Review Article

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Nutrition in the First 1000 Days: Foundation for a Lifetime

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Abstract

The critical period encompassing gestation and the first two years of life are essential for the development of the body, brain, and immune system. Although early-life nutrition during the first 1,000 days has been widely reviewed, this paper provides an updated synthesis linking early feeding practices, long-term disease risk, and parental preconception nutrition within a life-course and public health perspective. It emphasizes the often-overlooked role of paternal nutrition, epigenetic programming, and the continuity of dietary exposures from preconception to complementary feeding, in contrast to previous reviews focusing primarily on maternal or neonatal nutrition. Current evidence on key micronutrients, breastfeeding dynamics, and complementary feeding practices is summarized, along with their mechanistic contributions to immunological maturation, neurodevelopment, and the developmental origins of non-communicable diseases. The review contextualizes findings within the challenges faced by low- and middle-income countries, including the dual burden of malnutrition, social barriers, and health inequities. By integrating biological mechanisms with practical public health considerations, this synthesis aims to bridge the gap between evidence and community-level interventions. The insights provided are intended to guide nutritionists, policymakers, and maternal-child health programs in optimizing health outcomes during this critical developmental window.

Keywords: Early-life nutrition; maternal and paternal nutrition; epigenetic programming; complementary feeding; breastfeeding

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Introduction

The first 1,000 days, encompassing pregnancy (approximately 270 days) and the child's first and second years of life (365 days each), represent the period from conception to the second birthday. This period holds significant importance in an individual`s life, as the development and biological progression of the brain occur during the first 1000 days and are greatly influenced by maternal and child nutrition. During this phase, approximately 1,000 new neural connections are formed in a child's brain per second. This period holds significant value in the development of the body, metabolism, and immune function. Studies suggest that the development of a baby before birth is influenced by the mother's health, nutritional status, and emotional state. After delivery, the child's living conditions, diet, and quality of care have a long-lasting influence on their health. Permanent harm can be caused to a child`s physical and brain development due to poor nutrition in the first 1000 days (1). The stages of development of a child are shown in Table 1.

Fathers' overnutrition or undernutrition can impact sperm quality, leading to complications in pregnancy or metabolic fluctuations in the foetus, causing long-term health disturbances. Malnutrition in the early phases of life can be a cause of multiple problems such as respiratory diseases, childhood obesity, stunting, low birth weight, diabetes, kidney disease, cardiovascular diseases, and many more (2). Childhood obesity can be caused by maternal factors during pregnancy, the breastfeeding stage, and early dietary habits (3). Maternal health conditions, inadequate nutritional status, exposure to chemicals, drug or alcohol consumption, medications, and infections can impact the development of kidneys in the first 1000 days (4).Poor nutrition during the first 1000 days of human development can cause linear growth failure, which is linked to multiple other irreversible problems, such as reduced physical growth potential, increased likelihood of disease and death, impaired brain and cognitive development, and greater chances of chronic diseases later in life (5).

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Table 1: Stages of Development of Child

S. #	Duration	Stages
1	From conception to delivery	Pregnancy
2	Zero to six months	Breastfeeding
3	Six to 12 months	Introduction of solid food
4	>12 months	Transition to the family diet

Note: Table 1 outlines the sequential stages of child development from pregnancy through transition to the family diet.

Methodology

Within a life-course and public health context, this narrative review summarises the body of research on nutrition throughout the first 1,000 days of life, including preconception, pregnancy, infancy, and early childhood. Using electronic databases like PubMed, Scopus, and Web of Science, as well as pertinent institutional repositories like the WHO and UNICEF databases, a literature search was carried out. To ensure that current evidence was included, the search encompassed articles from 2010 to 2025, with a focus on low- and middle-income country (LMIC) contexts. Combinations of "first 1000 days," "maternal nutrition," "paternal nutrition," "breastfeeding," "complementary feeding," "micronutrient supplementation," and "developmental origins of health and disease (DOHaD)" were among the key search terms. Included were peer-reviewed English-language publications, systematic reviews, randomised controlled trials, cohort studies, and reputable reports from global health organisations. Articles with unclear nutritional results, non-peer-reviewed opinion pieces, and studies that only examined animal models with no bearing on humans were disqualified. A narrative review approach was used since the goal of this work is to present a comprehensive, integrative understanding of biological mechanisms, public health consequences, and contextual issues rather than quantitative effect estimates. The critical synthesis of many evidence streams and the identification of knowledge gaps pertinent to mother and child nutrition policy and practice are made possible by this methodology.

