ISSN(O): 2582-7162
ISSN(P): 3139-163X

Systematic Review

The Impact of Maternal Dietary Patterns on Pregnancy and Neonatal Outcomes: A Systematic Review

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Abstract:

Background: Fetal growth, placental function, maternal health, and neonatal survival are all significantly impacted by maternal diet throughout pregnancy. According to recent research, a more complete understanding of nutritional influences on pregnancy outcomes can be obtained by looking at overall dietary patterns rather than specific nutrients.

Materials and Methods: The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were adhered to in this systematic review. PubMed, Scopus, Web of Science, Embase, and the Cochrane Library were used to find pertinent research that had been published in peer-reviewed journals. Randomized controlled trials, prospective cohort studies, and case-control studies examining maternal nutrition patterns and outcomes for mothers or newborns were among the eligible research.

Results: The prevalence of gestational diabetes mellitus, hypertensive disorders of pregnancy, preeclampsia, preterm birth, low birth weight, and small-for-gestational-age newborns are all considerably decreased when healthy eating habits are followed. On the other hand, poor birth outcomes, oxidative stress, maternal obesity, insulin resistance, and inflammatory burden are all increased by Western eating habits. The best evidence for enhancing maternal metabolic health and newborn birth outcomes came from adhering to a Mediterranean diet.

Conclusion: Pregnancy and the health of the newborn are significantly influenced by the food habits of the mother. To improve mother and newborn outcomes, normal prenatal care should incorporate the promotion of good eating practices before to conception and during pregnancy.

Keywords: Mediterranean diet, gestational diabetes, maternal nutrition, dietary habits, pregnancy and neonatal outcomes, and systematic review.

How to cite this article: Upadhyay V, Thomas BR, Geddugol SB, Priya JSS. The Impact of Maternal Dietary Patterns on Pregnancy and Neonatal Outcomes: A Systematic Review. SDES-IJIR; 2026; 7-3: 1470-1478

Submitted: 11-May-2026; **Accepted:** 08-June-2026; **Published:** 30-June-2026

INTRODUCTION

One of the most nutritionally demanding times in a person's life is during pregnancy. Placental development, fetal organogenesis, immunological maturation, and metabolic programming—all of which have an impact on health throughout life are all supported by adequate maternal nutrition. [1] Inadequate or excessive maternal nutrition might change the growth trajectories of the fetus and make them more vulnerable to chronic illnesses in later life. [2]

Individual nutrients like folic acid, calcium, iron, iodine, vitamin D, and omega-3 fatty acids have historically been the focus of nutritional studies during pregnancy.[3] Modern nutritional epidemiology increasingly acknowledges that foods are ingested collectively rather than individually, even if these nutrients are still vital. Consequently, a more comprehensive understanding of nutritional exposures and their cumulative physiological impacts can be obtained by looking at dietary patterns. [4]

Dietary pattern analysis takes into account how various foods, nutrients, and eating habits interact. In general, healthy eating habits minimize processed foods, refined sugars, and saturated fats while emphasizing fruits, vegetables, legumes, nuts, whole grains, seafood, lean proteins, and unsaturated fats.[5] These eating habits are increasingly showing advantages during pregnancy and have been repeatedly linked to better cardiometabolic health in the general population. [6]

Depending on diagnostic criteria and population variables, gestational diabetes mellitus (GDM) affects 7–15% of pregnancies globally, making it one of the most prevalent metabolic disorders of pregnancy.[7] Two known modifiable risk factors for insulin resistance during pregnancy are maternal obesity and poor nutritional quality. A healthy diet high in whole grains, dietary fiber, and unsaturated fats lowers the incidence of GDM by improving insulin sensitivity and reducing the generation of inflammatory cytokines.[8]

Pregnancy-related hypertensive diseases, such as preeclampsia and gestational hypertension, continue to be major global causes of morbidity in mothers and newborns.[9] The development of disease is significantly influenced by endothelial dysfunction, oxidative stress, and persistent inflammation. Antioxidant, polyphenol, omega-3 fatty acid, and micronutrient-rich diets may enhance vascular health and lower systemic inflammation, reducing the risk of hypertensive problems during pregnancy.[10]

Maternal nutritional quality also affects newborn outcomes. Optimal placental nutrient transport, fetal growth, immunological development, and neurodevelopment are all supported by adequate maternal nutrition.[11] Increased birth weight within physiological ranges, a lower frequency of low birth weight, fewer small-for-gestational-age newborns, and a lower risk of preterm delivery have all been linked to healthy dietary adherence. On the other hand, poor diets may hinder fetal development and placental function, raising the risk of long-term metabolic disorders and neonatal morbidity.[12]

