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# The Effectiveness of Iron Supplementation on Postpartum Depression in Low- and Middle-Income Countries: A Systematic Review

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***Abstract***

***Introduction:*** *Postpartum depression (PPD) is a significant mental health challenge among women in low- and middle-income countries (LMICs), with iron deficiency recognized as a potential risk factor.* ***Objective:*** *This systematic review aimed to evaluate the effectiveness of iron supplementation in reducing postpartum depression among women in low- and middle-income countries.* ***Method:*** *Following PRISMA 2020 guidelines, PubMed, Scopus, ScienceDirect, and Google Scholar were searched for English-language randomized controlled trials, clinical trials, and quasi-experimental studies on iron supplementation in postpartum women published from 2015–2026. Study quality was assessed using the Joanna Briggs Institute Critical Appraisal Checklist.* ***Results and Discussion:*** *Eleven studies involving 8,337 participants met the inclusion criteria, showing mixed evidence: two reported significant reductions in depressive symptoms following supplementation, while most found no significant difference versus comparators. Variations likely reflect differing participant characteristics, interventions, duration, and PPD's multifactorial nature.* ***Conclusion:*** *Iron supplementation may contribute to reducing postpartum depressive symptoms in some women; however, current evidence remains inconclusive. Further well-designed randomized controlled trials are required to clarify its effectiveness*

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## Introduction

The postpartum period is a critical transition characterized by substantial physiological, hormonal, psychological, and social changes following childbirth. During this period, women must recover from pregnancy and delivery while adapting to new caregiving responsibilities. Although physical recovery is an important component of postpartum care, maternal mental health is equally critical. Psychological disorders during the postpartum period may adversely affect maternal well-being, mother–infant bonding, breastfeeding practices, infant development, and family functioning (Hadriani et al., 2026; Khamidullina et al., 2025). Among these conditions, postpartum depression is one of the most common and clinically important mental health disorders affecting women after childbirth. It may develop within several weeks to one year postpartum and is characterized by persistent sadness, loss of interest, fatigue, sleep disturbances, anxiety, impaired concentration, and difficulties in caring for the newborn (Marshall et al., 2022). Globally, postpartum depression affects approximately 10–20% of postpartum women, with a substantially higher burden reported in low- and middle-income countries due to socioeconomic inequalities, inadequate social support, limited access to mental health services, and poor maternal nutrition (Araujo Costa & de Paula Ayres-Silva, 2023; World Health Organization, 2025).

Iron deficiency anemia represents another major maternal health problem in low- and middle-income countries. Blood loss during childbirth, increased iron requirements during pregnancy, and inadequate dietary intake may contribute to depleted maternal iron stores during the postpartum period (Kwak et al., 2025). Iron deficiency is traditionally considered primarily a hematological problem; however, increasing evidence suggests that it may also affect neurological and psychological functioning. Iron plays an essential role in oxygen transport, mitochondrial energy metabolism, myelin formation, and the synthesis of neurotransmitters, including serotonin, dopamine, and norepinephrine, which are involved in mood regulation and cognitive function (Parningotan Simanjuntak et al., 2025). Consequently, iron deficiency may contribute to fatigue, impaired concentration, irritability, anxiety, and depressive symptoms. Women experiencing postpartum anemia have also been reported to have a greater risk of depressive symptoms, suggesting a potential biological link between maternal iron status and postpartum mental health (UNICEF Indonesia, 2023).

Iron supplementation is widely recommended for the prevention and treatment of maternal anemia and is routinely incorporated into antenatal and postpartum health programs in many low- and middle-income countries. Its established benefits include improving hemoglobin concentrations and reducing anemia-related complications (Mattalitti & Haque, 2025). Beyond these hematological benefits, several studies have suggested that iron supplementation may improve fatigue, cognitive function, energy levels, and psychological well-being among postpartum women (Baroah et al., 2020; Røhder et al., 2020). However, evidence regarding its effect on postpartum depression remains inconsistent, with some studies reporting significant reductions in depressive symptoms while others have found no meaningful differences between intervention and comparison groups. This inconsistency may be related to substantial differences in participant characteristics, baseline iron status, supplementation type and route, comparison interventions, treatment duration, follow-up periods, and instruments used to assess depressive symptoms. Furthermore, existing evidence has largely emphasized hematological outcomes, while the potential mental health benefits of iron

supplementation have received comparatively less attention. Evidence specifically focusing on postpartum depression among women in low- and middle-income countries also remains fragmented and has not been comprehensively synthesized. Given the substantial burden of both iron deficiency anemia and postpartum depression in these settings, synthesizing the available evidence is important for informing evidence-based maternal healthcare strategies (Watt et al., 2025).

