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Factors Associated With Anemia Incidence Among Pregnant Women At Kapau Public Health Center, Agam Regency

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Abstract

This study aimed to analyze the factors associated with anemia among pregnant women in the working area of Kapau Public Health Center, Agam Regency, Indonesia, in 2022. The study employed a quantitative analytical design with a cross-sectional approach. A total of 126 third-trimester pregnant women were selected using simple random sampling from the population of pregnant women attending antenatal care services. Data were collected through structured questionnaires assessing knowledge, educational level, family income, and adherence to iron (Fe) tablet consumption, while anemia status was determined based on hemoglobin levels recorded in maternal health books. Data were analyzed using the Chi-square test with a 95% confidence level ($\alpha = 0.05$). The findings revealed significant associations between maternal knowledge and anemia incidence ($p < 0.05$), as well as between adherence to Fe tablet consumption and anemia incidence ($p < 0.05$). In contrast, educational level and family income were not significantly associated with anemia among pregnant women ($p > 0.05$). These results indicate that behavioral factors, particularly knowledge and compliance with iron supplementation, play a more important role in preventing anemia than sociodemographic factors. In conclusion, improving maternal knowledge and strengthening adherence to iron tablet consumption are essential strategies to reduce anemia among pregnant women. Health promotion and continuous monitoring by healthcare providers are recommended to improve maternal health outcomes.

Keywords: Anemia, Pregnant Women, Knowledge, Iron Supplementation, Compliance.

INTRODUCTION

Anemia remains one of the most persistent public health challenges globally, particularly in developing nations like Indonesia. Characterized by a decrease in hemoglobin (Hb) concentration below 11.0 g/dL during pregnancy, anemia poses severe risks including postpartum hemorrhage, low birth weight (LBW), and increased risk of maternal mortality. According to the 2018 Basic Health Research (Riskesdas) data, the prevalence of anemia among pregnant women in Indonesia stood at 48.9%, a figure that signifies a "severe" public health problem based on WHO criteria.

Anemia during pregnancy remains one of the major public health problems worldwide and contributes significantly to maternal and fetal morbidity and mortality. Maternal mortality is widely used as an indicator of the quality of healthcare services in a country. In Indonesia, maternal mortality rates remain relatively high, with hemorrhage and hypertension during pregnancy identified as leading causes of maternal death. Anemia is considered one of the important contributing factors because it increases the risk of bleeding, infection, and complications during pregnancy and childbirth (Ministry of Health of the Republic of Indonesia, 2020).

Pregnant women are highly vulnerable to anemia because pregnancy increases the body's demand for iron to support fetal growth and the expansion of maternal blood volume. The World Health Organization defines anemia in pregnancy as a condition in which hemoglobin levels fall below normal levels, resulting in reduced oxygen transportation throughout the body. Iron deficiency is recognized as the most common cause of anemia among pregnant women, particularly in developing countries where nutritional intake remains inadequate (World Health Organization, 2019).

Anemia during pregnancy may lead to various adverse consequences for both mother and fetus. Maternal complications include postpartum hemorrhage, prolonged labor, infection, and decreased physical endurance during childbirth. Meanwhile, fetal complications may include low birth weight, premature birth, intrauterine growth restriction, and increased perinatal mortality. These conditions indicate that anemia remains an important maternal health issue requiring immediate attention and

preventive interventions (Prawirohardjo, 2016).

Several factors are associated with the occurrence of anemia among pregnant women, including educational level, maternal knowledge, family income, and adherence to iron (Fe) tablet consumption. Previous studies revealed that pregnant women with limited knowledge regarding anemia prevention and low compliance with iron supplementation tend to have a higher risk of developing anemia. In addition, socioeconomic conditions may influence the ability of families to provide adequate nutritional intake during pregnancy (Kartika et al., 2018; Darmawati, 2018).

