

## **Literature Review: The Influence of Socioeconomic Status and Nutritional Intake on Anemia in Pregnant Women**

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### **Abstract**

*Anemia in pregnancy remains a major public health problem, particularly in low- and middle-income countries, including Indonesia. This condition is influenced by multiple factors, especially socioeconomic status and nutritional intake, which may affect maternal hemoglobin levels and pregnancy outcomes. This study aimed to analyze the influence of socioeconomic status and nutritional intake on the incidence of anemia among pregnant women. A systematic literature review was conducted using the PICOS framework and PRISMA 2020 guidelines. Articles were searched through PubMed, Google Scholar, ScienceDirect, ResearchGate, ProQuest, and other scientific sources, with publication years ranging from 2020 to 2025. The inclusion criteria covered full-text peer-reviewed articles written in Indonesian or English, using cross-sectional, cohort, or case-control designs, and focusing on pregnant women and anemia-related socioeconomic or nutritional factors. From 1,250 initially identified articles, 15 studies met the eligibility criteria and were included in the final analysis. The review showed that low education, limited family income, informal employment, rural residence, poor access to health services, and inadequate antenatal care were associated with a higher risk of anemia in pregnancy. Nutritional factors, including insufficient intake of iron, protein, folic acid, vitamin B12, vitamin C, calcium, and low dietary diversity, were also strongly related to reduced hemoglobin levels. These findings indicate that anemia in pregnant women is influenced by the interaction between socioeconomic conditions and nutritional adequacy. Therefore, prevention strategies should integrate nutrition improvement, iron-folic acid supplementation, health education, socioeconomic support, and improved access to antenatal care.*

## **Introduction**

Anemia in pregnant women is a public health issue of global concern, particularly in developing countries (Karami et al., 2022; Shaw & Friedman, 2011; Obeagu & Obeagu, 2025). According to the World Health Organization, anemia in pregnancy is a condition in which a pregnant woman's hemoglobin (Hb) level is less than 11 g/dL in the first and third trimesters, or less than 10.5 g/dL in the second trimester. This condition not only poses a risk to the mother's health but can also affect fetal growth and overall pregnancy outcomes.

Anemia in pregnant women remains a major public health problem worldwide. Globally, the prevalence of anemia in pregnant women in 2019 was estimated at 36.5%, with the figure being higher in low- and middle-income countries, at around 45.2%. Various cross-country studies have shown that socioeconomic factors, education level, and parity are significantly associated with the incidence of anemia in women of reproductive age, including pregnant women. This situation indicates that anemia in pregnancy remains a serious health problem that requires evidence-based management efforts and ongoing interventions (Onyeneho et al., 2021; Alem et al., 2023).

In Indonesia, anemia in pregnant women remains at a relatively high level. The 2018 Basic Health Research (Riskesdas) showed that the prevalence of anemia among pregnant women

reached 48.9%. Meanwhile, several subsequent analyses found varying prevalence rates, around 33.1%. The WHO also estimated that the prevalence of anemia among pregnant women in Indonesia in 2019 was around 44.2%. This high incidence of anemia is influenced by various factors, such as low iron intake, suboptimal adherence to iron supplementation, and inadequate maternal nutrition during pregnancy (Determinants of Anemia in Pregnant Women in Indonesia, 2018).

The 2022 Indonesian Health Profile also states that anemia in pregnant women remains a nutritional problem that has not been optimally addressed (Suparji et al., 2024; Zulfikar et al., 2025; Prasetyo et al., 2025). Data from the 2023 Indonesian Health Survey (SKI) shows the prevalence of anemia among pregnant women at 27.7%, with the highest prevalence among those aged 35–44 (39.6%), followed by those aged 25–34 (31.4%). The 2023 SKI (Survey of the Indonesian Health System) showed that anemia was more common in pregnant women living in rural areas and in communities with low socioeconomic status, indicating that socioeconomic factors and nutritional patterns play a role in the incidence of anemia in pregnant women.

In South Sulawesi Province, based on the 2024 South Sulawesi Provincial Health Profile, the prevalence of anemia in pregnant women was 28.1%. Data from the Makassar City Health Office shows that the prevalence of anemia increased from 5.50% in 2021 to 5.97% in 2022. This indicates that anemia in pregnant women remains a public health problem in Makassar City despite various preventative measures.

Socioeconomic factors such as family income level, maternal education, and employment status are known to influence the incidence of anemia during pregnancy (Azmi & Puspitasari, 2022; Xu et al., 2016). Economic limitations can lead to limited access to nutritious food, quality antenatal care, and iron supplements. Research in Indonesia shows that pregnant women from lower socioeconomic groups have a higher risk of anemia than those from middle- to upper-income groups. Furthermore, low education levels and non-compliance with iron supplementation are also dominant factors (Geta et al., 2022; Arfan et al., 2024).