This systematic review aimed to evaluate the effectiveness of iron supplementation in reducing postpartum depression among women in low- and middle-income countries. The findings are expected to contribute to evidence-based maternal healthcare by clarifying the potential role of iron supplementation in postpartum mental health and informing the integration of nutritional and mental health interventions within postpartum care.

## Method

This study was conducted as a systematic review to evaluate the effectiveness of iron supplementation in reducing postpartum depression among women in low- and middle-income countries (LMICs). The review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The research question and search strategy were developed using the Population, Intervention, Comparison, Outcome (PICO) framework. The population consisted of postpartum women living in LMICs. The intervention included oral or intravenous iron supplementation, while the comparison groups comprised placebo, standard care, no supplementation, or alternative nutritional interventions. The primary outcome was postpartum depression or postpartum depressive symptoms measured using validated assessment instruments. A comprehensive literature search was conducted in four electronic databases: PubMed, Scopus, ScienceDirect, and Google Scholar. Articles published in English between January 2015 and May 2026 were considered eligible. The search strategy combined Medical Subject Headings (MeSH) terms and free-text keywords using Boolean operators ("AND" and "OR"). The search strategy used included: (“postpartum depression” OR PPD OR “postnatal depression” OR “puerperal depression” OR postpartum OR post-partum OR postnatal OR post-natal OR depression ) AND ( “iron supplementation” OR iron OR “oral iron” OR “intravenous iron infusion” OR “iron folate supplementation” OR “micronutrient supplementation” OR “maternal anemia” OR “iron deficiency anemia” ) AND ( “randomized controlled trial” OR “clinical trial" OR trial OR random OR RCT OR placebo ) AND ( "low- and middle-income countries" OR LMICs OR "developing countries" ).

Studies were included if they met the following criteria: (1) randomized controlled trials, clinical trials, or quasi-experimental studies; (2) evaluated oral or intravenous iron supplementation among postpartum women; (3) assessed postpartum depression or depressive symptoms using validated instruments such as the Edinburgh Postnatal Depression Scale (EPDS) or the Patient Health Questionnaire-9 (PHQ-9); (4) published in English; and (5) published between January 2015 and May 2026. Studies were excluded if they were review articles, systematic reviews, meta-analyses, editorials, letters to the editor, case reports, animal studies, or articles without accessible full-text versions. All retrieved references were imported into Rayyan.ai to facilitate duplicate removal and study screening. Two reviewers independently screened titles and abstracts, followed by full-text assessment according to the predefined eligibility criteria. Any

disagreements between reviewers were resolved through discussion, and when consensus could not be reached, a third reviewer made the final decision. The study selection process is presented using the PRISMA 2020 flow diagram. The methodological quality of the included studies was independently assessed by three reviewers using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist appropriate for experimental study designs. The assessment covered key methodological domains, including randomization procedures, allocation concealment, comparability of groups, outcome measurement, validity of measurement instruments, completeness of follow-up, and statistical analysis

The quality assessment was used to evaluate the risk of bias and to support interpretation of the review findings. Data extraction was performed independently using a standardized extraction form. The extracted information included the first author, publication year, country, study design, sample size, participant characteristics, intervention and comparison groups, outcome measurement instruments, duration of follow-up, and the main findings related to postpartum depression. A narrative synthesis was conducted because substantial clinical and methodological heterogeneity existed among the included studies regarding participant characteristics, intervention types, comparator groups, follow-up duration, outcome measurement instruments, and reported effect measures. Owing to this heterogeneity, quantitative meta-analysis was considered inappropriate. Therefore, findings were synthesized narratively by comparing study characteristics and summarizing the reported effects of iron supplementation on postpartum depression among postpartum women in LMICs.

