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Impact of Maternal Nutrition on Child Health Outcome: A Scoping Review

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ABSTRACT: The maternal nutrition plays a crucial role in shaping the health and development of infants and children, influencing outcomes from prenatal stages through early childhood and beyond. This scoping review examines the complex connection between the nutrition of the mothers and child health, encompassing factors such as macronutrient and micronutrient intake, maternal dietary patterns, and their implications on birth outcomes and long-term health. Key findings underscore the significance of adequate maternal nutrition in promoting optimal foetal growth, organ development, and cognitive abilities. However, disparities in nutritional access and healthcare services globally continue to pose challenges, impacting maternal nutritional status and subsequent child health outcomes. The study highlights many socioeconomic, cultural, and healthcare aspects impacting maternal nutrition by synthesizing information from several research conducted in numerous countries. The review's conclusions point to the necessity of focused treatments and legislative actions to close the dietary gaps in mothers, increase the development trajectories of their offspring, and improve maternal health outcomes. By examining the complex interplay of maternal nutrition and child health across different contexts, this study contributes to broader discussions on public health strategies aimed at reducing maternal and child mortality, enhancing well-being, and achieving sustainable health outcomes.

Keywords: Maternal nutrition, child health, developmental milestone, prenatal development, micronutrients
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INTRODUCTION

The intake, digestion, absorption, and metabolism of nutrients required for the growth, development, and support of life may be summed up as nutrition. The nutritional and nutritional status of women during their adolescence, pregnancies, and postpartum periods especially in the initial six weeks following childbirth is referred to as maternal nutrition. According to WHO (2023), improved nutrition is associated with a longer life expectancy, improved immunity, safer pregnancies and deliveries, a reduced incidence of non-communicable illnesses which includes diabetes and cardiovascular disease, and better health for mothers and babies. From infancy until maturity, a child's general growth and overall quality of life are greatly influenced by the mother's diet. Maternal nutrition is not just about feeding, but it is the foundation to the best foetal development, neonatal health, and future health and development of the child. When we try to understand the relationship between maternal nutrition and child outcomes, it becomes important to acknowledge the fact that the quality of food consumed by a mother has a far-reaching effect on the physical, mental, and even educational potential of her children. Healthy diet of a woman during pre and post pregnancy is crucial as it sets the pace for future well-being of a child (Marshall et al. 2022). The foods that a mother takes during pregnancy affect the growth of the foetus, the development of the different organs in the foetus, the formation of the foetal brain, and the physical and mental ability of the foetus. Maternal nutrition is more than just feeding; it is the cornerstone of optimal foetal

growth, neonatal health, and the child's future health and development. When attempting to comprehend the connection between maternal diet and child outcomes, it becomes critical to recognize that a mother's food choices have a profound impact on her children's mental, physical, and even educational potential. The macronutrients, or those that are needed in substantial quantities for the foetus's proper development include protein, carbohydrates, and lipids. Micronutrients like as iron, folic acid, iodine, and calcium are critical in preventing developmental issues. If a pregnant woman does not consume the necessary amount of nutrients, her unborn child is likely to have low birth weight, poor cognitive development, and birth defects.

According to Englund-Ogge (2019), maternal nutrition, especially before and throughout pregnancy, has a significant impact on the development of the foetus. Certain maternal traits can affect the birth weight of the kid. For example, petite women (i.e., low maternal height, maternal underweight) are more prone to give birth to Small for gestational age (SGA) infants, and they may even be more anaemic than mothers of average size. Additionally, these mothers are more likely to give birth to a baby who is underweight or SGA. Low calorie, low protein, low vitamin A, low salt, low zinc, or low iron diets all cause their kids to have fewer nephrons after giving birth. It was also shown that smaller kidneys in Indian neonates were linked to maternal vitamin A insufficiency. Thus, it is important to ensure optimal maternal nutrition in order to promote the development of the foetus' kidneys. Furthermore, Rajput et al. (2024) have discovered that malnutrition exposure during conception or pregnancy raises the risk of diabetes, proteinuria, hypertension, and kidney impairment in later life.

Despite advancements in the field of medicine, particularly with regard to maternal nutrition, obstacles still exist, and disparities in nutrition persist to have an adverse effect on the well-being of mothers as well as their offspring. Pregnant women still face obstacles in most regions of the world, such as inadequate health facilities, a lack of knowledge about appropriate diet, and financial difficulties, which make it challenging for them to achieve their nutritional demands. The purpose of this study is to provide essential answers to concerns such as how maternal nutrition or lack thereof affects the health and development of children at various stages, from prenatal to the beginning of childhood, and what the long-term effects of inadequate maternal nutrition are on the health and welfare of the child. In addition to being conceptually significant, answering this issue is crucial for practice and has real-world implications for the healthcare sector, decision-makers, and communities that aim to enhance the lives of women and children (Omer et al., 2021).

In examining the link, the study will look into the complexity of maternal nutrition, taking into account a few of the variables that affect it, such as socioeconomic status, cultural factors, and the accessibility of healthcare resources. Additionally, the complex relationship that is present between maternal food intake and child health will lay the foundation for community-based interventions, potential courses of action, and policies that can lessen the pressure on mothers to provide their children with a healthy diet and advance maternal and child health for all people worldwide. By better understanding this important relationship connecting maternal nutrition and the well-being of children, the study hopes to alter this and pave the way for further discussions and initiatives aimed at enhancing the future chances of future generations (Dahab and Sakellariou, 2020).