Inadequate nutritional intake, particularly iron, folic acid, protein, and vitamin B12, is a direct cause of nutritional deficiency anemia in pregnant women. A systematic review and meta-analysis in Africa showed that low dietary diversity during pregnancy is associated with an increased risk of anemia in mothers and low birth weight in infants. Furthermore, structured nutrition education has been shown to improve adherence to iron and folic acid supplementation and help reduce the prevalence of anemia in pregnant women in low- and middle-income countries (Seid et al., 2023).

Various studies have shown that factors influencing the incidence of anemia in pregnant women still produce mixed results, requiring more integrated studies. Several studies have shown that socioeconomic factors, such as family income and maternal education, have a dominant influence on the occurrence of anemia in pregnant women. However, other studies have shown that dietary patterns and the frequency of iron intake are statistically stronger factors in influencing the incidence of anemia. These differing research findings highlight the need for a systematic and comprehensive literature review to synthesize the latest scientific evidence before formulating targeted intervention recommendations. Therefore, this study is structured as a literature review to analyze the influence of socioeconomic status and nutritional intake on the incidence of anemia in pregnant women (Hayati et al., 2024; Devinia et al., 2021).

## **Method**

### **Research Methods and Types of Research**

This study employed a systematic literature review method, which aims to systematically examine and analyze various research findings using the PICOS framework. In this study, primary studies originate from published individual studies, while the literature review is a secondary research approach that processes and synthesizes findings from various previous studies. The approach employed encompasses both quantitative and qualitative methods, involving various research designs, such as randomized controlled trials (RCTs), cross-sectional studies, cohort studies, case-control studies, and relevant research. The data used comprises primary and secondary data obtained from various online literature sources, such as journal articles, theses, textbooks, and e-books. The literature search was conducted through several electronic databases, namely PubMed, Google Scholar, ScienceDirect, and ResearchGate, as well as through a manual search of national journals published between 2020 and 2025. The selected literature includes publications in both Indonesian and English.

### **Place and Time of Research**

This research was conducted online on several scientific data platforms, including Google Scholar, PubMed, ResearchGate, ScienceDirect, and others, from April to June 2026.

### **Inclusion and Exclusion Criteria**

The inclusion criteria for this study included articles published in peer-reviewed scientific journals and available in accessible full-text versions. Included articles were those published between 2020 and 2025, or within the last five years, written in Indonesian or English, and using a cross-sectional, cohort, or case-control study design. The selected study subjects were pregnant women of all gestational ages and all maternal age groups. Furthermore, articles must address socioeconomic variables and nutritional intake as factors influencing anemia in pregnant women. Exclusion criteria for this study included articles not available in full-text format, preventing comprehensive information extraction. Articles in the form of literature reviews, opinion pieces, scientific commentaries, letters to the editor, and case reports that did not present complete research data were also excluded. Furthermore, duplicate articles or articles using data from the same population as other included articles were not included in the analysis.

### **Variable Identification**

The independent variables in this study include socioeconomic status and nutritional intake of pregnant women. Socioeconomic factors describe social and economic conditions, including family income, education level, and employment. Socioeconomic status can influence a pregnant woman's ability to meet nutritional needs, among other things. Nutritional status refers to the amount and type of nutrients consumed during pregnancy, which is influenced by the body's consumption, absorption, and utilization of nutrients. The nutritional intake of pregnant women can be assessed based on the adequacy of daily intake. The dependent variable in this study is the prevalence of anemia in pregnant women.

## Operational Definition

Table 1. Operational Definitions

| Variable Type            | Operational Definition                                                                                           | Measurement Tools                                              | Measurement Scale | Objective Criteria                                                            |
|--------------------------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-------------------|-------------------------------------------------------------------------------|
| Socioeconomic Status     | Social and economic conditions can affect the ability to obtain nutritional needs and access to health services. | Medical record data/clinical reports (questionnaires)          | Ordinal           | Low, medium, and high socioeconomic categories                                |
| Nutritional Intake       | The amount and type of nutrients consumed during pregnancy.                                                      | 24-hour food recall, food frequency questionnaire, food record | Numeric           | Nutritional needs (energy, protein, iron, folic acid, vitamin B12, vitamin C) |
| Anemia in Pregnant Women | Routine blood test results (Hb) are below normal values during pregnancy.                                        | Laboratory examination data recorded in the primary study      | Nominal           | Anemia in pregnancy: Hb level <11 g/dL                                        |

## Data collection technique

Data collection in this study was conducted through a literature search, collecting scientific articles relevant to the research topic, namely "The Influence of Socioeconomic and Nutritional Intake on Anemia in Pregnant Women." The article search was conducted systematically through electronic databases such as PubMed, Google Scholar, ScienceDirect, ResearchGate, ProQuest, and other scientific sources.