## Results and Discussions

### 1. Result

### Study Selection

The literature search across four electronic databases (PubMed, Scopus, ScienceDirect, and Google Scholar) identified a total of 311 records. After removing 41 duplicate records, 270 articles remained for title and abstract screening. During this stage, 255 articles were excluded because they did not meet the eligibility criteria, including inappropriate population (n = 27), intervention (n = 76), outcome (n = 83), study design (n = 59), publication type (n = 8), and unavailable full-text articles (n = 2). The remaining 11 full-text articles were assessed for eligibility, and all met the predefined inclusion criteria. Consequently, 11 studies were included in the final narrative synthesis. The study selection process is illustrated in the PRISMA 2020 flow diagram (Figure 1).

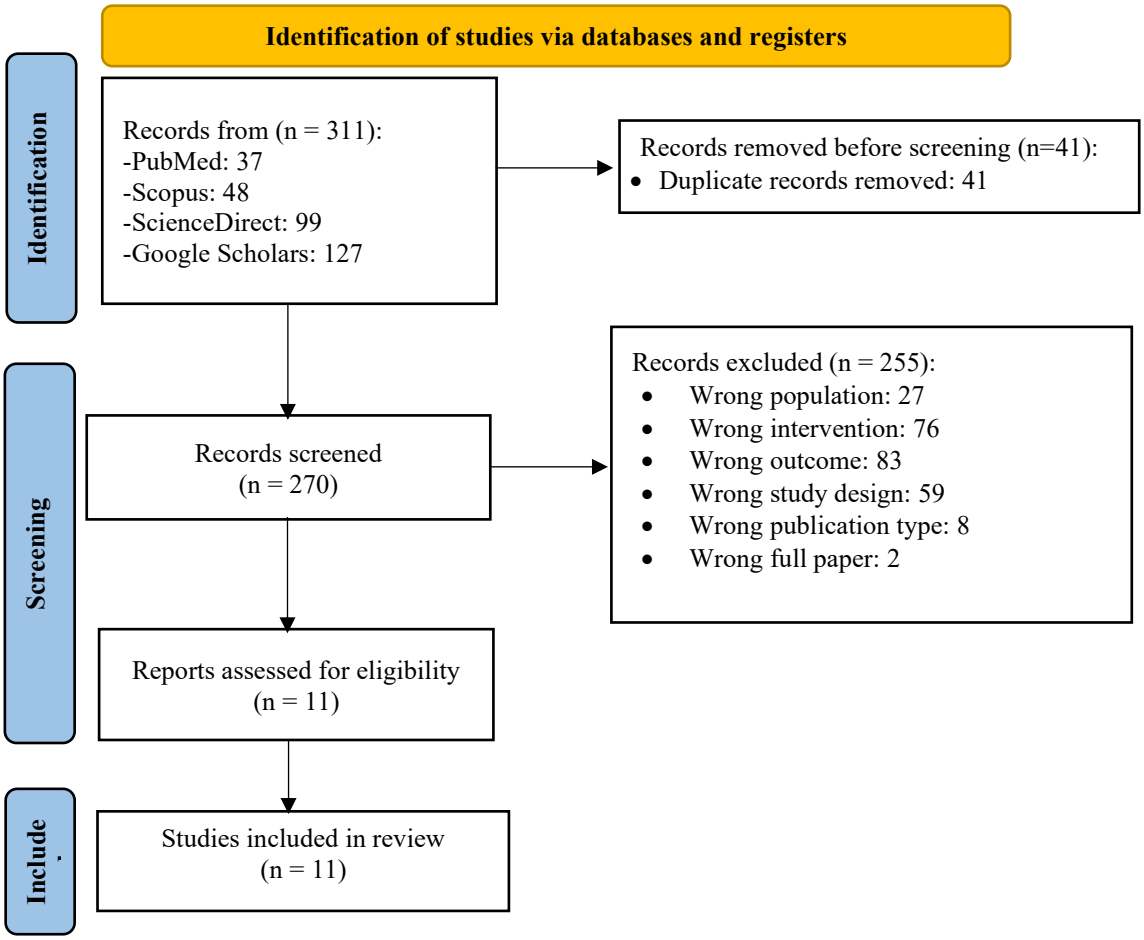



**Figure 1.** PRISMA 2020 Flow Diagram of the Study Selection Process

**Table 1**
Methodological Characteristics and Summary of Findings of the Included Studies (n = 11)

| Code | Author (Year) | Country | Study Design | Population (N) | Age | Intervention vs Comparison | Outcome Measure & Follow-up | Main Findings |
|---|---|---|---|---|---|---|---|---|
| A1 | Nguyen et al. (2017) | Vietnam | Double-blind RCT | 1,465 | 18–40 years | Oral iron vs folic acid | EPDS (3 months postpartum) | No significant difference in mean postpartum EPDS scores between groups (*P*=0.72). |
| A2 | Stewart et al. (2017) | Malawi | RCT | 1,057 | ≥15 years | SQ-LNS/MMN vs oral iron (IFA) | EPDS (6 months postpartum) | No significant difference in PPD prevalence (*P*=0.654); OR=0.80 (LNS) and OR=0.87 (MMN). |
| A3 | Okronipa et al. (2018) | Ghana | RCT | 1,151 | Mean 26 years | SQ-LNS/MMN vs oral iron (IFA) | EPDS (6 months postpartum) | No significant difference in PPD scores or prevalence (*P*=0.13); OR=0.72 (MMN vs IFA). |
| A4 | Sheikh et al. (2017) | Iran | RCT | 70 | Not specified | Oral iron vs placebo | EPDS (6 weeks postpartum) | EPDS scores decreased significantly in the oral iron group (*P*<0.001); PPD improvement rate was 42.8% vs 20.0% (*P*=0.03). |
| A5 | Sulistiawati et al. (2025) | Indonesia | Quasi-experimental | 52 | Majority 20–35 years | Oral iron vs nutrition education only | PHQ-9 (30 days postpartum) | A significant reduction in depressive symptoms was observed in the intervention group compared with the control group (*P*=0.000). |
| A6 | Afolabi et al. (2026) | Nigeria | RCT | 1,400 | Mean 29 years | Intravenous ferric carboxymaltose (FCM) vs oral iron | EPDS (6 weeks and 6 months postpartum) | No significant difference in depression outcomes at either follow-up point; RR ranged from −0.09 to −0.10. |
