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Maternal nutrition and healthy lifestyle in pregnancy: A framework for nutritional intervention and breastfeeding support

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Abstract

Pregnancy is a critical period characterized by significant physiological, psychological, and lifestyle changes that influence both maternal and fetal health. Adequate nutrition, healthy lifestyle behaviors, and appropriate maternal care during pregnancy are essential for optimal fetal development and for the prevention of pregnancy-related complications.

The aim of this study is to highlight the importance of healthy dietary and lifestyle practices during pregnancy and to examine the role of breastfeeding as a key determinant of neonatal health. Additionally, the study proposes a structured nutritional intervention framework that can be implemented within maternity care services to support women during pregnancy and the postpartum period.

The analysis emphasizes the importance of balanced nutrition, adequate intake of essential macro- and micronutrients, appropriate physical activity, and the avoidance of harmful behaviors such as smoking and alcohol consumption. The benefits of breastfeeding for both infants and mothers are also highlighted, including enhanced neonatal immune protection, reduced risk of chronic diseases, and improved maternal recovery after childbirth.

The proposed intervention framework includes educational sessions, peer-support groups, interdisciplinary collaboration among healthcare professionals, and continuous monitoring of maternal lifestyle behaviors and pregnancy outcomes. These strategies may contribute to improved maternal and neonatal health outcomes by promoting healthier behaviors, reducing pregnancy-related complications, and supporting successful breastfeeding practices. Promoting healthy lifestyle behaviors during pregnancy represents an important public health strategy with long-term benefits for mothers, infants, and population health.

Keywords: Pregnancy; Maternal nutrition; Breastfeeding; Maternal health; Neonatal health; Nutritional intervention

1. Introduction

Pregnancy represents one of the most significant and demanding periods in a woman's life as it is accompanied by profound biological, psychological, and social changes that affect both maternal health and fetal development [1]. It is a physiological process that typically lasts approximately 40 weeks, beginning from the first day of the last menstrual period, and involves adaptations in nearly all physiological systems of the female body. These changes highlight the importance of adopting healthy lifestyle behaviors during pregnancy, including balanced nutrition, adequate physical activity, avoidance of harmful habits, and effective stress management. Maternal dietary and lifestyle practices are closely associated with pregnancy outcomes, maternal well-being, and fetal development.

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Proper nutrition during pregnancy is defined as the adequate and balanced intake of macronutrients and micronutrients that meet the increased physiological demands of both the mother and the developing fetus [1]. Macronutrients constitute the primary components of body tissues and represent the total caloric intake, serving as the main source of energy for the human body, including carbohydrates, proteins, and lipids. In contrast, micronutrients, such as vitamins and minerals, are required in smaller quantities but play a crucial role in maintaining metabolic processes and supporting normal physiological functions [2]. Adequate intake of nutrients such as iron, folic acid, calcium, iodine, and vitamin D is particularly important for preventing anemia, congenital anomalies, and fetal developmental disorders.

Lifestyle during pregnancy extends beyond nutrition and includes factors such as physical activity, sleep quality, stress management, and the avoidance of smoking, alcohol consumption, and other harmful exposures. Epidemiological evidence suggests that a considerable proportion of pregnancy complications, including gestational diabetes mellitus, hypertension, preterm birth, and low birth weight, are associated with maternal lifestyle factors [3]. Pre-pregnancy and gestational obesity, inadequate nutrient intake, and insufficient physical activity have been identified as important risk factors that may negatively influence pregnancy outcomes [4]. Conversely, the adoption of healthy lifestyle behaviors has been associated with improved weight management, reduced risk of pregnancy complications, and better maternal and neonatal outcomes [5].

The relationship between maternal lifestyle and pregnancy outcomes is multifactorial and complex. Maternal nutrition directly affects metabolic regulation, placental function, and nutrient transfer to the fetus. Physical activity, when adapted to the needs and capabilities of the pregnant woman, contributes to improved cardiorespiratory function, reduced fatigue, and better psychological well-being. Furthermore, maternal mental health plays a significant role in pregnancy outcomes, as chronic stress and depression have been associated with adverse maternal and neonatal effects [6].

Breastfeeding represents one of the most important health-promoting practices in early life and is internationally recognized as the optimal method of infant feeding [7]. It is associated with protection against infectious diseases, enhanced immune function, and improved infant growth and development. For mothers, breastfeeding also contributes to postpartum recovery and long-term health benefits. Therefore, providing pregnant women with appropriate information and support regarding breastfeeding should be considered an essential component of maternal health promotion.

