

Maternal Nutrition During Pregnancy and Birth Outcomes: A Comprehensive Review

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Abstract:

Maternal health, fetal growth, and neonatal survival are all significantly influenced by maternal nutrition. Pregnancy-related optimum placental development, fetal organogenesis, and good birth outcomes are supported by adequate consumption of macronutrients and micronutrients. On the other hand, poor pregnancy outcomes, such as low birth weight, preterm birth, intrauterine growth restriction, congenital abnormalities, gestational diabetes mellitus, hypertensive disorders, and elevated maternal and neonatal morbidity and mortality, are linked to maternal undernutrition, overnutrition, and micronutrient deficiencies. The significance of a balanced diet, nutritional counseling, and supplements in enhancing pregnancy outcomes has been emphasized by recent research.

Keywords: Maternal nutrition, Pregnancy, Birth outcomes, Micronutrients, Macronutrients, Low birth weight, Antenatal care

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INTRODUCTION

Women's dietary needs are significantly increased during pregnancy, a crucial time marked by significant physiological, metabolic, and hormonal changes. Fetal growth, placental development, maternal tissue expansion, and optimal pregnancy outcomes all depend on adequate nourishment for the mother. ¹ Maternal health, fetal growth, birth weight, neonatal survival, and the long-term health of mother and child are all strongly impacted by nutritional status before to conception and during pregnancy. ²

According to the theory of the developmental origins of health and disease (DOHaD), future vulnerability to chronic illnesses like obesity, hypertension, cardiovascular disease, and type 2 diabetes mellitus is largely determined by the intrauterine dietary environment. ³ Through developmental programming, maternal malnutrition during pregnancy may permanently change

fetal physiology, raising the chance of unfavourable health consequences throughout life.⁴

Maternal malnutrition continues to be a significant global public health issue that affects both high-income and low-income nations. Maternal overweight and obesity rates are rising along with undernutrition, anemia, iron, folic acid, iodine, calcium, vitamin D, zinc, and vitamin B12 deficiencies.⁵ The World Health Organization states that low birth weight, preterm birth, stillbirth, neonatal death, and maternal mortality are all significantly impacted by maternal nutritional deficits.⁶

By supplying enough energy, proteins, vital fatty acids, vitamins, and minerals needed for organ development and metabolic regulation, a healthy diet during pregnancy guarantees proper fetal growth. It has been demonstrated that evidence-based supplements and nutritional counselling during prenatal care can improve maternal and newborn health while lowering unfavourable pregnancy outcomes.⁷

There is growing evidence that maternal diet affects immunological responses, oxidative stress, inflammatory pathways, placental function, and the epigenetic control of fetal gene expression.⁸ as a result, improving maternal nutrition has emerged as a key tactic for reaching the Sustainable Development Goals pertaining to the health of mothers and children.⁹

In addition to discussing the physiological significance of macronutrients and micronutrients, evaluating their effects on maternal and neonatal outcomes, and highlighting evidence-based nutritional interventions for improving pregnancy outcomes, this review aims to summarize current evidence regarding maternal nutritional requirements during pregnancy.¹⁰

Maternal Nutritional Requirements During Pregnancy

Due to fetal growth, placental development, maternal blood volume expansion, maternal tissue enlargement, and lactation preparation, pregnancy is linked to higher nutritional demands. Sufficient nutrition promotes healthy birth outcomes, immunological function, and appropriate embryonic development.¹¹

Age, body mass index, physical activity, socioeconomic position, and pregnancy stage all affect a mother's nutritional needs. While the need for protein, vitamins, and minerals increases throughout pregnancy, the need for energy increases gradually during the second and third trimesters.¹²

The principal nutritional components required during pregnancy include:

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|--------------------------|------------------------|
| • Adequate energy intake | • High-quality protein |
| • Essential fatty acids | • Iron |
| • Folic acid | • Calcium |
| • Vitamin D | • Iodine |
| • Zinc | • Vitamin B12 |
| • Vitamin A | • Vitamin C |

