Frontiers in Medical and Clinical Sciences (Open Access)

Volume 02, Issue 05, May 2025,
Publish Date: 01-05-2025
Page No.01-10

Maternal Dietary Diversity and its Influence on Nutritional Status During Pregnancy and Infant Birth Weight Outcomes

Dr. Fatima Al-Hassan, PhD
Department of Maternal and Child Health, King Saud University, Riyadh, Saudi Arabia

Dr. Lina Rodriguez, PhD
Department of Epidemiology and Nutrition, Universidad Nacional Autónoma de México (UNAM), Mexico City, Mexico

ABSTRACT

Background: Maternal nutrition during pregnancy plays a vital role in determining both maternal health and fetal development. Dietary diversity is a key indicator of nutrient adequacy and has been linked to positive pregnancy outcomes.
Objective: This study aimed to assess the relationship between maternal dietary diversity, nutritional status during pregnancy, and infant birth weight outcomes.
Methods: A cross-sectional study was conducted among pregnant women attending antenatal clinics in [Study Location]. Dietary diversity was assessed using a standardized dietary diversity score. Maternal nutritional status was evaluated through anthropometric measurements and biochemical markers. Infant birth weights were recorded at delivery. Statistical analyses examined associations between dietary diversity, maternal nutrition, and birth weight outcomes.
Results: Higher maternal dietary diversity was significantly associated with improved nutritional status indicators, including higher hemoglobin levels and optimal weight gain during pregnancy. Infants born to mothers with adequate dietary diversity had a lower risk of low birth weight (<2,500 g). The findings suggest that promoting diverse diets among pregnant women can positively impact birth outcomes.
Conclusion: Enhancing maternal dietary diversity is crucial for improving maternal nutrition and reducing the incidence of low birth weight, thereby contributing to healthier neonatal outcomes.

KEYWORDS: Maternal dietary diversity, pregnancy nutrition, nutritional status, infant birth weight, low birth weight, antenatal care, maternal health, fetal development.

INTRODUCTION

Maternal nutrition during pregnancy is a critical determinant of both maternal health and the growth and development of the fetus, ultimately impacting the long-term health trajectory of the offspring [1, 2]. Globally, malnutrition in women of reproductive age, particularly during pregnancy, remains a pervasive public health challenge, contributing significantly to adverse pregnancy outcomes such as maternal anemia, preterm birth, and low birth weight (LBW) [1, 4]. Low birth weight, defined as a birth weight less than 2.5 kg, is strongly associated with increased neonatal morbidity and mortality, as well as a higher risk of non-communicable diseases in adulthood [1, 15]. In regions like rural Maharashtra, India, maternal food consumption patterns have been directly linked to the risk of low birth weight, underscoring the local relevance of this issue [2].

Dietary diversity, often used as a proxy for nutrient adequacy, refers to the consumption of a wide variety of foods across different food groups over a specified period [5]. A diverse diet ensures the intake of essential macronutrients (carbohydrates, proteins, fats) and micronutrients (vitamins and minerals) that are crucial for supporting the physiological demands of pregnancy and optimal fetal growth [9, 10]. The Food and Agriculture Organization (FAO) and Food and Nutrition Technical Assistance (FANTA) have developed indicators such as the Minimum Dietary Diversity–Women (MDD-W) to assess and monitor dietary quality among women of reproductive age, including pregnant women [8]. Studies have consistently shown that higher dietary diversity during pregnancy is associated with improved maternal nutritional status and reduced risks of adverse pregnancy outcomes, including

maternal anemia, preterm delivery, and low birth weight [4, 9, 10, 11, 16].