The aim of this review is to highlight the importance of healthy dietary habits and lifestyle behaviors during pregnancy. Additionally, the study examines the role of breastfeeding in promoting maternal and neonatal health and proposes a structured nutritional intervention framework that can be implemented within maternity care settings to support women from early pregnancy through the postpartum period.

2. Materials and Methods

2.1. Study design

The present study is based on a narrative review and conceptual analysis of existing scientific literature concerning maternal nutrition, lifestyle behaviors during pregnancy, and breastfeeding promotion. The aim of this approach was to synthesize current evidence and to develop a structured nutritional intervention framework that could be implemented within maternity care services to support maternal and neonatal health.

2.2. Literature search strategy

A comprehensive literature search was conducted using major scientific databases, including PubMed, Scopus, and Google Scholar. The search focused on studies examining maternal nutrition, lifestyle behaviors during pregnancy, breastfeeding benefits, and maternity care interventions. Keywords used in the search included *pregnancy, maternal nutrition, breastfeeding, maternal health, neonatal health,* and *nutritional intervention*.

Peer-reviewed research articles, review papers, and international guidelines published between 2000 and 2026 were considered for inclusion. Studies were selected based on their relevance to maternal health, pregnancy outcomes, and breastfeeding promotion. Only studies published in English were included.

Studies focusing on non-human populations, unrelated health conditions, or lacking sufficient methodological clarity were excluded.

2.3. Development of the intervention framework

The proposed nutritional intervention framework was developed through the synthesis of evidence identified in the reviewed literature. Particular emphasis was placed on identifying key components that support healthy lifestyle behaviors during pregnancy and facilitate breastfeeding preparation. These components include nutritional education, lifestyle counseling, multidisciplinary collaboration among healthcare professionals, and continuous monitoring of maternal lifestyle behaviors and pregnancy outcomes. The framework aims to provide a practical structure that can be integrated into maternity care services to promote maternal and neonatal health.

2.4. Ethical considerations

This study is based exclusively on previously published literature and does not involve human participants or animal subjects. Therefore, ethical approval and informed consent were not required for the purposes of this study.

3. Results and Discussion

3.1. Maternal Nutritional Requirements During Pregnancy

During pregnancy and lactation, women's nutritional requirements increase to support maternal physiological adaptations and ensure optimal fetal growth and neonatal development. Pregnancy represents a critical period during which maternal lifestyle, dietary habits, and overall health behaviors directly influence pregnancy outcomes and the long-term health of the child. Therefore, a balanced diet that includes adequate macronutrients and micronutrients, such as vitamins, minerals, and omega-3 fatty acids, is essential for maintaining maternal health and supporting fetal development [8].

Although dietary patterns in many European countries have improved in recent years, nutritional deficiencies during pregnancy remain relatively common. In particular, inadequate intake of micronutrients such as iron and vitamin D may negatively affect maternal health and fetal development if not adequately addressed [8]. For this reason, emphasis should be placed on the quality and diversity of the maternal diet. Prenatal supplementation, including folic acid and iron, is frequently recommended in order to support optimal pregnancy outcomes and ensure sufficient nutrient availability during pregnancy and lactation.

Adequate protein intake plays an essential role in fetal tissue formation and maternal physiological adaptations. High-quality protein sources include lean meat, poultry, fish, eggs, legumes, and dairy products [9, 10]. Carbohydrates constitute the primary source of energy for both the mother and the developing fetus, with recommended intake during pregnancy estimated at approximately 175 g per day to support stable glucose levels and fetal brain development [11]. Prolonged fasting should be avoided, as extended periods without food may reduce glucose and amino acid availability and potentially affect fetal neurological development

Energy requirements gradually increase during pregnancy. Overall, an additional 40,000–70,000 kcal may be required across the entire pregnancy to support fetal growth and maternal metabolic demands [11]. In women with normal pre-pregnancy weight, energy intake typically increases by about 50–100 kcal per day in early pregnancy and by 200–300 kcal per day during the second and third trimesters.

3.2. Micronutrient Requirements and Dietary Recommendations

In addition to macronutrients, several micronutrients are particularly important during pregnancy. Adequate intake of vitamins and minerals is essential for supporting fetal development and maintaining maternal health. Folic acid plays a crucial role in preventing neural tube defects and is therefore recommended before conception and during early pregnancy [12]. Iron is essential for hemoglobin synthesis and helps prevent maternal anemia, which is one of the most common nutritional deficiencies during pregnancy **[**13].