The literature search process used keywords tailored to the research variables, both in Indonesian and English, such as: (1) "pregnant anemia" / "pregnancy anemia" / "anemia in pregnancy" / "anemia pregnant women" / "hemoglobin pregnant women" / "hemoglobin pregnancy"; (2) "socioeconomic status of pregnant women" / "family income anemia pregnant women" / "education pregnant women anemia" / "socioeconomic status anemia pregnancy" / "household income anemia pregnant" / "maternal education anemia"; (3) "nutritional intake of pregnant women" / "nutritional intake pregnant women anemia" / "nutritional intake for pregnant women" / "nutrient intake in pregnancy anemia" .

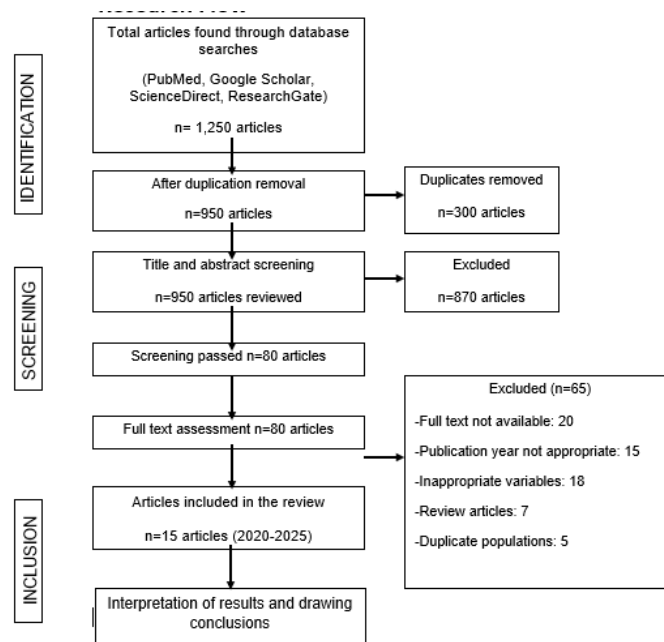
The stages of literature selection are carried out in stages and systematically, namely including: (1) Initial Identification (Title and Keyword Screening): All articles obtained from the literature search are selected based on their titles and keywords to identify articles relevant to the research topic; (2) Abstract Review: Relevant articles are then reviewed through their abstracts to ensure they align with the objectives, research variables, and the completeness of the required information; (3) Full-Text Review: Articles that pass the abstract review stage are then read in their entirety to assess the research methods, results, relevance of the content, and compliance with the inclusion criteria; (4) Final Selection: Selecting articles that meet all inclusion criteria

and do not fall under the exclusion criteria will be used as data sources for analysis and synthesis in this literature review.

## Data Management and Analysis

This data management was carried out by collecting articles from various electronic databases. The articles found were then selected based on predetermined inclusion and exclusion criteria. The selection process was analyzed using the PICOS method, then compiled and systematically arranged. Population (P): The population in this study was pregnant women of all gestational ages who served as subjects. Intervention (I): The exposure studied included the socioeconomic status and nutritional intake of pregnant women. Comparative (C): The comparison group consisted of pregnant women with a better socioeconomic status and normal nutritional intake. Outcome (O): The results analyzed were the incidence of anemia in pregnant women, determined by hemoglobin levels. Study Design (S): The research designs analyzed included analytical observational studies, such as cross-sectional, case-control, cohort, and relevant descriptive studies.

## Research Flow



## Result and Discussion

A systematic literature search was conducted using electronic databases, namely PubMed, Google Scholar, ScienceDirect, ResearchGate, and ProQuest, with a publication range from January 2020 to June 2025. The entire process of identifying, screening, and selecting articles followed the PRISMA 2020 (Preferred Reporting Items For Systematic Reviews and Meta-Analyses) guidelines. The initial search yielded 1,250 articles from all databases used. After the deduplication process, 300 articles were removed due to being identified as duplicates, leaving 950 articles for the title and abstract screening stage. At this stage, 870 articles were excluded because they did not meet the established inclusion criteria. Furthermore, 80 articles that passed the screening stage underwent full-text assessment. Of these, 65 articles were eliminated based on predetermined exclusion reasons. Thus, 15 articles met all inclusion criteria and were finally included in the systematic review. Each selected article was then analyzed comprehensively using the PICOS (Population, Intervention, Comparison, Outcomes, and Study Design) framework to ensure compliance with the research objectives.