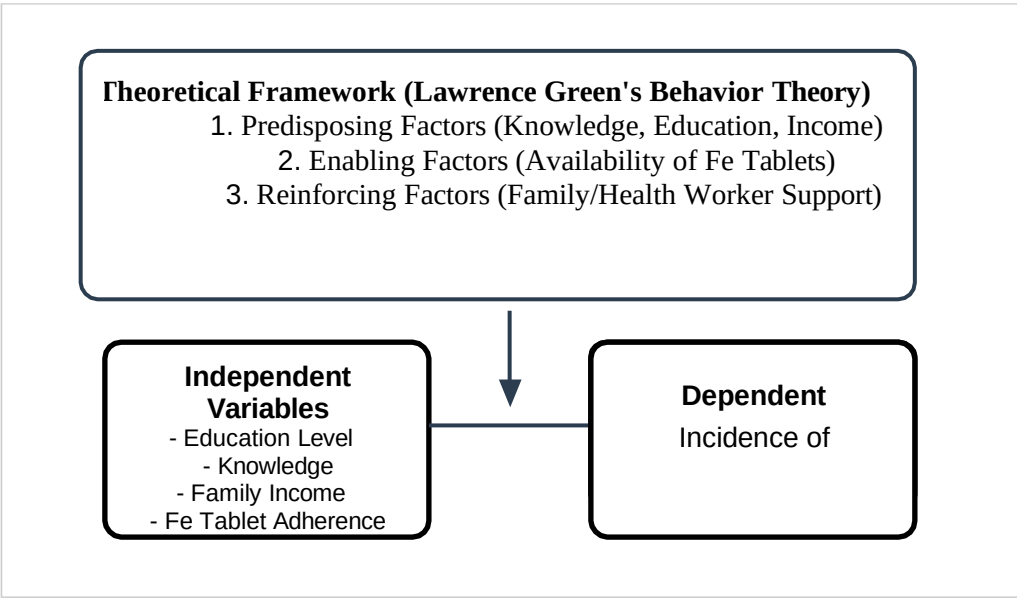
Although the Indonesian government has implemented iron supplementation programs for pregnant women, anemia prevalence remains high in several regions. Data from the Kapau Public Health Center indicated that cases of anemia among pregnant women fluctuated but remained relatively high between 2019 and 2021. Moreover, no previous study had specifically investigated the determinants of anemia among pregnant women in the Kapau Health Center working area. This condition demonstrates the existence of a research gap regarding factors influencing anemia among pregnant women in this region (Kapau Public Health Center Report, 2021).

Therefore, this study aimed to analyze the factors associated with anemia among pregnant women in the working area of Kapau Public Health Center, Agam Regency, in 2022. Specifically, this study examined the relationship between educational level, maternal knowledge, family income, and adherence to iron tablet consumption with the incidence of anemia among pregnant women.

THEORETICAL AND CONCEPTUAL FRAMEWORK

This research is grounded in Lawrence Green's Precede-Proceed model, which posits that health behavior is influenced by predisposing, enabling, and reinforcing factors. In the context of this study, predisposing factors include the knowledge, education, and economic status of the pregnant women. The conceptual framework bridges these theoretical constructs to measurable variables.

Figure 1. Theoretical and Conceptual Framework



Source: Analysis of Lawrence Green (1980)

RESEARCH METHODS

This study employed a quantitative analytical research design using a cross-sectional approach. The cross-sectional design was selected because it allows the researcher to examine the relationship between independent variables and the incidence of anemia simultaneously within a specific period. The study was conducted in the working area of Kapau Public Health Center, Agam Regency, West Sumatra, Indonesia, from December 2022 to January 2023.

The target population consisted of all pregnant women registered in the Kapau Public Health Center service area, totaling 216 individuals distributed across 21 villages. The study sample included third-trimester pregnant women who met the inclusion criteria, such as willingness to participate, possession of a maternal and child health handbook, and availability during data collection. Pregnant women with a history of blood disorders and those in the first or second trimester were excluded. Sample size determination was calculated using the Slovin formula with a 5% margin of error, resulting in 116 respondents, and an additional 10% was added to minimize drop-out risk, producing a final sample of 126 participants. A simple random sampling technique was applied to ensure equal selection opportunities for all eligible respondents.

Data were collected using structured questionnaires and observational methods. The questionnaire was designed to measure several variables, including maternal educational level, knowledge regarding anemia during pregnancy, family income, and adherence to iron (Fe) tablet consumption. Meanwhile, anemia status was identified through hemoglobin records documented in the maternal health handbook. The questionnaire items covered topics such as the definition, symptoms, prevention, risk factors, and impacts of anemia during pregnancy, as well as knowledge related to iron supplementation.

