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PREVENTION OF ANEMIA AMONG WOMEN OF REPRODUCTIVE AGE

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ABSTRACT
Anemia occurs when the body lacks an adequate number of red blood cells or sufficient hemoglobin to transport oxygen effectively to meet physiological demands. It remains a significant global public health issue, disproportionately affecting women and children.
This research discusses the epidemiology, causes, risk factors, and health consequences of anemia among women of reproductive age, with emphasis on the Indian context. It highlights evidence-based preventive strategies, including nutritional interventions, iron and folic acid supplementation, dietary modifications to enhance iron absorption, screening and early detection, management of underlying causes, and community- and health-system-based initiatives. National and International programs focusing on reducing anemia are also discussed. A comprehensive, multidisciplinary approach integrating nutrition, health education, routine screening, and public health interventions is essential for reducing the burden of anemia and improving the health and well-being of women of reproductive age.

Keywords: *Anemia, Women of Reproductive Age, Iron Deficiency Anemia, Iron and Folic Acid Supplementation, Nutrition, Public Health, Screening, Prevention.*

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INTRODUCTION

Anemia occurs when the body lacks an adequate number of red blood cells or sufficient hemoglobin to transport oxygen effectively to meet physiological demands. It remains a significant global public health issue, disproportionately affecting women and children. In women of reproductive age, anemia contributes to diminished physical productivity, reduced work efficiency, cognitive decline, and heightened vulnerability to infections. During pregnancy, anemia poses serious risks, including preterm delivery, low birth weight, depletion of neonatal iron stores, stillbirths or miscarriages, and increased maternal and infant mortality. [Smith C et al 2019]

Inadequate production of red blood cells can happen when the bone marrow itself is depressed, such as in HIV or some malignancies; because there are hormonal imbalances, such as with chronic inflammation; or due to increased demand (such as during pregnancy), nutrient malabsorption or inadequate supply of red blood cell building blocks, such as protein, iron, vitamin A, folate or vitamin B-12 Iron deficiency is often thought of as the most common cause of anemia, which is true but also misleading, because absolute and/or functional iron deficiency can arise as a consequence of any of the three pathways and, therefore, as a consequence of multiple different causes. Women of reproductive age (WRA; ages 15–49 years) are at particularly increased risk of iron deficiency and, therefore, anemia, compared to men, due to physiological changes such as menstruation (blood loss pathway), pregnancy (inadequate production pathway due to increased demand) and bleeding in childbirth. Additionally, unequal household food allocation can make WRA vulnerable to anemia as they might not have access to iron-rich foods. (Girard AW, Self JL, McAuliffe C, Olude O, 2012)

Iron deficiency is thought to be the most common cause of anemia globally, although other conditions, such as folate, vitamin B12 and vitamin A deficiencies, chronic inflammation, parasitic infections, and inherited disorders, can all cause anemia. There is an increased demand of dietary nutrients during pregnancy, and in the absence of nutritional supplementation, the severity of anemia increases with increasing gestational age. Iron deficiency anemia (IDA) accounts for about 50% cases of anemia. [World Health Organization: The Global Prevalence of Anaemia in 2011]

Other factors responsible for anemia during pregnancy are gestational age, parity, consecutive birth interval, history of excess bleeding during menstruation, intestinal parasitic infection, malaria, chronic illness, and blood loss during pregnancy. Low dietary intake and poor biological availability of iron in phytate and fiber-rich Indian diet are other contributing factors. [Alemayehu A et al 2016]

Iron-deficiency anaemia (IDA) among women in India is a problem of major public health significance. Using data from three waves of the National Family Health Survey, this article discusses the burden of and trend in IDA among women in India, and discusses the level of iron and folic acid (IFA) supplementation and its potential role in reducing the burden of IDA. Between 2005-2006 and 2015-2016, IDA in India decreased by only 3.5 percentage points (from 56.5% in 2005-2006 to 53.0% in 2015-2016) for women aged 15-49 years. However, during the same period, of 27 states compared, IDA increased in eight: Delhi, Haryana, Himachal Pradesh, Kerala, Meghalaya, Tamil Nadu, Punjab and Uttar Pradesh; furthermore, some of these (e.g. Kerala) are states that rank among the highest on the state Human Development Index but had failed to contain the burden of IDA. Although there is a standard guideline for IFA supplementation in place, the IFA intervention appears to be ineffective in reducing the burden of IDA in India (nationally only 30.3 % of mothers consumed IFA for 100 days or more when they were pregnant), probably due to irregular consumption of IFA where the provision of screening under the National Iron+ Initiative scheme appears to be unsuccessful. (Rai RK et al 2018)

Anemia in pregnant women remains one of the most intractable public health problems in developing countries because of various sociocultural problems like illiteracy, poverty, lack of awareness, cultural and religious taboos, poor dietary habits, and high prevalence of parasitic infestation. Current estimates from the World Health Organization (WHO) put prevalence of anemia at 41.8% among pregnant women, with the highest prevalence rate (61.3%) found among pregnant women in Africa and 52.5% among South East Asia [Ejeta E et al 2014].