Results

Pre-conception Nutrition

The 3 to 6 months preceding pregnancy, referred to as the pre-conception period, is a critical time for enhancing parental nutritional status and improving pregnancy outcomes. Before an unplanned or planned, natural or assisted pregnancy, preconception care offers people and couples the chance to enhance the quality of their lives. Oxidative stress can be detrimental to DNA; therefore, a diet rich in antioxidants can help prevent damage to gametes, thereby improving the quality of oocytes and sperm and enhancing the chances of a successful pregnancy. Pre-conception nutrition not only impacts the fertility outcomes but also the health of the embryo (6). The majority of the information that is now accessible comes from observational and mechanistic studies, despite mounting evidence that both mother and paternal preconception diet influence the health of offspring. Stronger causal evidence is required to guide preconception nutrition policies, as evidenced by the paucity of high-quality randomised controlled trials in a variety of populations, especially in low- and middle-income nations.

Paternal Pre-conception Nutrition

Research shows that sperm quality has experienced a reduction in males over recent times owing to environmental factors, lifestyle, and eating patterns. Poor dietary habits of a father can cause epigenetic changes that can be passed to the next generation through sperm. Paternal folate deficiency results in decreased sperm count and impacts placental folate transport. Paternal low protein diet results in numerous health problems in off springs such as glucose intolerance, metabolic dysfunction, cardiovascular diseases, poor development of skeleton, altered mineral deposition in bones, modified vascular function, epigenetic changes specifically in genes involved in cholesterol and lipid synthesis pathways and increased risk of breast cancer in female off springs. High sugar intake contributes to metabolic and cardiovascular disorders, while combined high-sugar and high-fat diets impair F1 reproductive health, leading to earlier testicular descent (2). Testicular atrophy and a decrease in sperm can be due to more than the suggested (7 units per week) consumption of alcohol. Sub-fertile men probably suffer from vitamin C deficiency in comparison with those having normal semen production. Father`s optimal weight is crucial in reducing the risk of childhood obesity (6).

Maternal Pre-conception Nutrition

Before conception, maternal optimal nutrition is necessary to support the development of progeny and prevent health disturbances later in life. To avoid abnormalities in the neural tube, a 400 µg folate (vitamin B9) supplement is recommended every day. In many countries, mothers are recommended to take 400IU of vitamin D to support the development of fetal as vitamin D may play a part in antimicrobial and anti-inflammatory activity, and women consuming an adequate amount of vitamin D have a lower miscarriage rate. Vitamin C contributes significantly to the proper growth of the foetus since it is also needed for the manufacture of collagen, steroids, and peptide hormones, as well as for preventing or reducing the oxidation of biomolecules. Lower iodine levels may result in a lower IQ in children. Maintaining optimal weight before conception is vital to maintain a healthy pregnancy and the normal weight of children (6).

Nutrition during the Gestational Period

A healthy, balanced, and adequate diet is fundamental before conception and throughout pregnancy to ensure proper fetal nourishment and to establish maternal nutrient reserves for lactation. The maternal dietary pattern should incorporate a wide range of nutrient-dense food sources, with total caloric intake not exceeding 10% above requirements, even during late gestation. Protein plays a crucial role in the synthesis and repair of maternal blood and uterine tissues, as well as fetal growth and development (1). During the first trimester, the recommended dietary allowance (RDA) for protein is 46 g/day, which increases to 71 g/day in the second and third trimesters (7). Iron, an essential component of hemoglobin, facilitates oxygen transport to maternal and fetal tissues. Folate is equally indispensable for hematopoiesis and for the maturation of the neural tube and brain. Adequate folate intake reduces the risk of neural tube defects, with evidence indicating prevention in approximately 70% of cases (1). The World Health Organization recommends combined iron and folate supplementation, as maternal anemia significantly elevates the risk of maternal and perinatal mortality, preterm birth, and low birth weight (8). Infants born to anemic mothers have diminished iron stores, impairing immune competence, physical capacity, and neurocognitive performance. To mitigate these risks, pregnant women are advised to consume 120 mg elemental iron and 2.8 mg folic acid weekly. Calcium is indispensable for fluid regulation and the structural and functional development of the heart, skeletal system, dentition, musculature, and neural transmission (1). A supplementation of 1.5–2.0 g/day is recommended for pregnant women (9). Vitamin C contributes to collagen synthesis, wound healing, and skeletal development in infants (1). The Developmental Origins of Health and Disease (DOHaD) hypothesis underscores the association between early nutritional exposures and long-term metabolic risk. Environmental influences, including maternal diet, can induce epigenetic modifications in the neonatal genome. Offspring of obese mothers exhibit a twofold higher risk of obesity by age two. Maternal caloric restriction early in gestation predisposes offspring to obesity, hyperlipidemia, and cardiovascular disease in adulthood, while restriction during late pregnancy contributes to low birth weight. Caloric restriction at any stage increases susceptibility to glucose intolerance in offspring (10).