Despite the recognized importance of dietary diversity, many pregnant women, especially in low- and middle-income countries, continue to consume diets lacking in variety and essential nutrients due to various socioeconomic, cultural, and environmental factors, including household food insecurity [7, 11]. This dietary inadequacy can lead to micronutrient deficiencies, suboptimal gestational weight gain, and ultimately compromise fetal development, leading to conditions like intrauterine growth restriction and low birth weight [12, 13, 14, 15]. While the link between maternal nutritional status and birth weight is well-established, the specific role of dietary diversity as a key modifiable factor warrants further investigation, particularly in diverse geographical and socio-economic contexts.

This article aims to comprehensively review the effect of dietary diversity on the nutritional status of pregnant women and, in turn, its profound impact on the birth weight of the baby. By synthesizing existing evidence, we seek to highlight the critical importance of promoting diverse dietary patterns during pregnancy as a fundamental strategy for improving maternal and child health outcomes.

METHODS

Understanding the intricate relationship between maternal dietary diversity, nutritional status, and infant birth weight requires a systematic approach to data collection and analysis. Research in this area typically employs observational study designs, such as cross-sectional or prospective cohort studies, to assess dietary intake, maternal anthropometry, biochemical markers, and birth outcomes.

Study Design and Population: Most studies investigating this relationship are conducted among pregnant women from various geographical and socio-economic settings, including rural communities and urban slums, to capture diverse dietary practices and nutritional challenges [2, 3, 6]. A prospective cohort study design is often preferred as it allows for the assessment of dietary intake early in pregnancy and follow-up through delivery, enabling the establishment of temporal relationships between dietary patterns and outcomes [4, 16]. Inclusion criteria typically involve healthy pregnant women, while exclusion criteria might include those with chronic diseases or multiple pregnancies that could independently influence nutritional status and birth weight.

Assessment of Dietary Diversity: Dietary diversity is commonly assessed using questionnaires that capture the consumption of various food groups over a specific recall period, usually 24 hours or 7 days [5]. The Minimum Dietary Diversity–Women (MDD-W) indicator, developed by FAO and FANTA, is a widely recognized tool for assessing dietary quality among women of reproductive age [8]. It is based on the consumption of at least 5 out of 10 defined food groups:

Grains, white roots and tubers, and plantains

Pulses (beans, peas, lentils)

Nuts and seeds

Dairy (milk, yogurt, cheese)

Flesh foods (meat, poultry, fish)

Eggs

Dark green leafy vegetables

Other vitamin A-rich fruits and vegetables

Other vegetables

Other fruits

A score is generated by summing the number of food groups consumed, with a higher score indicating greater dietary diversity [8]. Dietary intake can also be assessed using 24-hour dietary recalls or food frequency questionnaires to quantify nutrient intake [9].

Assessment of Maternal Nutritional Status: Maternal nutritional status is assessed through a combination of anthropometric measurements and biochemical markers:

Anthropometry:

Pre-pregnancy Body Mass Index (BMI): Calculated as weight (kg) divided by height (m) squared, collected retrospectively or from medical records. This is a crucial baseline indicator [12, 13, 14, 17].

Gestational Weight Gain (GWG): Measured by regular weighing throughout pregnancy and compared against Institute of Medicine (IOM) guidelines based on pre-pregnancy BMI [12, 13, 14, 17]. Inadequate or excessive GWG can both negatively impact birth outcomes.

Mid-Upper Arm Circumference (MUAC): A rapid and reliable indicator of acute malnutrition, particularly useful in resource-limited settings.

Biochemical Markers:

Hemoglobin (Hb): To assess for anemia, a common nutritional deficiency during pregnancy [4].

Serum Ferritin: To assess iron stores.

Serum Vitamin D levels: To assess vitamin D status.

Other micronutrient levels (e.g., folate, B12) may also be assessed depending on the study's scope.

Assessment of Birth Weight: Birth weight is measured immediately after delivery using a standardized scale and recorded in grams. Low birth weight (LBW) is defined as a birth weight less than 2500 grams [1, 4]. Other birth outcomes, such as preterm delivery (birth before 37 completed weeks of gestation) and small-for-gestational-age (SGA), are also typically recorded [4].

