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CROSS-SECTIONAL STUDY ON THE IMPACT OF MATERNAL NUTRITION ON NEONATAL HEALTH

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Abstract
Background: Maternal nutrition plays a critical role in neonatal outcomes, influencing various aspects of fetal development and birth outcomes. This study explores the association between maternal dietary habits and the health status of neonates at birth. **Methods:** A cross-sectional study was conducted involving 300 pregnant women recruited from a tertiary care hospital. Data on maternal diet were collected through structured interviews during the third trimester. Neonatal health outcomes, including birth weight, Apgar score were recorded at birth. **Results:** Preliminary analysis indicate a significant correlation between high maternal intake of micronutrients and macronutrients and positive neonatal outcomes such as higher birth weights and improved Apgar scores. Conversely, a diet low in micronutrients and macronutrients during pregnancy was associated with lower birth weights and reduced neonatal apgar score. **Conclusion:** This study underscores the importance of adequate maternal nutrition during pregnancy as a determinant of better neonatal health outcomes. Public health policies aimed at improving prenatal nutritional advice and support can potentially enhance neonatal health profiles. Keywords: Maternal Nutrition, Neonatal Health, Dietary Impact
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Introduction

The influence of maternal nutrition on neonatal outcomes has long been a subject of research, with various studies highlighting how prenatal diet affects everything from fetal development to long-term health risks in offspring and fetal origin of adult diseases. The primary focus of such studies is to understand the direct impacts of specific nutrients and overall dietary patterns on the health of new-borns.[1]

Nutritional deficiencies during pregnancy can lead to adverse outcomes such as low birth weight, preterm delivery, and impaired neurological development. Conversely a balanced diet that includes adequate amounts of macro and micronutrients can promote fetal growth and development enhancing neonatal health. This paper aims to explore the connection between

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maternal nutrition specifically tailored to the dietary intake during the third trimester of pregnancy and the immediate health outcomes of the neonate measured at birth.[2]
The hypothesis guiding this research stems from established studies that demonstrate the crucial role of nutrients such as folic acid, iron, calcium, and omega-3 fatty acids and protein in prenatal development. However, there is a need for more comprehensive research that correlates the overall dietary habits of pregnant women with the health status of their new-borns in different demographic settings.[3]

Aim

To assess the impact of maternal nutrition on neonatal health outcomes in a cross-sectional cohort of pregnant women.

Objectives

1. To correlate the dietary intake of pregnant women during the third trimester with neonatal birth weight.
2. To examine the relationship between maternal nutrition and Apgar scores in new-borns.

Material and Methodology

Source of Data

Data were retrospectively collected from medical records and direct interviews with pregnant women attending the prenatal clinic at the study location.

Study Design

A cross-sectional study design was employed to evaluate the impact of maternal nutrition on neonatal health

Study Location

The study was conducted at a tertiary care hospital, renowned for its comprehensive maternal and child health services

Study Duration

The study spanned from 13/10/23 to 30/06/24.

Sample Size

The study included 300 pregnant women who met the inclusion criteria.

Inclusion Criteria

Pregnant women in their third trimester, aged 18-40 years, with no chronic illness affecting nutritional status

Exclusion Criteria

Women with diagnosed chronic illnesses such as diabetes or hypertension, or those on specific dietary restrictions prior to pregnancy were excluded.

Procedure and Methodology

Dietary intake was assessed through a validated food frequency questionnaire administered during the third trimester. Neonatal outcomes were recorded at birth.

Sample Processing

No biological sample processing was required as this study focused on survey data and clinical outcomes.

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Statistical Methods

Statistical analysis was performed using SPSS. Multivariate regression models were used to adjust for potential confounders like maternal age, BMI, and socioeconomic status.

Data Collection

Data were collected through structured interviews and review of medical records to ensure comprehensive capture of relevant variables.

Observation and Results

Table 1: Impact of Maternal Nutrition on Neonatal Health Outcomes

Variable	n (%)	Odds Ratio (OR)	95% CI	P value
Adequate Nutrition	150 (50%)	1.50	1.1-2.0	0.02
Inadequate Nutrition	150 (50%)	0.67	0.5-0.9	0.01

Table 1 evenly divided between those receiving adequate nutrition and those with inadequate nutrition during pregnancy. Those with adequate nutrition representing 50% of the sample showed a statistically significant odds ratio of 1.50 suggesting a 50% increase in positive neonatal health outcomes compared to the baseline with a confidence interval (CI) of 1.1 to 2.0 and a p-value of 0.02. Conversely inadequate nutrition was associated with a decreased odds ratio of 0.67 indicating a 33% lower likelihood of favourable outcomes significant at a p-value of 0.01.

Table 2: Correlation between Dietary Intake and Neonatal Birth Weight

Variable	n (%)	Odds Ratio (OR)	95% CI	P value
High intake (high in fruits, vegetables, proteins)	150 (50%)	2.0	1.4-2.8	0.001
Low intake (high in processed foods, sugars low protein)	150 (50%)	0.5	0.3-0.7	0.005

Table 2 also divides 300 participants into two groups based on their dietary habits: high intake of fruits, vegetables, and proteins versus high intake of processed foods and sugars low intake of protein. The group with a high intake comprising 50% of the sample had an odds ratio of 2.0 doubling the likelihood of higher birth weights with a robust significance (p=0.001). In contrast those with a low dietary intake had an odds ratio of 0.5 halving the likelihood of achieving higher birth weights also statistically significant (p=0.005).

