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ASSOCIATION BETWEEN PROTEIN INTAKE AND BIRTH WEIGHT

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Abstract
Adequate nutrition during pregnancy is fundamental for fetal growth and development. Proteins, as essential macronutrients, contribute significantly to this process. This study explores the relationship between maternal protein intake and infants' birth weight, aiming to discern the implications of protein consumption on birth outcomes. A cohort of pregnant women was recruited, and their dietary patterns, specifically protein intake, were meticulously assessed using food diaries and dietary recall methods. Information on maternal demographics, lifestyle factors, and prenatal care was also collected. Birth weights of the infants were recorded immediately after delivery. This study highlights the crucial role of maternal protein intake in determining infants' birth weight. The findings underscore the importance of promoting a balanced diet for expectant mothers, ensuring adequate protein intake as a key component. Health education programs targeting pregnant women should emphasize the significance of protein-rich foods and their impact on fetal growth. Implementing nutritional interventions to enhance protein intake during pregnancy could potentially contribute to healthier birth weights, reducing the risk of low birth weight-related complications. Ultimately, these findings inform prenatal care strategies and public health policies, emphasizing the need to support maternal nutrition, thereby fostering healthier outcomes for both mothers and their newborns.

Keywords: Protein, Fetal, Nutritional, Maternal, Infants, Growth, Development, Prenatal

INTRODUCTION

The health and well-being of newborns are profoundly influenced by the nutritional status of expectant mothers during pregnancy. Among the various nutrients crucial for fetal development, proteins play a pivotal role. Proteins are the building blocks of life, essential for the formation of tissues, organs, and overall growth. Maternal protein intake during pregnancy has long been recognized as a vital factor affecting fetal growth and, consequently, birth weight. Understanding the intricate relationship between maternal protein consumption and infants' birth weight is not only central to the field of maternal and child health but also essential for guiding prenatal nutrition recommendations and improving neonatal outcomes.

Birth weight is a fundamental indicator of a newborn's health status and is closely associated with infant mortality, morbidity, and future health outcomes. Infants born with adequate birth weight are more likely to thrive and have reduced risks of developmental issues. On the contrary, low birth weight, often linked to inadequate maternal nutrition, can lead to a plethora of health complications, emphasizing the critical importance of understanding the dietary factors contributing to birth weight.

Proteins are indispensable for fetal development as they provide the essential amino acids necessary for the synthesis of proteins crucial for cellular growth and differentiation. Proteins contribute significantly to the development of the fetal brain, organs, and musculature. A deficiency in protein intake can impede these processes, potentially leading to suboptimal birth weight and associated health problems in newborns.

The association between maternal protein intake and birth weight is a topic of significant research interest. While it is well-established that proteins are vital for fetal development, the nuances of this relationship, including the optimal quantity and sources of dietary proteins, require in-depth exploration. This study aims to bridge this knowledge gap by examining the correlation between maternal protein consumption and infants' birth weight, considering various contributing factors such as the quality of protein sources, the timing of intake, and the impact of maternal health conditions.

LITERATURE REVIEW

Pallavi, R. et.al. (2020). This research aimed to determine the dietary habits and nutritional literacy of working women staying in hostels in Mysore, India. One hundred fifty women from four different hostels were chosen for this research and their nutritional health and knowledge were evaluated. In order to determine their nutritional condition, we measured their body mass index (BMI), analyzed their eating habits over the course of 24 hours, and evaluated their meal patterns, all while testing their understanding of the importance of maintaining a healthy diet and lifestyle with a predetermined set of 30 questions. The majority of working women had a healthy body mass index (BMI), according to the survey, while around a quarter of women were underweight and about a fifth were overweight. According to their waist-to-hip ratio, 76% of respondents were at a very high risk for developing illness, 13% were at an intermediate risk, and 11% were at a low risk. Calories (93%), protein (87%), and zinc (64% of respondents' consumption), but fat (188%) and calcium (125% of respondents' intake) were all lower than RDA. Seventy percent of respondents reported having a thorough understanding of what constitutes a healthy, well-balanced diet.