## Article Description

Table 2. Article Description

| Author                             | Year | Source       |
|------------------------------------|------|--------------|
| Rooney et al. <sup>34</sup>        | 2024 | PubMed       |
| Ramadhani et al. <sup>35</sup>     | 2021 | ResearchGate |
| Wijayanti et al. <sup>36</sup>     | 2024 | ResearchGate |
| Sinha et al. <sup>37</sup>         | 2021 | PubMed       |
| Samsir et al. <sup>38</sup>        | 2025 | PubMed       |
| Khotima et al. <sup>39</sup>       | 2025 | PubMed       |
| Arifah et al. <sup>40</sup>        | 2023 | PubMed       |
| Mayasari et al. <sup>41</sup>      | 2023 | ResearchGate |
| Bayyari et al. <sup>42</sup>       | 2024 | PubMed       |
| Nurfajriah et.al <sup>43</sup>     | 2024 | ResearchGate |
| Saliu Auwal et.al <sup>44</sup>    | 2025 | ResearchGate |
| Mariyana et.al <sup>45</sup>       | 2023 | ResearchGate |
| Ramadhani R et.al <sup>23</sup>    | 2024 | ResearchGate |
| Sitorus E et.al <sup>46</sup>      | 2024 | PubMed       |
| ZalfaTuffahati et al <sup>47</sup> | 2024 | PubMed       |

Table 3. Research Results

| Title                                                                                                                                                                                               | Population                                                                                                                                            | Intervention                                                                                     | Comparative                                                                                                                           | Outcome                                                                                                                                                                                                                                | Study Design              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Dietary Intakes of Iron, Folate, and Vitamin B12 During Pregnancy and Correlation with Maternal Hemoglobin and Fetal Growth: Findings from the ROLO Longitudinal Birth Cohort (Rooney et al., 2024) | Pregnant women participating in the ROLO Birth Cohort Study in Ireland, consisting of women with singleton pregnancies followed throughout pregnancy. | Intake of iron, folic acid (folate), and vitamin B12 from food and supplements during pregnancy. | Pregnant women with adequate intake according to recommendations compared with those whose intake was below recommended requirements. | Micronutrient intake, particularly iron and folate, was associated with maternal hemoglobin levels. Inadequate intake was associated with lower hemoglobin and potentially increased anemia risk, while adequate intake was associated | Longitudinal cohort study |

|                                                                                                                                                       |                                                                                                  |                                                                                                                               |                                                                                                                                                                                     |                                                                                                                                                                                                          |                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
|                                                                                                                                                       |                                                                                                  |                                                                                                                               |                                                                                                                                                                                     | with more optimal fetal development.                                                                                                                                                                     |                                                                |
| The Relationship between Socioeconomic Status and Nutritional Status of Pregnant Women in Temporary Shelter (Ramadhani et al., 2021)                  | 85 pregnant women living in temporary housing in Palu City.                                      | Socioeconomic status, including education, occupation, and family income.                                                     | Pregnant women with high socioeconomic status (income $\geq$ district/city minimum wage) compared with those with low socioeconomic status (income $<$ district/city minimum wage). | A significant relationship was found between socioeconomic status and nutritional status of pregnant women based on Chronic Energy Deficiency (CED) status ( $p = 0.001$ ).                              | Quantitative observational study with cross-sectional approach |
| Social and Economic Factors Affecting the Incidence of Anemia in Pregnant Women (Wijayanti et al., 2024)                                              | 200 pregnant women receiving health services at hospitals, clinics, or community health centers. | Socioeconomic factors, including maternal education, income, employment, access to health services, diet, and social support. | Pregnant women with low versus high socioeconomic status and easy versus difficult access to health services.                                                                       | Low education, low income, and limited access to health services were significantly associated with increased anemia risk. Good social support also contributed to reducing anemia risk.                 | Quantitative cross-sectional study                             |
| A Study on Anemia and Its Risk Factors Among Pregnant Women Attending Antenatal Clinic of a Rural Medical College of West Bengal (Sinha et al., 2021) | 200 pregnant women attending ANC at a rural medical college/hospital in West Bengal, India.      | Socioeconomic status, gravida, timing of first ANC visit, age, education, occupation, and demographic characteristics.        | Pregnant women with low versus high socioeconomic status, multigravida versus primigravida, and early versus late first ANC visits.                                                 | Anemia prevalence was 90%, with 60.5% experiencing moderate anemia. Low socioeconomic status, multigravida status, and delayed first ANC visit were significantly associated with anemia ( $p < 0.05$ ). | Descriptive cross-sectional study                              |
| The Influence of                                                                                                                                      | 80 pregnant women                                                                                | Education level,                                                                                                              | Pregnant women with                                                                                                                                                                 | 66.2% of pregnant                                                                                                                                                                                        | Observational analytical                                       |

