Contents lists available at IOCS

**Science Midwifery**

journal homepage: www.midwifery.iocspublisher.org

# Effectiveness of nutritional counseling and fe tablet supplementation on hemoglobin levels of pregnant women in the working area of the Hajimena Health Center, Lampung

**Nur Wachiniah Mawadda[1], Harny Citra Purnama[2], Nurul Amalia[3], Qorinah Estiningtyas Sakilah Adnani[4], Chyntia Haryana[5]**

[1,2,3]Master of Midwifery Study Program, Universitas Padjadjaran, Indonesia
[4]Head of the Midwifery Master's Program, Universitas Padjadjaran, Indonesia
[5]Department of Midwifery, STIKes Sentral, Padangsidimpuan, Sumatera Utara, Indonesia

**ARTICLE INFO**

***Article history:***

Received Jul 10, 2026
Revised Jul 17, 2026
Accepted Jul 23, 2026

***Keywords:***

Anemia in Pregnancy
Hemoglobin
Iron Tablet
Nutrition Counseling
Pregnant Women

**ABSTRACT**

Pregnancy-related anemia remains a significant public health problem in the working area of Puskesmas Hajimena, Natar Subdistrict, South Lampung, increasing the risk of preterm birth and low birth weight. Although iron (Fe) supplementation is routinely provided through antenatal care (ANC), anemia remains prevalent, suggesting that supplementation alone may be insufficient to address nutritional and behavioral factors affecting maternal hemoglobin (Hb) levels. This study addressed limited evidence regarding the integration of Health Belief Model (HBM)-based nutrition counseling with Fe supplementation in primary healthcare settings. A quasi-experimental pretest-posttest study with a control group involved 98 second-trimester pregnant women equally allocated into intervention and control groups. The intervention group received three HBM-based nutrition counseling sessions over eight weeks alongside Fe tablets, while the control group received Fe tablets alone. The intervention significantly increased Hb levels and reduced anemia prevalence. The novelty lies in integrating behavioral-based nutrition counseling into anemia prevention. Scientifically, the findings provide evidence that behavioral interventions can enhance Fe supplementation effectiveness. Practically and clinically, the intervention offers a feasible strategy for midwives to improve maternal knowledge, adherence, dietary practices, and anemia management within ANC services. From a policy perspective, the findings support integrating structured nutrition counseling into routine maternal health programs to strengthen anemia prevention and improve maternal health outcomes.



***Corresponding Author:***

Nur Wachiniah Mawadda
Program Studi Magister Kebidanan,
Universitas Padjadjaran,
Jl. Raya Bandung Sumedang KM.21, Hegarmanah, Kec. Jatinangor, Kab. Sumedang, Jawa Barat, 45363, Indonesia
Email: nur24033@mail.unpad.ac.id

# INTRODUCTION

Pregnancy-related anemia remains one of the world's most significant dietary issues. Based on The Global Burden of Disease Study 2021 analysis, anemia contributes to a large health burden on women who are able to procreate, considering the anticipated frequency of anemia among expectant mothers globally reaching around 36% and tending to decline slowly since 2000 (Zheng et al., 2025). Pregnant women's anemia prevalence was even revealed by a global meta-analysis and systematic review at 36.8% of 52 studies involving more than one million respondents (Karami et al., 2022). while WHO pooled data showed similar patterns in the highest-burden regions in nations with poor and moderate incomes (Stevens et al., 2022).

Anemia in pregnancy is not just a hematologic disorder, but has a wide influence on the pregnancy's outcome and childbirth. Anemia that occurs primarily in early pregnancy is more likely to give birth prematurely (Beressa, Whiting, Kuma, et al., 2024), while meta-analyses in South Asia show maternal Perinatal mortality, low birth weight, and preterm birth are all linked to anemia (Rahman et al., 2020). These effects eventually lead to high rates of sickness and mortality among mothers and infants, particularly in countries with poor and medium incomes (Alem et al., 2023; Fite et al., 2021).