The health of Under-five children, that of newborn and the mothers (MNCH) represent a significant and developing segment of the global public health landscape, with high rates of maternal and infant mortality as well as persistent health disparities across various geographic and sociodemographic contexts. The danger of avoidable morbidity and death for mothers, babies, and children makes the MNCH conditions concerning even with their current treatment. In 2020, the World Health Organization (WHO) noted that over 287,000 women died during pregnancy and delivery, and that high rates of maternal mortality are still a serious problem, particularly in poorer nations. One of the main MNCH subsectors is newborn health. The Global Nutrition Report (2020) indicates that the problem of inadequate nutrition of women of reproductive years still remains relevant worldwide, with an estimated 2,300,000 children dying within the first month of birth in 2019, accounting for nearly half of all under the age of-5 child deaths. Additionally, there is considerable concern that maternal food intake plays an essential part in assessing the general well-being of mothers and children, but there are always appearing and present challenges in mother's nutrition that inhibit an achievement of ideal physiological and developmental or good health status of the child. Furthermore, newborn mortality is still elevated, with 5,200,000 children under the age of five dying in 2019. All in all, maternal nutrition remains a major concern. Anaemia was found to afflict around 32.8% of women between the ages of 15.49 and 49 who are childbearing, which is an indicator of a rise in maternal malnutrition. According to World Health Organization research as cited by Bater et al., (2020), 20,500,000 newborns were linked to poor birth outcomes in 2015, including low birth weight and preterm delivery as a result of inadequate nutrition for the mother during pregnancy. This accounted for 14.6% of every live birth that year. According to the World Bank, around 144 million under-five children worldwide, experienced stunting in 2020. This condition hinders the physical and intellectual growth of these children and is caused by maternal malnutrition. Deficits in some micronutrients, such iron, iodine, and vitamin A, have a negative impact on the health of children.

Globally, more than 2 billion individuals are thought to be deficient in some micronutrients. According to WHO mortality figures, iron deficiency is thought to be the cause of around 0.8 million deaths annually. Limited availability to nutrient-dense meals and widespread food instability are factors contributing to maternal malnutrition. The Food and Agriculture Organization (FAO) estimates that 690 million people globally suffered from malnutrition in 2019. Maternal malnutrition can result from a number of socioeconomic factors, including low socioeconomic level, illiteracy, and inadequate health care. Put another way, addressing every factor is necessary to end the harmful effects of malnutrition and enhance children's health outcomes. Therefore, it is important to investigate the causes of maternal malnutrition and the effects it has on children's health since maternal nutrition has a significant impact on their wellbeing.

Along with providing information on effective interventions, policy recommendations, and strategies that can be used to improve maternal nutrition and thereby promote better health for mothers and their children worldwide, the study evaluates the relationship between mothers' micronutrient intake and their children's developmental milestones.

Objectives of the study

The main purpose of the study is to assess the relationship between the health of children and maternal nutrition. Specific objectives are:

1. To determine the essential maternal nutrient that have been studied in relation to key developmental milestones in children.
2. To identify the factors that affect the nutritional habits of mothers throughout her pregnancy and their reported impact on the incidence of chronic health conditions in children.
3. To provide an overview of the research on the effects of a mother's dietary practices during pregnancy, particularly on the long-term physical development and health of her unborn child or children.

Research question

1. What maternal micronutrient (e.g. folic acid, Iron, Calcium) have been studied in relation to positive developmental milestones in children and what are the key findings?
2. What factor (e.g. socioeconomic, behavioural, environmental) have been reported to affect the nutritional habits of mothers throughout her pregnancy and how does these factors correlate with the incidence of chronic health conditions in children?
3. What information is available on the effects of a mother's dietary practices during pregnancy on the physical well-being and developmental development of her unborn child?

MATERIALS AND METHODS

Study design

This study is a scoping review that follows the methodological framework outlined by Arksey, O'Malley, and PRISMA-ScR guidelines as cited by Westphaln et al., (2021) and Tricco et al., (2018), aiming to map the extent, range and nature of research activities related to maternal nutrition and child health outcomes.

Search Strategy

A thorough literature search was conducted across multiple databases, including Google Scholar, Web of Science, PubMed. The search was to identify relevant studies published from January 2004 to May 2024. The following key words and their combinations were used: maternal nutrition, child health, developmental milestones, maternal micronutrient, birth outcomes, and chronic health conditions.

Inclusion Criteria

- Studies published in peer reviewed journals between 2004 and 2024
- Studies providing qualitative and quantitative data on maternal nutrition and child health outcomes.
- Studies involving human participants; women of all ages, and children.
- Studies evaluating specific micronutrients (e.g. folate, Iron, calcium) or dietary patterns during pregnancy.
- Studies discussing on key developmental milestones or chronic health situation in children in relation to maternal nutrition.

Exclusion Criteria

- Animal studies
- Non-peer-reviewed articles
- Article with non-specific data on maternal nutrition or child health outcome
- Case studies and reviews without original data.
- Studies published in other languages other than English.

Data Extraction

Data was extracted independently by two reviewers using a standardized form. Extracted data included:

- Study characteristics (author, year, country, study

design).