Before the main data collection process, the research instrument underwent validity and reliability testing. The validity test was conducted among pregnant women in another health center area with similar demographic characteristics. Most questionnaire items demonstrated acceptable validity scores, while one invalid item was removed from the final instrument. Reliability analysis using Cronbach's Alpha produced a coefficient above the acceptable threshold, indicating that the questionnaire had strong internal consistency and was suitable for research use.

Data analysis was carried out using statistical software. Univariate analysis was performed to describe the frequency distribution of each variable, including anemia prevalence and respondent characteristics. Furthermore, bivariate analysis using the Chi-square test was applied to examine the association between independent variables and anemia incidence among pregnant women. Statistical significance was determined at a confidence level of 95% with a p-value threshold of less than 0.05.

RESULTS AND DISCUSSION

Respondent Characteristics

A total of 126 pregnant women participated in this study. Most respondents had a low educational background (69.8%), while only 30.2% had higher education. In terms of knowledge, 77.8% of respondents demonstrated good knowledge regarding anemia during pregnancy, whereas 22.2% had poor knowledge. Family income distribution showed that 55.6% of respondents belonged to the low-income category, while 44.4% had higher family income. Furthermore, the majority of respondents (76.2%) were compliant with iron (Fe) tablet consumption during pregnancy, while 23.8% were categorized as non-compliant.

The prevalence of anemia among pregnant women in this study was 20.6%, indicating that anemia remains a significant maternal health concern in the Kapau Public Health Center area. This finding demonstrates the importance of strengthening preventive strategies focused on maternal nutrition and behavioral health interventions.

Relationship Between Educational Level and Anemia Incidence

Table 1. Association Between Educational Level and Anemia

Educational Level	Anemia n (%)	Non-Anemia n (%)	Total	p-value	OR
Low	19 (21.6%)	69 (78.4%)	88	0.687	1.22
High	7 (18.4%)	31 (81.6%)	38		
Total	**26 (20.6%)**	**100 (79.4%)**	**126**		

Source: Primary data analysis

The Chi-square analysis showed no significant relationship between educational level and anemia incidence among pregnant women (p = 0.687). This result suggests that formal education alone does not directly determine maternal anemia status. Pregnant women with lower educational backgrounds may still obtain health information from healthcare workers, social interactions, or community health programs.

This finding is consistent with previous studies conducted by Apriliani et al. (2020), which also reported no association between educational attainment and anemia incidence among pregnant women. Theoretically, education may improve cognitive ability and access to information; however, health behavior is more strongly influenced by practical knowledge, awareness, and behavioral adaptation. Therefore, public health interventions should prioritize health literacy and community education rather than relying solely on formal educational status. From a health development perspective, this finding emphasizes the importance of equitable health promotion programs that reach all pregnant women regardless of educational background. Community-based maternal health education can play a critical role in reducing maternal health disparities.

Educational attainment is commonly associated with an individual's ability to understand health-related information and make informed decisions regarding disease prevention. However, the absence of a significant relationship in this study indicates that formal education may not always reflect practical health awareness among pregnant women. In rural and semi-urban communities, information related to maternal health is often obtained through community health centers, midwives, family support, and public health campaigns rather than through formal academic institutions. As a result, women with limited formal education may still develop adequate preventive behaviors when exposed to effective health education programs (Notoatmodjo, 2018). Another possible explanation is the strong influence of cultural and environmental factors on maternal health practices. In many communities, pregnant women follow recommendations provided by healthcare workers or experienced family members regardless of their educational background. This condition suggests that social support systems and access to healthcare services may reduce the gap between women with high and low educational levels. Therefore, educational status alone cannot fully predict anemia risk without considering behavioral and environmental determinants (Apriliani et al., 2020).

From a policy perspective, these findings emphasize the importance of strengthening inclusive maternal health programs that are understandable and accessible to all population groups. Public health communication strategies should use simple language, visual educational media, and culturally sensitive approaches to ensure that information reaches women from various educational backgrounds. Such interventions are important to support equitable health development and improve maternal health outcomes at the community level (Ministry of Health of the Republic of Indonesia, 2020).