Data Analysis: Statistical analyses are performed to determine the associations between dietary diversity (independent variable), maternal nutritional status (mediating variable), and infant birth weight (dependent variable).

Descriptive statistics are used to characterize the study population and the distribution of dietary diversity scores, nutritional status indicators, and birth weights.

Inferential statistics, such as linear regression (for continuous outcomes like birth weight) and logistic regression (for dichotomous outcomes like LBW or preterm birth), are employed to assess the strength and significance of associations.

Confounding factors (e.g., maternal age, parity, education, socio-economic status, household food security, smoking status, pre-existing health conditions) are controlled for in multivariate models to isolate the independent effect of dietary diversity [4, 11].

Mediation analysis can be used to explore if maternal nutritional status acts as a mediator in the relationship between dietary diversity and birth weight.

By employing these rigorous methods, researchers can provide robust evidence on the critical role of dietary diversity in influencing maternal nutritional health and subsequent infant birth weight outcomes.

RESULTS

Studies investigating the impact of dietary diversity on maternal nutritional status and infant birth weight consistently demonstrate a strong positive association, highlighting the critical role of a varied diet during pregnancy. The findings from various research endeavors, spanning different geographical and socio-economic contexts, converge to underscore this relationship.

1. Dietary Diversity and Maternal Nutritional Status:

Reduced Anemia Risk: A significant body of evidence indicates that higher dietary diversity among pregnant women is associated with a reduced risk of maternal anemia [4, 9]. For instance, a prospective cohort study in rural Ethiopia found that dietary diversity during pregnancy was associated with a reduced risk of maternal anemia [4]. This is largely attributed to the increased intake of iron-rich foods (e.g., flesh foods, dark green leafy vegetables) and vitamin C-rich foods (which enhance iron absorption) when the diet is diverse [9].

Improved Anthropometric Measures: While not always directly linked, studies suggest that adequate dietary diversity contributes to appropriate gestational weight gain (GWG) [12, 13, 14]. Although pre-pregnancy BMI and GWG are primary determinants of neonatal birth weight [12, 13, 14, 17], a diverse diet provides the necessary energy and nutrients to support healthy weight gain during pregnancy. Conversely, low dietary diversity has been identified as a predictor for undernutrition among pregnant women, especially in contexts of household food insecurity [11].

Enhanced Micronutrient Intake: Pregnant women with higher dietary diversity scores tend to have a greater intake of essential micronutrients, including vitamins and minerals, which are vital for both maternal health and fetal development [9, 10]. A study in Kenya revealed that dietary diversity was positively correlated with nutrient intake among pregnant women [9].

2. Dietary Diversity and Infant Birth Weight:

Reduced Risk of Low Birth Weight (LBW): A consistent finding across multiple studies is the inverse relationship between maternal dietary diversity and the risk of low birth weight [2, 4, 6]. Zerfu et al. [4] reported that dietary diversity during pregnancy was associated with a reduced risk of low birth weight in a rural Ethiopian cohort. Similarly, a study from urban slums of Mumbai found a positive effect of maternal diet diversity on neonatal birth weight [6]. Raje and Rao [2] also highlighted that maternal food consumption patterns influence the risk of low birth weight in rural Maharashtra.

Prevention of Preterm Delivery: Beyond LBW, adequate dietary diversity has also been linked to a reduced risk of preterm delivery [4]. This suggests that a comprehensive nutritional intake supports the full gestational period, preventing premature births that often result in lower birth weights and increased health complications.

Improved Mean Birth Weight: Studies often show that infants born to mothers with higher dietary diversity scores have a higher mean birth weight compared to those born to mothers with less diverse diets [4, 6]. This indicates not just a reduction in LBW, but an overall improvement in fetal growth and development.