- Sample size and population demographics.
- Maternal nutrition assessment (type and method of assessment).
- Child health outcomes measured using birth weight and developmental milestones.
- Key findings and reported correlations.

Data compilation and quality synthesis

The extracted data were charted in a tabular format to summarize study characteristics and key findings. Data were synthesized qualitatively to identify common themes, key nutrients studied, factors affecting maternal nutrition, and reported impacts on child health outcomes. Gaps in the literature were also identified and discussed.

Ethical considerations

Since this evaluation analyses data that has previously been published, no new ethical authorization was needed. It was considered that the original research that were part of this review adhered to the ethical guidelines that their authors had specified.

Collating, summarizing, and reporting results

A review of the present status of the study findings on the nutrition of mothers and child health was created by compiling and summarizing the data. Significant themes and patterns were found through thematic analysis. The key nutrients under investigation, variables influencing mother nutrition, and their effects on the health of the children were highlighted in the organization of the data. Research gaps were noted, and suggestions for more study were given.

RESULTS

The search process that was carried out, identifies a total sum of 1000 records from data base searches and additional sources. After removing duplicates, 850 records remained for screening. Based on title and the abstract screening, 700 record were excluded, leaving 150 full-text articles for eligibility assessment. From these, 130 were excluded for various reasons, resulting in 20 studies included in the final qualitative reconciliation (Figure 1).

Summary of the studies that were included

Table 1 summarizes the key characteristics of the 21 studies included in the study, which features the name of the authors, year of publication, country where the study was carried out, the study design, sample size and population, maternal nutritional assessment and the factors affecting maternal nutrition, and lastly the key findings in the study.

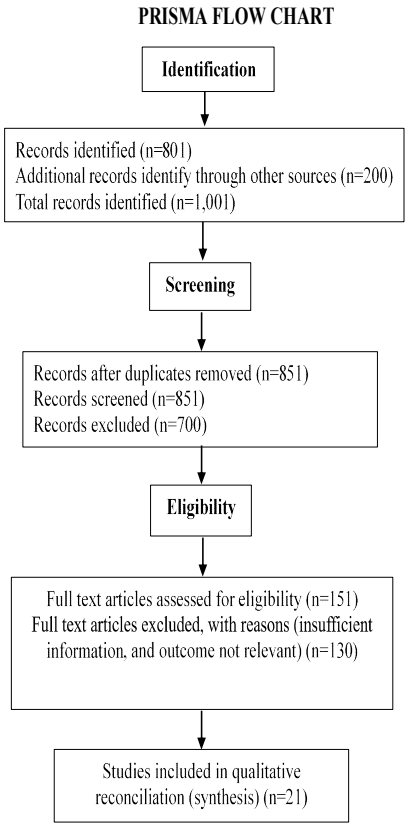

Figure 1: PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Flow Chart (Author's Design)

DISCUSSION

The results of this scoping review are presented in line with the specific objectives of the study, which provide a comprehensive review and overview of the literatures related to each of the objectives.

Objective 1: Essential maternal nutrients and developmental milestones

Summary of findings

Finkelstein et al. (2024): Oral Vitamin B12 supplementation during pregnancy reduced the risk of the mothers having vitamin B12 deficiency and improved maternal vitamin B12 status during pregnancy, postpartum and as well influence the developmental milestones of the newborn positively.

Siegfried et al. (2012): Supplementation of Multivitamins, was associated/connected with a significant reduction in child diarrhoea risk and improved CD4 counts among children of HIV-positive mothers.

Table 1: Summary of the Studies that were included

Author(s), year, country	Study design	Sample size and population	Maternal nutritional assessment & factors affecting maternal nutrition	KEY FINDINGS
Finkelstein et al., 2024, India, Bangladesh, South Africa, and Croatia	Randomised controlled Trials	984, pregnant women	Evaluating Vitamin B12, haemoglobin level	Pregnancy-related vitamin B12 deficiency is less likely to occur in mothers who take oral vitamin B12 supplements, and postpartum vitamin B12 levels are improved.
Mortaii et al., 2023, USA	Randomised Controlled Trials (RCT)	74 mothers (intervention 42, control 32)	The intervention included bi-weekly nutrition counselling, high dairy protein diet, and a walk out goal of about 10,000 steps each day Factors Affecting Maternal Nutrition: Maternal factors such as BMI before pregnancy and weight gain as a result of pregnancy were examined as potential moderators	The study found that a structured nutrition and the use of interventions like exercise during pregnancy led to improved language expression and general behaviour adapted to among 12-month-olds. The intervention group showed higher language expression and general adaptive composite scores which when compared to the control group, has medium effect sizes
Workneh, et al, 2023, Ethiopia	Qualitative study design	40 participants, consisting pregnant women, family members, and health providers.	The study's main focus was on pregnant women's nutritional attitudes and behaviours, including what supports and undermines a balanced diet. Factors Influencing Nutrition in Mothers: Alcohol usage, religious fasting, low money, restricted dietary choices, and restricted access to a variety of foods were all obstacles to a balanced diet during pregnancy	Participants encountered obstacles such food insecurity, restrictive eating habits, and dietary taboos while knowing how important it is to have a balanced diet during pregnancy. As a result, their intake of nutrients was insufficient and their diet was not diverse.
Abas et al, 2020, Ethiopia	Qualitative community-based research method	17 focused group and 20 in-depth interviews, Mothers, grandmothers, health professionals, religious leaders	Maternal nutrition is vital for the health and well-being and the child's survival	Barriers to the best feeding habits for mothers and their children have been identified. These include cultural factors, misconceptions, traditional beliefs, and inadequate understanding and health-seeking behaviours.
Siegfried, et al, 2012, South Africa	Randomized Controlled Trials	788 Children between 6 weeks and 24-month, HIV pregnant and lactating mothers and infants	Multivitamin supplemen-tation, child anthropometry	Statistically, with multivitamin supplementation, there significant reduction in child diarrhoea risk, improved CD4 counts.

