# Bridging nutritional gaps in pregnancy: The case for comprehensive multiple micronutrient supplementation in India

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***Abstract***—Micronutrient deficiencies during pregnancy remain a major public health issue in India, contributing to maternal morbidity, adverse birth outcomes and long-term developmental impairments in children. Although iron-folic acid supplementation is routinely recommended, this approach overlooks the broader spectrum of deficiencies prevalent among Indian women. This review explores the importance of multiple micronutrient supplementation (MMN), highlights evidence supporting its efficacy over single-nutrient strategies and provides practical recommendations for integrating MMN into standard maternal healthcare protocols in India. Tailored interventions aligned with local nutritional profiles are crucial to improving outcomes for both mother and child.

***Index Terms***—maternal nutrition, multiple micronutrient supplementation, pregnancy outcomes, India, foetal development, gynaecology.

## I.INTRODUCTION

Nutrition plays a vital role in maternal and foetal health. During pregnancy, the demand for both macronutrients and micronutrients increases substantially to support foetal development and maternal well-being. In India, where dietary diversity and access to nutrient-rich foods can be limited, micronutrient deficiencies are common among pregnant women. A multicentric study by Gopal *et al*. (2022) found that **54.6% of Indian pregnant women suffer from anaemia**, often coupled with deficiencies in vitamin B12 (41.7%), ferritin (42.4%), zinc (11.5%) and iodine (14.4%) [1]. These deficiencies are associated with a spectrum of complications including neural tube defects, preterm birth, intrauterine growth restriction (IUGR) and low birth weight (LBW) [2,3].

## II.THE CRITICAL WINDOW: THE FIRST 1,000 DAYS

The first 1,000 days—from conception to a child's second birthday—are widely recognised as a window of opportunity to influence lifelong health [4]. This period is crucial for organogenesis, neurodevelopment, immune function and metabolic programming [5]. Inadequate maternal intake of key micronutrients such as folate, vitamin D, B12, iron and iodine during this time can have irreversible consequences, including impaired cognitive function and increased risk of chronic diseases later in life [6].

## III.LIMITATIONS OF IRON-FOLIC ACID ALONE

India's current antenatal care guidelines emphasise iron and folic acid supplementation. While these nutrients are essential, emerging evidence indicates that this approach is inadequate to address the complex nutritional demands of pregnancy. A 2020 WHO guideline update recognised this and issued a **conditional recommendation** for multiple micronutrient supplementation in pregnancy, especially in regions with high deficiencies [7].

Several studies and meta-analyses have found that MMN supplementation is more effective than iron-folic acid alone in reducing risks of:

- **LBW** by up to 12% [8]
- **Small-for-gestational-age births** by 8%–9% [9]
- **Preterm births**, especially with vitamin D and zinc [10]

## IV.KEY MICRONUTRIENTS IN PREGNANCY

### *Folate and Vitamin B12*

Crucial for DNA synthesis and neural tube development. Their deficiency is linked to neural tube defects (NTDs) such as spina bifida and anencephaly [11].

### *Iron and Vitamin C*

Iron supports oxygen transport and foetal growth. Vitamin C enhances iron absorption and boosts immune function [12].

### *Iodine and Selenium*

Iodine is vital for thyroid hormone synthesis and brain development, while selenium protects against oxidative stress and supports placental health [13].

### *Vitamin D and Calcium*

Vitamin D supports foetal skeletal development and reduces preeclampsia risk; calcium reduces the risk of hypertensive disorders [14].

### *Zinc and Magnesium*

Involved in cellular growth, DNA synthesis, immune function and neurodevelopment [15].

### *Choline*

An emerging key nutrient for foetal brain development, choline supplementation has been shown to improve cognitive outcomes and reduce risk of birth defects [16].

## V.LOCAL CONSIDERATIONS AND INDIAN CONTEXT

Despite significant efforts, India continues to face a dual burden of undernutrition and micronutrient deficiencies. The **Indian Council of Medical Research (ICMR)** recommends dietary and supplemental intake of iron, calcium, vitamin D and folate during pregnancy [17]. However, **formulations currently available in India often lack choline, magnesium or zinc in optimal quantities**, despite high prevalence of their deficiencies.

Moreover, **routine screening for micronutrient deficiencies beyond haemoglobin** is rarely practiced. Serum ferritin, vitamin D and B12 are often missed unless severe symptoms manifest.

## VI.EVIDENCE SUPPORTING MULTIPLE MICRONUTRIENT SUPPLEMENTATION

**Several randomised trials and meta-analyses support the use of MMNs:**

- Haider *et al*. (2017) analysed 17 trials involving over 137,000 women and reported **fewer low birth weight and SGA infants** with MMN compared to iron-folic acid alone [8]
- The JiVitA-3 trial in Bangladesh showed **18% lower infant mortality** in mothers who received MMN [18]
- In India, the UNIMMAP formulation containing 15 vitamins and minerals (including iron, zinc, copper, selenium and iodine) was associated with better maternal serum nutrient levels and improved neonatal outcomes [19]

## VII.PRACTICAL RECOMMENDATIONS FOR GYNAECOLOGISTS

1. **Screen comprehensively** for iron, vitamin D, B12 and ferritin during antenatal visits
2. **Educate patients** about dietary sources of micronutrients and the importance of supplementation
3. **Prescribe tailored MMN formulations**, ideally as a single daily tablet
4. **Encourage preconception supplementation**, particularly for women with prior poor pregnancy outcomes or undergoing fertility treatment
5. **Continue supplementation during lactation**, as maternal micronutrient status affects breastmilk quality and infant growth

## VIII.THE ROLE OF CHOLINE: A MISSED OPPORTUNITY

Despite its crucial role in foetal brain development and preventing NTDs, choline is often absent from Indian prenatal supplements. The **recommended intake is 400 mg during pregnancy and 900 mg postpartum**, yet surveys show inadequate intake among Indian women [16,20]. Inclusion of choline in MMN formulations should be prioritised.

## IX.CONCLUSION

Comprehensive MMN supplementation is a scientifically backed, cost-effective intervention to improve maternal and child health in India. Although iron and folic acid remain important, they are insufficient alone. Gynaecologists are in a pivotal position to

advocate for the integration of MMNs into routine antenatal care. Formulations must be contextualised to Indian dietary gaps, with an emphasis on practical, single-pill solutions. Public health policy, clinical practice and education must converge to address this pressing need.

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