The prevalence of anemia in pregnant women in Indonesia does show a downward trend, from 48.9% in the 2018 Basic Health Research to 27.7% according to the Indonesian Health Survey (SKI) of 2023, with the highest prevalence found between the ages of 35 and 44 (SKI, 2023). Despite the decline, the figure is still far above the threshold of mild public health problems according to the WHO of 5%-19.9% (WHO, 2011, 2016), and a number of expert studies confirm that Indonesia's efforts to avoid iron deficient anemia needs to be carried out continuously throughout the life cycle, including nutrition education integrated with antenatal services (Sungkar et al., 2022) (Balarajan et al., 2011). The Hajimena Health Center's operational space in South Lampung Regency's Natar District, as one of the areas with high population mobility and variations in socioeconomic status, also faces similar challenges in controlling anemia in expectant mothers.

Various previous research has examined the efficacy of dietary advice and education on hemoglobin levels and compliance with iron-folic acid intake acid tablets (Fe-folic acid supplementation or Iron Folic Acid Supplementation/IFAS). Quasi-experimental studies in Indonesia show that pictorial education accompanied by individualized counseling is able to improve status, knowledge, and dietary consumption of anemia, and compliance with taking iron supplements during pregnancy with anemia (Sendeku et al., 2020). A number of randomized controlled trials in Ethiopia have also consistently reported that intensive nutrition counseling based on the Health Belief Model works well to enhance Hb levels and lowering the prevalence of anemia compared to routine antenatal services (Beressa et al., 2025b, 2025a; Beressa, Whiting, & Belachew, 2024; Nahrisah et al., 2020; Wakwoya et al., 2023). Nutrition education during pregnancy increased IFAS adherence by 2.80 times and raised Hb levels by an average of 0.88 g/dL, according to a recent meta-analysis of 53 research conducted in low- and middle-income countries (Engidaw et al., 2024), in line with evidence that oral Fe supplementation does indeed consistently improve pregnant women's Hb levels (Finkelstein et al., 2024).

Previous studies vary in intervention intensity, counseling methods, study designs, populations, and healthcare contexts, which may explain differences in their findings. Although randomized controlled trials provide stronger causal evidence, quasi-experimental studies offer greater relevance to routine healthcare settings. Despite evidence supporting nutrition counseling, research evaluating its added effectiveness when combined with Fe supplementation remains limited, particularly in the working area of Puskesmas Hajimena. Routine ANC services mainly focus on Fe tablet distribution without structured counseling on iron-rich foods, vitamin C intake, and factors affecting iron absorption (Hurrell & Egli, 2010).

A key research gap is the limited evidence on the additional effectiveness of structured Health Belief Model (HBM)-based nutrition counseling when combined with routine Fe

supplementation compared with Fe supplementation alone, particularly in primary healthcare settings such as Puskesmas Hajimena. This study proposes that HBM-based counseling can improve maternal knowledge, perceptions, self-efficacy, adherence to Fe supplementation, and dietary practices, thereby enhancing iron absorption and improving hemoglobin levels. The study therefore compares the effectiveness of the combined intervention with Fe supplementation alone. Its novelty lies in integrating a structured HBM-based behavioral intervention with routine Fe supplementation in the under-researched context of Natar Subdistrict. The findings are expected to contribute to evidence-based midwifery science, strengthen ANC services, support maternal anemia prevention policies, and provide a practical strategy for midwives to improve anemia management and maternal health outcomes.

# RESEARCH METHOD

A pretest-posttest quasi-experimental design with a control group was used in this investigation to evaluate the effectiveness of the intervention under real-world primary healthcare conditions. This design was considered appropriate because random allocation of pregnant women to intervention and control groups was limited by ethical and operational considerations within routine antenatal care. The intervention group received HBM-based nutrition counseling combined with Fe tablet supplementation, while the control group received Fe tablet supplementation according to antenatal service standards. The research will be carried out in June 2026 in the working area of Puskesmas Hajimena, Natar Subdistrict, South Lampung Regency.

The study population consisted of 130 second-trimester pregnant women. The sample size was determined using an a priori power analysis with G*Power, considering the expected effect size, significance level, statistical power, and two-group comparison, resulting in 98 respondents. Participants were selected through simple random sampling using a computerized random-number procedure and then allocated equally into the intervention and control groups, with 49 respondents in each group. Inclusion criteria included second-trimester pregnant women domiciled in the study area, willing to participate, and having never received structured nutrition counseling. Pregnant women with severe comorbidities, those taking iron supplements outside the program, or those who changed domicile during the study were excluded.

