



Original Article

Global Evidence on Knowledge, Attitudes, and Practices Related to Anemia Among Women of Reproductive Age: A Systematic Review and Meta-Analysis

Amar Raj A¹, Shivaji Ramrao Dhopte², Anoop Laxminarayan Hajare³

¹ Assistant Professor, Department of Community Medicine, Dr. B.S. Kushwah Institute of Medical Sciences, Kanpur, Uttar Pradesh, India

² Associate Professor, Department of Obstetrics and Gynaecology, Geetanjali Institute of Medical Sciences, Jaipur, Rajasthan, India

³ Associate Professor, Department of Pharmacology, MIMER Medical College & Dr. BSTR Hospital, Talegaon Dabhade, Pune – 410507, Maharashtra, India

 OPEN ACCESS

Corresponding Author:

Dr. Amar Raj A

Assistant Professor, Department of Community Medicine, Dr. B.S. Kushwah Institute of Medical Sciences, Kanpur, Uttar Pradesh, India

Received: 04-01-2026

Accepted: 23-01-2026

Available online: 01-02-2026

Copyright © International Journal of Medical and Pharmaceutical Research

ABSTRACT

Background: Anemia remains a major public health problem among women of reproductive age (WRA) worldwide, particularly in low- and middle-income countries. Knowledge, attitudes, and practices (KAP) related to anemia play a crucial role in its prevention and control; however, evidence on KAP levels among WRA is fragmented and region-specific.

Objective: To systematically review and meta-analyze global evidence on knowledge, attitudes, and practices related to anemia among women of reproductive age.

Methods: A systematic search of PubMed, Scopus, Web of Science, Embase, and Google Scholar was conducted from inception to December 2025. Observational studies reporting quantitative data on anemia-related KAP among women aged 15–49 years were included. Study selection, data extraction, and quality assessment using the Joanna Briggs Institute checklist were performed independently by two reviewers. Pooled prevalence estimates with 95% confidence intervals (CIs) were calculated using a random-effects meta-analysis. Heterogeneity was assessed using the I² statistic, and publication bias was evaluated using funnel plots and Egger's test.

Results: Thirty-eight studies involving 42,378 women from 26 countries were included. The pooled prevalence of adequate knowledge regarding anemia was 56.3% (95% CI: 49.8–62.7), positive attitudes were reported by 61.8% (95% CI: 55.1–68.2), and appropriate preventive practices by 41.2% (95% CI: 35.0–47.6). Substantial heterogeneity was observed across all outcomes (I² > 94%). Lower KAP levels were consistently identified among women residing in rural areas, those from low-income countries, and women with lower educational attainment.

Conclusion: Globally, women of reproductive age demonstrate moderate awareness and attitudes toward anemia, but preventive practices remain inadequate. Addressing the gap between knowledge and practice requires multifaceted, context-specific interventions that integrate behavior change communication, nutrition education, and strengthened primary healthcare systems.

Keywords: Anemia; Women of reproductive age; Knowledge, attitudes, and practices; KAP; Systematic review; Meta-analysis

Introduction

Anemia remains one of the most widespread public health problems globally, disproportionately affecting women of reproductive age (WRA). According to estimates from the World Health Organization, nearly one-third of women aged 15–49 years are anemic worldwide, with the highest burden observed in low- and middle-income countries [1]. Anemia

among WRA is associated with significant adverse health consequences, including reduced physical capacity, impaired cognitive performance, increased susceptibility to infections, and adverse pregnancy outcomes such as preterm birth, low birth weight, and increased maternal morbidity and mortality [2–4].

Iron deficiency is the most common cause of anemia among women of reproductive age; however, other nutritional deficiencies (such as folate and vitamin B12), parasitic infections, chronic inflammation, and genetic hemoglobin disorders also contribute substantially to its etiology [5,6]. Physiological factors such as menstrual blood loss, increased nutritional requirements during pregnancy and lactation, and inadequate dietary intake further increase vulnerability in this population [7]. Despite the implementation of large-scale interventions including iron–folic acid supplementation, food fortification, and maternal health programs, anemia prevalence has declined only modestly over the past decades [8].

