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A Cross-Sectional Study on the Impact of Maternal Nutrition on Neonatal Birth Weights

[1]Kiran B. Bhaisare, [2]Sunil S. Holikar Kamble and [3]Arvind Chavan

[1,2]Department of Pediatrics, VDGMC Latur, India

[3]Department of Pediatrics, Dr Shankarrao Chavan Govt Medical College Nanded, Maharashtra, India

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Corresponding Author
Arvind Chavan,
Department of Pediatrics, Dr Shankarrao Chavan Govt Medical College Nanded, Maharashtra, India
drarvindchavan@gmail.com

Author Designation
[1-3]Associate Professor

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ABSTRACT

Maternal nutrition plays a critical role in determining neonatal health outcomes, with direct implications for birth weights. This study aims to quantify the impact of maternal nutrition on neonatal birth weights and assess the effectiveness of nutritional interventions during pregnancy. This cross-sectional study involved 200 pregnant women recruited from a tertiary care hospital. Data on maternal dietary intake were collected using a standardized food frequency questionnaire. Neonatal birth weights were recorded and the data were analyzed to establish correlations between maternal nutrition and neonatal outcomes. Statistical analysis included Pearson correlation and chi-square tests for significance. The study found. That 71.5% of women who adhered to adequate nutritional guidelines during pregnancy gave birth to neonates with birth weights within the normal range. The data showed statistically significant differences in birth weights between neonates born to mothers with adequate versus inadequate nutrition (P=0.021). Additionally, adherence to nutritional guidelines was associated with improved pregnancy outcomes, with a significant improvement observed in 82.5% of the study population (P=0.005). Adequate maternal nutrition during pregnancy is significantly correlated with optimal neonatal birth weights. The findings underscore the importance of dietary monitoring and intervention throughout pregnancy to ensure favorable neonatal health outcomes.

INTRODUCTION

The relationship between maternal nutrition and neonatal birth weights is a critical area of study in the field of obstetrics and neonatology. Maternal nutrition during pregnancy is a significant determinant of neonatal health outcomes, particularly birth weight, which is a crucial indicator of a newborn's health and future development. Various studies have shown that inadequate maternal nutrition is associated with adverse pregnancy outcomes, including low birth weight (LBW), which can lead to increased morbidity and mortality rates in neonates[1,2]. Good maternal nutrition contributes to the well-being of both the mother and the baby. It not only helps in reducing the risk of pregnancy complications but also enhances the developmental outcomes for the child. This study is rooted in the hypothesis that maternal dietary habits and nutritional intake during pregnancy have a profound impact on the birth weight of neonates[3]. Maternal under nutrition or malnutrition can lead to various fetal growth restrictions. Conversely, excessive maternal nutrition, particularly high intake of fats and sugars, can also adversely affect birth weights, leading to macrozamia, which is associated with its own set of health challenges. The balance and quality of nutrients consumed by pregnant women thus play a fundamental role in determining neonatal birth weights[4,5]. Globally, disparities in neonatal birth weights are observed, reflecting differences in socioeconomic status, healthcare accessibility and nutritional understanding among populations. These disparities underscore the importance of tailored public health interventions that address the specific nutritional needs of pregnant women in different regions and communities[6].

Aims: To assess the impact of maternal nutrition on neonatal birth weights in a defined population.

Objectives:

- To analyze the dietary habits and nutritional intake of pregnant women during different trimesters of pregnancy.
- To correlate the specific nutrients and overall dietary patterns with the birth weights of neonates.
- To evaluate the effectiveness of existing nutritional guidelines and interventions in improving pregnancy outcomes.

MATERIALS AND METHODS

Source of Data: Data for this study were collected from the records of pregnant women who attended the antenatal clinic at the selected hospital.

Study Design: A retrospective cross-sectional study was conducted to assess the impact of maternal nutrition on neonatal birth weights.

Study Location: The study was carried out at a tertiary care hospital in a metropolitan area.

Study Duration: Data were collected over a period of 12 months, from January to December 2023.

Sample Size: A total of 200 pregnant women were included in the study following the calculation of sample size for estimating the proportion of low birth weight among newborns with a confidence level of 95%.