|                                                                                                                                                              |                                                                                                                                 |                                                                                                                                             |                                                                                                                           |                                                                                                                                                                                                                |                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| Education Level, Knowledge, and Pregnancy Spacing on the Incidence of Anemia Among Pregnant Women (Samsir et al., 2025)                                      | undergoing examination at Bungus Community Health Center, Padang City, selected through incidental sampling.                    | knowledge about anemia, and pregnancy spacing.                                                                                              | low versus high education, low versus good knowledge, and risky (<2 years) versus non-risky (≥2 years) pregnancy spacing. | women experienced anemia. Education level ( $p = 0.000$ ) and pregnancy spacing ( $p = 0.021$ ) were significantly associated with anemia, while knowledge was not significant ( $p = 0.073$ ).                | study with cross-sectional design                    |
| Economic and Residential Differences in Nutritional Anemia Among Pregnant Women: Insights from Indonesia's National Health Insurance (Khotimal et al., 2025) | 3,512 pregnant women participating in Indonesia's National Health Insurance program who were diagnosed with nutritional anemia. | Economic status, residential area (urban/rural), and socioeconomic factors.                                                                 | Pregnant women with high versus low economic status and those living in urban versus rural areas.                         | Pregnant women with low economic status and those living in rural areas had a higher prevalence of nutritional anemia ( $p < 0.05$ ). Economic status and residence significantly influenced anemia incidence. | Observational analysis using national secondary data |
| Effectiveness of Daily Educational Message on Pregnancy Anemia Prevention Behavior and Knowledge (Arifah et al., 2023)                                       | 44 pregnant women in the first and second trimesters receiving ANC at two community health centers in Surakarta City.           | Daily educational messages via WhatsApp for seven weeks concerning anemia prevention, iron tablet consumption, and anemia-preventive diets. | Control group receiving routine ANC and standard education without daily educational messages.                            | Significant increases in anemia knowledge and preventive behaviors, particularly adherence to iron tablet consumption (knowledge $p = 0.007$ ; adherence $p = 0.003$ ).                                        | Intervention study                                   |
| Relationships between Dietary Patterns and                                                                                                                   | 1,430 pregnant women in Taiwan                                                                                                  | Dietary patterns and intake of iron,                                                                                                        | Comparison of pregnant women with healthier and                                                                           | Dietary patterns were significantly associated                                                                                                                                                                 | Pilot randomized controlled trial                    |

|                                                                                                                                             |                                                                                                                        |                                                                                                                                                                            |                                                                                                                                            |                                                                                                                                                                                                                                                                                   |                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| Erythropoiesis-Associated Micronutrient Deficiencies (Iron, Folate, and Vitamin B12) among Pregnant Women in Taiwan (Mayasari et al., 2023) | receiving antenatal care.                                                                                              | folate, and vitamin B12.                                                                                                                                                   | less healthy dietary patterns and different micronutrient intake levels.                                                                   | with iron, folate, and vitamin B12 deficiencies. A healthier diet was associated with better micronutrient status and lower anemia risk.                                                                                                                                          |                                                      |
| Dietary Diversity and Iron Deficiency Anemia among a Cohort of Singleton Pregnancies (Al-Bayyari et al., 2024)                              | 198 pregnant women with singleton pregnancies aged 19–45 years receiving ANC in North Jordan, stratified by trimester. | Dietary patterns, diet quality, and iron supplement consumption measured using 24-hour dietary recall and MDD-W.                                                           | Pregnant women with healthy/diverse diets compared with those with unhealthy diets or low intake of iron, folate, and vitamin B12 sources. | Anemia prevalence was 27.8% and IDA prevalence was 21.7%. Dietary diversity, good diet quality, and iron supplementation were associated with higher hemoglobin and ferritin levels.                                                                                              | Observational analysis with cross-sectional approach |
| Factors Associated with the Incidence of Anemia among Pregnant Women in Indonesia (Nurfajriah et al., 2024)                                 | 292 pregnant women in Indonesia from the Indonesia Family Life Survey (IFLS-5).                                        | Education, nutritional status, gestational age, iron and protein consumption, ANC visits, socioeconomic status, vitamin C, green vegetables, occupation, and maternal age. | Pregnant women with high versus low dietary diversity/quality and those taking versus not taking iron supplements.                         | Anemia prevalence was 46.2%. Significant factors included education ( $p = 0.006$ ), nutritional status ( $p = 0.003$ ), gestational age ( $p = 0.001$ ), iron consumption ( $p = 0.001$ ), ANC examination ( $p = 0.006$ ), and protein consumption ( $p = 0.012$ ). Gestational | Cross-sectional study                                |

