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Nutritional status and anemia in pregnant women: A systematic review

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Abstract

Background: Anemia in pregnant women is a significant global health problem. Anemia in pregnant women is closely related to morbidity and mortality in mothers and their babies.

Purpose: To find out in depth the factors that influence anemia in pregnant women.

Method: The study began with data retrieval from PubMed, using the keywords "Nutritional status", "anemia", and "pregnant women", limiting inclusion to English-language articles published between 2014 and 2024. The use of the Perish and Publish application facilitated the initial literature selection, followed by VOSviewer analysis to visualize trends and patterns in the literature. Furthermore, the PRISMA 2020 framework was used for a more systematic and focused selection, screening, and assessment of the literature.

Results: This study revealed that risk factors for anemia in pregnant women were awareness (knowledge), food consumption practices, pica, BMI, income, assertiveness, and number of pregnancies. In-depth insights into nutritional status and anemia among pregnant women, underscore the importance of effective nutrition interventions and tailored health strategies.

Conclusion: The importance of education or counseling for pregnant women to prevent anemia during pregnancy. These findings contribute significantly to the formulation of evidence-based health policies and practice recommendations, with the ultimate goal of improving maternal and newborn health.

Keywords: Anemia; Nutrition; Pregnant Woman.

INTRODUCTION

Anemia is a nutritional problem that often occurs in pregnant women and is the biggest and most difficult micronutrient problem to overcome worldwide (Rahadian, 2024; Abioye, & Fawzi, 2020). Anemia is functionally defined as a decrease in the number of erythrocyte mass (red cell mass) so that it cannot fulfill its function of carrying sufficient oxygen to peripheral tissues (decreased oxygen carrying capacity) (Khairunnisa, Wiyati, & Adespon, 2019). Anemia in pregnancy is defined as a hemoglobin level <11 g/dl in the first trimester and <10.5 g/dl in the second and/or third trimester (Tazkiah, Qomah, hardiyanti, Solechah, & Hidayah, 2024). During pregnancy, the body's need for iron increases, especially during the second and third trimesters.

The amount of iron absorbed from food and body reserves is usually not sufficient for the mother's needs during pregnancy, so Fe tablet supplementation is needed to help restore hemoglobin levels (Novianti, 2024; Benson, Shah, Frise, & Frise, 2021). Based on the severity, anemia in pregnant women can be divided into mild anemia (hemoglobin 10 to 10.9 g/dl), moderate anemia (hemoglobin 7 to 9.9 g/dl), and severe anemia (hemoglobin <7 g/dl) (Lopez, Cacoub, Macdougall, & Peyrin-Biroulet, 2016).

The incidence of anemia or lack of blood in pregnant women in Indonesia is still relatively high, which is 48.9%. This condition shows that anemia is quite high in Indonesia and shows a figure

approaching a severe public health problem (Minister of Health of the Republic of Indonesia, 2018). The cause of anemia is a lack of nutrients for blood formation, such as iron, folic acid, and vitamin B12. But what often happens is anemia due to iron deficiency (Siagian, 2024). Anemia in pregnancy can have serious consequences, such as an increased risk of complications in pregnant women and unborn babies. This can include premature rupture of membranes, postpartum infection, fetal growth retardation, fetal hypoxia, premature birth, low birth weight, or even increase the risk of death of the mother and her baby (Arbainah, Friscila, Fitriani, & Hartinah, 2024; Tan, Qi, He, Yang, Zhang, Zou, & Liu, 2018). Identifying and treating anemia is a priority in efforts to improve maternal health and reduce maternal and infant mortality. This study was designed to answer the identified problem formulation by adopting a comprehensive Systematic Literature Review (SLR) methodology. Through a systematic review, the study aims to uncover key determinants that can be used to inform policy recommendations and design interventions that have the potential to mitigate anemia problems in pregnant women. Thus, this study will provide an important contribution to efforts to improve the quality of maternal and child health, as well as support the achievement of the objectives of the Sustainable Development Goals (SDGs) related to maternal health and child welfare (Alam, & Rahman, 2023).