Relationship Between Maternal Knowledge and Anemia Incidence

Table 2. Association Between Maternal Knowledge and Anemia

Knowledge Level	Anemia n (%)	Non-Anemia n (%)	Total	p-value	OR
Poor	21 (75.0%)	7 (25.0%)	28	0.000	55.8
Good	5 (5.1%)	93 (94.9%)	98		
Total	**26 (20.6%)**	**100 (79.4%)**	**126**		

Source: Primary data analysis

The analysis revealed a statistically significant relationship between maternal knowledge and anemia incidence (p = 0.000). Pregnant women with poor knowledge were substantially more likely to experience anemia compared to those with adequate knowledge.

This result supports Lawrence Green's behavioral theory, which states that knowledge functions as a predisposing factor influencing individual health behavior. Women with better understanding of anemia prevention are more likely to consume nutritious foods, recognize anemia symptoms, and adhere to antenatal care recommendations.

The findings are also in line with research conducted by Kusumasari et al. (2021), which demonstrated that maternal knowledge significantly influences anemia prevention behavior during pregnancy. Inadequate health literacy may expose pregnant women to misinformation, unhealthy dietary restrictions, and poor nutritional practices. The contribution of this finding to health development is highly significant because it highlights the role of health education as a sustainable strategy for maternal health improvement. Increasing maternal knowledge through counseling, antenatal education, and community outreach programs may help reduce anemia prevalence and improve maternal and fetal outcomes. Maternal knowledge plays a critical role in shaping preventive health behavior during pregnancy. Women who understand the causes, symptoms, and complications of anemia are more likely to adopt healthy dietary practices, consume iron-rich foods, and comply with antenatal care recommendations. Adequate knowledge also improves awareness regarding the importance of iron supplementation and routine hemoglobin monitoring during pregnancy. Consequently, informed pregnant women tend to demonstrate better self-care behavior and reduced vulnerability to anemia (Green, 1991).

The findings of this study indicate that poor knowledge substantially increases the likelihood of anemia among pregnant women. This situation may occur because limited understanding often leads to misconceptions regarding nutrition and pregnancy care. Some women may underestimate the importance of iron tablets, avoid nutritious foods due to cultural beliefs, or fail to recognize early symptoms of anemia. Inadequate health literacy may therefore contribute directly to delayed prevention and treatment efforts (Kusumasari et al., 2021).

In the broader context of public health development, improving maternal knowledge can generate long-term positive impacts on maternal and child health indicators. Health education interventions delivered through antenatal counseling, community outreach programs, and maternal classes may strengthen women's capacity to make healthier decisions during pregnancy. Moreover, increasing maternal knowledge not only benefits current pregnancies but may also improve health practices in future pregnancies and family nutrition management (Ministry of Health of the Republic of Indonesia, 2021).

Relationship Between Family Income and Anemia Incidence

Table 3. Association Between Family Income and Anemia

Family Income	Anemia n (%)	Non-Anemia n (%)	Total	p-value	OR
Low	15 (21.4%)	55 (78.6%)	70	0.806	1.12
High	11 (19.6%)	45 (80.4%)	56		
Total	**26 (20.6%)**	**100 (79.4%)**	**126**		

Source: Primary data analysis

The statistical analysis demonstrated no significant relationship between family income and anemia incidence among pregnant women (p = 0.806). Although economic status may influence access to nutritious food, the findings suggest that behavioral and knowledge-related factors have a stronger influence on anemia prevention than income alone. This result corresponds with previous research conducted in Bengkulu, which also found no significant association between family income and maternal anemia. In many cases, pregnant women from lower-income households may maintain good health if they possess adequate nutritional knowledge and positive health behaviors. In the context of health development, this finding indicates that anemia prevention programs should not only focus on economic assistance but also prioritize health literacy, nutrition education, and accessible

maternal healthcare services. Behavioral interventions may provide broader and more sustainable impacts than purely economic approaches.

Although economic status is generally considered an important determinant of nutritional health, this study found no statistically significant relationship between family income and anemia incidence. This finding suggests that adequate financial resources do not automatically guarantee healthy nutritional behavior during pregnancy. Some families with relatively sufficient income may still prioritize non-nutritional expenditures or lack awareness regarding balanced dietary intake for pregnant women (Darmawati, 2018).

Conversely, pregnant women from lower-income households may still maintain adequate nutritional status if they possess strong health awareness and receive support from government health programs. Indonesia has implemented several maternal health initiatives, including free antenatal care services and iron tablet distribution programs, which may help reduce disparities caused by economic limitations. These programs potentially minimize the direct influence of income on anemia prevention among pregnant women (Ministry of Health of the Republic of Indonesia, 2020).