|                                                                                                                                                                 |                                                                                                                              |                                                                                                                                                                 |                                                                                                                                                               |                                                                                                                                                                                                                                              |                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
|                                                                                                                                                                 |                                                                                                                              |                                                                                                                                                                 |                                                                                                                                                               | age was the dominant factor (OR = 3.029; 95% CI = 1.520–6.038).                                                                                                                                                                              |                                             |
| Iron Deficiency Anemia and Associated Factors During Pregnancy: A Longitudinal Study of Women Attending Antenatal Care Facility in Nigeria (Saliu et al., 2025) | 112 pregnant women in the second trimester receiving ANC at AKTH, Kano, Nigeria; 85 were followed until the third trimester. | Compliance with iron-folic acid supplementation, iron-rich food intake, education, family income, parity, gestational age, and birth spacing.                   | Pregnant women compliant versus non-compliant with iron-folic acid supplementation and women with different socioeconomic and dietary characteristics.        | IDA increased from 10.7% to 16.5%, while anemia increased from 37.5% to 65.9%. Compliance with iron-folic acid supplementation was associated with better hemoglobin and iron status.                                                        | Prospective cohort study                    |
| Association between Socioeconomic Factors, Nutritional Intake and Incidence of Anemia in Pregnant Women (Mariyana et al., 2023)                                 | 112 pregnant women in the second trimester receiving ANC at AKTH, Kano, Nigeria; 85 were followed until the third trimester. | Socioeconomic factors and nutritional intake, including maternal age, parity, education, family income, family size, food consumption patterns, and ANC visits. | Pregnant women with high versus low education/income, diverse versus non-diverse diets, ANC $\geq 4$ versus $< 4$ visits, and anemic versus non-anemic women. | Risk factors included multigravida status ( $p = 0.011$ ), low family income ( $p = 0.035$ ), dietary diversity ( $p = 0.002$ ), and ANC $< 4$ visits ( $p = 0.010$ ). Low education showed an association with anemia risk ( $p = 0.056$ ). | Observational analytical case-control study |
| Relationship of Nutrition Knowledge, Nutrition Intake, Provision of Supplementary Food With Nutritional Status of Pregnant                                      | 100 pregnant women examined at Wedi Community Health Center, Klaten Regency, Central Java.                                   | Nutritional knowledge, energy, carbohydrate, protein and fat intake, and supplementary feeding (PMT).                                                           | Pregnant women with normal nutritional status compared with those experiencing Chronic Energy Deficiency (CED).                                               | Women with normal nutritional status had better nutritional knowledge ( $p = 0.018$ ) and higher energy ( $p = 0.016$ ), carbohydrate                                                                                                        | Comparative cross-sectional study           |

|                                                                                                                              |                                                                                |                                                             |                                                                                                  |                                                                                                                                                                                                                                                     |                                                |
|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| Women<br>(Ramdhani et al., 2024)                                                                                             |                                                                                |                                                             |                                                                                                  | (p = 0.047), and fat (p = 0.016) intake. PMT was significantly associated with nutritional status (p < 0.001).                                                                                                                                      |                                                |
| The Correlation between Protein, Iron, and Vitamin C Intake with Hemoglobin Levels in Pregnant Women (Sitorus et al., 2024)  | 78 pregnant women at Gang Kelor Community Health Center, Bogor City.           | Protein, iron, and vitamin C intake during pregnancy.       | Pregnant women with sufficient versus insufficient intake of protein, iron, and vitamin C.       | Protein, iron, and vitamin C intake were significantly correlated with hemoglobin levels (p < 0.05). Better nutritional intake was associated with higher Hb and lower anemia risk.                                                                 | Analytical observational cross-sectional study |
| Relationship Between Energy, Protein, Iron, and Calcium Intake with Hemoglobin Levels of Pregnant Women (Zalfa et al., 2024) | Pregnant women receiving antenatal care who participated as study respondents. | Energy, protein, iron, and calcium intake during pregnancy. | Pregnant women with sufficient versus insufficient intake of energy, protein, iron, and calcium. | Significant relationships were found between energy (p = 0.018), protein (p = 0.006), iron (p = 0.001), calcium (p = 0.021) intake and maternal hemoglobin levels. Adequate nutritional intake was associated with higher Hb and lower anemia risk. | Observational analytical cross-sectional study |

## Discussion

Low socioeconomic status, generally characterized by low education levels, can affect pregnant women's knowledge about healthy eating patterns and nutritional needs during pregnancy. Research conducted by Samsir et al. (2025) on 80 pregnant women at the Bungus Community Health Center in Padang City showed that education level was significantly associated with the incidence of anemia (p=0.000), with a prevalence of 66.2%. However, knowledge about

anemia did not show a statistically significant association ( $p=0.073$ ). These results indicate that formal education has a more consistent influence on the incidence of anemia than knowledge measured momentarily through questionnaires.

In addition to education, family income is also a determinant of anemia in pregnant women. Research by Mariyana et al. (2023) on 100 pregnant women at the Wedi Community Health Center in Klaten Regency showed that low family income was significantly associated with the incidence of anemia ( $p=0.035$ ). This study also revealed that a less diverse diet was the most dominant factor in increasing the risk of anemia ( $p=0.002$ ). These findings suggest that low family income can affect the dietary diversity of pregnant women, thus contributing to increased risks during pregnancy.