RESEARCH METHOD

This study will implement two layers of methodological approaches to conduct a Systematic

Literature Review (SLR), namely through the use of VOSviewer and the PRISMA 2020 framework. The process begins with data collection from the PubMed database, using the keywords "Nutritional status", "anemia", and "pregnant women" to identify relevant research articles. Inclusion is limited to English-language articles published in the last ten years, from 2014 to 2024, to ensure that the analysis includes information that is up-to-date and relevant to current trends.

The use of the Perish and Publish application facilitates the process of retrieving data from PubMed, ensuring efficiency in selecting literature according to the specified keywords. Once the initial dataset is collected, the study will use VOSviewer for an initial analysis aimed at visualizing trends and patterns in the literature. This visualization will reveal relationships between different topics and sub-topics, making it easier to identify research areas that have grown significantly and identify gaps in the literature. Furthermore, once patterns and trends are identified, the study will move on to using the PRISMA 2020 framework to conduct a more focused and systematic selection of relevant literature. PRISMA 2020 will be adopted to ensure transparency and rigor in the selection, screening, and eligibility assessment of studies included in the review.

Through this process, researchers will be able to answer research questions regarding the factors that determine anemia in pregnant women. This entire process will not only improve the quality and relevance of research findings but will also ensure that the results of this SLR are reliable and contribute to the formation of evidence-based health policies.

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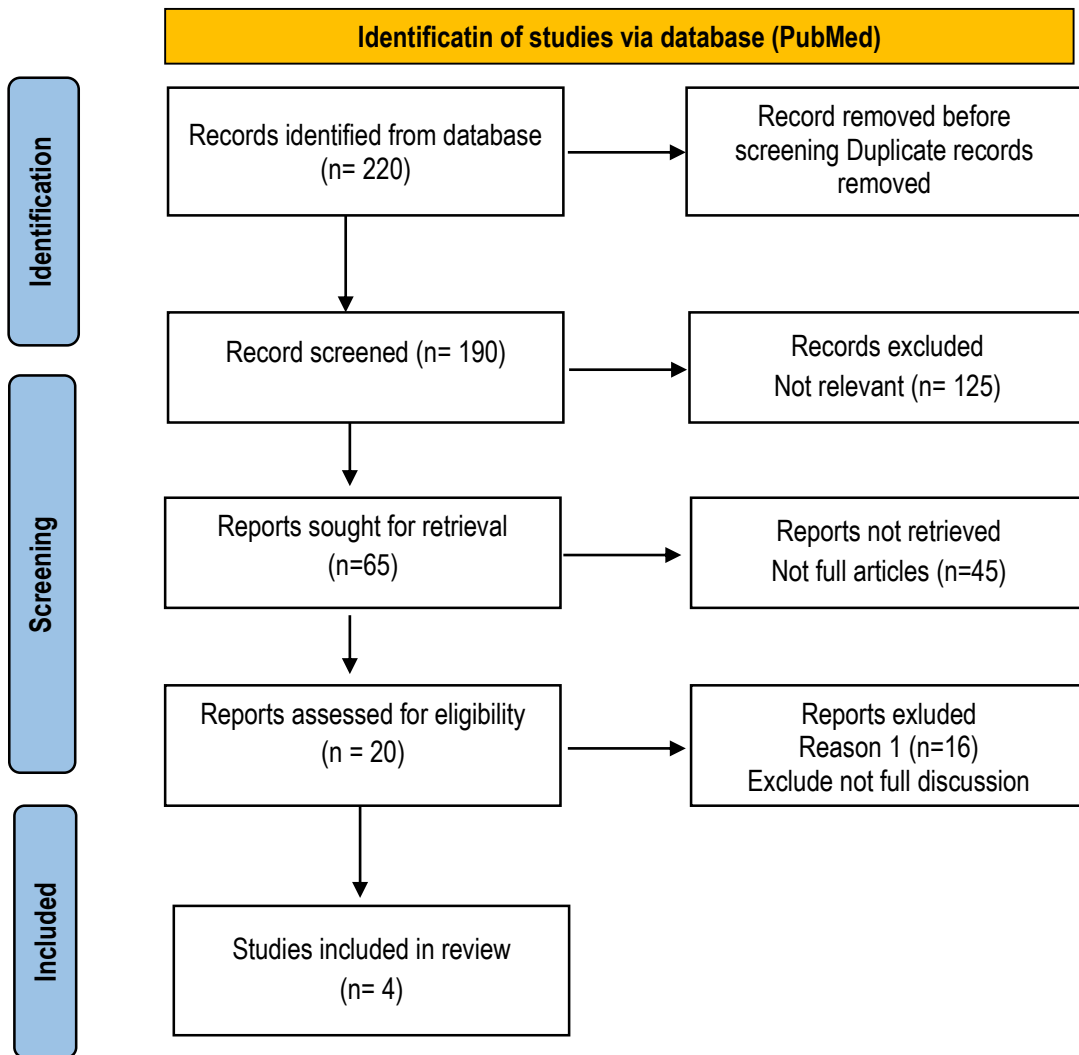