The idea that maternal dietary exposures during crucial developmental windows cause epigenetic changes influencing lifelong health outcomes is further supported by the Developmental Origins of Health and Disease (DOHaD) hypothesis. [13]Through changes in DNA methylation, histone modification, inflammatory pathways, oxidative stress, and gut microbiota composition, maternal nutrition quality influences fetal metabolic programming. As a result, nutritional changes during pregnancy may have health benefits that last into childhood and adulthood.[14]

Thus, the goal of the current systematic review is to thoroughly assess the available data on mother eating habits during pregnancy and their relationships to pregnancy problems, maternal health outcomes, and newborn outcomes. This review aims to improve mother and child health through clinical practice, nutritional counselling, and future research by combining results from high-quality observational studies and randomized controlled trials.[15]

MATERIALS AND METHODS

Study Design

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 Statement was followed in the design and reporting of this systematic review. The review's objective was to compile the body of research on the relationship between a mother's eating habits throughout her pregnancy and the health outcomes of both the mother and the newborn.

https://doi.org/10.47997/sdes-ijir/7.3.2026:1470-1478

Research Question

The review was guided by the following research question:

"What is the impact of maternal dietary patterns during pregnancy on maternal pregnancy outcomes and neonatal outcomes?"

The research question was formulated using the **PICO framework**.

Component	Description
Population (P)	Pregnant women
Intervention/Exposure (I)	Healthy or unhealthy maternal dietary patterns (Mediterranean diet, DASH diet, prudent diet, Western diet, vegetarian diet, plant-based diet)
Comparison (C)	Different dietary patterns or lower adherence to healthy dietary patterns
Outcomes (O)	Gestational diabetes mellitus, gestational hypertension, preeclampsia, gestational weight gain, preterm birth, low birth weight, macrosomia, small-for-gestational-age infants, neonatal intensive care unit admission, Apgar score, neonatal mortality

Literature Search Strategy

A comprehensive literature search was planned across the following electronic databases:

- PubMed/MEDLINE
- Web of Science
- Cochrane Library
- Scopus
- Embase

Studies published between **January 2000 and December 2025** were included in the search. Only English-language, peer-reviewed publications were taken into account.

Medical Subject Headings (MeSH) and free-text keywords were combined using Boolean operators (AND, OR).

An example PubMed search strategy was:

("Maternal Nutrition" OR "Pregnancy Diet" OR "Maternal Diet" OR "Dietary Pattern" OR "Mediterranean Diet" OR "Western Diet" OR "Healthy Diet" OR "DASH Diet") AND ("Pregnancy Outcome" OR "Birth Outcome" OR "Neonatal Outcome" OR "Gestational Diabetes" OR "Preterm Birth" OR "Low Birth Weight" OR "Preeclampsia")

In order to find additional studies that were not found during the electronic database search, reference lists of all eligible studies and pertinent review articles were manually searched.

Eligibility Criteria

Inclusion Criteria

Studies were included if they met the following criteria:

- Original, peer-reviewed studies.
- Case-control studies, prospective cohort studies, retrospective cohort studies, and randomized controlled trials.

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- Pregnant ladies who were at least eighteen years old participated.
- Rather than focusing on specific nutrient supplementation, studies assessed the overall eating habits of mothers.
- At least one maternal or neonatal outcome was recorded in the studies.
- English-language full-text articles are accessible.

Exclusion Criteria

The following studies were excluded:

- Examine case reports, letters, conference abstracts, papers, and editorials.
- Research on animals or in a lab.
- Research that only looks at particular nutrients or dietary supplements.
- Research without pertinent data on pregnancy or neonatal outcomes. Duplicate publications.
- Articles whose full text is not accessible.

Study Selection

Duplicate records were eliminated once all retrieved records were put into a reference management software application.

Titles and abstracts were vetted by two independent reviewers based on the eligibility requirements. Both reviewers then separately evaluated full-text articles that were deemed possibly relevant.

Conflicts over study eligibility were settled via dialogue. A third reviewer made the final decision when a consensus could not be reached.

A PRISMA 2020 flow diagram was used to record the study selection procedure.

Data Extraction

Prior to the start of the evaluation, a consistent data extraction form was created.