| A7 | Mzembe et al. (2024) | Malawi | RCT | 793 | Mean 22 years | Intravenous FCM vs oral iron | Hemoglobin and EPDS (12 months postpartum) | Intravenous iron was more effective than oral iron in preventing postpartum anemia (PR=0.64; *P*=0.039). |
| A8 | Sirsam et al. (2025) | India | RCT | 108 | 20–35 years | Intravenous FCM vs oral iron | Hemoglobin and EPDS (6 weeks postpartum) | Intravenous iron achieved significantly higher hemoglobin levels than oral iron at 6 weeks |

| Code | Author (Year) | Country | Study Design | Population (N) | Age | Intervention vs Comparison | Outcome Measure & Follow-up | Main Findings |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | (10.7±0.6 vs 9.7±0.9 g/dL; *P*<0.001). |
| A9 | Pal & Naskar (2019) | India | RCT | 50 | Mean 26.1 years | Intravenous FCM vs oral iron | Hemoglobin and EPDS (Days 15 and 42 postpartum) | Hemoglobin levels increased significantly more in the intravenous iron group than in the oral iron group on Days 15 and 42 (*P*<0.0001). |
| A10 | Amina et al. (2022) | Pakistan | RCT | 90 | 20–35 years | Intravenous FCM vs oral iron | Hemoglobin and EPDS (6 weeks postpartum) | Intravenous iron demonstrated a higher treatment success rate than oral iron (82.22% vs 62.22%; *P*=0.034). |
| A11 | Vishwakarma et al. (2018) | India | RCT | 100 | 18–45 years | Intravenous FCM vs oral iron | Hemoglobin and EPDS (Days 0, 15, and 42 postpartum) | Intravenous iron resulted in significantly higher hemoglobin levels than oral iron at Week 6 (10.91±0.77 vs 10.16±0.87 g/dL; *P*<0.001). |

### Characteristics of the Included Studies

A total of 11 studies were included in this systematic review. Overall, the methodological characteristics showed variation in study design, with the majority employing a randomized controlled trial (RCT) design (9 studies, 81.8%), while the remaining two studies (18.2%) used a quasi-experimental design. The participants' ages ranged from adolescents (≥15 years) to women of reproductive age (up to 49 years), representing postpartum populations from several low- and middle-income countries (LMICs) across Asia and Africa. The Edinburgh Postnatal Depression Scale (EPDS) was the most frequently used instrument for assessing postpartum depressive symptoms, whereas the Patient Health Questionnaire-9 (PHQ-9) was used in one study. Detailed methodological characteristics, intervention strategies, and reported maternal mental health outcomes of the included studies are presented in Table 1.