Calcium and vitamin D contribute to fetal skeletal development and maternal bone health [9]. Iodine is necessary for thyroid hormone production and supports fetal neurological development [14], while zinc contributes to cell growth, tissue repair, and immune function [10]. Furthermore, B-complex vitamins, particularly vitamin B12, support red blood cell formation and proper nervous system development [9].

Polyunsaturated omega-3 fatty acids, especially docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), also play an important role in fetal brain and visual development [15]. Consequently, a balanced dietary pattern during pregnancy should include a wide variety of nutrient-dense foods, such as fruits, vegetables, whole grains, low-fat dairy products,

lean protein sources, and fatty fish. Such dietary patterns help ensure adequate intake of essential micronutrients necessary for maternal health and optimal fetal development [9, 10].

3.3. Dietary Risks and Harmful Lifestyle Behaviors

Certain foods should be avoided during pregnancy because they may pose potential risks to fetal health. These include unpasteurized dairy products, raw or undercooked meat, and fish with high mercury content, such as shark and swordfish. High caffeine intake should also be limited, as excessive consumption has been associated with an increased risk of miscarriage and low birth weight [16].

Alcohol consumption during pregnancy is strongly discouraged, as alcohol readily crosses the placenta and may cause serious developmental disorders, including fetal alcohol spectrum disorders [17]. Similarly, smoking exposes the fetus to nicotine and other toxic substances that reduce oxygen and nutrient delivery to the fetal tissues, thereby increasing the risk of miscarriage, preterm birth, and low birth weight [18, 19].

3.4. Physical Activity and Lifestyle Factors During Pregnancy

In addition to nutrition, lifestyle factors such as physical activity play an important role in supporting maternal health during pregnancy. Regular physical activity is generally considered safe for healthy pregnant women in the absence of medical or obstetric complications. Moderate-intensity exercise has been associated with improved cardiorespiratory fitness, reduced risk of gestational diabetes and hypertension, improved weight management, and enhanced psychological well-being [20, 21].

Current international guidelines recommend approximately 150 minutes of moderate-intensity aerobic activity per week during pregnancy [19, 22]. Safe forms of exercise include walking, swimming, stationary cycling, stretching, resistance training, and aquatic exercise [19]. However, physiological changes during pregnancy-such as weight gain, altered balance, and increased cardiovascular demands-require appropriate adjustments to exercise routines. Supine exercise positions after 20 weeks of gestation are generally discouraged and particular attention should be given to adequate hydration and temperature regulation during physical activity.

3.5. Pregnancy-Related Symptoms and Nutritional Challenges

Pregnancy is frequently accompanied by symptoms such as nausea, vomiting, fatigue, constipation, and heartburn, which may affect dietary intake and adherence to a balanced diet [8]. Consequently, individualized nutritional guidance and continuous professional support are important throughout pregnancy [23].

The first trimester is often characterized by heightened sensitivity to odors and taste changes, which may require adjustments in meal composition, portion size, and meal frequency. The second trimester is generally considered a more physiologically stable period, during which healthy dietary and lifestyle behaviors can be reinforced. During the third trimester, attention often shifts toward preparation for childbirth and breastfeeding, highlighting the importance of adequate energy intake and continued nutritional support.

3.6. Breastfeeding and Neonatal Health

Breastfeeding represents a natural continuation of maternal care after childbirth and is widely recognized as the optimal method of infant feeding. Breast milk provides the essential nutrients required for healthy infant growth and development during the first months of life. In addition to proteins, fats, and carbohydrates, breast milk contains numerous bioactive components-including immunoglobulins, lactoferrin, lysozyme, hormones, and growth factors-which support immune system maturation and help protect infants against infections such as diarrhea, pneumonia, and otitis media [24].

The composition of breast milk changes dynamically to meet the evolving nutritional needs of the infant, providing optimal nutrition during early development. Exclusive breastfeeding during the first six months of life has been strongly associated with multiple short- and long-term health benefits, including a reduced risk of respiratory and gastrointestinal infections, lower incidence of allergic diseases, decreased likelihood of childhood obesity, and improved cognitive development [25, 26].

Breast milk also supports the development of a healthy intestinal microbiota, partly through the presence of bioactive compounds such as prebiotics and beneficial microorganisms, which contribute to improved immune function and gastrointestinal health [25].