Figure 3. PRISMA 2020

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Table. Summary of The Articles' Review

(Author, Year) (Country)	Purpose	Method	Results
(Syarif et al., 2023) (Indonesia)	Determining awareness and preventive behaviors related to iron deficiency incidents in pregnant women living in urban slums.	Cross-sectional study using KoboToolbox, an Android-based tool. Iron status was examined by measuring serum ferritin levels using ELISA at the Microbiology Laboratory Unit of Hasanuddin University Hospital.	As many as 78% of pregnant women in urban slums are iron deficient, with the main factors being poor awareness and dietary practices, indicating the need for improved health education and health services to reduce anemia.
(Ali, Hassan, & Adam, 2023) (Sudan)	To assess the prevalence and factors associated with anemia among pregnant women in Northern Sudan.	Community-based cross-sectional study with sociodemographic and obstetric data collection through questionnaires, hemoglobin (Hb) measurement using automated hematology analyzers, and linear and multivariate regression analyses.	Approximately half of pregnant women in Northern Sudan are anemic; increased BMI and obesity are associated with lower risk of anemia, while pica is associated with increased risk of anemia.
(El-Kholy et al., 2023) (Saudi Arabia)	To assess the prevalence and factors associated with anemia during pregnancy in Al-Madinah, and the impact of counseling by clinical pharmacists.	Descriptive cross-sectional study of 300 pregnant women to measure the prevalence of anemia and associated factors, with the use of counseling interventions by clinical pharmacists in selected groups.	44% of pregnant women suffer from anemia; income, consuming healthy food, getting education, and number of pregnancies have an influence on the incidence of anemia in pregnant women.
(Etea et al., 2023) (Ethiopia)	Assessing the relationship between individual and composite dimensions of women's empowerment with nutritional outcomes of pregnant women in West Shewa Zone, Ethiopia.	A cross-sectional study, health facility-based study of 1,453 pregnant women, using exploratory and confirmatory factor analysis to identify and validate dimensions of pregnant women's empowerment.	Pregnant women who are economically and assertively empowered have a higher chance of not being anemic and having a normal upper arm circumference compared to those who are not empowered in these dimensions.

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DISCUSSION

The visualization results from VOSviewer in Figure 1 focus on anemia as a very important and frequently explored research area in the context of pregnant women's health. With anemia as a large central node, it is clear that there are many relationships and density of connections with other keywords, indicating that this topic is at the center of many scientific discussions. Next, as seen in the keyword supplementation, especially iron supplementation, which is reflected in the strong connection between "iron status", "supplementation", and "iron deficiency", indicating that there is a strong consensus in the literature on the importance of micronutrient management to address anemia. The keyword "ferritin", which is an indicator of iron stores in the body, often appears together with anemia, indicating that ferritin measurement is a frequently used method to evaluate iron status and the risk of anemia. Furthermore, the association between anemia and "low birth weight" is seen, highlighting the consequences of anemia that affect not only the mother but also pregnancy outcomes, including the birth weight of the child. The keyword "aor" (adjusted odds ratio), often used in epidemiological studies, indicates that in-depth statistical analysis has been carried out to determine the risk factors associated with anemia in pregnancy. Furthermore, "antenatal care" stands out as an important area, indicating recognition of the important role of prenatal health care in the early detection and management of anemia. This reflects the importance of access to comprehensive health services during pregnancy to reduce the risk and impact of anemia.