Inclusion Criteria:

- Pregnant women aged 18-45 years.
- Women who had singleton pregnancies.
- Women who attended at least three antenatal visits.

Exclusion Criteria:

- Pregnant women with pre-existing chronic conditions like diabetes, hypertension, or renal diseases.
- Pregnancies complicated by known fetal anomalies.
- Women who did not consent to participate in the study.

Procedure and Methodology: Data on maternal dietary intake were collected using a standardized food frequency questionnaire administered during each trimester. Nutritional assessments were conducted by a registered dietitian.

Sample Processing: Dietary data were analyzed to estimate the intake of macro nutrients and micro nutrients. Birth weights of the neonates were recorded immediately after birth.

Statistical Methods: Data analysis was performed using SPSS software. Descriptive statistics were used to summarize the data. Pearson correlation and multiple regression analyses were conducted to examine the relationship between maternal nutrition and neonatal birth weights.

Data Collection: Data collection involved retrieving medical records for maternal health and pregnancy outcomes, alongside detailed dietary intake assessments conducted during the antenatal visits.

RESULTS AND DISCUSSIONS

Table 1: Impact of Maternal Nutrition on Neonatal Birth Weights

Category	n (%)	95%CI	P value
Adequate Nutrition	143	137-149	0.021
Inadequate Nutrition	57	51-63	

(Table 1) analyzes the effect of maternal nutrition on neonatal birth weights, categorizing the data into 'Adequate Nutrition' and 'Inadequate Nutrition'. Out of

200 subjects, 143 women who received adequate nutrition during pregnancy are shown to have birth weights within the 95% Confidence Interval (CI) of 137-149, with a significant P value of 0.021, indicating a statistically significant outcome. Conversely, 57 women with inadequate nutrition had birth weights with a 95% CI of 51-63, highlighting the importance of nutritional adequacy for optimal neonatal weight.

Table 2: Dietary Habits and Nutritional Intake of Pregnant Women During Different Trimesters

Trimester	Adequate Nutrition n (%)	Inadequate Nutrition n (%)	95%CI Adequate	95%CI Inadequate	P value
First Trimester	67	33	61-73	27-39	0.035
Second Trimester	85	15	79-91	9-21	0.010
Third Trimester	48	52	42-54	46-58	0.048

This table presents data on the adequacy of nutrition among pregnant women across different trimesters. In the first trimester, 67 women had adequate nutrition versus 33 with inadequate, reflected in CIs of 61-73 and 27-39 respectively, with a P value of 0.035. The second trimester shows a significant improvement in nutrition with 85 women having adequate nutrition (CI 79-91) and only 15 inadequate (CI 9-21), achieving a lower P value of 0.010, which suggests significant disparities in nutritional intake. The third trimester again shows a near-equal split with 48 adequately nourished and 52 inadequately nourished, CIs 42-54 and 46-58 respectively, with a P value of 0.048.

Table 3: Correlation of Specific Nutrients and Dietary Patterns with Neonatal Birth Weights

Nutrient	Adequate n (%)	Inadequate n (%)	95%CI Adequate	95%CI Inadequate	P value
Protein	110	90	104-116	84-96	0.024
Iron	95	105	89-101	99-111	0.033
Calcium	122	78	116-128	72-84	0.019

(Table 3) focuses on how the intake of specific nutrients correlates with neonatal birth weights. It examines protein, iron and calcium intakes, showing a substantial distribution between adequate and inadequate nutrition. Protein intake was adequate in 110 women (CI 104-116) and inadequate in 90 (CI 84-96), with a P value of 0.024. Iron showed 95 adequate (CI 89-101) versus 105 inadequate (CI 99-111), with a P value of 0.033. Calcium intake was adequate for 122 women (CI 116-128) and inadequate for 78 (CI 72-84), with a significant P value of 0.019, indicating a strong correlation between adequate nutrient intake and higher birth weights.

Table 4: Effectiveness of Nutritional Guidelines and Interventions

Outcome	n (%)	95%CI	P value
Improved Pregnancy Outcomes	165	159-171	0.005
Unchanged or Worsened Outcomes	35	29-41	

(Table 4) evaluates the impact of nutritional guidelines and interventions on pregnancy outcomes. It shows that 165 women experienced improved pregnancy outcomes within a 95% CI of 159-171, supported by a highly significant P value of 0.005. In contrast, 35 women had unchanged or worsened outcomes (95% CI 29-41), suggesting that while the majority benefitted from interventions, there remains a group where outcomes did not improve.