Table 3: Relationship between Maternal Nutrition and Apgar Scores in Newborns

Variable	n (%)	Odds Ratio (OR)	95% CI	P value
High APGAR Score	165 (55%)	1.80	1.2-2.7	0.003
Low APGAR Score	135 (45%)	0.56	0.4-0.8	0.002

Table 3 analyzed 300 subjects where 55% followed a balanced diet and 45% an unbalanced diet. The balanced diet group had an odds ratio of 1.80 indicating an 80% higher probability of better Apgar scores with a CI of 1.2-2.7 and a p-value of 0.003. The unbalanced diet group had a lower odds ratio of 0.56, suggesting a 44% reduction in achieving higher Apgar scores significant at a p-value of 0.002.

Discussion

The data indicates that adequate maternal nutrition is linked with better neonatal health outcomes (OR=1.50, P=0.02), while inadequate nutrition correlates with poorer outcomes

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(OR=0.67, P=0.01). This aligns with findings from Kramer *et al.*, who highlighted that maternal nutritional status significantly influences neonatal birth weight and developmental metrics Cui Y *et al.*(2023)[4]. Similarly, Ramakrishna *et al.*'s systematic review underscores the long-term impacts of maternal nutrition on infant health beyond the neonatal period, emphasizing the need for adequate maternal nutrient intake during pregnancy Prasetyo YB *et al.*(2023)[5]

The strong associations between high dietary intake of micronutrients and macronutrients in the form of vegetables and proteins with increased birth weight (OR=2.0, P=0.001) and the adverse effects of a diet rich in processed foods and sugars poor in micronutrients and macronutrients (OR=0.5, P=0.005) are consistent with the broader literature. Studies by Godfrey and Barker have demonstrated that specific nutrients play critical roles in promoting fetal growth, and deficiencies can lead to reduced birth weights Strobel KM *et al.*(2023)[6]. Furthermore, Barker's hypothesis on fetal programming suggests that suboptimal prenatal nutrition can predispose individuals to chronic conditions later in life Apostolopoulou A *et al.*(2023)[7].

Our findings that a balanced diet correlates with higher Apgar scores (OR=1.80, P=0.003) are supported by research indicating that maternal diet quality directly affects immediate postnatal life markers Maher SE *et al.*(2023)[8]. The inverse relationship found with unbalanced diets (OR=0.56, P=0.002) reflects studies showing that nutritional deficiencies can lead to complications at birth and impact newborns' initial vitality Shankar K *et al.*(2023)[9].

Conclusion

The study underscores the significant influence of maternal diet during pregnancy on neonatal outcomes. This study demonstrated that adequate maternal nutrition is not only crucial for the health of the mother but also plays a pivotal role in ensuring optimal health outcomes for the newborn.

Our findings highlight that a diet rich in micronutrients and macronutrients during the third trimester is associated with favorable neonatal outcomes including higher birth weights and better Apgar scores reflecting the baby's health at birth. Conversely a diet predominantly low intake of micronutrients and macronutrients is linked to lower birth weights and reduced neonatal APGAR Score, which can have long-term implications on the child's health and development.

These conclusions are not only consistent with previous research but also add to the growing body of evidence that supports targeted nutritional interventions during pregnancy. It is evident that public health initiatives should focus on improving the nutritional education and resources available to pregnant women emphasizing the importance of a balanced and nutrient-rich diet

Moreover healthcare providers play a critical role in counseling and supporting pregnant women to adopt and maintain healthy dietary habits thereby improving pregnancy outcomes and contributing to the 12 long-term health of the population. In light of these findings further research is warranted to explore specific nutritional interventions that could be most effective in diverse populations and to assess the impact of maternal nutrition on additional neonatal outcomes.

In conclusion this study affirms the critical importance of adequate and balanced maternal nutrition as a key factor in promoting healthy neonatal outcomes highlighting the need for enhanced dietary support and education during pregnancy.

Limitations of Study

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1. **Cross-sectional design** One of the main limitations of this study is its cross-sectional nature which captures data at a single point in time. This design prevents the assessment of causality between maternal nutrition and neonatal health outcomes. Longitudinal studies would be more effective in determining the temporal sequence of events and understanding the causal relationships
2. **Self-reported dietary data**: The study relies on self-reported dietary intake which is subject to recall bias and may not accurately reflect actual consumption. Future research could benefit from using more objective measures such as food diaries or dietary assessments conducted by nutrition professionals.
3. **Lack of detailed nutritional data**: The study assessed dietary patterns broadly without considering the quantity and quality of nutrient intake. This lack of granularity may overlook specific nutritional deficiencies or excesses that could influence neonatal outcomes. More detailed analysis including micronutrient intake, could provide deeper insights.
4. **Confounding variables**: While the study adjusted for several potential confounders there may be other unmeasured variables such as genetic factors maternal health conditions, and environmental factors that could affect both maternal diet and neonatal outcomes. The inability to control for all possible confounding factors may impact the study's results
5. **Generalizability**: The study was conducted at a single tertiary care center which may limit the generalizability of the findings to other populations or settings. Differences in socioeconomic, cultural, and environmental factors can significantly influence dietary habits and health outcomes.
6. **Sample size**: Although a sample size of 300 may provide sufficient power for detecting significant associations larger studies are needed to validate these findings and enable subgroup analyses which could highlight specific dietary impacts on different population groups.
7. **No follow-up**: The study does not include follow-up data on long-term health outcomes of the neonates, which limits understanding of the enduring impacts of maternal nutrition

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