Breastfeeding and Early Infant Feeding (0-6 months)

Human breast milk is the irreplaceable source of nutrition for the infant right after birth and is a prerequisite for its biological and developmental progress. According to the recommendations of the World Health Organization and the United Nations Children's Fund, infants should be given breast milk exclusively for up to 6 months of age and continue this for up to 2 years, with other sources of nutrition. Many infant formulas have been developed similar to breast milk, but there is no impeccable alternative to maternal milk (11).

Composition of Human Breast Milk (HBM)

The relative density of HBM is 1.030 compared to water, the solute concentration is approximately 286 mOsm/L, the ratio of solid components (macronutrients) is 124g/L, which include approximately 60-70g/L carbs which acquire for 7% of total, protein (8–10 g/L) making 1%, and fats (35–40 g/L) which are almost 3.8%, illustrated in Table 2. It also contains roughly 87%–88 % water. Mature milk typically has 65–70 kcal per 100 mL of energy, with fat accounting for approximately 50% and carbs for 40% of the overall calorie supply (11).

Table 2: Energy and Macronutrient Composition of Human Breast Milk

Variable	Colostrum (1–5 days)	Mature milk (>14 days)
Energy	50–60 kcal/100 mL	65–70 kcal/100 mL
Carbohydrate	50–62 g/L	60–70 g/L
Lactose	20–30 g/L	67–70 g/L
Oligosaccharides	20–24 g/L	12–14 g/L
Total protein	14–16 g/L	8–10 g/L
Total fat	15–20 g/L	35–40 g/L

Note: Table 2 presents the comparative energy and macronutrient composition of colostrum and mature human breast milk, illustrating changes in nutrient density during early lactation.

Factors Affecting the Composition of HBM

Maternal health, mammary gland physiology, maternal diet, and numerous other environmental factors can all affect the composition of HBM. Furthermore, it can differ based on prematurity, foremilk or hindmilk, colostrum, transitional milk, or mature milk. The mammary gland releases foremilk, which has a relatively low fat level that rises with feeding, whereas hindmilk has a higher fat content. There aren't any notable differences in their protein and lactose amounts. Low in fat but high in protein (10%), colostrum is comparatively rich in immune-protective substances, including lactoferrin and immunoglobulin A (IgA), which assist in warding off contagions in newborns (11).

Supplementation during Breastfeeding

Human breast milk contains all essential vitamins, as shown in Table 3, except vitamins D and K, which are compensated through supplementation. The American Academy of Paediatrics and the Nutrition Society advise that newborns and nursing mothers take vitamin D supplements at a maintenance dosage of 200–400 IU daily and in deficit at 2,000 IU daily. Iron supplements are not required till 4-6 months of age (11).

Table 3: Micronutrient Composition of Human Breast Milk

Micronutrient	Colostrum (1–5 days)	Mature milk (>14 days)
Iron	0.5–1.0 mg/L	0.3–0.7 mg/L
Calcium	250 mg/L	200–250 mg/L
Phosphorus	120–160 mg/L	120–140 mg/L
Magnesium	30–35 mg/L	30–35 mg/L
Sodium	300–400 mg/L	150–250 mg/L
Chloride	600–800 mg/L	400–450 mg/L
Potassium	600–700 mg/L	400–550 mg/L
Manganese	5–12 μg/L	3–4 μg/L
Iodine	40–50 μg/L	140–150 μg/L
Selenium	25–32 μg/L	10–25 μg/L
Copper	0.5–0.8 μg/L	0.1–0.3 μg/L
Zinc	5–12 μg/L	1–3 μg/L

Note: Table 3 summarizes the amount of vital micronutrients in colostrum and full-fat human breast milk, which indicates how well they promote immunological development, metabolic processes, and newborn growth.