3. Mediating Role of Maternal Nutritional Status: The observed effect of dietary diversity on birth weight is often mediated through its influence on maternal nutritional status. A diverse diet leads to better maternal micronutrient status (e.g., reduced anemia) and adequate gestational weight gain, which in turn directly impact fetal growth and birth weight [4, 12, 13, 14, 15]. The interplay between pre-pregnancy BMI, gestational weight gain, and neonatal birth weight is well-documented, emphasizing that dietary diversity contributes to these maternal factors [12, 13, 14, 17].

In summary, the evidence strongly supports that dietary diversity during pregnancy is a crucial factor influencing maternal nutritional health and, consequently, the birth weight of the baby. Promoting a varied diet can significantly contribute to reducing the burden of low birth weight and improving overall maternal and child health outcomes.

DISCUSSION

The findings from numerous studies consistently underscore the profound impact of maternal dietary diversity on both the nutritional status of pregnant women and the subsequent birth weight of their infants. This discussion synthesizes these findings, elucidating the mechanisms through which dietary diversity exerts its influence and highlighting the critical implications for public health interventions.

The direct correlation between higher dietary diversity and improved maternal nutritional status is a cornerstone of the observed relationships. A varied diet, encompassing multiple food groups, inherently increases the likelihood of consuming a wider spectrum of essential macronutrients and micronutrients [5, 9, 10]. For instance, the reduced risk of maternal anemia associated with diverse diets is attributable to enhanced intake of iron-rich foods (from flesh foods, pulses, and dark green leafy vegetables) and bioavailability enhancers like vitamin C (from fruits and vegetables) [4, 9]. Micronutrient deficiencies, such as iron-deficiency anemia, are prevalent during pregnancy, particularly in low-resource settings, and have well-documented adverse effects on both maternal health and fetal development [4, 15]. By mitigating these deficiencies, dietary diversity directly contributes to a healthier maternal physiological state, which is a prerequisite for optimal fetal growth.

Furthermore, adequate dietary diversity supports appropriate gestational weight gain (GWG), a critical determinant of neonatal birth weight [12, 13, 14, 17]. While pre-pregnancy BMI sets a baseline, the quality and quantity of food consumed during pregnancy directly influence GWG. A diverse diet provides the necessary energy and protein for maternal tissue accretion and fetal growth, reducing the risk of both inadequate and excessive weight gain, both of which can negatively impact birth outcomes [12, 13, 14]. Conversely, limited dietary diversity, often a reflection of household food insecurity, can lead to chronic energy and nutrient deficits, contributing to maternal undernutrition and suboptimal GWG [11].

The most compelling finding is the consistent inverse association between maternal dietary diversity and the risk of low birth weight (LBW) and preterm delivery [2, 4, 6]. This relationship is likely mediated by the improved maternal nutritional status achieved through a diverse diet. A mother who is well-nourished, with adequate stores of macro and micronutrients, is better equipped to support the rapid growth and development of the fetus. Essential nutrients like folate, iron, zinc, and various vitamins play crucial roles in cell division, organogenesis, and overall fetal growth [9, 10]. Deficiencies in these nutrients, often a consequence of monotonous diets, can lead to intrauterine growth restriction (IUGR) and, consequently, LBW [15]. The prevention of preterm delivery through dietary diversity further contributes to higher birth weights, as infants born prematurely are inherently at a higher risk of being of lower weight [4].

The implications of these findings for public health and nutrition interventions are substantial. Strategies aimed at improving dietary diversity among pregnant women should be prioritized, especially in vulnerable populations. Such interventions could include:

Nutrition Education: Promoting awareness about the importance of consuming a variety of food groups, including locally available and affordable options.

Food-Based Approaches: Encouraging home gardening, promoting consumption of diverse local foods, and supporting food security initiatives at the household level [7].

Supplementation: While dietary diversity is key, targeted micronutrient supplementation may still be necessary to address specific deficiencies, especially in populations with high prevalence of malnutrition.

Policy Support: Implementing policies that improve access to diverse and nutritious foods, such as agricultural policies that promote diversified farming systems and market access for diverse food products.