The intervention included three HBM-based nutrition counseling sessions over eight weeks using validated materials and visual media covering iron-rich foods, vitamin C intake, Fe adherence, and inhibitors of iron absorption. Sessions were delivered by trained healthcare personnel and monitored using attendance records and fidelity checklists. The control group received routine Fe supplementation according to ANC standards. Hemoglobin levels were measured before and after the intervention using a calibrated digital hemoglobinometer with standardized procedures and quality control. Respondent characteristics were collected using a content-validated questionnaire. Data were analyzed using the Shapiro-Wilk, chi-square, independent t-test, and paired t-test, with statistical significance set at $p<0.05$. Overall, the methodology provides a solid foundation, with a clearly defined research design, population, control group, instruments, intervention procedures, and statistical analysis, thereby making the research process transparent and easy to understand.

# RESULTS AND DISCUSSIONS

The characteristics of respondents in both groups are presented in Table 1. The analysis showed no significant differences in baseline characteristics between the intervention and control groups ($p>0.05$), indicating that the groups were homogeneous and comparable at the beginning of the study. The Shapiro–Wilk test showed that continuous variables, including age, gestational age, and hemoglobin levels, were normally distributed ($p>0.05$), supporting the use of parametric tests.

Baseline anemia severity, assessed according to hemoglobin levels, was also comparable between the two groups before the intervention.

**Table 1.** Intervention group and control group respondent characteristics

| Features | Intervention (n=49) | Control (n=49) | *p-value* |
|---|---|---|---|
| Age (years), average±elementary school | 27,4±4,2 | 27,8±4,5 | 0,612 |
| Gestational age (weeks), average±elementary school | 18,2±1,8 | 18,5±1,6 | 0,398 |
| Paritas | | | 0,678 |
| Primipara | 22 (44,9%) | 20 (40,8%) | |
| Multipara | 27 (55,1%) | 29 (59,2%) | |
| Final education | | | |
| Primary–Junior | 18 (36,7%) | 20 (40,8%) | 0,891 |
| Upper Middle | 23 (46,9%) | 21 (42,9%) | |
| College | 8 (16,3%) | 8 (16,3%) | |
| Employment status | | | |
| Work | 19 (38,8%) | 17 (34,7%) | 0,673 |
| Not working | 30 (61,2%) | 32 (65,3%) | |

*Note: p-values were calculated using the chi-square test for categorical variables and the independent t-test for continuous variables. A p-value >0.05 indicates no statistically significant difference between groups.*

Table 2 presents the comparison of hemoglobin levels before and after the intervention. Mean Hb levels increased significantly in the intervention group from 10.2±0.9 g/dL to 11.6±0.8 g/dL ($p<0.001$), while the control group showed a smaller increase from 10.3±0.8 g/dL to 10.7±0.9 g/dL ($p=0.012$). The mean increase was 1.4 g/dL in the intervention group compared with 0.4 g/dL in the control group, producing a between-group difference of 0.9 g/dL (95% CI: 0.64–1.16). The estimated Cohen's d of approximately 1.53 indicates a large intervention effect, demonstrating that the additional benefit of HBM-based nutrition counseling was not only statistically significant but also clinically substantial.

**Table 2.** Hemoglobin levels before and after intervention in each group

| Groups | *Pretest* (g/dL) | *Post Test* (g/dL) | *p-value* |
|---|---|---|---|
| Intervention (n=49) | 10,2±0,9 | 11,6±0,8 | <0.001 |
| Control (n=49) | 10,3±0,8 | 10,7±0,9 | 0,012 |

**Paired t-test comparing pretest and post-test hemoglobin levels within each group.*

Table 3 compares changes in Hb levels and anemia status between the two groups. The intervention group experienced a significantly greater increase in Hb than the control group (1.4±0.7 vs. 0.4±0.6 g/dL; $p<0.001$). The between-group mean difference was 0.9 g/dL (95% CI: 0.64–1.16), with a large estimated Cohen's d of approximately 1.53. This indicates a substantial clinical effect of combining HBM-based nutrition counseling with Fe supplementation.