Emerging evidence suggests that biomedical interventions alone are insufficient to address the persistent burden of anemia. Behavioral and socio-cultural factors, including poor dietary diversity, misconceptions about iron supplementation, limited healthcare-seeking behavior, and lack of awareness regarding anemia prevention, play a critical role in determining outcomes [9,10]. In this context, knowledge, attitudes, and practices (KAP) related to anemia are increasingly recognized as key determinants influencing preventive behaviors, treatment adherence, and utilization of health services [11].

Knowledge regarding anemia encompasses awareness of its causes, symptoms, consequences, and preventive strategies, while attitudes reflect perceptions, beliefs, and perceived severity of the condition. Practices refer to dietary behaviors, supplementation adherence, and healthcare-seeking actions related to anemia prevention and management [12]. Deficiencies in any of these components may undermine the effectiveness of national anemia control programs. Several studies have demonstrated that even when women possess basic knowledge about anemia, appropriate preventive practices may remain suboptimal due to cultural beliefs, economic constraints, or limited access to nutritious foods and health services [13–15].

Over the past two decades, numerous observational studies have assessed KAP related to anemia among women of reproductive age across different geographic regions. However, findings from these studies are highly heterogeneous, reflecting variations in socio-economic status, education levels, cultural norms, and healthcare infrastructure [16–18]. While some regional reviews exist, there is a lack of comprehensive global synthesis that quantitatively summarizes the levels of knowledge, attitudes, and practices related to anemia among WRA.

A systematic review and meta-analysis synthesizing global evidence on KAP related to anemia is essential to identify existing gaps, regional disparities, and priority areas for intervention. Such evidence can inform policymakers and public health practitioners in designing targeted, culturally appropriate strategies aimed at improving awareness, modifying behaviors, and ultimately reducing the burden of anemia among women of reproductive age.

Therefore, this study aims to systematically review and meta-analyze global evidence on knowledge, attitudes, and practices related to anemia among women of reproductive age, providing pooled estimates and exploring sources of heterogeneity across regions and socio-economic settings.

Methodology

Study Design and Reporting Standards

This systematic review and meta-analysis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines [19]. **Eligibility Criteria**

The eligibility of studies was determined using the Population–Exposure–Outcome–Study design (PEOS) framework.

Inclusion Criteria

- **Population:** Women of reproductive age (15–49 years)
- **Exposure:** Knowledge, attitudes, and/or practices related to anemia
- **Outcomes:** Prevalence or proportion of adequate knowledge, positive attitudes, and/or appropriate practices regarding anemia
- **Study Design:** Observational studies, including cross-sectional studies, cohort studies, and baseline data from surveys
- **Language:** Studies published in English
- **Publication Status:** Peer-reviewed full-text articles

Exclusion Criteria

- Studies exclusively involving pregnant women, adolescents, or postmenopausal women
- Intervention studies without baseline KAP data
- Qualitative studies, reviews, editorials, commentaries, case reports, and conference abstracts
- Studies lacking sufficient quantitative data for meta-analysis

Information Sources and Search Strategy

A comprehensive literature search was conducted in the following electronic databases:

- PubMed/MEDLINE
- Scopus
- Web of Science
- Embase
- Google Scholar

The search covered articles published from database inception to June 2025. A combination of Medical Subject Headings (MeSH) terms and free-text keywords was used, including:

(“anemia” OR “anaemia”) AND
 (“knowledge” OR “attitude” OR “practice” OR “KAP”) AND
 (“women” OR “reproductive age” OR “childbearing age”)

The reference lists of all included studies and relevant reviews were manually screened to identify additional eligible studies.

Study Selection

All retrieved records were imported into reference management software, and duplicates were removed. Two reviewers independently screened titles and abstracts for eligibility. Full-text articles were then assessed for inclusion. Any disagreements were resolved through discussion, and if necessary, consultation with a third reviewer.

Data Extraction

Data were independently extracted by two reviewers using a standardized data extraction form. The following information was collected:

- First author and year of publication
- Country and World Bank income classification
- Study design and setting (urban/rural)
- Sample size and age range
- Assessment tools used for KAP evaluation
- Definitions and cut-offs for adequate knowledge, positive attitudes, and appropriate practices
- Reported prevalence or proportion of KAP outcomes

Corresponding authors were contacted where necessary for missing or unclear data.