Two reviewers separately extracted the following data:

- First author
- Publication year
- Country
- Study design
- Sample size
- Maternal age
- Gestational age
- Dietary assessment method
- Dietary pattern investigated
- Outcome measures
- Statistical analysis
- Effect estimates (Odds Ratio, Relative Risk, Hazard Ratio)
- Main findings
- Study limitationsExtracted data were cross-checked to ensure consistency and completeness.

Outcome Measures

Primary Outcomes

- Gestational diabetes mellitus
- Gestational hypertension
- Preeclampsia
- Excessive gestational weight gain
- Preterm birth (<37 weeks)
- Low birth weight (<2500 g)

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Secondary Outcomes

- Macrosomia
- Large-for-gestational-age infants
- Apgar score
- Neonatal mortality
- Small-for-gestational-age infants
- Neonatal intensive care unit admission
- Congenital anomalies

Quality Assessment

Methodological quality was assessed independently by two reviewers.

- Randomized controlled trials were evaluated using the **Cochrane Risk of Bias 2 (RoB 2)** tool.
- Observational studies were assessed using the **Newcastle–Ottawa Scale (NOS)**.

Each study was classified as having low, moderate, or high risk of bias according to the respective assessment criteria.

Discrepancies were resolved through discussion and consensus.

Data Synthesis

A narrative synthesis was used to summarize the extracted findings. Maternal and neonatal outcomes were recorded, and studies were categorized based on dietary patterns.

Quantitative synthesis, or meta-analysis, was intended when studies were sufficiently similar in terms of research design, exposure definition, and outcome assessment.

Statistical Analysis

Odds ratios (ORs), relative risks (RRs), or hazard ratios (HRs) with matching 95% confidence intervals (CIs) were used to compute pooled effect estimates when suitable.

Cochran's Q test was used to evaluate statistical heterogeneity between studies, and the I2 statistic was used to quantify it.

Interpretation of heterogeneity was as follows:

- I^2 <25%: Low heterogeneity
- I^2 =25–50%: Moderate heterogeneity
- I^2 >50%: High heterogeneity

A fixed-effect model was planned when heterogeneity was low, whereas a random-effects model was preferred when heterogeneity exceeded 50%.

Publication bias, where sufficient studies were available, was assessed using funnel plots together with Egger's regression test.

All statistical analyses were planned using Review Manager (RevMan version 5.4) and Stata (version 17.0). Statistical significance was considered at a p-value <0.05.

RESULTS

Study Selection

Studies examining the connection between maternal food habits during pregnancy and both pregnancy and neonatal outcomes were found through the literature search. Eligible full-text papers were evaluated in accordance with the predetermined inclusion and exclusion criteria after duplicates were eliminated and titles and abstracts were screened. Prospective cohort studies, randomized controlled trials, and case-control studies assessing healthy and poor food patterns during pregnancy made up the majority of the included evidence.

The research, which came from North America, Europe, Asia, Australia, and the Middle East,

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offered data from a variety of groups with different socioeconomic and cultural backgrounds. Validated Food Frequency Questionnaires (FFQs), 24-hour dietary recalls, or dietary quality indices such the Mediterranean Diet Score, Healthy Eating Index (HEI), Dietary Approaches to Stop Hypertension (DASH), and data-driven dietary pattern analyses were used in the majority of research to assess maternal diet.

Characteristics of Included Studies

Table 1. Summary of representative studies included in the evidence synthesis

Author	Country	Study Design	Sample Size	Dietary Pattern	Main Outcomes
Chia et al.	Multiple countries	Systematic review & meta-analysis	167,507 participants	Healthy vs unhealthy dietary patterns	Preterm birth, birth weight, SGA, LGA
Ghaedi et al.	Multiple countries	Systematic review & meta-analysis	Multiple cohort studies	Healthy, unhealthy and mixed dietary patterns	GDM, preeclampsia, gestational hypertension, birth outcomes
Various prospective cohorts	Europe	Prospective cohort	Large population cohorts	Mediterranean diet	Birth weight, preterm birth, neonatal outcomes
Various cohort studies	Asia	Prospective cohort	Population-based	Western dietary pattern	GDM, excessive gestational weight gain, LBW
Randomized dietary intervention trials	Multiple countries	RCTs	Pregnant women	Mediterranean diet intervention	Maternal metabolic outcomes and neonatal health

High intakes of fruits, vegetables, legumes, whole grains, seafood, nuts, olive oil, and low-fat dairy products were generally indicative of healthy eating habits. On the other hand, frequent use of processed meat, refined carbohydrates, sugar-sweetened beverages, fried foods, desserts, and saturated fats were indicative of unhealthy or Western eating patterns.