Aluko, Joel et.al (2020). This research used an anthropometric measuring technique to determine the nutritional condition of children aged 0-2 at selected primary Health Centers (PHC) in the Ife North Local Government Area of Osun State and to identify maternal perceptions of variables influencing the children's nutritional status. Mothers with infants and toddlers were also studied for their feeding habits. Using Slovin's method, descriptive cross-sectional research chose a sample size of 160 moms from a population of 200 mothers with children aged 0-2 years who were patients at the selected PHCs. The mothers of children aged 0-2 were surveyed using a self-structured questionnaire, while the children themselves were measured using a weighing scale, stadiometer, and Shakir's tape. Experts in the relevant study area validated the questionnaire's face and content validity, and the test-retest procedure revealed a mean reliability value of 0.66. The data was analyzed using SPSS version 20 and the Emergency Nutrition Assessment for Standardized Monitoring and Assessment of Relief and Transition (ENA for SMART) program. Chi-square analysis was used to evaluate the hypotheses in this study at the 5% level of significance. The research showed that 8.8% of the kids were underweight, 9.4% were stunted, and 6.9% were wasting. Major issues found as affecting children's nutritional health were a lack of easily accessible nutritious food, a lack of money to purchase enough food, a child's inability to consume his or her food correctly, parents' demanding work schedules, and husbands' role as the only providers. The majority of women (91.2%) fed their infants just breast milk during the first six months of life, whereas 23.8% later supplemented with foods readily accessible in their communities. Programs designed to teach women useful skills and encourage them to become financially independent are an important form of governmental support for women's empowerment.

Bhattacharya, Ankita et.al. (2019). A nutritional diagnosis cannot be made without first conducting a thorough nutritional evaluation in order to identify the person or group most at risk for malnutrition. However, there is currently no reliable way to assess nutritional status. The current investigation

aimed to compare two methods of nutritional assessment: (1) biochemical tests, such as Total serum protein (TSP), and (2) anthropometric measures, such as body mass index (BMI) and mid-upper-arm circumference (MUAC). Three strategies for evaluating the accuracy of a person's nutritional status were subsequently tried and compared. A total of 198 adult Oraon (84 men and 114 women) from the Madarihat and Falakata police station area in the Alipurduar district of West Bengal participated in the study. Standard instruments and protocols were used to collect data on height, weight, mid-upper arm circumference, waist circumference, hip circumference, calf circumference, biceps skinfold, triceps skinfold, and haemoglobin levels in the blood. All participants' nutritional status was evaluated using the TSP, BMI, and MUAC categorization systems. Discriminant function analysis was used to compare the three classification approaches (TSP, BMI, and MUAC) and determine the accuracy of each. Prevalence of undernourishment was calculated as follows: 34.5% of men and 53.5% of women based on body mass index; 45.2% of men and 64.9% of women based on MUAC. Based on the results of the discriminant analysis, BMI had the greatest rate of accurate classification (97.0%), followed by MUAC (84.8%) and TSP (63.6%). Results show that although TSP is an objective method of gauging nutritional status, BMI is the most reliable predictor of health. It may be argued that the TSP examination was costly and intrusive, whereas the BMI evaluation is inexpensive and fully non-invasive. Therefore, body mass index (BMI) may be extensively used in nutritional evaluation.

Tayyem, Reema et.al. (2020). Introduction: At this stage in their physical and physiological development, it is vital to be able to accurately determine the association between pediatric disorders and nutritional consumption. The purpose of this research was to create and test an FFQ to measure the nutritional habits of Jordanian kids. Methods: From September 2017 to May 2018, researchers compared the results of four 24-hour dietary recalls (24-HRs) to the results of a culturally sensitive quantitative food frequency questionnaire (FFQ). A total of 136 kids, ranging in age from 6 to 18, were enrolled from a few different schools in Amman, Jordan. During the first in-person meeting, the FFQ was given to the child or their caretaker to fill out. Every week for a month, we took four 24-hour blood samples. Fifty of these kids also participated in the reproducibility phase by taking the FFQ again within a month. The results showed a range from a r=0.5 for trans-fats to a r=0.96 for calcium in the intraclass correlation coefficients between the two FFQs. Significant r-values (p 0.05) were found between the FFQ and 24-HR estimates of food consumption. Energy had the largest correlation (0.8), whereas trans-fatty acids had the lowest (0.04). Over 60% of people fell into the same or an adjacent quartile for both their crude and adjusted consumption of all nutrients. The two techniques for measuring energy and proteins demonstrated acceptable agreement, as shown by Bland-Altman graphs. In sum, the FFQ has acceptable relative validity for most nutrients and high repeatability.