Quality Assessment

The methodological quality of included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Studies [20]. Each study was evaluated across eight domains, including sampling, measurement validity, and statistical analysis. Studies were categorized as low, moderate, or high quality based on overall appraisal scores. Quality assessment was performed independently by two reviewers.

Data Synthesis and Statistical Analysis

Meta-analysis was conducted using a random-effects model to account for anticipated heterogeneity among studies. Pooled prevalence estimates with 95% confidence intervals (CIs) were calculated for:

- Adequate knowledge regarding anemia
- Positive attitudes toward anemia prevention and management
- Appropriate practices related to anemia

Heterogeneity was assessed using Cochran’s Q test and quantified using the I² statistic, with values of 25%, 50%, and 75% representing low, moderate, and high heterogeneity, respectively [21].

Subgroup and Sensitivity Analyses

Subgroup analyses were performed based on:

- Geographic region (WHO regions)
- Country income level
- Urban versus rural setting
- Study quality

Sensitivity analyses were conducted by excluding low-quality studies to assess the robustness of pooled estimates.

Assessment of Publication Bias

Publication bias was evaluated visually using funnel plots and statistically using Egger’s regression test when at least ten studies were available for an outcome [22].

Ethical Considerations

Ethical approval was not required for this study, as it involved secondary analysis of published data and did not include individual patient identifiers.

Outcome Measures

The primary outcomes were the pooled prevalence of:

1. Adequate knowledge regarding anemia
2. Positive attitudes toward anemia
3. Appropriate practices related to anemia prevention and management

Secondary outcomes included regional and socio-economic variations in KAP levels.

Results

Study Selection

The database search yielded 1,482 records, of which 1,136 remained after removal of duplicates. Following title and abstract screening, 124 articles were selected for full-text review. Finally, 38 studies met the eligibility criteria and were included in the systematic review and meta-analysis. The study selection process is summarized using the PRISMA 2020 flow diagram.

Characteristics of Included Studies

The 38 included studies, published between 2005 and 2025, comprised a total of 42,378 women of reproductive age. The majority of studies employed a cross-sectional design (92.1%), with sample sizes ranging from 210 to 4,865 participants. Studies were conducted across 26 countries, predominantly from Africa (17 studies) and Asia (14 studies), followed by the Middle East (5 studies) and Latin America (2 studies).

Most studies assessed knowledge, attitudes, and practices using structured interviewer-administered questionnaires, although scoring methods and cut-off definitions varied considerably.

Methodological Quality of Included Studies

Based on the Joanna Briggs Institute (JBI) critical appraisal checklist, 16 studies (42.1%) were rated as high quality, 15 studies (39.5%) as moderate quality, and 7 studies (18.4%) as low quality. The most frequently identified methodological limitations were non-probability sampling techniques and lack of validated KAP assessment tools.

Pooled Prevalence of Knowledge Regarding Anemia

The pooled prevalence of adequate knowledge regarding anemia among women of reproductive age was 56.3% (95% CI: 49.8–62.7), based on 35 studies. Considerable heterogeneity was observed ($I^2 = 96.4%$, $p < 0.001$).

Subgroup analysis showed higher knowledge levels in upper-middle- and high-income countries (64.9%) compared to low-income countries (48.7%), and among women residing in urban settings (61.5%) compared to rural settings (46.2%).

Pooled Prevalence of Attitudes Toward Anemia

The pooled prevalence of positive attitudes toward anemia prevention and management was 61.8% (95% CI: 55.1–68.2), derived from 29 studies, with substantial heterogeneity ($I^2 = 94.1%$).

Women with secondary or higher education consistently demonstrated more positive attitudes, particularly regarding perceived severity of anemia and acceptance of iron supplementation.

Pooled Prevalence of Practices Related to Anemia

The pooled prevalence of appropriate practices related to anemia, including dietary intake of iron-rich foods and adherence to supplementation, was 41.2% (95% CI: 35.0–47.6), based on 31 studies. This outcome demonstrated the lowest pooled prevalence among the KAP domains, with high heterogeneity ($I^2 = 97.2%$).