Heland et al. (2022): Suboptimal levels of iodine and folate during pregnancy potentially impacted child's brain development (neurodevelopment) at the age of 3 years. Maternal nutrients such as folate, iodine, vitamin D, polyunsaturated fatty acids, and choline were essential for foetal growth and neurodevelopment.

Han et al. (2021): Supplementation with folic acid, calcium, vitamin D, iron, and other vitamins during pregnancy reduced the risk of mothers having anaemia, preterm birth, and preeclampsia, improving awareness of nutrient supplementation.

McStay et al. (2017): Mothers folic acid supplementation and intake before conception and during the period of first trimester reduced the risk of the infant developing neural tube defects (brain issues abnormality).

The findings from multiple studies highlight the critical role of specific maternal nutrients, such as Vitamin B12, folate, iodine, and multivitamins, in supporting key developmental milestones in children. For instance, mother's supplementation of Vitamin B12 significantly reduces deficiency risks and enhances postpartum health, while folic acid supplementation is crucial in preventing neural tube abnormality/ defects. Moreover, iodine and folate intake are vital for neurodevelopment, as seen in children at the age of 3 years, demonstrating the long-term impact of maternal nutrition on child development.

Gong et al. (2018), China	Cross-Sectional Study, using a stratified multistage cluster sampling method	74,501 participants aged 6 years or older which excludes pregnant women.	Examined nutrient supplement use in the previous month. factors like age, gender, education level, income, and urban/rural residence influenced supplement use	They discovered that Only 0.71% reported using nutrient supplements, with higher usage among females, higher education levels, and higher family incomes and there is need to explore reason behind the disparities in the use of nutritional supplement which may affect the health of the children.
Heland et al, 2022, Norway	Cohort Study, focusing on Nowergian mothers and children	N/A	Factors affecting maternal nutrition in the study include iodine and folate intake during pregnancy, with suboptimal levels potentially impacting child neurodevelopment at 3 years of age. Micronutrients that were studied in the research include, folate, iodine, vitamin D, Polyunsaturated fatty acid, and choline.	Maternal nutrients are essential to support a healthy environment for foetal growth and development particularly neurodevelopment.
Akhtar & Satapathy, (2021), India	Review of Existing scientific literature and records	Not specified, women in India	Focus on maternal nutrition requirements and impacts on child health	Giving adequate nutrition to mothers reduce complications and adverse birth outcomes.
Ramakrishnan et al., (2012), India	Intervention trials and observational studies and systematic study	45 articles, pregnant women and their offspring	Assessed maternal nutrition (preconception folic acid supplementation) before conception and during the early pregnancy period Factors such as maternal pre-pregnancy size, stature, underweight, overweight, and specific nutrient deficiencies were identified as influencing maternal nutrition and subsequent pregnancy outcomes	Periconceptional folic acid supplementation reduced the risk of the foetus having neural tube abnormality/defect, while vitamin and mineral supplementation reduces risks of adverse effect during birth outcome. The review highlighted the importance of nutrients like folic acid, vitamin and mineral supplements, iron, zinc, iodine, vitamin B-6, and B-12 in maternal nutrition before conception took place and during the period of early pregnancy
Dickinson et al, (2009), Southern Malawi	Pilot study	100, pregnant women	Blood, micronutrient supplementation (iron, vit A, Iodine, Zinc)	Micronutrient deficiency was a concern, results reveal health and nutritional disparities between regions.
Prado & Dewey, (2014), Guatemala, Indonesia, Nepal, Ghana, China, South Africa, Mexico, Bangladesh.	Randomised Trials	N/A though study population was among pregnant women and children up to 7 years old.	Randomized trials on food supplementation with micronutrients and balanced protein and energy to mothers and/or children. Maternal Nutritional Assessment/Nutrients: High protein and energy drink with micronutrients.	Maternal nutrition while pregnant, have positive effects on cognitive and motor development, reading readiness, and activity levels
Han et al, (2021), China	Cross-sectional study	1081 pregnant women aged ≥20 years	Folic acid, calcium, vitamin D, Iron, vitamin (A, B-group, C, multivitamins), DHA and other dietary supplements	Reduced risk of puerperal sepsis, maternal anaemia, preterm birth and preeclampsia. Increase awareness of nutrient supplementation with pregnancy progression.