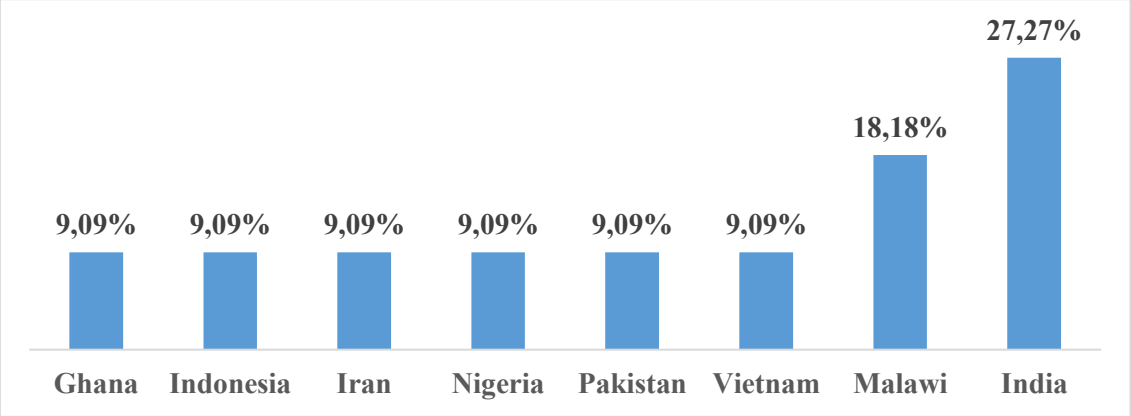
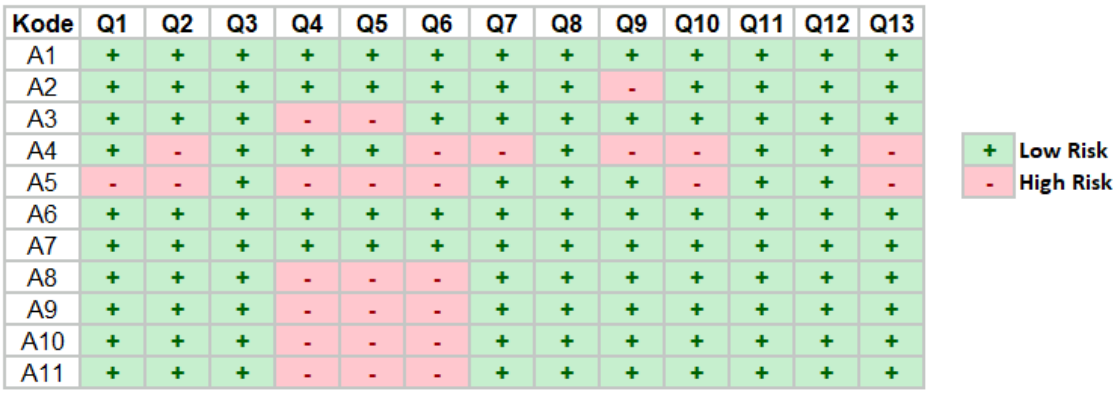



**Figure 2.** Percentage Distribution of Included Studies by Country (n = 11)

### Methodological Quality Assessment

The methodological quality of the 11 included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for experimental studies. The assessment evaluated potential sources of bias, including randomization procedures, blinding, completeness of outcome data, validity of outcome measurement, and appropriateness of statistical analyses. A summary of the risk-of-bias assessment for each individual study is presented in Figure 3. Overall, most studies demonstrated high methodological quality, with the majority of assessment domains judged as having a low risk of bias. However, several studies presented either some concerns or a higher risk of bias, particularly in the domains related to blinding and the randomization process.