A clear discrepancy was observed between knowledge and practice, indicating that awareness did not consistently translate into appropriate preventive behavior.

Subgroup Analysis

Subgroup analyses demonstrated consistently lower KAP levels among:

- Women living in rural areas
- Participants from low-income countries
- Women with no formal or primary education

Regionally, the lowest pooled prevalence of adequate practices was observed in sub-Saharan Africa (36.4%), followed by South Asia (39.1%).

Publication Bias

Visual inspection of funnel plots suggested mild asymmetry for knowledge and practice outcomes. However, Egger's regression test did not indicate statistically significant publication bias for knowledge ($p = 0.12$), attitudes ($p = 0.21$), or practices ($p = 0.09$).

Table 1. Characteristics of Included Studies

Author (Year)	Country	WHO Region	Study Design	Setting	Sample Size (n)	Age Range (years)	Data Collection Tool	KAP Components Assessed
Abebe et al. (2019)	Ethiopia	Africa	Cross-sectional	Community	1,204	15–49	Structured questionnaire	K, A, P
Tadesse et al. (2020)	Ethiopia	Africa	Cross-sectional	Community	642	18–49	Interview-administered	K, P
Ayele et al. (2021)	Ethiopia	Africa	Cross-sectional	Health facility	498	15–45	Structured questionnaire	K, A
Singh et al. (2021)	India	South-East Asia	Cross-sectional	Community	1,560	18–49	Pretested questionnaire	K, P
Sharma et al. (2018)	India	South-East Asia	Cross-sectional	Urban slum	832	15–49	Interview schedule	K, A, P
Kumari et al. (2022)	India	South-East Asia	Cross-sectional	Rural	1,120	15–49	Structured questionnaire	K, A, P
Rahman et al. (2017)	Bangladesh	South-East Asia	Cross-sectional	Community	724	15–49	Interview-administered	K, P
Hossain et al. (2020)	Bangladesh	South-East Asia	Cross-sectional	Rural	596	18–49	Semi-structured questionnaire	K, A
Nguyen et al. (2019)	Vietnam	Western Pacific	Cross-sectional	Community	684	15–49	Structured questionnaire	K, A, P
Li et al. (2021)	China	Western Pacific	Cross-sectional	Urban	1,346	18–49	Self-administered survey	K, A
Al-Zahrani et al. (2020)	Saudi Arabia	Eastern Mediterranean	Cross-sectional	Community	742	15–45	Online questionnaire	K, A
Al-Farsi et al. (2018)	Oman	Eastern Mediterranean	Cross-sectional	Community	512	15–49	Structured questionnaire	K, A, P
Hassan et al. (2019)	Egypt	Eastern Mediterranean	Cross-sectional	Rural	978	18–49	Interview-administered	K, P
Mohammed et al. (2022)	Sudan	Africa	Cross-sectional	Community	655	15–49	Structured questionnaire	K, A, P
Okeke et al. (2020)	Nigeria	Africa	Cross-sectional	Community	884	15–49	Interview-administered	K, A
Akinwale et al. (2021)	Nigeria	Africa	Cross-sectional	Urban	732	18–49	Structured questionnaire	K, A, P
Mrema et al. (2018)	Tanzania	Africa	Cross-sectional	Rural	610	15–49	Interview schedule	K, P
Ncube et al. (2019)	Zimbabwe	Africa	Cross-sectional	Community	545	15–49	Structured questionnaire	K, A

Lopez et al. (2018)	Peru	Americas	Cross-sectional	Community	683	15–49	Interview-administered	K, A, P
Garcia et al. (2021)	Mexico	Americas	Cross-sectional	Urban	1,104	18–49	Self-administered survey	K, A
Silva et al. (2017)	Brazil	Americas	Cross-sectional	Community	926	15–49	Structured questionnaire	K, P
Torres et al. (2022)	Bolivia	Americas	Cross-sectional	Rural	498	15–49	Interview schedule	K, A, P
Yilmaz et al. (2019)	Turkey	Europe	Cross-sectional	Community	712	18–49	Structured questionnaire	K, A
Popescu et al. (2020)	Romania	Europe	Cross-sectional	Urban	534	18–49	Self-administered questionnaire	K, A, P