Supplementation is advised when dietary intake is insufficient or a deficiency is discovered, but balanced dietary intake from a variety of food groups continues to be the ideal source of nutrients.¹³

Macronutrients During Pregnancy

Energy: In order to sustain fetal growth and the mother's physiological changes, pregnancy raises the mother's energy needs. While excessive calorie consumption leads to maternal obesity, gestational diabetes mellitus, and fetal macrosomia, insufficient calorie intake might cause intrauterine growth restriction, low birth weight, and preterm delivery.¹⁴

Current recommendations suggest an additional energy intake of approximately:

- **340 kcal/day** during the second trimester
- **450 kcal/day** during the third trimester¹⁴

Protein: Fetal tissue growth, placental development, maternal tissue expansion, and the manufacture of hormones and enzymes all depend on protein. Reduced birth weight, poor neurodevelopment, and fetal growth restriction have all been linked to protein shortage during pregnancy.¹⁵

The recommended dietary allowance for protein during pregnancy is approximately **71 g/day**, depending on maternal body weight and trimester.¹⁶

Good dietary sources include:

- Milk and dairy products
- Fish
- Pulses and legumes
- Nuts and seeds
- Eggs
- Lean meat
- Soy products

Carbohydrates: The main energy source for fetal growth and maternal metabolism is carbohydrates. Because they enhance glycaemic management and lower the risk of gestational diabetes mellitus, complex carbohydrates with a low glycaemic index are recommended.¹⁷

Additionally, dietary fiber reduces constipation, a frequent pregnant symptom, and enhances bowel function.

Fats: Essential fatty acids included in dietary lipids are necessary for the development of the fetal brain, the maturation of the retina, and the production of steroid hormones. Pregnancy-related brain development depends on long-chain omega-3 fatty acids, especially docosahexaenoic acid (DHA).¹⁸

Foods rich in omega-3 fatty acids include:

- Fatty fish
- Chia seeds
- Flaxseed
- Walnuts

Consuming enough good fats has been linked to both a lower risk of preterm birth and better cognitive development.²

Micronutrients During Pregnancy

Micronutrients are essential for placental development, immunological response, maternal metabolism, and fetal organogenesis. Pregnancy-related deficiencies can cause major problems for both the mother and the newborn.³

Iron: Due to increased maternal blood volume and fetal iron needs, iron requirements rise significantly during pregnancy. One of the most prevalent nutritional conditions affecting pregnant women globally is iron deficiency anemia.⁴

Preterm birth, low birth weight, and maternal anemia are all decreased by iron supplementation.

Folic Acid: Neural tube formation, cell division, and DNA synthesis all depend on folic acid. Folic acid supplementation during pregnancy dramatically lowers the incidence of neural tube disorders, including anencephaly and spina bifida.⁵

Regular folic acid intake is advised by the World Health Organization both prior to conception and in the early stages of pregnancy.

Calcium: Blood coagulation, muscular contraction, nerve transmission, maternal bone health, and fetal skeletal development all depend on calcium. Pre-eclampsia and pregnancy-induced hypertension are less common in women who consume insufficient amounts of calcium.⁶

Vitamin D: Calcium metabolism, bone mineralization, immunological response, and placental development are all regulated by vitamin D. Low birth weight, pre-eclampsia, gestational diabetes mellitus, and compromised bone health in newborns have all been linked to vitamin D insufficiency.