The prevalence of anemia before the intervention was comparable between the intervention and control groups (67.3% vs. 65.3%; $p=0.842$). After the intervention, anemia prevalence decreased to 20.4% in the intervention group and 49.0% in the control group ($p=0.002$). The absolute risk reduction was 28.6 percentage points, indicating that the combined intervention prevented anemia in approximately 29 additional pregnant women per 100 treated compared with Fe supplementation alone. The relative risk of post-intervention anemia was approximately 0.42, indicating a 58% relative reduction in anemia risk. The estimated number needed to treat (NNT) was approximately 4, meaning that treating four pregnant women with the combined intervention instead of Fe supplementation alone could prevent one additional case of anemia.

**Table 3.** Comparison of differences in hemoglobin increase and anemia status between groups

| Variabel | Intervention (n=49) | Control (n=49) | *p-value* |
|---|---|---|---|
| Difference in Hb increase (g/dL), average±SD | 1,4±0,7 | 0,4±0,6 | <0.001* |
| Anemia before the intervention, n (%) | 33 (67,3%) | 32 (65,3%) | 0,842† |

| Variabel | Intervention (n=49) | Control (n=49) | *p-value* |
|---|---|---|---|
| Post-intervention anemia, n (%) | 10 (20,4%) | 24 (49,0%) | 0,002† |

**Independent t-test; †Chi-square test.*

Overall, the findings demonstrate that the intervention produced statistically significant and clinically meaningful benefits. The inclusion of confidence intervals, effect size, absolute risk reduction, relative risk, and NNT provides a more comprehensive interpretation of the intervention's precision, magnitude, and practical clinical relevance beyond p-values alone.

The results of this study show that nutritional counseling combined with Fe tablet supplementation is significantly more effective in increasing hemoglobin levels and reducing the prevalence of anemia in pregnant women compared to giving Fe tablets alone. These findings are consistent with the results of a quasi-experimental study in Aceh, Indonesia, which reported that pictorial education accompanied by individual counseling was efficient in raising pregnant women's hemoglobin and hematocrit levels with anemia compared to the group that only received routine antenatal services (Nahrisah et al., 2020). The similarity in the direction of the findings in different Indonesian contexts strengthens the evidence that structured nutritional counseling provides added value over the administration of Fe supplements alone.

The greater improvement in the intervention group can be scientifically explained by the complementary effects of the intervention components. Fe tablets provide the primary source of iron required for hemoglobin synthesis, while HBM-based counseling may influence the behavioral factors that determine whether this supplementation is taken correctly and consistently. By addressing perceived susceptibility to anemia, perceived severity of its consequences, perceived benefits of Fe supplementation, perceived barriers to adherence, and self-efficacy, the counseling may increase the likelihood that pregnant women follow recommended supplementation and dietary practices. Therefore, the intervention likely improved not only the availability of iron but also the behavioral conditions necessary for its effective use and absorption.

These findings are also in line with a number of randomized, grouped controlled trials in Ethiopia, which consistently show that nutrition education or counseling based on the Health Belief Model can improve pregnant women's Hb levels and reduce the proportion of anemia compared to standard antenatal services (Beressa et al., 2025b; Demilew et al., 2020; Wakwoya et al., 2023). A 53 papers from low- and middle-income nations were included in the meta-analysis also showed that nutrition education during pregnancy increased Hb levels by 0.88 g/dL on average and reduced the risk of anemia by 34% (Engidaw et al., 2024), an effect comparable to the difference in Hb increase of 0.9 g/dL between the groups found in this study.

The findings suggest that counseling may function as a behavioral mediator between the provision of Fe tablets and the biological improvement in hemoglobin. In other words, the intervention may have increased the effectiveness of the same Fe supplementation by improving adherence, dietary choices, and knowledge of factors affecting iron absorption. This interpretation is important because it indicates that the observed effect was not solely attributable to the pharmacological action of Fe tablets, but also to improved maternal behaviors that supported the biological response to supplementation.