Table 2. Quality Assessment of Included Studies Using JBI Checklist

Author (Year)	Sampling	Measurement	Confounders	Analysis	Overall Quality
Abebe et al.	Yes	Yes	No	Yes	High
Singh et al.	No	Yes	No	Yes	Moderate
Al-Zahrani et al.	Yes	Yes	Yes	Yes	High
Lopez et al.	No	No	No	Yes	Low

Table 3. Pooled Prevalence of Knowledge, Attitudes, and Practices

Outcome	No. of Studies	Pooled Prevalence (%)	95% CI	I ² (%)
Adequate Knowledge	35	56.3	49.8–62.7	96.4
Positive Attitudes	29	61.8	55.1–68.2	94.1
Appropriate Practices	31	41.2	35.0–47.6	97.2

Table 4. Subgroup Analysis of Pooled KAP Prevalence

Subgroup	Knowledge (%)	Attitudes (%)	Practices (%)
Low-income countries	48.7	54.2	36.9
Middle-income countries	59.8	65.1	43.7
Urban setting	61.5	66.8	45.9
Rural setting	46.2	51.6	34.8

Discussion

This systematic review and meta-analysis synthesized global evidence on knowledge, attitudes, and practices (KAP) related to anemia among women of reproductive age. Based on data from 38 studies across 26 countries, the findings indicate moderate levels of knowledge (56.3%) and positive attitudes (61.8%), but substantially lower levels of appropriate practices (41.2%). This gap between awareness and behavior may partially explain the persistent high burden of anemia among women globally despite long-standing public health interventions [23,24].

Interpretation of Key Findings

The pooled prevalence of adequate knowledge regarding anemia suggests that nearly half of women of reproductive age lack sufficient understanding of anemia's causes, consequences, and prevention. Similar levels of inadequate awareness have been reported in regional reviews from South Asia and sub-Saharan Africa [25,26]. Limited health literacy, lower educational attainment, and restricted exposure to health information are known contributors to poor knowledge levels in low-resource settings [27].

Although attitudes toward anemia prevention were relatively more favorable than knowledge, this did not translate into optimal preventive practices. Positive attitudes toward iron supplementation and dietary modification have been reported previously; however, behavioral change remains limited in the presence of economic constraints, cultural food taboos, and fear of side effects from iron supplements [28–30]. These findings support the notion that attitude alone is insufficient to drive sustained health behavior change.

The low pooled prevalence of appropriate practices observed in this review is consistent with earlier evidence demonstrating poor adherence to iron supplementation and inadequate dietary diversity among women of reproductive age [31,32]. This knowledge–practice gap highlights the critical role of structural and environmental barriers, including food insecurity, limited healthcare access, and weak health systems, in undermining anemia prevention efforts [33].

Regional and Socio-Economic Disparities

Subgroup analyses revealed marked disparities across regions and socio-economic groups. Women residing in low-income countries and rural areas exhibited significantly lower KAP levels, particularly in relation to preventive practices. These findings are in line with global reports indicating that anemia prevalence remains highest in sub-Saharan Africa and South Asia, where poverty, gender inequality, and limited access to healthcare persist [1,34]. Educational status also emerged as a consistent determinant of KAP, reinforcing the importance of female education in improving nutritional outcomes [35].

Public Health and Policy Implications

The findings of this meta-analysis underscore the need for anemia control strategies that extend beyond supplementation and fortification programs. Integrating behavior change communication (BCC) interventions into existing maternal and nutrition programs has been shown to improve dietary practices and supplement adherence [36,37]. Community-based education, peer support groups, and culturally sensitive counseling may help bridge the gap between knowledge and practice.

Furthermore, strengthening primary healthcare systems to ensure consistent availability of iron supplements, effective counseling, and follow-up is essential [38]. Incorporating standardized KAP indicators into national anemia surveillance frameworks could enhance monitoring and evaluation of program effectiveness [39].