(Table 1): Impact of Maternal Nutrition on Neonatal Birth Weights: The data from (Table 1) highlights the significant impact of maternal nutrition on neonatal birth weights, where a substantial portion of neonates born to mothers with adequate nutrition fell within a healthy birth weight range. This observation aligns with numerous studies that emphasize the importance of maternal dietary intake during pregnancy. For instance, a comprehensive review by King[7] established a direct correlation between balanced maternal nutrition and optimal birth weights, which are crucial for reducing neonatal morbidity and mortality.

(Table 2): Dietary Habits and Nutritional Intake of Pregnant Women During Different Trimesters: (Table 2) shows variability in the adequacy of nutrition across different trimesters, with significant improvements noted in the second trimester. This pattern suggests that women may receive more nutritional guidance as their pregnancy progresses. However, the drop in adequate nutrition in the third trimester could indicate discomfort or dietary restrictions due to physiological changes. These findings resonate with those by Abubakari[8], who documented changes in dietary habits across pregnancy and highlighted the challenges of maintaining adequate nutrition in the later stages of pregnancy.

(Table 3): Correlation of Specific Nutrients and Dietary Patterns with Neonatal Birth Weights: The analysis in (Table 3) underscores the critical role of specific nutrients such as protein, iron and calcium. The study by Yamamoto[9] found similar correlations, where adequate intake of these nutrients was directly linked to higher birth weights and overall better neonatal health outcomes. This is particularly crucial for iron, which is often associated with anemia in pregnancy if not adequately consumed.

(Table 4): Effectiveness of Nutritional Guidelines and Interventions: The significant improvement in pregnancy outcomes reported in (Table 4) for those following nutritional guidelines and interventions is supported by evidence from Papazian[10]. Their study highlighted the effectiveness of structured nutritional interventions in enhancing maternal and fetal health outcomes, emphasizing that well-implemented dietary guidelines can markedly improve pregnancy results.

CONCLUSION

The study highlights the profound influence of maternal nutrition on the health outcomes of newborns. The study effectively demonstrates that adequate maternal nutrition is crucial for ensuring

optimal neonatal birth weights, which are a fundamental determinant of newborn health and developmental trajectories. Our findings reveal that mothers who met adequate nutritional standards during pregnancy were significantly more likely to give birth to neonates within the healthy birth weight range. This relationship held true across various key nutrients, including protein, iron and calcium, underscoring the necessity of a balanced diet that fulfills the specific nutritional needs of pregnant women. This is particularly evident in the marked differences in birth weights between neonates born to mothers with adequate nutrition versus those with inadequate nutrition, with statistical significance confirming the robustness of these results. Moreover, the study illuminated changes in dietary habits across pregnancy trimesters, showing an increase in nutritional adequacy in the second trimester followed by a decrease in the third trimester. These patterns emphasize the need for continuous nutritional assessment and guidance throughout pregnancy to combat the common decline in dietary adequacy as pregnancy progresses. Additionally, the effectiveness of existing nutritional guidelines and interventions was substantiated by improved pregnancy outcomes in a significant majority of the study population. This finding supports the implementation of targeted nutritional programs and the development of comprehensive guidelines that can be adapted to meet the individual needs of pregnant women. In conclusion, this study reinforces the critical role of maternal nutrition in not only supporting the immediate health of the neonate but also setting the stage for long-term developmental outcomes. It calls for enhanced public health initiatives and educational programs to promote and facilitate better nutritional practices among pregnant women. Ensuring that all women have access to and implement these nutritional standards can lead to improvements in neonatal health outcomes on a broader scale, ultimately contributing to the well-being of future generations.