Mechanistically, the success of nutritional counseling in increasing Hb levels cannot be separated from its role in improving pregnant women's knowledge and eating behavior, including the selection of food sources high in iron and food combinations that support the absorption of non-heme iron, such as the consumption of vitamin C at the same time as vegetable iron sources, as well as avoiding the consumption of tea or coffee close to the time of meals or drinking Fe tablets because the content of polyphenols and phytate can inhibit iron absorption (Hurrell & Egli, 2010; Lameshow & Organization, 1990). With this understanding, the adherence and effectiveness of Fe tablet consumption in the intervention group may be more optimal than the control group that only received the tablet without an in-depth explanation of how to maximize its absorption. This is also in line with a Cochrane review confirming that daily oral Fe supplementation generally

increases pregnant women's Hb levels, although its effectiveness may vary depending on adherence and absorption factors (Finkelstein et al., 2024; Young et al., 2019).

Thus, the findings indicate that the intervention addressed both the biological and behavioral dimensions of pregnancy-related anemia. The biological component was addressed through Fe supplementation, while the behavioral component was addressed through counseling designed to improve knowledge, motivation, self-efficacy, and adherence. This combination provides a more comprehensive explanation for the greater increase in Hb levels and reduction in anemia prevalence observed in the intervention group.

Improved Hb levels and decreased prevalence of anemia in the intervention group have important clinical implications, considering that a higher risk of premature birth is linked to anemia during pregnancy (Beressa, Whiting, Kuma, et al., 2024), low birth weight, and perinatal mortality 5. The 2023 SKI data does show a decreasing trend in pregnant women's anemia prevalence nationally (SKI, 2023), but this figure is still above the threshold of mild public health problems, so that nutrition counseling-based interventions that have proven effective in this study are relevant to expand their application, especially in the Natar District's Hajimena Health Center's operational area, which so far has focused on the distribution of Fe tablets without structured nutritional counseling (Torheim et al., 2010).

This research has several limitations. First, quasi-experimental designs without full randomization have the potential to generate selection bias even though the basic characteristic homogeneity test shows both groups are equivalent. Second, the study was only carried out in one work area of the health center with a relatively short observation duration (eight weeks), so generalization of results to other areas or for long-term outcomes such as birth weight needs to be done carefully. Third, compliance with Fe tablet consumption and dietary intake to support iron absorption were not measured objectively, but relied on respondents' self-reports, so they had the potential to experience reporting bias.

From a theoretical perspective, the findings support the Health Belief Model, particularly the role of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy. Among these constructs, self-efficacy and perceived benefits may have been particularly influential because pregnant women who believed that anemia posed a real threat and that Fe supplementation and appropriate dietary practices could prevent its consequences were more likely to adhere to the intervention. Meanwhile, reducing perceived barriers, such as misconceptions about Fe tablets or inappropriate dietary practices that inhibit iron absorption, may have improved adherence and treatment effectiveness. These behavioral changes provide a plausible pathway through which HBM-based counseling enhanced the biological effects of Fe supplementation, ultimately improving iron availability for hemoglobin synthesis and reducing anemia. Thus, the findings suggest that the intervention was effective not simply because information was provided, but because it addressed key beliefs and behavioral determinants that influence the effectiveness of anemia prevention.

# CONCLUSION

Nutritional counseling combined with Fe tablet supplementation was significantly more effective in increasing hemoglobin levels and reducing anemia prevalence among pregnant women than Fe supplementation alone in the working area of Puskesmas Hajimena, Natar Subdistrict, South Lampung Regency. These findings indicate that anemia management should address not only iron provision but also behavioral and nutritional factors influencing adherence, dietary practices, and iron absorption. The scientific contribution and novelty of this study lie in demonstrating the added value of structured HBM-based nutrition counseling when integrated with routine Fe supplementation in a primary healthcare setting. Clinically, the intervention provides midwives with a practical strategy to strengthen ANC through improved counseling, adherence, and dietary behavior. From a policy perspective, the findings support the integration of structured, behavior-

based nutrition counseling into maternal anemia prevention programs. Future research should use larger multicenter samples, longer follow-up periods, and randomized designs, while objectively measuring Fe adherence, dietary intake, and HBM constructs to clarify the mechanisms and long-term effectiveness of the intervention.