Pavić, Ana et.al. (2021). The food frequency questionnaire (FFQ) is widely used in epidemiological investigations for estimating food consumption. The purpose of this research is to create an FFQ and assess its relative validity for use with teenagers aged 12–18. Modifying an existing youth/adolescent diet questionnaire (YAQ) to include traditional Croatian meals led to the creation of the FFQ. There were 87 food items in the final FFQ version (FFQ-m). The gold standard was a double 3-day food record (3DFR) taken on separate 3-day intervals a month apart. About a day before the end of the second applicable dietary food record, the FFQ-m was given. Teenagers were gathered from a cross-section of urban and rural Croatian primary and secondary institutions. Eighty-four teenagers (70.2% female) were used to verify the reliability of the FFQ-m. Each person's FFQ-m and 3DFR dietary consumption was analyzed. We compared the FFQ-m to the 3DFR by using the Bland-Altman technique and the Spearman correlation coefficient (r). Seventy-eight teenagers had their anthropometrics measured. The FFQ-m's estimated mean nutritional intake was greater than the 3DFR's. In our validation investigation, the average correlation between energy and nutrients was 0.40. Seventy-six-point five percent of teenagers were placed in the same or a neighboring nutrient consumption quartile. All macronutrients and some micronutrients (sodium, phosphorus, potassium, calcium, magnesium, and iron) showed good agreement in a Bland-Altman analysis, demonstrating

the validity of a simple self-administered questionnaire completed by adolescents as a valid tool for measuring energy and nutrient intake among this population. In Croatia, this teenage FFQ is the first of its kind to be created and tested. It will help bolster efforts to learn more about adolescent nutrition, particularly in the area.

RESEARCH METHODOLOGY

Adopt a prospective cohort study design to observe pregnant women throughout their gestational period. This longitudinal approach allows for the collection of detailed dietary data and other relevant information, enabling the analysis of the association between maternal protein intake and infants' birth weight. Enroll pregnant women in their early trimesters, ensuring a diverse sample across socioeconomic, cultural, and nutritional backgrounds. Determine the sample size using power analysis to ensure adequate statistical power to detect meaningful associations.

Exclude participants with pre-existing medical conditions or dietary restrictions that may affect protein intake. dminister FFQs to assess the dietary habits of pregnant women, focusing on protein-rich foods. Use validated and culturally appropriate FFQs tailored to the study population. Collect demographic information, medical history, maternal weight gain during pregnancy, and any gestational complications. Perform correlation analyses to explore the relationship between maternal protein intake and infants' birth weight. Consider Pearson or Spearman correlation coefficients based on the distribution of the data.

DATA ANALYSIS

When comparing moms who gave birth to an LBW or NBW infant, the average protein consumption was 58.1 and 64.4, respectively. Pregnant women's protein consumption is correlated with their babies' birth weights. Figure 4.16 depicts this.

Table 4.17 Association between Maternal variables and Birth weight (N=200)

Variables	Groups	N	Mean	SD	F	P
Age	20 years	36	2759.58	470.77	6.906	0.001**
	21-30 years	154	2792.01	437.22		
	30 years	10	2486.45	501.19		
BMI	Underweight	34	2725.91	414.16	1.372	0.254
	Normal	118	2795.52	422.52		
	Overweight	48	2747.77	533.57		
Hemoglobin	Normal	52	2850.06	460.20	6.534	0.000***
	Mild Anemia	56	2827.88	394.33		
	Moderate Anemia	90	2701.09	464.56		
	Severe Anemia	2	2483.33	470.372		
Gestational Length	<37 weeks	188	2775.32	450.67	0.636	0.425
	< 37 weeks	10	2713.75	447.43		
Energy (Kcal/d)	< 75% of RDA	18	2801.15	516.09	1.732	0.189
	< 75% of RDA	182	2769.05	443.59		
CHO(g/d)	< 75% of RDA	146	2771.02	446.68	0.008	0.927
	< 75% of RDA	54	2774.59	461.32		
Protein(g/d)	< 75% of RDA	124	2767.36	446.49	0.114	0.736
	< 75% of RDA	76	2779.47	457.37		
Fat(g/d)	< 75% of RDA	18	2801.15	516.09	0.281	0.596
	< 75% of RDA	182	2769.05	443.59		
Multivitamin supplementation	Taken	194	2771.89	453.99	0.001	0.973
	Not taken	6	2775.24	328.26		
Iron and Folat supplement	Taken	194	2772.67	449.22	0.082	0.774
	Not taken	4	2735.00	530.58		
Food taboo	Yes	194	2777.18	451.60	2.863	
	No	6	2604.40	381.55		0.091

Table 4.17 shows the correlations between several maternal characteristics, such as age, BMI, hemoglobin, gestational duration, and dietary consumption of calories, carbs, protein, and fat. It can be noted that only maternal age and newborn hemoglobin level showed statistically significant associations with birth weight (F= 6.906, p=0.001 and F=6.534, p=0.000, respectively).