The results of a study by Sinha et al. (2021) of 200 pregnant women attending antenatal visits showed a very high prevalence of anemia, at 90%, with the majority of respondents experiencing moderate anemia (60.5%). The study found that low socioeconomic status was significantly associated with anemia ( $p<0.05$ ). The high prevalence of anemia suggests that structural poverty in rural communities can increase the risk of anemia through limited access to nutritious food and adequate health services. Furthermore, a study by Wijayanti et al. (2024) of 200 pregnant women showed that low education levels, low family income, and limited access to health services were significantly associated with an increased risk of anemia in pregnant women. This study also emphasized the importance of social support as a protective factor. Good support from family and the surrounding community can help reduce the risk of anemia.

Khotima et al.'s (2025) study used data from the Indonesian Health Insurance (BPJS Kesehatan) program from 2015-2022 on 3,512 pregnant women diagnosed with nutritional anemia, which, after weighting, represented 76,505 cases. The results showed that pregnant women working in the informal sector and those unemployed had a higher risk of developing anemia. The most common type of anemia was nonspecific iron deficiency anemia, at 29.2%, with the highest prevalence in Central Java Province at 15.6%. These findings suggest that socioeconomic factors not only stand-alone but also interact with geographic factors in influencing the risk of anemia in pregnant women.

Research by Ramadhania et al. (2021) conducted on 85 pregnant women living in temporary housing after the disaster in Talise, Palu City, showed a significant relationship between socioeconomic status and nutritional status of pregnant women, as measured by the incidence of Chronic Energy Deficiency (KDRT) ( $p=0.001$ ). Pregnant women from families with incomes above the district/city minimum wage have better nutritional status than those with incomes below the minimum wage. These results indicate that in emergency situations or with limited access to food, the influence of socioeconomic status on the nutritional status of pregnant women becomes more pronounced.

In addition to socioeconomic factors, nutritional intake also plays a direct role in the process of hemoglobin formation. Research by Azam et al. (2024) found that iron consumption ( $p=0.001$ ) and protein consumption ( $p=0.012$ ) were significantly associated with the incidence of anemia, with a prevalence of 46.2%. In this study, gestational age was the most dominant factor influencing the incidence of anemia ( $OR=3.029$ ; 95%  $CI=1.520-6.038$ ), consistent with the increasing need for iron as gestational age increases. Furthermore, maternal education ( $p=0.006$ ) and nutritional status ( $p=0.003$ ) were significantly associated with the incidence of anemia.

A longitudinal study conducted by Auwal et al. (2025) in 112 pregnant women in Nigeria showed that the prevalence of iron deficiency anemia increased from 10.7% in the second trimester to 16.5% in the third trimester, while the overall prevalence of anemia increased from 37.5% to 65.9%. Compliance with iron and folic acid supplementation was associated with better hemoglobin levels and iron status. Education, family income, parity, and birth spacing also influenced adherence to supplementation. Furthermore, research by Rooney et al. (2024) showed that adequate intake of iron, folic acid, and vitamin B12 during pregnancy was associated with higher maternal hemoglobin levels and fetal growth and development through placental nutrient transfer.

A study by Noor et al. (2023) on 1,430 pregnant women in Taiwan showed that a healthy and diverse diet was associated with a reduced risk of iron, folate, and vitamin B12 deficiencies, thus playing a role in preventing anemia. Similar results were reported by Bayyari et al. (2024) on 198 pregnant women in Northern Jordan, who found a prevalence of anemia of 27.8% and a prevalence of iron deficiency anemia of 21.7%. Pregnant women with higher dietary diversity and better diet quality had higher hemoglobin and ferritin levels and benefited from iron supplementation.

A study by Sitorus et al. (2024) showed that protein, iron, and vitamin C intake were associated with increased hemoglobin levels in pregnant women. These findings are supported by Zalfa et al. (2023), who stated that adequate energy, protein, iron, and calcium intake were associated with higher hemoglobin levels and a lower risk of anemia. Thus, adequate macronutrient and micronutrient intake during pregnancy is an important factor in preventing anemia.

Furthermore, Ramadhani's (2024) study of 78 pregnant women showed that women with normal nutritional status had better nutritional knowledge ( $p=0.018$ ), higher energy intake ( $p=0.016$ ), better carbohydrate intake ( $p=0.047$ ), and better fat intake ( $p=0.016$ ) than women with Chronic Energy Deficiency (CED). Supplemental feeding (PMT) was also significantly associated with maternal nutritional status ( $p<0.001$ ), making it an important intervention to prevent anemia, especially in pregnant women with limited economic conditions.

#### The Influence of Socioeconomic Status and Nutritional Intake on Anemia in Pregnant Women

Anemia in pregnancy is a condition in which a pregnant woman's hemoglobin (Hb) levels are below normal, namely less than 11 g/dL in the first and third trimesters, and less than 10.5 g/dL in the second trimester. The incidence of anemia in pregnant women is multifactorial, but the most common cause is iron deficiency due to increased physiological needs during pregnancy that are not balanced by adequate nutritional intake. Furthermore, poor socioeconomic conditions can also exacerbate the situation by limiting the family's ability to meet nutritional food needs and access optimal health services.