Objective 2: Factors that affect the nutritional habit of mothers while pregnant and impact on Chronic Health Conditions in Children

Summary of findings

Mortaii et al. (2023): Factors such as BMI before conception and weight gain while pregnant moderated the effectiveness of having a structured nutrition and exercise intervention, which improved language expression and behaviour that is generally adaptive in 12-month-olds. Workneh et al. (2023): Barriers to healthy nutrition during and while the woman is pregnant includes low income, limited access to different, important and needed foods, religious fasting/starvation, food restrictions which may be intentional, and alcohol use, leading to inadequate nutrient intake. Gong et al. (2018): Discovered that factors like age, gender, education level, income, and urban/rural residence influenced the use of nutritional supplement and that only 0.71% reported using nutrient supplements, with higher usage among females, higher education levels, and higher family incomes and there is need to explore reason behind the disparities in the use of nutritional supplement which may affect the health of the children. According to Abas et al. (2020), traditional beliefs, myths, cultural influences, and poor knowledge and health-seeking behaviours were identified as

Bhanbro, et al, (2020), Indonesia	Qualitative study	19 participants, women, men, midwives, and community health extension workers	Dietary patterns, access to food, nutritional information Cultural beliefs, economic constraints, food taboos and inadequate nutritional information	Health dietary patterns, challenges with access to food and nutritional information
Dahab & Sakellario (2020), Countries not specified, though in low-income countries in Africa	Systematic Review	N/A though it involved community members and health providers in the regions used.	Focus on examining access barrier to maternal health, including transportation barriers, economic factors, cultural beliefs, lack of family support, and poor quality of care.	The most significant barriers to maternal health identified were transportation barriers to health facilities, economic factors, cultural beliefs, lack of family support, and poor quality of care.
Cortés-Albornoz et al. (2021), US	Scoping review design	84 studies focussing on maternal nutritional and dietary intake during pregnancy and development of the brain (neurodevelopment) in the foetus.	Investigated inadequate intake of Vitamin B12, Folate, Iron, Zinc. Fatty acids, Proteins, and various diets Inadequate nutrient intake, high fat diets, ketogenic diets, hypercaloric diets, and maternal undernutrition	Associated with brain defects, abnormal behaviour, neuropsychiatric disorder, altered cognition, visual impairment, and motor deficits. Maternal nutritional and dietary intake during pregnancy impacts neurodevelopment in the foetus, emphasizing adequate supplementation for optimal child health.
Obanewa, O., & Newell, M. L. (2017). Country not specified	Experimental/Interventional and observational cohort studies	N/A though varied sample sizes across studies focused on maternal malnutrition and infant response to immunity Population: infants age 0-2years.	Evaluated maternal malnutrition during pregnancy.Nutrients Identified: Zinc, vitamin A, D, folate, iodine, iron, and protein energy malnutrition. Factors Affecting Maternal Nutrition: Maternal dietary intake, micronutrient deficiencies, and overall nutritional status	Maternal malnutrition linked to impaired foetal immune development and reduced response of the child to vaccination in other words, Maternal malnutrition while pregnant, may lead to long-term immune deficiencies in offspring, impacting vaccine response
Duttaroy, (2023), Norway	Review study focused on maternal dietary intake and factors in the environment, impacting foetal development	Pregnant women and their offspring	Emphasized the importance of maternal n-3 and n-6 long chain polyunsaturated fatty acids (PUFA) Maternal diet, environmental factors like microbiota, plastic, and endocrine disruptive chemicals	Maternal nutrition influences placenta growth, foetal development, and long-term health outcomes for the offspring.
McStay, et al (2017), Country not Specified.	Systematic review and meta-analysis.	N/A	Maternal nutritional assessment discussed were on folic acid supplementation and deficiency and its impact on the pregnancy outcome, especially its effect on the growing foetus.	Maternal folic acid supplementation is recommended before and during the period of first trimester to reduce the risk of the infant having neural tube abnormality/defects. Adequate folate levels during pregnancy are crucial to prevent neural tube defects like spina bifida and anencephaly

barriers/obstacles to optimal mother and child feeding practices. According to Bhanbro et al. (2020), cultural beliefs, economic constraints, food taboos, and inadequate nutritional information impacted dietary patterns and access to food.

Englund-Ogge et al. (2019): Maternal educational level, income, and physical activity level influenced dietary patterns and total energy intake, impacting infant birth weight. Dahab and Sakellario (2020): Identified barriers to maternal health as transportation barriers, economic factors, cultural beliefs, lack of family support, and poor quality of care.

The studies underscore various socio-economic, cultural, family related issues, and behavioural factors influencing maternal health and nutrition. Low income, limited food access, lack of transportation, poor family support, poor quality of care and cultural practices such as religious fasting and dietary taboos are significant barriers. Moreover, maternal BMI before conception and weight gain while pregnant were noted as critical moderators affecting nutritional interventions' success. Addressing these factors is essential to improve maternal nutritional status and dietary intake and as well, prevent chronic health conditions in children.