It is important to acknowledge that while dietary diversity is a powerful predictor, it is part of a complex interplay of factors influencing maternal and infant health. Socioeconomic status, access to healthcare, cultural practices, and pre-existing maternal health conditions also play significant roles [3, 11]. Future research should continue to explore these interacting factors, perhaps through longitudinal studies that track dietary patterns and outcomes over longer periods, and intervention studies that evaluate the effectiveness of specific dietary diversity promotion programs. Understanding the specific nutrient

contributions of different food groups in diverse cultural contexts would also be beneficial.

In conclusion, the evidence strongly supports that promoting dietary diversity during pregnancy is a fundamental and effective strategy for improving maternal nutritional status and reducing the incidence of low birth weight and preterm delivery. Investing in interventions that enable pregnant women to consume a varied and nutrient-rich diet is crucial for fostering healthier mothers and stronger, healthier babies, thereby breaking the intergenerational cycle of malnutrition.

CONCLUSION

The comprehensive review of existing literature unequivocally demonstrates the critical role of maternal dietary diversity in shaping both the nutritional status of pregnant women and the subsequent birth weight outcomes of their infants. A diverse diet, characterized by the consumption of a wide array of food groups, is intrinsically linked to improved maternal nutrient intake, reduced prevalence of anemia, and adequate gestational weight gain. Crucially, this enhanced maternal nutritional well-being directly translates into favorable fetal growth and development. Studies consistently show that higher maternal dietary diversity significantly reduces the risk of low birth weight and preterm delivery, while contributing to a higher mean birth weight. These findings underscore that a varied and nutrient-rich diet during pregnancy provides the essential building blocks for optimal fetal development, mitigating the adverse consequences associated with maternal malnutrition.

Given the pervasive challenge of malnutrition among pregnant women globally, particularly in low-resource settings, promoting dietary diversity emerges as a fundamental and highly impactful public health strategy. Interventions focused on nutrition education, enhancing household food security, and creating supportive food environments are paramount. By prioritizing and implementing initiatives that enable pregnant women to access and consume diverse diets, we can significantly improve maternal health, reduce the burden of low birth weight, and lay a stronger foundation for the long-term health and well-being of future generations.

REFERENCES

1. UNICEF. State of the World's Children: Celebrating 20 years of the Convention on the Rights of the child. UNICEF;2009. Retrieved December 12, 2018. . 2009. Available from: https://www.unicef.org/.../SOWC_Spec._Ed._CRC_Main_Report_EN_090409(1).pdf.
2. Raje S, Rao S. Maternal food consumtion patterns and risk of low birth weight in rural Maharashtra. The Indian Journal of Nutrition and Dietetics. 2015;52(2):153–65. Available from: https://www.informaticsjournals.com/index.php/ijnd/article/view/2457.
3. Ramlal RT, Tembo M, King CC, Ellington S, Soko A, Chigwenembe M, et al. Dietary Patterns and Maternal Anthropometry in HIV-Infected, Pregnant Malawian Women. Nutrients. 2015;7(1):584–594. Available from: https://doi.org/10.3390/nu7010584.
4. Zerfu TA, Umeta M, Baye K. Dietary diversity during pregnancy is associated with reduced risk of maternal anemia, preterm delivery, and low birth weight in a prospective cohort study in rural Ethiopia. The American Journal of Clinical Nutrition. 2016;103(6):1482–1488. Available from: https://doi.org/10.3945/ajcn.115.116798.
5. Kennedy G, Ballard T, Dop MC. Food and Agriculture organization of the United Nations. 2011. Available from: https://www.fao.org/3/i1983e/i1983e.pdf.
6. Manerkar K, Gokhale D. Effect of Maternal Diet Diversity and Physical activity on Neonatal Birth Weight: A study from Urban slums of Mumbai. Journal of Clinical and Diagnostic Research. 2017;11(10):YC07–YC11. Available from: http://dx.doi.org/10.7860/JCDR/2017/29261.10737.
7. Sahu AK, Chüzho Z, Das S. Measuring Household Food Security Index for High Hill Tribal Community of Nagaland, India. India Journal of Food Security. 2017;5(5):155–161. Available from: http://dx.doi.org/10.12691/jfs-5-5-1.
8. FAO (Food and Agriculture Organization) and FANTA (Food and Nutrition Technical Assistant), Introducing the Minimum Dietary Diversity–Women (MDD-W) Global Dietary Diversity Indicator for Women, FAO, Washington, DC, USA, 2014,. Washington, DC. . Available from: https://www.fantaproject.org/sites/default/files/resources/Introduce-MDD-W-indicator-brief-Sep2014_0.pdf.
9. Kiboi W, Kimiywe J, Chege P. Dietary Diversity, Nutrient Intake and Nutritional status among pregnant women in Laikipia county,Kenya. Kenya International journal of Health Sciences & Research. 2016;6(4):378–385. Available from: https://www.ijhsr.org/IJHSR_Vol.6_Issue.4_April2016/52.pdf.
10. Ndung'u J, Nyanchoka AM. Dietary diversity, nutrient intake and nutritional status of pregnant women aged 18-45 years in developing countries. A systematic review. International Journal of Food science and Nutrition. 2018;3(4):217–220. Available from: http://www.foodsciencejournal.com/archives/2018/vol3/issue4/3-4-67.pdf.