| Kode | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | Q11 | Q12 | Q13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | + | + | + | + | + | + | + | + | + | + | + | + | + |
| A2 | + | + | + | + | + | + | + | + | - | + | + | + | + |
| A3 | + | + | + | - | - | + | + | + | + | + | + | + | + |
| A4 | + | - | + | + | + | - | - | + | - | - | + | + | - |
| A5 | - | - | + | - | - | - | + | + | + | - | + | + | - |
| A6 | + | + | + | + | + | + | + | + | + | + | + | + | + |
| A7 | + | + | + | + | + | + | + | + | + | + | + | + | + |
| A8 | + | + | + | - | - | - | + | + | + | + | + | + | + |
| A9 | + | + | + | - | - | - | + | + | + | + | + | + | + |
| A10 | + | + | + | - | - | - | + | + | + | + | + | + | + |
| A11 | + | + | + | - | - | - | + | + | + | + | + | + | + |



**Figure 3.** Summary of Risk-of-Bias Assessment Across Included Studies

## Synthesis of Findings

**Table 2**
Thematic Analysis and Mapping of Findings from the Included Studies

| No. | Main Theme | Sub-theme | Study Code |
|---|---|---|---|
| 1 | Iron Supplementation Interventions | Oral iron vs folic acid | A1 |
| | | Oral iron (IFA) vs small-quantity lipid-based nutrient supplements (SQ-LNS) | A2, A3 |
| | | Oral iron vs nutrition education | A5 |
| | | Oral iron vs multiple micronutrient supplementation (MMN) | A2, A3 |
| | | Oral iron vs intravenous iron | A6, A7, A8, A9, A10, A11 |
| 2 | Clinical Outcomes (Postpartum Depression) | Reduction in postpartum depressive symptoms | A4, A5, A7, A8, A9, A10, A11 |
| | | No significant improvement in postpartum depressive symptoms | A1, A2, A3, A6 |

The synthesis of the included studies demonstrated mixed evidence regarding the effectiveness of iron supplementation in reducing postpartum depression among women in low- and middle-income countries. Of the 11 included studies, only two reported a statistically significant reduction in postpartum depressive symptoms following iron supplementation. Sheikh et al. (2017) found that oral iron supplementation significantly reduced Edinburgh Postnatal Depression Scale (EPDS) scores compared with placebo ($P$<0.001), with a higher recovery rate from postpartum depression in the intervention group (42.8%) than in the control group (20.0%; $P$=0.03). Similarly, Sulistiawati et al. (2025) reported a significantly greater reduction in depressive symptoms among postpartum women receiving oral iron supplementation compared with those receiving nutrition education alone ($P$=0.000). In addition, several studies comparing intravenous ferric carboxymaltose with oral iron supplementation also incorporated maternal mental health assessments, reflecting increasing recognition of postpartum psychological outcomes in evaluations of iron supplementation (A7, A8, A9, A10, A11).

Conversely, four studies reported no significant differences in postpartum depressive symptoms between the intervention and comparison groups. Nguyen et al. (2017) found no significant difference in mean EPDS scores between women receiving oral iron supplementation and those receiving folic acid ($P$=0.72). Similar findings were reported (A2) and (A3), in which multiple micronutrient supplementation (MMN) and

small-quantity lipid-based nutrient supplements (SQ-LNS) showed no significant advantage over standard iron supplementation in reducing the prevalence or severity of postpartum depression. (A6) observed no significant differences in postpartum depression outcomes between women receiving intravenous ferric carboxymaltose and those receiving oral iron supplementation at either six weeks or six months postpartum.

## 2. Discussion

This systematic review found that the effectiveness of iron supplementation in reducing postpartum depression among women in low- and middle-income countries remains inconclusive. Among the 11 included studies, only a minority reported significant improvements in depressive symptoms, while most found no significant differences compared with control or comparison groups. These findings suggest that the relationship between iron supplementation and postpartum depression is complex and influenced by biological, psychological, social, and intervention-related factors (Dennis & Dowswell, 2013; Tian et al., 2020). Postpartum depression is particularly important in low- and middle-income countries, where nutritional deficiencies, maternal anemia, poverty, limited healthcare access, and inadequate social support coexist (Govender et al., 2020). Its etiology is multifactorial, involving hormonal and neuroendocrine changes, inflammation, neurotransmitter dysregulation, psychosocial stress, genetic susceptibility, and environmental factors (Cowell et al., 2021; Payne & Maguire, 2019;). Therefore, iron supplementation is unlikely to independently prevent or treat postpartum depression but may influence one of its biological pathways. Iron has an important role in neurotransmitter synthesis, mitochondrial energy metabolism, and normal neurological function. Iron deficiency may therefore contribute to fatigue, impaired cognition, irritability, and depressive symptoms (Berthou et al., 2022; Wu et al., 2023). Consistent with this biological rationale, Sulistiawati et al. (2025) reported significant reductions in depressive symptoms following oral iron supplementation. These findings support previous evidence suggesting that anemia and depleted iron stores may increase the risk of postpartum depression and that iron supplementation may be beneficial, particularly among women with iron deficiency or anemia (Wassef et al., 2019).