Englund-Ogge L et al., (2019), Norway	Prospective cohort study	N/A though population was among pregnant women	Maternal Nutritional Assessment: Dietary patterns and total energy intake, it Impacts on infant birth weight Factors which impact/ affects Maternal Nutritional and dietary status: Maternal educational level, income, physical activity level	Maternal dietary patterns influence birth weight, with implications for infant health
Koletzko et al. (2019), Germany, United Kingdom, Poland, The Netherlands, Australia	Systematic Review	Sample size is not specified but population includes Women before pregnancy, pregnant and breastfeeding women, infants and young children	Maternal nutritional assessment is crucial due to its impact on offspring health. Factors affecting maternal nutrition include maternal obesity, excessive weight gain, and diet during pregnancy Micro nutrients discussed include Folic acid, Iron, Vitamin D, Vitamin B12, Iodine, calcium, Zinc, Vitamin A and polyunsaturated fatty acid. Micronutrients were discussed in relation to maternal nutrition and their impact on offspring health	Early nutrition and lifestyle have long-term effects on health and disease later in life. Recommendations were formulated on nutritional state and lifestyle before conception and during the period of pregnancy, infancy, and early childhood, considering long-term health impact
Nyaradi et al. (2013)	Randomized controlled Trial	Undernourished pregnant mothers and pre-schoolers	Maternal Nutritional Assessment: Multiple micronutrient supplementation Factors Affecting Maternal Nutrition: Undernourishment, others include uncontrolled severe hypertension during pregnancy, which can lead to restricted placental blood flow and abnormalities affecting the foetus's oxygen and nutrient supply Micronutrients discussed are Omega 3 fatty acid (particularly polyunsaturated fatty acid, Vitamin B12, folic acid, choline, Zinc, Iron, and Iodine. Also, overall diet and food, breastfeeding, malnutrition, are part of what impacts on cognitive development.	Improved motor development, visual attention, and spatial ability in pre-schoolers. The study suggest that individual micronutrients play important/vital role in the brain development (cognitive development) of the children and infants.

Objective 3: Impact of Maternal Nutritional Habits on Long-Term Physical Health and Development of Children

Summary of findings

Ramakrishnan et al. (2012): Periconceptional folic acid supplementation reduced the risk of neural tube abnormality/defects, and vitamin and mineral supplementation reduced the risks of adverse health outcome during birth processes. Prado and Dewey (2014): Maternal nutrition positively impacted cognitive and motor development, reading readiness, and activity levels in children. Heland et al. (2022): Adequate maternal nutrient intake, particularly folic acid, vitamin B12, and polyunsaturated fatty acids, supported foetal neurodevelopment.

Cortés-Albornoz et al. (2021): Inadequate intake of nutrients like Vitamin B12, folate, iron, and zinc during pregnancy has a connection with brain

defects, abnormal behaviour, neuropsychiatric disorders, altered cognition, visual impairment, and motor deficits in children.

Nyaradi et al. (2013): Micronutrient supplementation improved motor development, visual attention, and spatial ability in preschoolers, suggesting individual micronutrients play significant roles in cognitive development. The impact of mother's nutritional habits on the health outcome and development of the child with its long-term effect, is very profound. Periconceptional folic acid and other micronutrient supplementation are critical for preventing abnormality seen in neural tube formation and promoting healthy birth outcomes. Moreover, maternal intake of essential nutrients such as folic acid, vitamin B12, and polyunsaturated fatty acids supports foetal neurodevelopment and cognitive functions, reducing the risks of brain defects and developmental disorders. Therefore, ensuring adequate maternal nutrition through dietary interventions and supplements can significantly enhance long-term physical health and developmental outcomes in children.

Conclusion

After analyzing the data on the association between maternal nutritional habits/intake and child health outcomes, it becomes evident that this connection is multifaceted and dynamic, impacting not only individual well-being but also future generations. The findings underscore how maternal nutrition and dietary choices influence various aspects of child health, including brain development, cognitive abilities, and overall physical health throughout the life cycle. This understanding emphasizes the urgency for adequate proactive ways and measures to mitigate the risks associated with maternal malnutrition and enhance maternal dietary adequacy. Improving maternal nutrition is not only a health imperative but a social and economic necessity for societal and national health. As attention to maternal nutrition spans across generations, this study addresses critical life phases, advocating that optimal health begins during pregnancy. Implementation of these insights into healthcare policies and community engagement is pivotal for ensuring healthier individuals from early stages and breaking intergenerational health disparities. Thus, promoting a healthy lifestyle for mothers and ensuring positive child outcomes are essential goals for societal well-being.

Recommendations

Based on the comprehensive findings of the scoping review on maternal nutrition and child health, it is recommended to prioritize strategies that enhance maternal nutrient supplementation, particularly focusing on essential vitamins and minerals crucial for maternal and foetal health. Programs should aim to increase awareness and accessibility to supplements like folic acid, Vitamin B12, and iron, known to mitigate risks of abnormality in neural tube formation, anaemia, and other developmental issues. Additionally, promoting maternal dietary diversity and addressing socio-economic barriers to nutritious food access are critical. Education and support initiatives should be tailored to empower expectant mothers with knowledge on optimal nutrition during pregnancy, emphasizing its profound impact on long-term child health outcomes. Integrating nutritional counselling into prenatal care services and further research into population-specific needs will help refine policies and interventions, ensuring comprehensive mother and child health support worldwide.

Conflict of interest

Regarding this article's publication, the authors state that they have no conflicts of interest.