11. Nigatu M, Gebrehiwot TT, Gemeda DH. Household Food Insecurity, Low Dietary Diversity, and Early Marriage Were Predictors for Undernutrition among Pregnant Women Residing in Gambella, Ethiopia. Advances in Public Health. 2018;2018:1–10. Available from: https://doi.org/10.1155/2018/1350195.
12. Du MK, Ge LY, Zhou ML, Ying J, Qu F, Dong MY, et al. Effects of pre-pregnancy body mass index and gestational weight gain on neonatal birth weight. Journal of Zhejiang University-SCIENCE B. 2017;18(3):263–271. Available from: https://doi.org/10.1631/jzus.b1600204.
13. Soltani H, Lipoeto NI, Fair FJ, Kilner K, Yusrawati Y. Pre-pregnancy body mass index and gestational weight gain and their effects on pregnancy and birth outcomes: a cohort study in West Sumatra, Indonesia. BMC Women's Health. 2017;17(1):102–114. Available from: https://doi.org/10.1186/s12905-017-0455-2.
14. Du MK, Ge LY, Zhou ML, Ying J, Qu F, Dong MY, et al. Effects of pre-pregnancy body mass index and gestational weight gain on neonatal birth weight. Journal of Zhejiang University-Science B. 2017;18(3):263–271. Available from: https://doi.org/10.1631/jzus.b1600204.
15. Verma S, Shrivastava R. Effect of Maternal nutritional status of birth weight of baby. International journal of comtemporary medical research. 2016;3(4):943–945. Available from: https://www.ijcmr.com/uploads/7/7/4/6/77464738/*effect_of_maternal_nutritional_status_on_birth_weight_of_baby*.pdf.
16. Osman SM, Saaka M, Siassi F, Qorbani M, Yavari P, Danquah I, et al. A comparison of pregnancy outcomes in Ghanaian women with varying dietary diversity: a prospective cohort study protocol. BMJ Open. 2016;6(9):e011498–e011498. Available from: https://doi.org/10.1136/bmjopen-2016-011498.
17. Haugen M, Brantsæter AL, Winkvist A, Lissner L, Alexander J, Oftedal B, et al. Associations of pre-pregnancy body mass index and gestational weight gain with pregnancy outcome and postpartum weight retention: a prospective observational cohort study. BMC Pregnancy and Childbirth. 2014;14(201). Available from: https://doi.org/10.1186/1471-2393-14-201.