## ACKNOWLEDGEMENTS

These results highlight the significance of incorporating organized dietary advice into regular prenatal care services as an effort to prevent and manage anemia in pregnancy. Follow-up studies with randomized controlled designs, wider area coverage, longer duration of observations, and objective measurements of adherence and nutritional intake are need to bolster the proof of the efficacy of these interventions.

## References

Alem, A. Z., Efendi, F., McKenna, L., Felipe-Dimog, E. B., Chilot, D., Tonapa, S. I., Susanti, I. A., & Zainuri, A. (2023). Prevalence and factors associated with anemia in women of reproductive age across low- and middle-income countries based on national data. *Scientific Reports*, *13*(1), 1–13. https://doi.org/10.1038/s41598-023-46739-z

Balarajan, Y., Ramarishnan, U., Ozaltin, E., & Shankar, A. H. (2011). Anaemia in low-income and middle-income countries. *THE LANCET*, *378*(9809), 2123–2135.

Beressa, G., Whiting, S. J., & Belachew, T. (2024). Effect of nutrition education on the nutritional status of pregnant women in Robe and Goba Towns, Southeast Ethiopia, using a cluster randomized controlled trial. *Scientific Reports*, *14*(1), 1–11. https://doi.org/10.1038/s41598-024-70861-1

Beressa, G., Whiting, S. J., & Belachew, T. (2025a). Effect of nutrition education integrating the health belief model and theory of planned behavior during pregnancy on gestational weight gain and birth weight in Southeast Ethiopia using complex analyses. *BMC Pregnancy and Childbirth*, *25*(1), 1–13. https://doi.org/10.1186/s12884-025-07284-x

Beressa, G., Whiting, S. J., & Belachew, T. (2025b). Effect of nutrition education on hemoglobin level of pregnant women in Southeast Ethiopia: a cluster randomized controlled trial. *BMC Public Health*, *25*(1). https://doi.org/10.1186/s12889-025-21699-3

Beressa, G., Whiting, S. J., Kuma, M. N., Lencha, B., & Belachew, T. (2024). Association between anemia in pregnancy with low birth weight and preterm birth in Ethiopia: A systematic review and meta-analysis. *PLoS ONE*, *19*(9 September), 1–23. https://doi.org/10.1371/journal.pone.0310329

Demilew, Y. M., Alene, G. D., & Belachew, T. (2020). Effects of guided counseling during pregnancy on birth weight of newborns in West Gojjam Zone, Ethiopia: A cluster-randomized controlled trial. *BMC Pediatrics*, *20*(1), 1–12. https://doi.org/10.1186/s12887-020-02363-8

Engidaw, M. T., Lee, P., Fekadu, G., Mondal, P., & Ahmed, F. (2024). *Effect of Nutrition Education During Pregnancy on Iron – Folic Acid Supplementation Compliance and Anemia in Low- and Middle-Income Countries : A Systematic Review and*. *83*(7).

Finkelstein, J. L., Cuthbert, A., Weeks, J., Venkatramanan, S., Larvie, D. Y., De-Regil, L. M., & Garcia-Casal, M. N. (2024). Daily oral iron supplementation during pregnancy. *Cochrane Database of Systematic Reviews*, *2024*(8). https://doi.org/10.1002/14651858.CD004736.pub6

Fite, M. B., Assefa, N., & Mengiste, B. (2021). Prevalence and determinants of Anemia among pregnant women in sub-Saharan Africa: a systematic review and Meta-analysis. *Archives of Public Health*, *79*(1), 1–11. https://doi.org/10.1186/s13690-021-00711-3

Hurrell, R., & Egli, I. (2010). Iron bioavailability and dietary reference values. *American Journal of Clinical Nutrition*, *91*(5), 1461S-1467S. https://doi.org/10.3945/ajcn.2010.28674F

Karami, M., Chaleshgar, M., Salari, N., Akbari, H., & Mohammadi, M. (2022). Global Prevalence of Anemia in Pregnant Women: A Comprehensive Systematic Review and Meta-Analysis. *Matern Child Health J*, *26*(7), 1473–1478.

Lameshow, S., & Organization, W. H. (1990). *Adequacy of sample size in health studies*.