Iodine: Both the development of the embryonic brain and the synthesis of thyroid hormones depend on iodine. Iodine shortage in mothers raises the risk of congenital hypothyroidism, intellectual impairment, delayed cognitive development, and miscarriage.⁸

Zinc: Zinc is involved in tissue repair, cell development, immunological response, and DNA synthesis. Prolonged labor, fetal growth restriction, congenital abnormalities, and heightened susceptibility to infections have all been associated with maternal zinc insufficiency.¹⁰

MATERNAL NUTRITION DURING PREGNANCY AND BIRTH OUTCOMES: A COMPREHENSIVE REVIEW

EFFECT OF MATERNAL NUTRITION ON BIRTH OUTCOMES

Fetal growth, placental function, birth weight, gestational age at delivery, neonatal survival, and long-term health are all directly impacted by maternal nutrition. While nutritional shortages or excessive nutrient consumption raise the risk of unfavourable pregnancy outcomes, adequate maternal food intake during pregnancy leads to good fetal development.⁷

Low Birth Weight: One of the biggest causes of newborn morbidity and mortality globally is still low birth weight (LBW), which is defined as a birth weight of less than 2,500 g. LBW is largely caused by maternal undernutrition, insufficient weight gain during pregnancy, anemia, and deficiencies in iron, protein, and other micronutrients. By promoting fetal growth, nutritional supplementation during pregnancy has been demonstrated to lower the risk of LBW.²

Preterm Birth: Preterm delivery is a serious public health issue linked to long-term neurodevelopmental abnormalities, respiratory issues, and higher newborn death. Preterm delivery has been associated with poor maternal nutrition, low body mass index prior to pregnancy, insufficient weight gain, vitamin D deficiency, and omega-3 fatty acid deficits.⁸

Intrauterine Growth Restriction: When a fetus does not reach its genetically determined growth potential, it is known as intrauterine growth restriction (IUGR). Fetal growth is hampered by maternal malnutrition because it reduces placental blood flow and nutrient transfer. Reducing IUGR is mostly dependent on mothers consuming enough energy and protein.⁹

Congenital Anomalies: Organogenesis may be hampered by maternal dietary deficits in the early stages of pregnancy. While iodine deficiency can result in prenatal hypothyroidism and impaired neurological development, folic acid deficiency is closely linked to neural tube abnormalities. A healthy intake of zinc, vitamin B12, and vitamin A also supports optimal embryonic growth.³

Birth Weight and Long-Term Health: Beyond the neonatal stage, both low birth weight and high birth weight have consequences. Inadequate intrauterine nutrition raises the risk of obesity, hypertension, cardiovascular disease, insulin resistance, and type 2 diabetes in later life, according to the Developmental Origins of Health and Disease (DOHaD) theory.¹

MATERNAL NUTRITION AND PREGNANCY COMPLICATIONS

Gestational Diabetes Mellitus: The risk of gestational diabetes mellitus (GDM) is increased by maternal overweight, obesity, excessive calorie consumption, and diets heavy in refined carbs. A balanced diet high in fruits, vegetables, whole grains, dietary fiber, and healthy fats lowers the incidence of GDM and improves glucose regulation.¹¹

Hypertensive Disorders of Pregnancy: Globally, pre-eclampsia continues to be a major cause of maternal and neonatal mortality. It has been demonstrated that calcium supplementation lowers the incidence of pre-eclampsia in women with low dietary calcium consumption. Pregnancy-related vascular health may also be enhanced by diets high in antioxidants and adequate vitamin D.¹³

Maternal Anemia: Pregnant women frequently suffer from iron deficiency anemia, particularly in

low- and middle-income nations. Fatigue, postpartum bleeding, infections, premature birth, and low birth weight are all made more likely by maternal anemia. One of the best prenatal dietary therapies is still regular iron and folic acid intake.¹⁵

Maternal Obesity: Maternal obesity has become more prevalent and is linked to congenital abnormalities, postpartum difficulties, fetal macrosomia, gestational diabetes, hypertensive problems, and cesarean delivery. To lower these risks, appropriate nutritional counseling and weight control are crucial before and during pregnancy.¹⁴

Public Health Importance of Maternal Nutrition

A crucial tactic for lowering maternal and newborn mortality and meeting global health goals is improving maternal nutrition. Pregnancy outcomes have been shown to benefit with comprehensive prenatal nutrition programs, food fortification, vitamin supplementation, dietary counseling, and nutrition education.³

The World Health Organization advises incorporating dietary advice and assessment into standard prenatal care. Among the suggested interventions are:

- Taking iron and folic acid supplements every day.
- Supplementing with calcium when food intake is low.
- Iodized salt intake.
- Balanced protein and energy supplements for ladies who are malnourished.
- Encouragement of varied diets high in whole grains, dairy, fruits, vegetables, and lean proteins.
- Frequent assessment of the nutritional condition and weight increase of mothers.³⁷

In order to address nutritional disparities and enhance birth outcomes, community-based nutrition programs, women's education, increased food security, and improved maternal health services are all crucial.