Sub-Saharan Africa is the most affected region, with anemia prevalence among pregnant women estimated to be 17.2 million, which corresponds to approximately 30% of total global cases. Globally, anemia contributes to 20% of all maternal deaths. Anemia in pregnancy may also lead to premature births, low birth weight, foetal impairment, and infant deaths [Kefiyalew F et al 2014].

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Awareness about anaemia and its consequences for women's health and development has increased in the past decade. In 2012, the 65th World Health Assembly (WHA) approved global targets for maternal, infant, and young child nutrition, with a commitment to halve anaemia prevalence in women of reproductive age (15–49 years) by 2025.[4] WHO and UNICEF proposed extending this target to 2030 to align with the UN Sustainable Development Goals (SDGs). In 2020, the prevalence of anaemia in women aged 15–49 years was added as indicator 2.2.3 of the SDGs. (UNGA Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development. March, 2020.

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Anemia in reproductive-age women is most commonly iron-deficiency anemia, but can also be caused by folate or B12 deficiency, chronic disease, heavy menstrual bleeding, malaria, hookworm, and other infections. Because women lose iron through menstruation and have increased needs during pregnancy, prevention needs to be multi-pronged.

Nutrition and dietary measures:

- **Iron-rich foods:** Iron-rich foods are a cornerstone of nutrition and dietary measures to prevent anemia among reproductive-age women, because adequate dietary iron supports hemoglobin synthesis, replenishes iron stores lost through menstruation, and meets increased demands during pregnancy. Dietary iron exists as heme iron, found in animal sources like meat, liver, fish, and poultry, which has higher bioavailability, and non-heme iron from plant sources such as lentils, beans, fortified cereals, spinach, quinoa, and pumpkin seeds. Most women obtain their recommended iron intake from food sources; however, studies show that knowledge does not always translate into intake. Among urban poor women of reproductive age in Bangladesh, 100% of participants had low daily iron consumption despite varying awareness, highlighting a significant gap between knowledge and practice. To improve absorption, iron-rich meals should be paired with vitamin C sources—tomatoes, citrus, amla, or orange juice—while inhibitors like tea, coffee, and calcium-rich dairy should be spaced 1–2 hours apart from iron-rich meals. Dietary diversity is critical, yet social and economic barriers often limit women's access to nutrient-rich foods: intra-household food distribution practices, limited decision-making power, and lower access to animal-source foods contribute to inadequate intake of iron, B12, and folate. Therefore, effective prevention combines nutrition education with strategies to increase access to affordable iron-rich foods, promote fruit consumption with meals, and address gender norms that restrict women's diets. Primary healthcare should integrate counselling on iron-rich food selection and meal planning, while population-level approaches include fortification of staple foods like flour, rice, or soya sauce to reduce anemia prevalence. (Sarwer, M. S., Hossain, M. S., & Rahman, M. (2026).
- **Enhance absorption:** Enhancing iron absorption is a critical dietary strategy for preventing anemia among reproductive-age women, because nonheme iron—the form found in plant foods, fortified products, and most supplements—has variable bioavailability influenced by meal composition. Absorption can be substantially improved by consuming vitamin C-rich foods or beverages with iron-containing meals; ascorbic acid forms soluble chelates with iron, reduces ferric to ferrous iron, and counters inhibitory effects of phytates and polyphenols, with recommendations suggesting about 6 mg of ascorbic acid per 1 mg of iron to maximize uptake. Practical approaches include adding citrus, tomatoes, bell peppers, or amla juice to meals with lentils, beans, or fortified cereals, and taking iron supplements as single morning doses with water or juice rather than with tea, coffee, or calcium-rich dairy, which inhibit absorption. Emerging evidence also indicates that co-ingestion with animal meat enhances nonheme iron absorption via the "meat factor," while novel enhancers such as protein hydrolysates can improve solubility of nonheme iron salts in supplements. In contrast, high-dose daily iron may paradoxically reduce fractional absorption due to hepcidin upregulation, so lower-dose or intermittent regimens can improve tolerability and efficiency. Additionally, prebiotics and probiotics show low- to moderate-certainty evidence for increasing fractional iron absorption and ferritin in women, potentially by modifying gut pH and reducing inflammation. Counseling should therefore emphasize meal timing, food pairings, and supplement spacing to optimize absorption alongside adequate iron intake. (Stoffel, N. U., Cercamondi, C. I., & Zimmermann, M. B. (2025).
- **Avoid inhibitors at meals:** Avoiding dietary inhibitors at meals is an essential nutrition strategy to prevent anemia among reproductive-age women, because compounds in common foods and beverages can