The results highlight that health behavior and healthcare accessibility may have stronger effects on anemia prevention than economic status alone. Therefore, sustainable maternal health development should integrate economic support with educational and behavioral interventions. Nutrition counseling, household food management education, and accessible primary healthcare services are essential to ensure that all pregnant women, regardless of income level, can maintain healthy pregnancies and prevent anemia-related complications (WHO, 2019).

Relationship Between Fe Tablet Compliance and Anemia Incidence

Table 4. Association Between Fe Tablet Compliance and Anemia

Fe Tablet Compliance	Anemia n (%)	Non-Anemia n (%)	Total	p-value	OR
Non-Compliant	23 (76.7%)	7 (23.3%)	30	0.000	101.9
Compliant	3 (3.1%)	93 (96.9%)	96		
Total	**26 (20.6%)**	**100 (79.4%)**	**126**		

Source: Primary data analysis

The study found a highly significant relationship between adherence to Fe tablet consumption and anemia incidence among pregnant women ($p = 0.000$). Non-compliant pregnant women showed a substantially greater risk of developing anemia compared to those who regularly consumed iron tablets.

Physiologically, pregnancy increases iron requirements due to fetal growth and expansion of maternal blood volume. Failure to consume iron supplements consistently may reduce hemoglobin production and increase the risk of iron deficiency anemia. These findings are supported by previous studies conducted by Tambunan and Wahyuni (2020) and Dolang (2020), both of which identified Fe tablet adherence as a major determinant of maternal anemia prevention.

This result contributes significantly to maternal health development efforts because it demonstrates that preventive interventions focused on strengthening compliance with iron supplementation can effectively reduce anemia prevalence. Continuous counseling, monitoring during antenatal care visits, and family support are essential strategies to improve maternal adherence and optimize maternal health outcomes.

Overall, the findings of this study confirm that behavioral determinants, particularly maternal knowledge and adherence to Fe tablet consumption, are more influential than sociodemographic factors in preventing anemia among pregnant women. Adherence to iron tablet consumption emerged as one of the strongest determinants of anemia prevention in this study. Iron supplementation is essential during pregnancy because maternal iron requirements increase significantly to support fetal development, placental growth, and expanded blood circulation. Pregnant women who fail to consume iron tablets regularly may experience decreased hemoglobin production, leading to iron deficiency anemia and increased pregnancy-related risks (Prawirohardjo, 2016).

Non-compliance with iron supplementation may be influenced by several factors, including side effects such as nausea, constipation, and unpleasant taste sensations. In addition, inadequate

counseling regarding the benefits and proper consumption methods of Fe tablets may reduce maternal motivation to continue supplementation. Some pregnant women may discontinue iron tablet intake once they feel physically healthy, despite the continuing physiological need for iron during pregnancy (Tambunan & Wahyuni, 2020).

The findings underscore the importance of strengthening maternal adherence programs as part of national health development strategies. Healthcare providers should enhance counseling quality during antenatal visits by explaining the importance of iron supplementation and managing side effects effectively. Family involvement and community support are also crucial in encouraging pregnant women to maintain consistent supplement intake. Improving adherence to Fe tablet consumption has the potential to reduce maternal morbidity, improve fetal growth, and support broader efforts toward achieving better maternal and child health outcomes (Dolang, 2020).

CONCLUSION

This study concluded that maternal knowledge and adherence to iron (Fe) tablet consumption were significantly associated with the incidence of anemia among pregnant women in the working area of Kapau Public Health Center, while educational level and family income showed no significant relationship. These findings indicate that behavioral and health awareness factors play a more important role in anemia prevention during pregnancy than sociodemographic characteristics alone. The study highlights the importance of strengthening maternal education and promoting compliance with iron supplementation as effective strategies to reduce anemia prevalence and improve maternal health outcomes. However, this research was limited by its cross-sectional design, which restricted the ability to establish causal relationships between variables. Therefore, it is recommended that healthcare institutions, particularly public health centers, enhance antenatal counseling programs, strengthen monitoring of iron tablet consumption, and develop continuous community-based health education interventions to improve anemia prevention among pregnant women.

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