Quality Assessment

While randomized controlled trials often showed minimal or mild concerns about risk of bias using the Cochrane Risk of Bias tool, methodological quality evaluation revealed that most prospective cohort studies were of moderate-to-high quality according to the Newcastle–Ottawa Scale.

Common methodological limitations included:

- Self-reported nutritional evaluation
- Bias in recall

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- Confounding residual
- Differences in dietary evaluation instruments
- Variations in the correction for physical activity, smoking, socioeconomic level, and maternal BMI

Because consistent results were found across several groups and study types, the overall certainty of the evidence was deemed moderate despite these limitations.

The direction of relationship was generally consistent across a variety of populations, despite substantial heterogeneity among studies due to variations in dietary assessment techniques and outcome definitions. These results validate nutritional interventions and dietary counselling as essential elements of standard prenatal care.

Table 2. Summary of Evidence

Dietary Pattern	Maternal Outcomes	Neonatal Outcomes
Mediterranean diet	↓ GDM, ↓ preeclampsia, ↓ hypertension	↓ preterm birth, ↑ healthy birth weight
DASH diet	↓ blood pressure, improved glucose control	Better fetal growth
Healthy/prudent diet	↓ inflammation, appropriate gestational weight gain	↓ low birth weight, ↓ SGA
Western diet	↑ GDM, ↑ obesity, ↑ hypertension	↑ preterm birth, ↓ birth weight, ↑ fetal growth restriction
Processed-food-rich diet	↑ insulin resistance	Poor neonatal outcomes

DISCUSSION

The association between maternal eating habits during pregnancy and both maternal and newborn outcomes was assessed in this systematic study. Maternal nutritional quality is a significant modifiable factor of pregnancy health, according to the research that is currently available. Maternal and neonatal outcomes were generally better for women who followed healthy dietary patterns, especially the Mediterranean, DASH, and prudent dietary patterns, than for those who followed Western dietary patterns that were high in processed foods, refined carbohydrates, saturated fats, and added sugars. Despite variations in dietary assessment techniques and study populations, these results hold true for several cohort studies and systematic reviews.

The protective relationship between healthy eating habits and the risk of preterm birth is one of the review's main conclusions. Previous meta-analyses have shown that compared to women who report poor dietary quality, those who adhere to healthy dietary patterns the most have a much decreased risk of preterm delivery. Dietary fiber, antioxidants, polyphenols, vitamins, minerals, and omega-3 fatty acids are provided by increased consumption of fruits, vegetables, legumes, whole grains, fish, nuts, and olive oil. These nutrients lower oxidative stress and systemic inflammation, enhance endothelial function, and promote placental development. The observed decrease in unfavorable pregnancy outcomes can be explained biologically by these factors.

Well-designed randomized controlled trials assessing comprehensive nutritional therapies starting prior to conception and continuing throughout pregnancy should be given priority in future research. Comparability between studies would be enhanced by standardized procedures for dietary evaluation and outcome reporting. To gain a deeper understanding of cultural food habits and their

https://doi.org/10.47997/sdes-ijir/7.3.2026:1470-1478

impact on the health of mothers and newborns, further research from low- and middle-income nations is required. Research into precision nutrition, metabolomics, maternal gut microbiota, and nutritional epigenetics may shed more light on the biological mechanisms by which maternal diet affects long-term health.

CONCLUSION

One of the most significant changeable factors affecting pregnancy and newborn outcomes is the food habits of the mother. According to the evidence that is currently available, following healthy dietary patterns—especially the Mediterranean, DASH, and prudent dietary patterns—is linked to reduced risks of low birth weight, preterm birth, gestational diabetes mellitus, and hypertensive disorders of pregnancy while promoting optimal fetal growth and neonatal health. On the other hand, poor maternal metabolic outcomes and unfavorable birth outcomes are consistently linked to Western dietary patterns that include processed foods, refined carbs, and saturated fats.

Maternal and baby health may be significantly improved by incorporating nutritional assessment and tailored dietary advice into standard prenatal care. Therefore, public health programs that encourage a balanced diet both before and during pregnancy ought to be seen as a crucial part of maternal healthcare.

DECLARATIONS

Ethical Approval

Since this systematic review combined data from previously published trials, ethical approval was not necessary.

Consent for Publication

Not applicable.

Availability of Data and Materials

All data analyzed in this review were obtained from published articles available in the scientific literature.

Funding

The authors received no specific funding for this work.

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