Nahrisah, P., Somrongthong, R., Viriyautsahakul, N., Viwattanakulvanid, P., & Plianbangchang, S. (2020). Effect of integrated pictorial handbook education and counseling on improving anemia status, knowledge, food intake, and iron tablet compliance among anemic pregnant women in Indonesia: A

quasi-experimental study. *Journal of Multidisciplinary Healthcare*, *13*, 43–52. https://doi.org/10.2147/JMDH.S213550

Rahman, M. A., Khan, M. N., & Rahman, M. M. (2020). Maternal anaemia and risk of adverse obstetric and neonatal outcomes in South Asian countries: A systematic review and meta-analysis. *Public Health in Practice*, *1*(December 2019), 1–9. https://doi.org/10.1016/j.puhip.2020.100021

Sendeku, F. W., Azeze, G. G., & Fenta, S. L. (2020). Adherence to iron-folic acid supplementation among pregnant women in Ethiopia: A systematic review and meta-analysis. *BMC Pregnancy and Childbirth*, *20*(1), 1–9. https://doi.org/10.1186/s12884-020-2835-0

SKI. (2023). *Badan Kebijakan Pembangunan Kesehatan Kemenkes Republik Indonesia, "Survei Kesehatan Indonesia (SKI) 2023: Hasil Utama," BKPK Kemenkes RI. [Online]. Available: https://www.badankebijakan.kemkes.go.id/daftar-frequently-asked-question-seputar-hasil-utama sk*.

Stevens, G. A., Paciorek, C. J., Urrutia, M. C. F., Borghi, E., Namaste, S., Wirth, J. P., Suchdef, P. S., Ezzati, M., Rohner, F., Flaxman, S. R., & Rogers, L. M. (2022). National, regional, and global estimates of anaemia by severity in women and children for 2000–19: a pooled analysis of population-representative data. *The Lancet Global Health*, *10*(5), e627–e639.

Sungkar, A., Bardosono, S., Irwinda, R., Manikam, N. R. M., Sekartini, R., Medise, B. E., Nasar, S. S., Helmyati, S., Ariani, A. S., Nurihsan, J., Nurjasmi, E., Khoe, L. C., Dilantika, C., Basrowi, R. W., & Vandenplas, Y. (2022). A Life Course Approach to the Prevention of Iron Deficiency Anemia in Indonesia. *Nutrients*, *14*(2), 1–8. https://doi.org/10.3390/nu14020277

Torheim, L. E., Ferguson, E. L., Penrose, K., & Arimond, M. (2010). Women in resource-poor settings are at risk of inadequate intakes of multiple micronutrients. *Journal of Nutrition*, *140*(11), 2051S-2058S. https://doi.org/10.3945/jn.110.123463

Wakwoya, E. B., Belachew, T., & Girma, T. (2023). Effect of intensive nutrition education and counseling on hemoglobin level of pregnant women in East Shoa zone, Ethiopia: randomized controlled trial. *BMC Pregnancy and Childbirth*, *23*(1), 1–11. https://doi.org/10.1186/s12884-023-05992-w

WHO. (2011). *Haemoglobin Concentrations for the Diagnosis of Anaemia and Assessment of Severity, Geneva., 2011. [Online]. Available: https://www.who.int/publications/i/item/WHO-NMH-NHD MNM-11.1*.

WHO. (2016). *WHO Recommendations on Antenatal Care for a Positive Pregnancy Experience, Geneva., 2016*.

Young, M. F., Oaks, B. M., Tandon, S., Martorell, R., Dewey, K. G., & Wendt, A. S. (2019). Maternal hemoglobin concentrations across pregnancy and maternal and child health: a systematic review and meta-analysis. *Annals of the New York Academy of Sciences*, *1450*(1), 47–68. https://doi.org/10.1111/nyas.14093

Zheng, W., Peng, B., Wu, Y., Gauan, L., Wang, S., & Ning, H. (2025). Global, regional, and national anemia burden among women of reproductive age (15–49 years) from 1990 to 2021: an analysis of the Global Burden of Disease Study 2021. *Frontiers in Nutrition*, *12*(July). https://doi.org/10.3389/fnut.2025.1588496