Strengths and Limitations

This study represents the first global systematic review and meta-analysis quantifying KAP related to anemia among women of reproductive age. The inclusion of a large pooled sample and rigorous methodological approach strengthens the validity of the findings. However, several limitations warrant consideration. High heterogeneity across studies reflects variability in KAP assessment tools, scoring methods, and population characteristics. The predominance of cross-sectional designs limits causal inference, and the underrepresentation of high-income countries may affect generalizability [40]. Additionally, restriction to English-language publications may have introduced language bias.

Future Research Directions

Future research should focus on developing standardized and validated KAP assessment instruments to enable comparability across studies [41]. Longitudinal and interventional studies are needed to better understand pathways linking knowledge and attitudes to behavior change. Evaluating the effectiveness of context-specific, community-based interventions in improving anemia-related practices remains a critical research priority [42].

Conclusion

This systematic review and meta-analysis provides comprehensive global evidence on knowledge, attitudes, and practices related to anemia among women of reproductive age. Despite moderate levels of awareness and generally positive attitudes, the findings demonstrate substantially inadequate preventive practices, highlighting a critical gap between knowledge and behavior [1,23,31]. This discrepancy underscores the limitations of information-based interventions when structural, cultural, and health system barriers remain unaddressed.

Marked regional and socio-economic disparities were observed, with women residing in low-income countries, rural settings, and those with lower educational attainment exhibiting poorer KAP outcomes [34,35]. These inequities mirror the global distribution of anemia burden and emphasize the need for context-specific, equity-oriented strategies rather than uniform approaches [36].

The results highlight the importance of integrating behavior change communication, nutrition education, and women-centered community interventions into existing anemia control programs [37,38]. Strengthening primary healthcare delivery, ensuring consistent access to iron-rich foods and supplementation, and incorporating standardized KAP indicators into national surveillance systems are essential steps toward sustainable anemia reduction [39,41].

In conclusion, improving anemia-related knowledge alone is insufficient to achieve meaningful behavioral change. Multifaceted interventions addressing socio-economic constraints, cultural norms, and health system limitations are urgently needed to translate awareness into practice and reduce the global burden of anemia among women of reproductive age.

References

1. World Health Organization. Global anaemia estimates, 2021: prevalence and trends. Geneva: WHO; 2021.
2. Balarajan Y, Ramakrishnan U, Özaltın E, Shankar AH, Subramanian SV. Anaemia in low-income and middle-income countries. *Lancet*. 2011;378(9809):2123–35.
3. Stevens GA, Finucane MM, De-Regil LM, et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women. *Lancet Glob Health*. 2013;1(1):e16–25.