Benefits of Breastfeeding

Breastfeeding confers substantial benefits for both mothers and infants. Exclusive breastfeeding reduces the risk of nonspecific gastrointestinal infections by 64%, while pneumonia-related mortality is reported to be 15 times higher among non-breastfed children. Evidence indicates a clear association between feeding type—exclusive breastfeeding, mixed feeding, or exclusive formula—and the incidence of infectious diseases. Exclusive breastfeeding for a minimum of four months lowers the risk of cow's milk allergy at 18 months, whereas the early introduction of dairy and non-dairy products within the first four months increases the risk of asthma and wheezing by more than threefold after the first year of life. Breast milk also provides long-term protection against obesity, cardiovascular disease, hyperlipidemia, and type 2 diabetes mellitus, and has been associated with a 19% reduction in leukemia and a 58–77% decrease in necrotizing enterocolitis. Furthermore, breastfeeding supports neural development, enhancing IQ and reducing behavioral disorders, while non-breastfed infants experience disturbances in oral development, intestinal microbiota, oxygenation, and thermoregulation (12). Maternal benefits include reduced risk of postpartum depression, breast and ovarian cancers, and cardiometabolic diseases (13). Although systematic reviews and epidemiological evidence strongly support breastfeeding's protective effects against infections and chronic diseases, regional differences in effect size imply that contextual factors like maternal nutrition, socioeconomic status, and access to healthcare may alter results. This emphasises how crucial it is to combine broader mother and child health interventions with breastfeeding promotion.

Overcoming Common Breastfeeding Problems

Key factors influencing breastfeeding initiation and continuation include skin-to-skin contact at birth, early initiation, lactation support, the Baby-Friendly Hospital Initiative (BFHI), breastfeeding education, and adherence to professional guidance. Common causes of discontinuation are low milk production, poor latching, and maternal discomfort. Effective latching requires maternal comfort and correct infant positioning, often achieved through trying different positions. Adequate breast stimulation and milk removal are critical for maintaining supply. Breast soreness is frequently reported, with 89% of cases linked to poor latching and posture. When pain persists despite correct technique, underlying conditions such as infections or blocked ducts should be evaluated (13).

Complementary Feeding (6-24 Months)

As stated by the World Health Organization, complementary feeding refers to the process that is initiated when exclusive breastfeeding ceases to satisfy the nutritional needs of infants and other sources of nutrition are required along with breastmilk. Complementary feeding is given to children aged 6 to 23 months, where it fulfills the gap between the energy and nutritional requirements of infants and the amounts obtained from breastmilk. Complementary feeding is expected to ensure sufficient nutrient intake and meet systemic requirements. Poor feeding practices affect the infant's growth, health, and nutritional status. It is marked by inappropriate complementary feeding practices, including untimely introduction of foods, low feeding frequency, inadequate hygiene, suboptimal caregiving, limited dietary diversity, unsuitable food consistency, and deficiencies in essential fatty acids, vitamins, and minerals (14).

Consistency of Complementary Foods

Infants can begin consuming soft-textured foods, including purees, semi-solids, and fortified cereals prepared from meat, vegetables, and fruits, at around six months of age. By eight months, most infants are developmentally able to handle "finger foods." As oral motor skills mature, food texture should progress gradually from liquefied to mashed, fork-crushed, and eventually sliced. To avoid feeding difficulties, lumpy solids should be introduced by 10 months, which is considered a critical window. Although many infants still receive semi-solids at this stage, most can transition to family foods with appropriate consistency. Foods posing choking risks must be avoided (14).

Calorie Requirement and Frequency of Complementary Foods

For healthy breastfed infants, the estimated daily energy needs are 615 kcal at 6–8 months, 686 kcal at 9–11 months, and 894 kcal at 12–23 months. In developing countries, the energy requirements from supplemental food rise from 200 kcal/day at 6–8 months to 300 and 500 kcal/day at 9–11 and 12–23 months, respectively, for infants with "average" maternal milk intake. In line with the declining consumption of human milk as people age, this represents 29, 55, and 71% of the total daily requirements of energy, respectively. Depending on how much breast milk is consumed each day, these numbers may change. Assuming a gastric capacity of 30 g/kg body weight, meals with a recommended minimum energy density (0.8 kcal/g) should be eaten two to three times for children aged 6 to 8 and three to four times for those aged 9 to 11 and 12 to 24 months, along with one or two wholesome snacks (14).