Furthermore, in Figure 2 which displays the density analysis, it is also seen that the results of the study also show a focus on risk factors and the impact of anemia on pregnancy outcomes. The keywords "low birth weight" and "hemoglobin level" which are closely related to "anemia" reflect a strong emphasis on studies examining the direct impact of anemia on birth conditions. Low birth weight has been associated with maternal anemia status, and hemoglobin levels are a commonly used indicator to measure the severity of anemia. In addition, the analysis of geographic and demographic trends shows a strong connection between anemia and certain geographic locations, such as "Indonesia", "Kenya", "Malawi", and "Northwest Ethiopia". This

indicates that specific studies have been conducted in these regions, recognizing that environmental, social, and economic factors can play a role in the prevalence and management of anemia. These differences may include accessibility to nutritious food, health education levels, and the quality of prenatal health services which can vary significantly between regions.

Furthermore, terms such as "clinical trial" and "compliance" that are closely related to "supplementation" and "treatment" highlight the research focus on clinical trials designed to assess the effectiveness of supplementation interventions. The level of compliance with these treatment plans is critical to ensuring success in treating anemia, and clinical trials provide the scientific evidence needed to establish best practices. This analysis also shows that research in the field of anemia is not limited to iron deficiency alone but also explores its relationship to deficiencies of other micronutrients such as zinc.

Zinc deficiency has been identified as a possible factor contributing to anemia, both independently and through interacting mechanisms with iron deficiency. This underscores the need for a holistic approach to nutritional interventions, where supplementation is not focused on a single micronutrient but also considers the potential multifaceted nature of undernutrition. Studies examining the association between zinc deficiency and anemia provide a broader perspective on the complexity of interactions between different nutritional elements and how they collectively affect maternal health status. The keyword "malnutrition" also featured prominently in the analysis, indicating that anemia is often associated with poor nutritional outcomes in general. This suggests that anemia in pregnant women may be just one manifestation of a broader spectrum of nutritional problems, including undernutrition and malnutrition. Recognizing this association is important because it allows researchers and policymakers to develop comprehensive nutrition intervention programs that not only target anemia but also improve overall nutritional status.

Factors that contribute to the risk of anemia in pregnant women are the awareness of pregnant women (Syarif, Ansariadi, Wahiduddin, Wijaya,

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Amiruddin, Citrakesumasari, & Ishak, 2023). This study explains that the awareness of pregnant women affects their behavior during pregnancy. Lack of understanding in pregnant women has a negative impact on their behavior to prevent anemia (Syarif et al., 2023). Pregnant women with good understanding and knowledge will be able to take measures to prevent anemia. Pregnant women who receive knowledge and education during pregnancy pay more attention to nutrition compared to pregnant women who do not receive education, they have less knowledge about proper diet so that they can reduce anemia during pregnancy (El-Kholy, El Kholy, Abdou, Karar, Bushara, Abdelaal, & Sayed, 2023). Knowledge about anemia, including its causes, symptoms, and prevention, is an important factor that can help pregnant women avoid anemia. Pregnant women who have good knowledge about anemia can more easily recognize symptoms and seek medical help as early as possible (Arnianti, 2024).

The next risk factor for anemia in pregnant women is food consumption habits, which state that daily food consumption behavior is an external factor related to iron absorption in the body (Syarif et al., 2023). The habit of not consuming healthy foods can indicate a high prevalence of anemia. Pregnant women are more susceptible to loss of appetite. This can cause deficiencies of iron, vitamin B12, and folic acid which are important factors for erythropoiesis (El-Kholy et al., 2023). An unbalanced diet will cause an imbalance in nutrients entering the body and can cause malnutrition. In pregnant women, there is a need for additional nutrients in each trimester. To achieve balanced nutrition, every pregnant woman is expected to consume at least one type of food sourced from carbohydrate foods, animal protein, vegetable protein, vegetables and fruit, in addition, the amount of food is adjusted to the needs of pregnant women (Gozali, 2018).