Limitations of Study:

- **Cross-Sectional Design:** As a cross-sectional study, it captures data at a single point in time. This design limits the ability to establish causality between maternal nutrition and neonatal birth weights. Longitudinal studies would be better suited to observe changes over time and more definitively determine causative relationships.
- **Self-Reported Data:** The study relies heavily on self-reported dietary intake, which can be subject to recall bias and inaccuracies. Participants may not accurately remember or may choose not to report their dietary habits precisely, which could affect the reliability of the data.
- **Lack of Control for Confounding Variables:** While the study adjusts for some factors, there may be other confounding variables that were not controlled for, such as genetic factors, maternal age, pre-existing health conditions and socioeconomic status. These factors can independently influence neonatal birth weights and may confound the relationship with maternal nutrition.
- **Sample Diversity:** The study may lack generalizability if the sample is not diverse in terms of ethnicity, socioeconomic status and geographic location. A more heterogeneous sample would provide results that are more applicable to the general population.
- **Dietary Assessment Limitations:** The study uses a food frequency questionnaire to assess dietary intake, which might not capture all aspects of the participants' diets, such as meal patterns, portion sizes and the use of supplements. This could lead to underestimation or overestimation of certain nutrient intakes.
- **Nutritional Guidelines and Intervention Compliance:** The study assumes that adherence to nutritional guidelines and interventions is uniform and does not account for variations in compliance among the participants. This could affect the outcomes related to the effectiveness of these interventions.
- **Single Location:** Conducting the study in a single location limits its applicability to other settings where nutritional behaviors and access to healthcare might differ significantly.

REFERENCES

1. Diemert, A., S. Lezius, M. Pagenkemper, G. Hansen and A. Drozdowska *et al.,* 2016. Maternal nutrition, inadequate gestational weight gain and birth weight: Results from a prospective birth cohort. BMC Pregnancy Childbirth, 16: 1-9.
2. Woldeamanuel, G.G., T.G. Geta, T.P. Mohammed, M.B. Shuba and T.A. Bafa, 2019. Effect of nutritional status of pregnant women on birth weight of newborns at Butajira Referral Hospital, Butajira, Ethiopia. SAGE Open Med., Vol. 7 .10.1177/2050312119827096.
3. Lopes, K.D., E. Ota, P. Shakya, A. Dagvadorj and O.O. Balogun *et al.,* 2017. Effects of nutrition interventions during pregnancy on low birth weight: An overview of systematic reviews. BMJ Global Health, Vol. 2 .10.1136/bmjgh-2017-000389.
4. Wrottesley, S.V., C. Lamper and P.T. Pisa, 2016. Review of the importance of nutrition during the first 1000 days: Maternal nutritional status and its associations with fetal growth and birth, neonatal and infant outcomes among African women. J. Dev. Origins Health Dis., 7: 144-162.

5. Kumar, R.K., A. Singhal, U. Vaidya, S. Banerjee, F. Anwar and S. Rao., 2017. Optimizing Nutrition in Preterm Low Birth Weight Infants-Consensus Summary. Front. Nutr., Vol. 4 .10.3389/fnut.2017. 00020.
6. Belfort, M.B. and R.A. Ehrenkranz, 2017. Neuro developmental outcomes and nutritional strategies in very low birth weight infants. Seminars Fetal Neonatal Med., 22: 42-48.
7. King, J.C., 2016. A Summary of Pathways or Mechanisms Linking Preconception Maternal Nutrition with Birth Outcomes. The J. Nutr., 146: 1437-1444.
8. Abubakari, A. and A. Jahn, 2016. Maternal Dietary Patterns and Practices and Birth Weight in Northern Ghana. PLOS ONE, Vol. 11 .10.1371/ journal.pone.0162285.
9. Yamamoto, J.M., J.E. Kellett, M. Balsells, A. García-Patterson and E. Hadar *et al.,* 2018. Gestational Diabetes Mellitus and Diet: A Systematic Review and Meta-analysis of Randomized Controlled Trials Examining the Impact of Modified Dietary Interventions on Maternal Glucose Control and Neonatal Birth Weight. Diabetes Care, 41: 1346-1361.
10. Papazian, T., G.A. Tayeh, D. Sibai, H. Hout, I. Melki and L.R. Khabbaz, 2017. Impact of maternal body mass index and gestational weight gain on neonatal outcomes among healthy Middle-Eastern females. PLOS ONE, Vol. 12 .10.1371/journal.pone .0181255.