



"Safeguarding New Life: The Role of Prenatal Vitamins in Birth Defect Prevention"

Prof. Mereena Kuriakose¹

¹Vice Principal^a, PhD Scholar^b

^{1ab}OBG Nursing Department

^aIndira Gandhi Memorial College of Nursing, Perumbavoor, Kerala

^bMalwanchal University, Indore, MP

Author Email id: mereenaik@gmail.com

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Abstract: Birth defects continue to pose a significant challenge to maternal and child health worldwide, accounting for substantial infant morbidity and mortality. Nutritional interventions, particularly prenatal vitamins, have been identified as highly effective in reducing congenital anomalies. Among these, folic acid, vitamin B12, iron, iodine, and vitamin D are essential for embryonic and fetal development. Evidence from Indian studies, global randomized trials, and recent Kerala health reports highlight both the successes and ongoing gaps in supplementation programs. Global reviews, including Krista Crider's 30-year analysis, confirm that mandatory folic acid fortification programs in more than 70 countries have reduced neural tube defect prevalence by up to 78%. This review explores the mechanisms and public health importance of prenatal vitamins in preventing birth defects, with special reference to the Indian context.

Keywords: Prenatal vitamins, folic acid, neural tube defects, congenital anomalies, maternal nutrition, India, Kerala.

Introduction

Congenital anomalies represent a leading cause of infant morbidity and mortality globally, affecting an estimated 3–6% of newborns. In India, neural tube defects (NTDs) such as spina bifida and anencephaly remain prevalent, largely due to nutritional deficiencies. Nutritional supplementation through prenatal vitamins provides a simple, cost-effective preventive strategy.

Recent observations from Kerala in 2024–2025 show rising rates of preterm births and low-birth-weight infants, with maternal nutrition and inadequate antenatal care cited as contributing factors. These trends underscore the urgency of strengthening prenatal supplementation and maternal nutrition counseling within India's public health system.

Review of Literature

1. Folic Acid and Neural Tube Defects (NTDs)

Folic acid is the most studied micronutrient for birth defect prevention. Randomized controlled trials demonstrate that periconceptional supplementation can reduce the incidence of NTDs by up to 70% (Czeizel & Dudas, 1992). The U.S. Public Health Service recommends 400 µg/day for all women of reproductive age, while higher doses (4 mg/day) are advised for women with a previous NTD-affected pregnancy.

Recent evidence shows that optimal red blood cell folate levels ≥ 1000 –1180 nmol/L are associated with the lowest NTD risk (Crider et al., 2014). A comprehensive 30-year review further confirmed that fortification across 71 countries increased population folate levels ~1.5 times and reduced NTD rates by up to 78% (Crider et al., 2022).

In India, studies have shown significant reduction in NTD prevalence in populations receiving folic acid supplementation or food fortification. Recent reviews



also highlight the need for population-wide strategies, such as folic acid fortification of salt and flour.

2. Iron and Anemia-Related Outcomes

Iron deficiency remains one of the most common nutritional problems in Indian women. Maternal anemia contributes to intrauterine growth restriction (IUGR), preterm delivery, and low birth weight. Iron supplementation improves maternal hemoglobin levels and enhances placental oxygenation, indirectly reducing the risk of congenital anomalies.

3. Vitamin B12 and Vegetarian Diets

Vitamin B12 deficiency, particularly prevalent among vegetarian populations in India, has been associated with increased risk of NTDs and impaired neurodevelopment. Combined folic acid and vitamin B12 supplementation has been suggested for greater protective effect.

4. Vitamin D and Skeletal Development

Vitamin D deficiency in pregnancy may result in neonatal rickets and poor skeletal mineralization. Kerala, despite high sun exposure, reports suboptimal vitamin D levels in many pregnant women, emphasizing the importance of supplementation.

5. Iodine and Neurodevelopment

Iodine deficiency remains a preventable cause of congenital hypothyroidism and intellectual disability. Universal salt iodization and maternal iodine supplementation are critical in protecting fetal brain development.

Kerala has historically reported better maternal-child health indicators compared to other Indian states. However, recent trends show rising preterm births and low-birth-weight cases, partially attributed to maternal stress, nutritional deficiencies, and lifestyle changes. Ensuring access to prenatal vitamins, along with community-level awareness campaigns, is crucial to reverse these patterns.

Nationally, India's National Iron Plus Initiative (NIPI) and other supplementation programs have improved

coverage, but compliance remains suboptimal due to lack of awareness, late initiation of supplements, and poor adherence. Integration of preconception counseling, dietary education, and supplement provision into routine primary healthcare is essential.

Discussion

Prenatal vitamins act as a preventive rather than therapeutic measure. The timing of supplementation—ideally starting before conception—is critical for maximum benefit. While folic acid is most effective for NTD prevention, other vitamins and minerals collectively support healthy fetal growth.

International evidence, including Crider's work, demonstrates that mandatory fortification policies have the strongest population-level effect on NTD prevention. In India, fortification and supplementation programs are gradually expanding, but awareness gaps persist. Nurses, midwives, and primary healthcare workers have a pivotal role in educating women about the importance of prenatal vitamins and ensuring compliance. Kerala's recent increase in preterm births highlights the importance of maternal nutrition counseling alongside stress management.

Conclusion

Prenatal vitamins, particularly folic acid, are essential tools in preventing birth defects and improving pregnancy outcomes. Indian and Kerala-specific data emphasize the urgent need for improved awareness, preconception counseling, and universal access to supplements. Strengthening community-based maternal health programs and advocating for mandatory fortification policies could substantially reduce congenital anomaly rates.

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