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markedly reduce nonheme iron absorption from plant-based sources, fortified foods, and supplements. Polyphenols in black tea and coffee are potent inhibitors: consumption during or after a meal can reduce iron absorption by 79–84% for tea and 39% for coffee, while calcium from milk and dairy, phytates in cereal bran and legumes, and iron-binding phenolics in certain spices also impede uptake. Egg and milk proteins further decrease bioavailability, so spacing these items 1–2 hours apart from iron-rich meals or supplements improves iron status. Practical counselling should therefore advise women to drink tea, coffee, or herbal infusions between meals rather than with them, and to avoid consuming dairy or calcium supplements simultaneously with iron tablets or lentil-, bean-, or spinach-based dishes. Traditional food processing methods such as soaking, malting, fermenting, and germination can degrade phytates and enhance iron bioavailability from cereals and pulses. While inhibitors pose less concern with heme-iron sources from meat, poultry, and fish, most women in low-resource settings rely on nonheme iron, making inhibitor avoidance critical. Nutrition education that addresses meal timing and beverage choices has been shown to improve knowledge, attitudes, eating behaviour, and hemoglobin levels. Combining inhibitor avoidance with enhancers like vitamin C at meals offers a synergistic approach to maximize iron absorption without increasing total iron intake.(Skolmowska, D., & Głąbska, D. (2024).

- **Folate and B12:** Folate and vitamin B12 are essential B-vitamins for preventing anemia among reproductive-age women because both are required for DNA synthesis, red blood cell maturation, and prevention of megaloblastic anemia. Folate deficiency impairs erythropoiesis and is a major cause of anemia independent of iron, while vitamin B12 deficiency prevents proper folate metabolism and causes ineffective haematopoiesis, even when folate intake is adequate. Globally, deficiencies remain common: pooled data show folate deficiency in 11.1% and B12 deficiency in 17.1% of pregnant women, and surveys in India found 48.3% of reproductive-age women had B12 deficiency and 7.6% had RBC folate deficiency, with 79.3% below the threshold for optimal neural tube defect prevention. Dietary measures focus on regular intake of folate-rich foods—dark leafy greens, legumes, citrus, fortified grains—and B12 sources like meat, fish, eggs, and dairy. Because B12 is absent from plant foods, vegetarian and low-income women face higher risk; in India, 45% of rural reproductive-age women were B12 deficient, attributed to poor dietary intake rather than malabsorption. Periconceptional folic acid supplementation (400 µg daily) and fortified foods are critical to raise RBC folate >748 nmol/L for NTD prevention and anemia reduction, yet 39.8% of non-pregnant Tanzanian women still had insufficient RBC folate despite fortification programs. For B12, dietary adequacy or supplements are needed where animal-source foods are limited, as low B12 impairs hemoglobin synthesis and increases homocysteine. Thus, nutrition strategies should combine diversified diets, fortified staples, and targeted supplementation, with routine screening for at-risk women. Speak with a healthcare provider before starting high-dose supplements. (Finkelstein, J. L., Fothergill, A., Johnson, C. B., Guetterman, H. M., Bose, B., Jabbar, S & Mehta, S. (2023).
- **Supplementation:** WHO recommends intermittent or daily iron and folic acid supplementation for menstruating women in populations where anemia prevalence is ≥20%. The common public health dose is 30–60 mg elemental iron + 400 µg folic acid weekly or daily for 3 months, repeated annually. In pregnancy, daily IFA is standard starting as early as possible.
- **Address underlying causes:** Addressing underlying causes is essential for sustainable prevention of anemia among reproductive-age women because anemia results from multiple nutritional and non-nutritional factors beyond inadequate dietary iron alone. Iron deficiency remains the most common cause, but other drivers include deficiencies of folate, vitamin B12, and vitamin A, hemoglobinopathies, chronic infections such as malaria and hookworm, heavy menstrual bleeding, adolescent pregnancy, short birth intervals, and inflammation. Socioeconomic determinants are equally critical: women with no or primary education, from poorer wealth quintiles, and those lacking improved sanitation and safe water have significantly higher odds of anemia. In seven South and Southeast Asian countries, women without improved toilet facilities and unimproved water sources were more likely to be anaemic, while household poverty and low education consistently increased risk. Reproductive factors also contribute; multiparity, history of terminated pregnancy, and adolescent pregnancy are associated with higher prevalence due to cumulative iron losses and increased demands. Infections like malaria and HIV/AIDS are prominent non-nutritional causes in specific regions, and intrauterine contraceptive devices can increase menstrual blood loss. Therefore,

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prevention must integrate nutrition-specific actions—iron-folic acid supplementation, dietary diversification, deworming—with nutrition-sensitive interventions: family planning to space births and delay first pregnancy, screening and treatment of infections, menstrual health management, and improvements in water, sanitation, and girls' education. Addressing these root causes targets the structural and biological pathways that sustain anemia prevalence. (Sunuwar, D. R., Singh, D. R., Chaudhary, N. K., Pradhan, P. M. S., Rai, P., & Tiwari, K. (2020).