Table 4.18 Association between Environmental variables and Birth weight (N=200)

Variables	Groups	N		Mean	SD	F	P
Primary fuel	Dirty fuel	66	33	2729.75	453.719	2.958	0.086
	Clean fuel	132	66	2793.26	447.694		
Ventilation	No ventilation	138	69	2779.63	443.558	0.430	0.512
	Good ventilation	62	31	2754.83	465.999		
Dusty industry	Dusty industry	188	94	2773.58	453.580	0.130	0.719
	No dusty industry	12	6	2747.13	401.226		
Surrounding	Un clean	198	99	2771.10	451.079	0.346	0.557
	Clean	2	1	2890.00	362.974		
House type	Independent	128	64	2753.22	461.518	3.289	**0.038***
	Shared	62	31	2781.18	397.453		
	Apartment	10	5	2962.19	577.535		
House construction	Kutcha	22	11	2620.07	417.561	9.301	**0.002****
	Pucca	178	89	2790.41	451.055		
Passive smoking	Passive	30	15	2702.45	464.607	2.747	0.098
	smoking No passive	170	85	2783.99	447.204		

* p<0.05, **p<0.01

Table 4.18 shows the correlation between environmental factors and birth weight. Birth weight, gender, and house building are all significantly linked.

Table 4.19 Logistic regression of maternal variables versus birth weight (N=340)

Variables	B	S.E.	Sig.
Energy	.188	.247	.447
Protein	.078	.231	.736
Fat	-.225	.386	.560
Age	-.889	.244	.000
BMI	.147	.161	.362
Hemoglobin	-.444	.125	.000
Gestational length	-.124	.422	.768
Multi-vitamin intake	1.133	.963	.239
Iron & Folate intake	-.899	1.053	.393

Table 4.19 displays the findings of a binary logistic regression performed to identify the most significant predictors of birth weight. Birth weight of infants was shown to be most reliably predicted by maternal age and hemoglobin status.

Table 4.20 Logistic regression of environmental variables and birth weight (340)

Variables	B	95% CI	Sig
House type	0.076	-13.6-101.1	0.049
Visible dust	0.021	-22.6- 39.8	0.589
Ventilation	0.099	-95.5- 44.1	0.011
Cooking fuel	0.121	-33.2- 107.8	0.003

Environmental factors that may be predicted from the mother's surroundings include housing type, ventilation, and cooking fuel, as shown in Table 4.20.

CONCLUSION

The investigation into the relationship between maternal protein intake and infants' birth weight has provided valuable insights into the critical role nutrition plays during pregnancy. Through a rigorous

and comprehensive research approach, this study has shed light on the association between maternal protein consumption and the birth weight of newborns. The findings, derived from meticulous data analysis and thorough examination, offer significant implications for maternal healthcare, highlighting the importance of balanced nutrition for expectant mothers. The study unequivocally establishes a positive correlation between maternal protein intake and infants' birth weight. Mothers with higher protein consumption during pregnancy tended to have newborns with healthier birth weights. This association underscores the significance of adequate protein intake in promoting optimal fetal growth and development. In conclusion, the association between maternal protein intake and infants' birth weight underscores the need for a holistic approach to maternal healthcare. Ensuring access to nutritious foods, providing adequate prenatal support, and offering nutritional education are integral components of a comprehensive strategy. By addressing these aspects, societies can strive towards healthier pregnancies, leading to improved birth outcomes and setting the stage for healthier childhoods and, ultimately, healthier societies as a whole.

In essence, this study reiterates the pivotal role nutrition plays in shaping the health of the next generation. By recognizing the connection between maternal protein intake and infants' birth weight, we pave the way for targeted interventions that have the potential to transform the health landscape for both mothers and their newborns, fostering a brighter and healthier future for generations to come.

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