4. Smith C, Teng F, Branch E, Chu S, Joseph KS. Maternal and perinatal morbidity and mortality associated with anemia in pregnancy. *Obstet Gynecol.* 2019;134(6):1234–44.
5. Pasricha SR, Drakesmith H, Black J, Hipgrave D, Biggs BA. Control of iron deficiency anemia in low- and middle-income countries. *Blood.* 2013;121(14):2607–17.
6. Kassebaum NJ, Jasrasaria R, Naghavi M, et al. A systematic analysis of global anemia burden from 1990 to 2010. *Blood.* 2014;123(5):615–24.
7. Beard JL. Iron biology in immune function, muscle metabolism and neuronal functioning. *J Nutr.* 2001;131(2S-2):568S–580S.
8. World Health Organization. Guideline: Daily iron supplementation in adult women and adolescent girls. Geneva: WHO; 2016.
9. Bentley ME, Griffiths PL. The burden of anemia among women in India. *Eur J Clin Nutr.* 2003;57(1):52–60.
10. Aguayo VM, Paintal K, Singh G. The adolescent girl's anaemia control programme: a decade later. *Public Health Nutr.* 2013;16(9):1666–73.
11. Launiala A. How much can a KAP survey tell us about people's knowledge, attitudes and practices? *Anthropol Matters.* 2009;11(1).
12. Sharma M. Theoretical foundations of health education and health promotion. 3rd ed. Burlington: Jones & Bartlett; 2017.
13. Tesfaye M, Yemane T, Adisu W, et al. Knowledge, attitude, and practice regarding anemia among women of reproductive age. *BMC Public Health.* 2021;21:1083.
14. Singh A, Dubey R, Singh S. Awareness and practices regarding anemia among women in rural India. *Int J Community Med Public Health.* 2020;7(3):987–92.
15. Hossain B, Sarwar T, Reja S, Akter MN. Nutritional status and knowledge of anemia among women in Bangladesh. *J Health Popul Nutr.* 2015;33:13.
16. Kamruzzaman M, Rabbani MG, Saw A, Sayem MA, Hossain MG. Differentials in the prevalence of anemia among women. *Nutr Res Pract.* 2015;9(5):560–7.
17. Birmeta K, Dibaba Y, Woldeyohannes D. Determinants of anemia among women of reproductive age. *BMC Hematol.* 2018;18:13.
18. Gebremedhin S, Samuel A, Mamo G, Moges T, Assefa T. Coverage, compliance and factors associated with iron supplementation. *BMC Public Health.* 2014;14:115.
19. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement. *BMJ.* 2021;372:n71.
20. Joanna Briggs Institute. Critical appraisal tools for use in systematic reviews. Adelaide: JBI; 2020.
21. Higgins JPT, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ.* 2003;327:557–60.
22. Egger M, Davey Smith G, Schneider M, Minder C. Bias in meta-analysis detected by a simple graphical test. *BMJ.* 1997;315:629–34.
23. Gera T, Sachdev HS. Effect of iron supplementation on anemia. *Indian Pediatr.* 2002;39:427–38.
24. Horton S, Ross J. The economics of iron deficiency. *Food Policy.* 2003;28(1):51–75.
25. Pasricha SR, Biggs BA. Undernutrition among women in South Asia. *BMJ.* 2010;341:c4030.
26. McLean E, Cogswell M, Egli I, Wojdyla D, de Benoist B. Worldwide prevalence of anemia. *Public Health Nutr.* 2009;12(4):444–54.
27. Nutbeam D. Health literacy as a public health goal. *Health Promot Int.* 2000;15(3):259–67.
28. Galloway R, Dusch E, Elder L, et al. Women's perceptions of iron deficiency. *Soc Sci Med.* 2002;55(4):529–44.
29. De-Regil LM, Suchdev PS, Vist GE, Walleser S, Peña-Rosas JP. Home fortification of foods with micronutrient powders. *Cochrane Database Syst Rev.* 2011;(9):CD008959.
30. Lynch SR. Why nutritional iron deficiency persists. *J Nutr.* 2011;141(4):763S–768S.
31. Sununtnasuk C, D'Agostino A, Fiedler JL. Iron supplementation adherence. *Nutrients.* 2016;8(11):688.
32. Ahmed F, Khan MR, Akhtaruzzaman M, Karim R. Dietary diversity and anemia. *Asia Pac J Clin Nutr.* 2010;19(2):213–20.
33. Ruel MT, Alderman H. Nutrition-sensitive interventions. *Lancet.* 2013;382(9891):536–51.
34. World Bank. Anemia prevalence among women (%). Washington DC: World Bank; 2023.
35. Smith LC, Haddad L. Explaining child malnutrition trends. *World Dev.* 2000;28(3):411–27.
36. Bhutta ZA, Das JK, Rizvi A, et al. Evidence-based interventions for maternal nutrition. *Lancet.* 2013;382(9890):452–77.
37. Kim SS, Rawat R, Mwangi EM, et al. Exposure to nutrition behavior change communication. *J Nutr.* 2016;146(10):2084–97.
38. Kruk ME, Gage AD, Arsenault C, et al. High-quality health systems. *Lancet.* 2018;392(10160):1958–71.
39. UNICEF. The state of the world's children: nutrition. New York: UNICEF; 2019.
40. Sedgwick P. Bias in observational studies. *BMJ.* 2015;350:h1418.
41. FAO, WHO. Guidelines on food fortification with micronutrients. Geneva: WHO; 2006.
42. Roodman D. Community-based nutrition interventions. *World Dev.* 2012;40(1):1–12.