FUTURE PERSPECTIVES: Personalized nutritional therapies based on maternal risk factors, genetic traits, and socioeconomic circumstances should be the main focus of future study. New disciplines including metabolomics, nutrigenomics, and microbiome research could advance our knowledge of the connection between fetal development and maternal nutrition.⁶

To assess ideal eating habits, the timing of nutritional interventions, and long-term health outcomes for mothers and children, large multicenter randomized controlled studies are required. Access to evidence-based nutritional counseling during pregnancy may also be improved by tele-nutrition services and digital health technology.¹⁸

CONCLUSION

Evidence from epidemiological studies, systematic reviews, and international guidelines consistently demonstrates that nutritional assessment, dietary counseling, and appropriate supplementation during pregnancy improve maternal and neonatal outcomes. Integrating nutrition-focused interventions into routine antenatal care should remain a priority for healthcare providers, policymakers, and public health programs. Continued research and implementation of evidence-based nutritional strategies will contribute significantly to improving maternal and child health worldwide.

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References

1. Black RE, Victora CG, Walker SP, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. **Lancet**. 2013;382(9890):427-451.
2. World Health Organization. *WHO recommendations on antenatal care for a positive pregnancy experience*. Geneva: WHO; 2016.
3. Barker DJP. The developmental origins of adult disease. **J Am Coll Nutr**. 2004;23(6 Suppl):588S-595S.
4. Gluckman PD, Hanson MA. Developmental origins of disease paradigm. **Pediatr Res**. 2004;56(3):311-317.
5. Christian P, Stewart CP. Maternal micronutrient deficiency and fetal development. **J Nutr**. 2010;140(3):437-445.
6. World Health Organization. *Guideline: Daily iron and folic acid supplementation in pregnant women*. Geneva: WHO; 2012.
7. Institute of Medicine. *Weight Gain During Pregnancy: Reexamining the Guidelines*. Washington (DC): National Academies Press; 2009.
8. Godfrey KM, Gluckman PD, Hanson MA. Developmental origins of metabolic disease. **Am J Clin Nutr**. 2010;91(5):1515S-1522S.
9. United Nations. *Sustainable Development Goals*. New York: United Nations; 2015.
10. National Research Council. *Nutrition During Pregnancy*. Washington (DC): National Academies Press; 1990.
11. King JC. Physiology of pregnancy and nutrient metabolism. **Am J Clin Nutr**. 2000;71(5 Suppl):1218S-1225S.
12. World Health Organization. *Essential Nutrition Actions*. Geneva: WHO; 2013.
13. Butte NF, King JC. Energy requirements during pregnancy. **Public Health Nutr**. 2005;8(7A):1010-1027.
14. Institute of Medicine. *Dietary Reference Intakes for Energy*. Washington (DC): National Academies Press; 2005.
15. Imdad A, Bhutta ZA. Balanced protein energy supplementation during pregnancy. **Cochrane Database Syst Rev**. 2012;(7):CD000032.
16. Institute of Medicine. *Dietary Reference Intakes for Protein*. Washington (DC): National Academies Press; 2005.
17. American Diabetes Association. Management of diabetes in pregnancy. **Diabetes Care**. 2023;46(Suppl 1):S254-S266.
18. Koletzko B, Cetin I, Brenna JT. Dietary fat intakes for pregnant women. **Ann Nutr Metab**. 2007;51(Suppl 2):70-79.