- **Screening and early detection:** Screening and early detection are fundamental for preventing anemia among reproductive-age women because timely identification allows correction of underlying deficiencies before adverse outcomes occur. WHO defines anemia in non-pregnant women as hemoglobin <120 g/L and in pregnant women as <110 g/L, adjusted for altitude and smoking, and recommends routine hemoglobin assessment during antenatal care and in high-prevalence populations. Hemoglobin concentration is typically measured using the direct cyanmethemoglobin method in laboratories or portable hemoglobin photometers in field settings, enabling large-scale screening. Early detection is critical because anemia is associated with poor cognitive and motor development, reduced work capacity, and, during pregnancy, increased risk of preterm delivery, low birth weight, and impaired infant iron stores. In India, population-based surveys show a high burden of preconception morbidity, yet reliable estimates remain lacking, underscoring the need for systematic screening. Preconception screening can identify not only anemia but also related morbidities—undernutrition, hypothyroidism, diabetes, and reproductive tract infections—that exacerbate anemia risk. Combining hemoglobin testing with ferritin and transferrin saturation improves diagnostic accuracy by distinguishing iron deficiency from other causes and guiding targeted interventions. Implementing screening through primary health centres, as piloted in Belagavi, Karnataka, where 500 married women aged 18–25 received hemoglobin, ferritin, and transferrin tests alongside a 26-item survey, demonstrates feasibility of integrating anemia detection into routine care. Therefore, universal or risk-based screening of women of reproductive age, especially adolescents and women planning pregnancy, is a cost-effective preventive measure that facilitates early iron-folic acid supplementation, dietary counselling, and treatment of infections before conception. (Chowdhury, R., Taneja, S., Dhabhai, N., Mazumder, S., Upadhyay, R. P., Sharma, S & Bhandari, N. (2020).
- **Community and health-system actions:** Community and health-system actions are vital for preventing anemia among reproductive-age women because anemia stems from multiple nutritional, infectious, and social determinants that require multisectoral coordination. Effective programs combine facility-based services with community outreach: India's Anaemia Mukt Bharat (AMB), launched in 2018, targets women, children, and adolescents through prophylactic iron-folic acid (IFA) supplementation, intensified behaviour change communication, digital anemia testing, periodic deworming, point-of-care treatment, and training of medical officers and frontline workers such as ANMs, Anganwadi workers, and ASHAs. Community platforms like schools and Anganwadi centres deliver Weekly Iron and Folic Acid Supplementation (WIFS) for adolescents, while the National Iron Plus Initiative and ICDS provide IFA and nutritional meals to vulnerable groups. Health systems strengthen supply chains, ensure availability of IFA at primary health centres, and integrate anemia screening into antenatal and reproductive health services. At the community level, social norms-based interventions have proven successful: the Reduction in Anemia through Normative Innovations (RANI) project demonstrated that addressing descriptive and injunctive norms around IFA use significantly increased consumption and reduced anemia in treatment communities. Community health workers are key, as parental education and counselling delivered by CHWs improved childhood anemia cure rates and can be adapted for women's nutrition literacy. Sustainability requires convergence between nutrition, maternal health, gender, education, and social protection; embedding gender-transformative approaches, engaging men as partners, and improving intra-household food allocation practices address root causes like limited decision-making power and unequal food distribution. Together, these coordinated community and health-system actions—supplementation, screening, deworming, fortification, counselling, and gender-responsive strategies—create an enabling environment for anemia reduction. (Sharma, A., Ghosh, T., & Sharma, R. (2018).

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CONCLUSION

Anemia among women of reproductive age continues to be a major public health concern with significant implications for maternal health, pregnancy outcomes, productivity, and overall quality of life. Although iron deficiency remains the predominant cause, nutritional deficiencies, infections, chronic illnesses, menstrual blood loss, and socioeconomic factors also contribute substantially to its burden. Preventing anemia requires a comprehensive approach that integrates balanced nutrition, iron and folic acid supplementation, dietary practices that enhance iron absorption, routine screening, early diagnosis, treatment of underlying conditions, and effective health education. Strengthening community-based interventions, improving access to quality healthcare services, and implementing evidence-based national programs can significantly reduce the prevalence of anemia. A collaborative effort with healthcare professionals, policymakers, communities, and women themselves is essential to promote optimal nutritional status and improve the health and welfare of women of reproductive age.

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