In Indonesia, the prevalence of anemia in pregnant women remains relatively high, indicating that nearly half of pregnant women are at risk of developing anemia. This condition generally appears in the second trimester of pregnancy. In the first trimester, blood volume has not increased significantly, so symptoms of anemia are often not obvious. However, during the second and third trimesters, the increase in blood plasma volume, which accompanies the fetus's increased needs for growth and preparation for labor, causes symptoms of anemia to become more pronounced and easier to detect.

Based on the results of a review of 15 articles analyzed in this literature review, most studies indicate a significant influence between socioeconomic status and nutritional intake on the incidence of anemia in pregnant women. These two factors are not independent factors but are interrelated in determining maternal health status during pregnancy. Pregnant women with a

good socioeconomic status generally have wider access to nutritious food, health services, and adequate health information. These conditions enable mothers to meet their nutritional needs during pregnancy, thereby minimizing the risk of anemia. Conversely, limited socioeconomic status can hinder the fulfillment of nutritional needs and reduce access to health services, thereby increasing the risk of anemia.

According to the Social Determinations of Health theory, a person's health is influenced by various social and economic factors, such as education level, occupation, income, and access to health services. For pregnant women, a higher level of education can improve their ability to understand nutritional information, the importance of prenatal care, and their adherence to iron supplementation. Meanwhile, adequate family income allows mothers to obtain quality and varied food, thus optimally meeting nutritional needs during pregnancy.

Regarding diet, pregnant women with low socioeconomic status tend to have poor dietary quality. This is indicated by the habit of skipping breakfast, consuming insufficient amounts of food, adopting a less diverse and unbalanced diet, and frequently consuming foods high in sugar and fat but low in nutrients. Furthermore, limited family purchasing power also leads to low consumption of foods that are sources of iron, such as meat, liver, fish, eggs, and green vegetables. As a result, iron requirements during pregnancy are not optimally met, increasing the risk of anemia.

Nutritional intake plays a crucial role in hemoglobin formation and red blood cell production. During pregnancy, iron requirements increase significantly because it is used to increase the mother's blood volume, support fetal growth, develop the placenta, and prepare for labor. If iron requirements are not met through diet or supplementation, the body's iron reserves will be depleted, leading to iron deficiency anemia. In addition to iron, several other nutrients also play an important role in erythropoiesis, or red blood cell formation, including protein, folic acid, vitamin B12, vitamin C, and calcium. Protein functions in hemoglobin formation and helps transport iron within the body. Folic acid and vitamin B12 play a role in the formation and maturation of red blood cells, while vitamin C helps increase the absorption of non-heme iron in the intestine, thus optimizing iron availability in the body. Therefore, a diverse and balanced diet that meets nutritional needs is an important factor in preventing anemia during pregnancy. Dietary diversity is also an important indicator in assessing the quality of a pregnant woman's nutritional intake. Mothers who consume a variety of foods, such as animal protein sources, nuts, green vegetables, and fruits, tend to have better iron status and hemoglobin levels than mothers with less diverse diets. Conversely, a monotonous diet low in nutrients can increase the risk of iron and other micronutrient deficiencies, which are associated with anemia.

The results of this literature review indicate that anemia in pregnant women is a complex health problem influenced by the interaction of various factors, particularly socioeconomic status and nutritional intake. Therefore, anemia prevention efforts should not only focus on iron supplementation but also include improving family socioeconomic status, improving the quality and quantity of nutritional intake, providing health education, and increasing access to and utilization of health services during pregnancy.

## **Conclusion**

Based on the results of the research that has been conducted, the following conclusions can be drawn; (1) Socioeconomic status influences the incidence of anemia in pregnant women. Low education, limited family income, informal work increase the risk of anemia during pregnancy; (2) Nutritional intake influences the incidence of anemia in pregnant women. Deficiencies in iron, protein, folic acid, vitamin B12, vitamin C, and low dietary diversity are associated with

decreased hemoglobin levels and an increased risk of anemia; (3) Socioeconomic status and nutritional intake have a mutually related relationship in influencing the incidence of anemia in pregnant women. Good socioeconomic status allows mothers to obtain nutritious food, adequate health services, and better compliance with supplementation during pregnancy; (4) Other factors that influence anemia in pregnant women are gestational age, parity, pregnancy spacing, ANC visits, and compliance with taking iron tablets.

### Suggestion

It is recommended that further research be conducted with a stronger design, such as a cohort study or intervention study, to gain a deeper understanding of the causal relationship between socioeconomic status, nutritional intake, and the incidence of anemia in pregnant women.

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