There are other factors related to food consumption practices, namely pica. Pica affects nutritional status as well as stress and anxiety in pregnant women. Research in Sudan revealed that 37.7% of pregnant women had a history of pica and had a 1.76 times higher risk of anemia (Ali, Hassan, & Adam, 2023). Pica is a general term that refers to the desire and deliberate consumption of non-food items. Pica can also be interpreted as an eating

disorder, in the same category as bulimia and anorexia. Pica can increase the exposure of pregnant women to worm infections and micronutrient deficiencies. The majority of pregnant women who engage in pica behavior consume ice, which is not a source of iron and can cause anemia. In addition, pica can reduce iron absorption. Therefore, patients with iron deficiency anemia require a holistic approach, namely conducting a complete anamnesis in pica practices aimed at early diagnosis, treatment, and prevention of complications (Ali, Hassan, & Adam, 2023; Lumish, Young, Lee, Cooper, Pressman, Guillet, & O'Brien, 2014).

Furthermore, what influences anemia in pregnant women is BMI. Pregnant women with increased BMI and obesity tend not to experience anemia. There is a positive correlation between BMI (kg/m²) and Hb levels (gm/dL) among pregnant women (coefficient = 0.048, $p < 0.001$). Specifically, a one-unit increase in BMI (1 BMI unit means 1 kg/m²) reduces anemia by 6%, while determining obesity reduces anemia by 50%. Increased BMI is associated with increased muscle mass, obesity can reduce anemia due to good nutrition (Ali et al., 2023). In pregnancy, the decrease in hemoglobin levels found during pregnancy is due to increased nutrient requirements and changes in the blood. If the mother's nutritional status is lacking, the intake of nutrient requirements is inadequate, resulting in anemia (Floridha, Ekasari, & Zakiyyah, 2023).

Furthermore, the risk factor for anemia in pregnant women is income. Pregnant women with moderate incomes have a lower prevalence of anemia compared to those with low incomes. This can be attributed to the fact that higher incomes allow better access to a wider variety of foods (El-Kholy et al., 2023). The risk factor of income is closely related to the economic empowerment of pregnant women. This is in accordance with a study in Ethiopia which stated that economically empowered pregnant women are less likely to experience anemia. Income is associated with better nutritional status of women. Income increases self-confidence and self-esteem. Women's participation in household decision-making and their ability to purchase food have a positive impact on the availability of diverse and nutrient-rich foods in the

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household and, consequently, adequate food intake (Etea, Yalew, Sisay, & Shiferaw, 2023).

Furthermore, the risk factor for anemia in pregnant women is assertiveness in pregnant women. Assertive pregnant women are less likely to experience anemia compared to non-assertive pregnant women. Assertive mothers tend to stand up for their rights, say what they want or believe, and reject unreasonable requests. This can be reflected in their access to resources and utilization of health services, which in turn can be manifested in their nutritional status. It is proven that assertive mothers are confident and self-assured. They tend to be more psychologically empowered (Etea et al., 2023).

The last risk factor for anemia in pregnant women is the number of pregnancies. Previous studies have found a significant relationship between the incidence of anemia and the number of times a woman has been pregnant. Around 72.92% and 78.95% of anemic mothers have given birth 4–5 times or more, respectively. Multiparity increases the risk of anemia because the majority will enter pregnancy with depleted iron reserves, which is further complicated by close pregnancy spacing and long lactation (El-Kholy et al., 2023). Mothers who are pregnant/give birth frequently have a higher risk of anemia because during pregnancy, nutrients will be divided between the mother and fetus. The more often a mother is pregnant and gives birth, the greater the risk of blood loss and decreased Hb levels. Mothers who are pregnant and then give birth will lose 250 mg of iron (Hidayati & Nuryaningsih, 2019).

CONCLUSION

Factors that influence the occurrence of anemia in pregnant women are awareness (knowledge), food consumption practices, pica, BMI, income, assertiveness, and number of pregnancies. The importance of education or counseling for pregnant women to prevent anemia during pregnancy.

SUGGESTION

For further researchers, it is expected to use a more varied search engine and more specific keywords to obtain other risk factors that cause high incidence of anemia in pregnant women.

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