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REEFERENCE

Abas, A., Ahmed, A., Farah, A. and Wedajo, G. (2020) Barriers to Optimal Maternal and Child Feeding Practices in Pastoralist Areas of Somali Region, Eastern Ethiopia: A Qualitative Study. *Food and Nutrition Sciences*, **11**, 540-561. doi: 10.4236/fns.2020.116038. https://www.scirp.org/journal/paperinformation?paperid=100974

Akhtar, N., & Satapathy, S. (2021). IMPACT OF MATERNAL NUTRITION ON CHILD HEALTH. *Journal of Biomedical and Pharmaceutical Research*, *10*(2), 15-19. https://doi.org/10.32553/jbpr.v10i2.854

Bater, J., Lauer, J. M., Ghosh, S., Webb, P., Agaba, E., Bashaasha, B., Turyashemererwa, F. M., Shrestha, R., & Duggan, C. P. (2020). Predictors of low birth weight and preterm birth in rural Uganda: Findings from a birth cohort study. *PloS one*, *15*(7), e0235626. https://doi.org/10.1371/journal.pone.0235626

Bhanbhro, S., Kamal, T., Diyo, R. W., Lipoeto, N. I., & Soltani, H. (2020). Factors affecting maternal nutrition and health: A qualitative study in a matrilineal community in Indonesia. *PloS one*, *15*(6), e0234545. https://doi.org/10.1371/journal.pone.0234545 https://www.researchgate.net/publication/342222803_Factors_affecting_maternal_nutrition_and_health_A_qualitative_study_in_a_matrilineal_community_in_Indonesia

Cortés-Albornoz, M. C., García-Guáqueta, D. P., Velez-van-Meerbeke, A., & Talero-Gutiérrez, C. (2021). Maternal Nutrition and Neurodevelopment: A Scoping Review. *Nutrients*, *13*(10), 3530. https://doi.org/10.3390/nu13103530

Dahab, R., & Sakellariou, D. (2020). Barriers to Accessing Maternal Care in Low Income Countries in Africa: A Systematic Review. *International journal of environmental research and public health*, *17*(12), 4292. https://doi.org/10.3390/ijerph17124292.

Dickinson, N., Gulliver, J., MacPherson, G., Atkinson, J., Rankin, J., Cummings, M., Nisbet, Z., Hursthouse, A., Taylor, A., Robertson, C., & Burghardt, W. (2009). A framework to explore micronutrient deficiency in maternal and child health in Malawi, Southern Africa. *Environmental Health*, *8*(S1). https://doi.org/10.1186/1476-069x-8-s1-s13

Duttaroy A. K. (2023). Influence of Maternal Diet and Environmental Factors on Fetal Development. *Nutrients*, *15*(19), 4094. https://doi.org/10.3390/nu15194094

Englund-Ögge, L., Brantsæter, A.L., Juodakis, J., H, M., Meltzer, M., H., Jacobsson, B., & Sengpiel, V. (2019) Associations between maternal dietary patterns and infant birth weight, small and large for gestational age in the Norwegian Mother and Child Cohort Study. *European Jounrnal of Clinical Nutrition.* **73**, 1270–1282.. https://doi.org/10.1038/s41430-018-0356-y

Finkelstein, J. L., Fothergill, A., Venkatramanan, S., Layden, A. J., Williams, J. L., Crider, K. S., & Qi, Y. P. (2024). Vitamin B12 supplementation during pregnancy for maternal and child health outcomes. *Cochrane Library*, *2024*(1). https://doi.org/10.1002/14651858.cd013823.pub2

Food and Agricultural Organisation of the United Nation (FAO) (2019). The State of food Security And Nutriton in the World; Safeguarding against economic slowdowns and downturns. *International fund for Agricultrual Development*. https://openknowledge.fao.org/server/api/core/bitstreams/16480532-17e9-4b61-b388-1d6d86414470/content

GBD 2019 Diseases and Injuries Collaborators. (2020). Global Burden of 369 Diseases and Injuries in 204 Countries and Territories, 1990–2019: A Systematic Analysis for the Global Burden of Disease Study 2019. *The Lancet,* 396(10258), 1204–1222.https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30925-9/fulltext https://doi.org/10.1016/S0140-6736(20)30925-9

Gong, W., Liu, A., Yao, Y., Ma, Y., Ding, C., Song, C., Yuan, F., Zhang, Y., Feng, G., Chen, Z., & Ding, G. (2018). Nutrient Supplement Use among the Chinese Population: A Cross-Sectional Study of the 2010–2012 China Nutrition and Health Surveillance. *Nutrients*, *10*(11), 1733. https://doi.org/10.3390/nu10111733

Han, T., Dong, J., Zhang, J., Zhang, C., Wang, Y., Zhang, Z., & Xiang, M. (2021). Nutrient supplementation among pregnant women in China: an observational study. Public Health Nutrition, 25(6), 1537-1542. https://doi:10.1017/S1368980021001269

Heland S., Fields N.. Ellery S. J., Fahey M, Palmer K.R, (2022) The role of nutrients in human neurodevelopment and their potentioal to prevent neurodevelopmental adversity. Frontiers in Nutrition. vol 9. https://www.frontiersin.org/articles/10.3389/fnut.2022.992120/full

Koletzko, B., Godfrey, K., Poston, L., Szajewska, H., Van Goudoever, J. B., De Waard, M., Brands, B., Grivell, R. M., Deussen, A. R., Dodd, J. M., Patro-Golab, B., & Zalewski, B. M. (2019). Nutrition During Pregnancy, Lactation and Early Childhood and its Implications for Maternal and Long-Term Child Health: The Early Nutrition Project Recommendations. *Annals of Nutrition & Metabolism*, *74*(2), 93–106. https://doi.org/10.1159/000496471