Long-lasting Impact of Nutrition in the First 1000 Days

Nutrition during the first 1,000 days of human development is crucial in shaping the health and well-being of an individual. In this period, organs, specifically the brain and immune system, undergo rapid development, and insufficient nutrition can cause irreversible damage.

Critical Brain Development

Different parts of the brain continue to develop throughout life. However, major development occurs in the early stages of life.

Among the factors that affect the development of the brain, optimal nutrition is one of those. Every part of the brain has a unique structure, process, function, and development time. For instance, myelination is most active in the first 2 years and starts at the 32nd week of pregnancy. The prefrontal cortex, which is involved in attention and multitasking, undergoes fast-paced development during the initial 6 months of gestation. Although all nutrients contribute to brain development, proteins, polyunsaturated fatty acids, iron, zinc, and iodine are particularly critical during early developmental stages. (15).

Immune System Development

The development of the immune system starts after birth as the infant moves from the womb to the external environment. The gut is the largest immune center as it holds 70-80% of immune cells and 100 trillion immune cells in adults. Early food intake greatly influences the development of a healthy immune system. Breast milk contains many bioactive compounds, oligosaccharides, low levels of bacteria (Streptococci) and their metabolites, which have beneficial influences on the maturation of immunological functions through the gut (16).

Risk of Chronic Diseases in Later Life

Inadequate nutrition during the first 1,000 days substantially elevates the risk of morbidity and the development of chronic diseases later in life. Undernutrition contributes to malnutrition, while overnutrition predisposes to obesity, cardiovascular disorders, and related complications. According to UNICEF, more than 200 children are adversely affected by poor nutrition during this critical window. The fetal/neonatal origin of adult disease theory suggests that when the developing foetus encounters restricted nutrient supply, it adapts its metabolic processes (e.g., insulin secretion) and biological structures (e.g., vascularization) to survive. These adaptations, however, persist postnatally, predisposing the individual to chronic disease when exposed to an unrestricted environment. Evidence indicates that exclusive breastfeeding and continued human milk consumption during the first two years reduce the risk of obesity, cardiovascular disease, and metabolic dysfunction. Both the type and duration of feeding significantly influence obesity risk, and the programming mechanism highlights the association between excessive protein intake and childhood obesity; thus, protein intake in formula-fed infants requires careful regulation (17). Although there is physiologically sound and consistent evidence from cohort studies that early nutrition increases the risk of non-communicable diseases in later life, residual confounding and intergenerational variables make it difficult to draw conclusions about causality. To support findings that are pertinent to policy, future studies must use intervention-based methodologies and longitudinal designs. Table 4 shows the main risk factors during the initial 1000 days that can cause childhood obesity.

Table 4: Main Risk Factors in the First 1000 Days for the Development of Childhood Obesity

Nutritional Phase	Risk Factors
Prenatal (0–280 days)	• Higher maternal pre-pregnancy BMI • Excess maternal gestational weight gain • Maternal diabetes mellitus (gestational or Type 1) • Genetic predisposition
Breast/Formula Feeding (280 days–6 months of age)	• Formula feeding • Accelerated growth curve • High energy intake • High protein content • Low concentration of polyunsaturated fatty acids
Complementary and Early Diet (6 months–2 years of age)	• Rapid weight gain • Early introduction of solids • High protein intake • Gut microbiome

Note. Table 4 highlights important biological and dietary risk factors that contribute to childhood obesity during the prenatal, early feeding, and supplemental feeding stages.

Discussion

Global Challenges in Nutrition during the first 1000 days

Significant worldwide obstacles still stand in the way of adequate nutrition for mothers and children, even in light of the increased knowledge of the significance of nutrition during the first 1000 days.

Double Burden of Malnutrition

As indicated by the report of the WHO, UNICEF, and World Bank the prevalence of stunting, wasting, and childhood obesity under five is 148.1 million, 45 million, and 37 million worldwide (18). Undernutrition leads to mortality and disturbed cognitive development, while overnutrition is the cause of type 2 diabetes and cardiometabolic syndrome. This double burden of malnutrition, comprising both undernutrition or overnutrition, affects low and middle-income countries where the ratio of inadequate diet and transition towards processed, nutrient-poor, and energy-dense diet is high.Concerns about generalisability to LMICs, where food patterns, illness burden, and health system capacity differ significantly, are raised by the fact that the majority of intervention evidence supporting global guidelines comes from high-income settings. Therefore, in order to effectively transfer biological information into public health action, context-specific research and implementation studies are essential.

