iron intake and hemoglobin levels among pregnant women in the working area of Bumiratu Public Health Center, with $p = 0.019$. The study explained that pregnant women with inadequate iron intake tended to have lower hemoglobin levels than those with adequate iron intake. This indicates that meeting iron requirements during pregnancy is essential for preventing anemia (Ratna Dewi Finasari et al., 2023).

4. CONCLUSION

There was a significant relationship between protein and iron intake and hemoglobin levels among pregnant women in the working area of Tamalate Public Health Center. The cross-tabulation showed that pregnant women with inadequate protein and iron intake were more likely to experience anemia than those with adequate intake. The results indicate that adequate protein and iron intake are associated with hemoglobin levels among pregnant women.

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