However, most included studies did not demonstrate significant effects. Result (A1, A2, A3, A6) found no significant differences between intervention and comparison groups. Importantly, many comparison groups received active nutritional interventions, including folic acid, multiple micronutrients, small-quantity lipid-based nutrient supplements, or intravenous iron. These interventions may themselves improve maternal nutritional status and reduce potential differences in mental health outcomes. Furthermore, the potential effect of iron on mental health may be indirect, mediated through improved iron status, reduced fatigue, enhanced physical functioning, and better maternal well-being rather than a direct antidepressant effect (Watt et al., 2025). The inconsistent findings may also reflect substantial heterogeneity across studies in baseline anemia status, participant characteristics, intervention type and route, dosage and duration, comparator groups, follow-up periods, and depression assessment instruments. Follow-up ranged from six weeks to 12 months postpartum, while most studies used the Edinburgh Postnatal Depression Scale and one used the Patient Health Questionnaire-9. Such differences may influence the detection and magnitude of depressive symptoms. In addition, postpartum depression is influenced by multiple factors, including previous mental health problems, prenatal stress, social support, economic conditions, obstetric

complications, infant health, hormonal changes, inflammatory pathways, and hypothalamic-pituitary-adrenal axis dysregulation (Chen et al., 2025; Schiller et al., 2024). Thus, iron supplementation likely addresses only one component of a multifactorial condition.

The inclusion of depression measures in several studies comparing oral and intravenous iron indicates growing recognition of maternal mental health as an important outcome of nutritional interventions (A7, A8, A9, A10, A,11). From a public health perspective, iron supplementation should therefore remain an important component of maternal nutritional care according to clinical guidelines, while its potential mental health benefits should be considered as an additional rather than definitive effect. Integrating anemia prevention and management with routine mental health screening during antenatal and postpartum care may strengthen comprehensive maternal health services in LMICs (Kumar et al., 2022; Pan et al., 2024). This review has several strengths, including the predominance of randomized controlled trials and its specific focus on LMICs, where the burden of anemia and postpartum depression is substantial. However, the evidence is limited by the small number of studies specifically assessing postpartum depression as a primary outcome and substantial clinical and methodological heterogeneity. Differences in interventions, comparator groups, follow-up periods, and depression assessment tools limited direct comparison between studies. Consequently, meta-analysis was not performed because pooling these heterogeneous data could produce misleading estimates. A narrative synthesis was therefore considered more appropriate for interpreting the available evidence.

## Conclusion

The findings of this systematic review, which included 11 studies involving 8,337 postpartum women from LMICs, suggest that iron supplementation has the potential to reduce postpartum depressive symptoms. However, the available evidence remains inconsistent. Only two studies reported statistically significant improvements in postpartum depression, whereas most studies found no significant differences compared with control or comparison groups. These inconsistent findings are likely explained by substantial heterogeneity in participant characteristics, baseline anemia status, intervention type and duration, comparison groups, follow-up periods, and depression assessment tools, as well as the multifactorial etiology of postpartum depression. Therefore, although iron supplementation may serve as a supportive component of comprehensive maternal health care, the current evidence is insufficient to establish its definitive effectiveness in preventing or treating postpartum depression. Future research should prioritize well-designed randomized controlled trials with postpartum depression as the primary outcome, standardized intervention protocols, homogeneous comparison groups, adequate sample sizes, and validated depression assessment instruments. Integrating anemia prevention and management with routine mental health screening during antenatal and postpartum care may further enhance maternal health outcomes, particularly in low- and middle-income countries.

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