3.7. Maternal Health Benefits of Breastfeeding

Breastfeeding also provides important benefits for maternal health. The release of oxytocin during breastfeeding stimulates uterine contractions, facilitating uterine involution and reducing the risk of postpartum hemorrhage. In addition, breastfeeding has been associated with a reduced risk of breast and ovarian cancer, as well as a lower risk of type 2 diabetes, hypertension, and cardiovascular disease later in life [27].

Breastfeeding may also contribute to gradual postpartum weight loss due to increased maternal energy expenditure. Furthermore, the close physical contact between mother and infant and the hormonal changes associated with breastfeeding may enhance maternal emotional well-being and reduce the risk of postpartum depression and anxiety [28].

Despite these well-documented benefits, exclusive breastfeeding rates remain relatively low in many countries worldwide. According to the World Health Organization, increasing global breastfeeding rates could prevent hundreds of thousands of child deaths annually and significantly improve maternal and child health outcomes [24].

3.8. Importance of Educational and Nutritional Interventions

Structured educational and nutritional intervention programs targeting pregnant women and new mothers can play a crucial role in promoting healthy behaviors and supporting breastfeeding practices. Such programs may include prenatal educational seminars, peer support groups, individualized nutritional counseling, and practical training on breastfeeding techniques.

Multidisciplinary collaboration among healthcare professionals, including obstetricians, midwives, dietitians, and psychologists, can further enhance the effectiveness of these interventions by addressing the physical, psychological, and social dimensions of pregnancy and early motherhood.

The implementation and systematic evaluation of nutritional intervention programs are essential for improving maternal and child health outcomes. Assessment methods may include both quantitative and qualitative indicators, such as dietary adherence, gestational weight gain, pregnancy outcomes, breastfeeding initiation and duration, and participant satisfaction. Data collected through structured questionnaires, dietary records, and clinical health indicators may provide valuable insights into improving program design and supporting evidence-based public health policies aimed at promoting maternal and infant health [23, 29, 30].

3.9. Implications for Maternal Healthcare Practice

The findings of the present study highlight the importance of integrating structured nutritional guidance and lifestyle counseling into routine maternity care. Healthcare professionals, including obstetricians, midwives, dietitians, and pediatricians, play a key role in supporting pregnant women in adopting healthier dietary and lifestyle behaviors. Educational initiatives that combine prenatal counseling, practical breastfeeding guidance, and continuous support throughout pregnancy and the postpartum period may significantly improve maternal knowledge and confidence in making health-related decisions [29, 30].

However, the successful implementation of such programs may face several practical challenges, including limited healthcare resources, time constraints among professionals, and variations in access to maternity services across different regions. Socioeconomic inequalities, occupational demands, and cultural factors may also influence women's ability to adhere to recommended nutritional and lifestyle practices. Therefore, flexible and accessible intervention strategies, such as small group educational sessions, individualized counseling, and the use of digital health tools, may enhance program effectiveness and promote broader participation.

Strengthening maternity care systems through interdisciplinary collaboration and evidence-based educational interventions may contribute to improved pregnancy outcomes, increased breastfeeding initiation and duration, and overall improvements in maternal and child health [23, 29].

4. Conclusion

Pregnancy represents a critical period during which maternal nutrition and lifestyle behaviors significantly influence both maternal and neonatal health outcomes. Adequate intake of essential nutrients, balanced dietary patterns, and regular moderate physical activity contribute to the prevention of pregnancy-related complications and support

optimal fetal growth and development. Equally important is the avoidance of harmful behaviors such as smoking, alcohol consumption, and excessive caffeine intake.

Breastfeeding plays a fundamental role in infant nutrition and health, providing essential nutrients and bioactive components that promote immune protection, healthy growth, and long-term disease prevention. In addition to benefits for the infant, breastfeeding also supports maternal health and strengthens maternal-infant bonding.

Promoting healthy lifestyle behaviors during pregnancy and supporting breastfeeding practices should therefore be considered a major public health priority with long-term benefits for mothers, infants, and population health. The implementation of structured educational and nutritional intervention programs within maternity care services may further contribute to improving maternal knowledge, supporting breastfeeding practices, and enhancing overall maternal and neonatal health outcomes.

Compliance with ethical standards

Disclosure of conflict of interest

The author declares no conflicts of interest.

Author Contributions:

Dimitra Zisi contributed to the conception and design of the study, literature review, data analysis and interpretation, and the writing and revision of the manuscript. The author read and approved the final version of the manuscript.

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