Marshall, N. E., Abrams, B., Barbour, L. A., Catalano, P., Christian, P., Friedman, J. E., Hay, W. W., Jr, Hernandez, T. L., Krebs, N. F., Oken, E., Purnell, J. Q., Roberts, J. M., Soltani, H., Wallace, J., & Thornburg, K. L. (2022). The importance of nutrition in pregnancy and lactation: lifelong consequences. *American journal of obstetrics and gynecology*, *226*(5), 607–632. https://doi.org/10.1016/j.ajog.2021.12.035

McStay, C. L., Prescott, S. L., Bower, C., & Palmer, D. J. (2017). Maternal Folic Acid Supplementation during Pregnancy and Childhoo d Allergic Disease Outcomes: A Question of Timing?. *Nutrients*, *9*(2), 123. https://doi.org/10.3390/nu9020123

Mortaji, N., Krzeczkowski, J., Atkinson, S., Amani, B., Schmidt, L. A., & Van Lieshout, R. J. (2023). Early neurodevelopment in the offspring of women enrolled in a randomized controlled trial assessing the effectiveness of a nutrition + exercise intervention on the cognitive development of 12-month-olds. *Journal of Developmental Origins of Health and Disease*, *14*(4), 532–539. https://doi.org/10.1017/s204017442300020x

Nyaradi, A., Li, J., Hickling, S., Foster, J., & Oddy, W. H. (2013). The role of nutrition in children's neurocognitive development, from pregnancy through childhood. *Frontiers in Human Neuroscience*, *7*. https://doi.org/10.3389/fnhum.2013.00097

Obanewa, O., & Newell, M. L. (2017). Maternal nutritional status during pregnancy and infant immune response to routine childhood vaccinations. *Future virology*, *12*(9), 525–536. https://doi.org/10.2217/fvl-2017-0021

Omer, S., Zakar, R., Zakar, M. Z., & Fischer, F. (2021). The influence of social and cultural practices on maternal mortality: a qualitative study from South Punjab, Pakistan. Reproductive Health, 18(1), 97. https://doi.org/10.1186/s12978-021-01151-6

Prado, E. L., & Dewey, K. G. (2014). Nutrition and brain development in early life. *Nutrition reviews*, *72*(4), 267–284. https://doi.org/10.1111/nure.12102

Rajput, A., Siddiqui, M., & Ojha, K. (2024). Impact of Maternal Nutrition and Mental Health on Fetal Development and Pregnancy Outcomes: An Integrative Approach. 9. https://www.researchgate.net/publication/380537595_Impact_of_Maternal_Nutrition_and_Mental_Health_on_Fetal_Development_and_Pregnancy_Outcomes_An_Integrative_Approach

Ramakrishnan, U., Grant, F. K., Goldenberg, T., Bui, V., Imdad, A., & Bhutta, Z. A. (2012). Effect of multiple micronutrient supplementation on pregnancy and infant outcomes: a systematic review. *Paediatric and Perinatal Epidemiology*, *26*(s1), 153–167. https://doi.org/10.1111/j.1365-3016.2012.01276.x

Siegfried, N., Irlam, J. H., Visser, M. E., & Rollins, N. N. (2012). Micronutrient supplementation in pregnant women with HIV infection. *Cochrane Library*. https://doi.org/10.1002/14651858.cd009755

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., . . . Straus, S. E. (2018). PRISMA Extension for Scoping Reviews (PRISMA-SCR): Checklist and explanation. *Annals of Internal Medicine*, *169*(7), 467–473. https://doi.org/10.7326/m18-0850

Westphaln, K. K., Regoeczi, W., Masotya, M., Vazquez-Westphaln, B., Lounsbury, K., McDavid, L., Lee, H., Johnson, J., & Ronis, S. D. (2021). From Arksey and O'Malley and Beyond: Customizations to enhance a team-based, mixed approach to scoping review methodology. *MethodsX*, *8*, 101375. https://doi.org/10.1016/j.mex.2021.101375

WHO (2014), Global nutrition targets 2025: policy brief series? *World Health Organization Publication Overview.* https://www.who.int/publications/i/item/WHO-NMH-NHD-14.2

Workneh, F., Tsegaye, S., Amanuel, H., Eglovitch, M., Shifraw, T., Shiferie, F., Tadesse, A. W., Worku, A., Isanaka, S., Lee, A. C., & Berhane, Y. (2023). Dietary Perspectives and Practices during Pregnancy in Rural Amhara Region of Ethiopia: An Exploratory Qualitative Study. *Current developments in nutrition*, *7*(6), 100079. https://doi.org/10.1016/j.cdnut.2023.100079

World Health Organization (2020) The role of food fortification in the control of micronutrient. https://cdn.who.int/media/docs/default-source/micronutrients/gff-part-1-en.pdf?sfvrsn=afc1c426_2

World Health Organization (2020), Children: improving survival and well-being. *World Health Organization Publication Overview.* https://www.who.int/news-room/fact-sheets/detail/children-reducing-mortality.

World Health Organization (2023) Maternal Mortality. *World Health Organization Publication Overview* https://www.who.int/news-room/fact-sheets/detail/maternal-mortality

World Health Organization (2023) Nutrition. *World Health Organization Publication Overview.* https://www.who.int/health-topics/nutrition#tab=tab_1