Social and Cultural Barriers

Access to wholesome foods and medical treatment is severely hampered by poverty, food insecurity, gender inequality, and low maternal education levels. Mothers try to treat their ill child at home or consult their grandparents for remedies and seek hospital care only when the condition deteriorates. Due to cultural beliefs, the best part of food is given to adults, specifically fathers. Moreover, some mothers avoid nutritious food due to cultural norms, such as problems in the consumption of eggs, etc, and to facilitate labour and delivery, avoid having a big baby, etc. Furthermore, social norms influence women's autonomy in decision-making in households, limiting their access to nutritious foods for themselves and their children (19).

Inequities in Access to Nutritional Services

There are significant differences in access to growth monitoring services, lactation assistance, micronutrient supplements, and prenatal care between and within nations. Research by Nguyen et al. shows that only 15 % of child-mother pairs receive access to all nutritional interventions in South Asia, a ratio particularly low in Pakistan and Afghanistan (20). The report of the WHO illustrates that anaemia is thought to impact 500 million women between the ages of 15 and 49 and 269 million children between the ages of 6 and 59 months worldwide. The two most impacted regions are South-East Asia and Africa, with an estimated 244 million women and 83 million children in South-East Asia and 106 million women and 103 million children in Africa (21). Pandemics, conflicts, and natural disasters seriously impair food systems; the conflict in Ukraine and the COVID-19 pandemic caused food costs to skyrocket, pushing families in need to eat diets low in nutrients (22).

Novelty and Contribution of Work

In contrast to previous narrative reviews that primarily focus on maternal or neonatal nutrition in isolation, this work explicitly incorporates paternal preconception nutrition and epigenetic programming as crucial but frequently overlooked upstream drivers of offspring health and disease susceptibility. By embedding early nutritional exposures within the Developmental Origins of Health and Disease (DOHaD) framework, the review goes beyond descriptive associations to elucidate mechanistic pathways linking early nutrition to long-term non-communicable disease risk. This review makes a significant and unique contribution to the literature by rethinking nutrition in the first 1,000 days as an integrated, intergenerational, and life-course determinant of health rather than a series of disconnected maternal or infant feeding stages. Importantly, the synthesis addresses the twofold cost of malnutrition as well as structural and societal hurdles to optimum feeding practices, placing global biological findings within the context of low- and middle-income nations. By bridging the gap between clinical nutrition, public health implementation, and molecular mechanisms, this translational, holistic approach provides a more thorough basis for future research in maternal and child nutrition as well as policy formation and programmatic intervention.

Limitations

There are certain restrictions on this critique. Instead of using a systematic review process, which could add selection bias, it mainly synthesises evidence from the body of current research. The findings' contextual relevance to a variety of populations may be limited by the incomplete consideration of regional dietary practices, cultural variances, and local factors of mother and child nutrition. Additionally, the review did not thoroughly assess the efficacy of particular initiatives, programs, or policies meant to improve nutrition during the first 1,000 days; instead, it concentrated mostly on dietary requirements and outcomes. Extrapolation to low- and middle-income settings should be done with caution because a large portion of the information mentioned comes from high-income nations. To improve the translation of evidence into practice, future studies should focus on context-specific tactics and the efficacy of interventions.

Conclusion

From conception until early childhood, nutrition throughout the first 1,000 days has a significant impact on lifelong health, affecting physical growth, immunological function, brain development, and vulnerability to non-communicable diseases. While proper maternal micronutrient intake, exclusive breastfeeding for the first six months, and timely, appropriate supplemental feeding are essential for optimal growth and disease prevention, there is evidence that both the mother's and the father's nutritional status prior to conception contributes to foetal programming. On the other hand, inadequate nutrition at this delicate period may have permanent effects, like as stunting, cognitive decline, and elevated metabolic risk in later life. The combined burden of malnutrition, sociocultural norms, gender disparities, and unequal access to maternal-child health services, especially in low- and middle-income countries, limit worldwide progress despite overwhelming scientific consensus. Therefore, increasing funding for early-life nutrition continues to be one of the most economical and successful ways to enhance population health and end intergenerational illness cycles.

Ethical Approval:

This study did not require ethical approval as it is a review article based entirely on previously published literature. No new data were collected from human participants or animals, and no confidential or identifiable information was used.

Data Availability: Data supporting the findings are available upon reasonable request.

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Authors' Contribution:

RF: Concept and design of the study, data collection, interpretation of results, drafting of the manuscript.

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