**Association Between Maternal Dietary Intake and Neonatal Anthropometry: A Healthcare Based Study of Bilaspur District, Chhattisgarh, India**

**Abstract**

**Background:** Maternal health is regarded as an important indicator of fetal health. Thus it’s essential to investigate the relationship between maternal dietary intake and neonatal anthropometry.

**Objective:** The aim of the present study is to record the correlation between maternal dietary intake and neonatal anthropometry for the health care in Bilaspur district of Chhattisgarh.

**Methods:** This was a cross sectional study which includes 180 pregnant women referred to District Hospital of Bilaspur Chhattisgarh. From 180 sampled pregnant women 60.556% belong to urban area and 39.444% belong to rural areas of study area. The dietary record of sampled pregnancy patients was collected by using a food frequency questionnaire upto maternal delivery stage. The neonatal anthropometry was obtained from the records of District Hospital of Bilaspur Chhattisgarh. A long binomial regression model was run to examine the association between maternal dietary intake and neonatal anthropometry. The data analysis was performed by using SPSS statistics for window version 20.0.

**Results:** The results reveal that majority (68.88%) of the pregnant women has normal BMI. The results of binomial regression model explain a significant (p≤0.05) correlation between the mother’s dietary intake with the weight, height, head circumference and BMI of neonates.

**Conclusion:** The overall results reveal that the maternal dietary intake has a significant influence on the neonatal anthropometry. Thus we recommend that higher authorities of health system to prioritize the dietary intake of the pregnant women across different rural and urban areas of country.

**Keywords:**Maternal Dietary Intake, Anthropometry, Neonates, Correlation.

Introduction

The neonatal health is one of the major concerns in health care system across the globe (Rao, et.al., 2021). Literature has found that the health of neonates is affected by number of factors like; health of mother, nutrition, genetic potential, placental structure, environmental factors, maternal diets, and nutritional status (Wu, et.al., 2012; Hadia, et.al., 2021). Across all of these factors the material maternal dietary intake is regarded as a key factor which influences the growth and development of neonates (Deshpande, et.al., 2011). The nutritional factor of pregnant women is considered as the leading factor for the neonatal mortality and morbidity (Zage, et.al., 2024). Dietary intake during pregnancy is critical for health of mother on one side and on other side its essential for the proper fetal growth (Dolin and Kominiarek, 2024).The nutritional requirement of pregnant women differs from the non-pregnant women (Patherathna, et.al., 2025). During pregnancy a women undergoes number of physiological changes like hormonal changes, weight gain, cardiac and hematological alterations, gastrointestinal alteration, increase in oxygen demand and increase in nutritional requirement for the growth and development of healthy fetus (Tan and Tan, 2013). Thus for a pregnant women a proper nutrition advice is required to fulfill her nutritional requirements and the nutritional requirements of her fetus.

In some countries the intake of nutrient supplement by the pregnant women has been mandatory, while in other countries the nutrient supplement is only taken when it’s necessary (Tuncalp, et.al., 2020). In order to overcome the physiological changes in the women during pregnancy, fulfill the needs of fetus, and furthermore to prepare the body for breastfeeding, the nutritional requirement of a pregnant women need to be adapted through implementation of an adapted and balanced diet or by nutrient supplementation. The diet of pregnant women varies across the stages of its pregnancy and requirement of nutrition for the normal growth of fetus (Marshall, et.al., 2022). But still the relationship between dietary pattern and neonatal anthropometry remain indecisive. Thus it’s essential to examine the association between the dietary intake of a pregnant women and neonatal growth. Such studies can be used by the healthcare systems across the globe in making the women aware about the role of dietary intake during pregnancy period. In addition to this the results of these studies will explore the importance of dietary intake of pregnant women for her health and for the fetal health also. Keeping in view the above discussion the present was conducted to investigate the relationship between dietary intake of pregnant women and their neonatal anthropometry.

**Methodology**

The present study was a cross sectional study which includes 180 pregnant women referred to District Hospital of Bilaspur Chhattisgarh. Women eligible to be enrolled in present study were 180 healthy pregnant women between age group of 25 to 40 years, belonging to Bilaspur District of Chhattisgarh and were available for follow ups for dietary information for the analysis of present study. A pre-tested self structured valid interview questionnaire was used to collect the socio-economic and demographic attributes of the subject (sampled pregnant women). The Socio-demographic characteristics of sampled pregnant women of Bilaspur Chhattisgarh are given in Table-1. The pre-pregnancy anthropometry of 180 sampled pregnant patients was obtained from their medical records and also their Body Mass Index (BMI) was calculated. The neonatal anthropometric profile was measured and recorded within a period of 24 hrs of birth.

A food frequency questionnaire was used to determine the dietary intake of sampled 180 pregnant patients of Bilaspur Chhattisgarh before delivery time. In this study the standard procedures of Thimmayamma and Rau, (2003) was followed for describing the diet status of subjects. From the nutrient assessment method, the type of food of the subjects was determined.After reaching to the gestational age the pregnancy outcome of each sampled subject was recorded through different parameters via; Mode of Delivery, Gestational Age (in weeks), Pregnancy Outcome, Neonatal Sex, Neonatal Birth Weight (kg), Neonatal Length (cm), Neonatal Head Circumference (cm), and Ponderal Index (g x 100/cm3).A long binomial regression model was run to examine the association between maternal dietary intake and neonatal anthropometry. The data analysis was performed by using SPSS statistics for window version 20.0.

**Table-1.** Detail of Socio-demographic characteristics of selected pregnant women of Bilaspur Chhattisgarh **(N=180)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.No** | **Personal Information** | **Frequency (n=180)** | **Percentage** | **Mean±SD** |
| **01** | **Age** | Below 25 years | 62 | 34.444% | **1.90±0.7378** |
| 26-30 years | 91 | 50.556% |
| 30-40 years | 27 | 15.000% |
| **02** | **Religion** | Hindu | 117 | 65.000% | **1.700±1.050** |
| Muslim | 29 | 16.111% |
| Christian | 18 | 10.000% |
| Other | 16 | 8.889% |
| **03** | **Category/Caste** | ST | 17 | 9.444% | **2.90±0.994** |
| SC | 23 | 12.778% |
| OBC | 78 | 43.333% |
| General | 62 | 34.444% |
| **04** | **Locale** | Urban  | 109 | 60.556% | **1.40±0.5164** |
| Rural | 71 | 39.444% |
| **05** | **Size of Family** | 02 or below | 24 | 13.333% | **2.40±0.6992** |
| 03-05  | 69 | 38.333% |
| 06 or above | 87 | 48.333% |
| **06** | **Type of Family** | Joint  | 82 | 45.556% | **1.50±0.5270** |
| Nuclear | 98 | 54.444% |
| **07** | **Occupation** | Salaried Employ | 16 | 8.889% | **2.500±1.509** |
| Housewife | 126 | 70.000% |
| Agriculture | 21 | 11.667% |
| Other | 17 | 9.444% |
| **08** | **Monthly Income** | Below Rs 8000 | 47 | 26.111% | **2.30±0.8233** |
| Rs 8000-15000 | 34 | 18.889% |
| Above Rs 15000 | 99 | 55.000% |
| **09** | **Age at Marriage** | Below 25 | 65 | 36.111% | **1.900±0.7379** |
| 25-30 | 82 | 45.556% |
| Above 30 | 33 | 18.333% |
| **10** | **Education** | Illiterate | 21 | 11.667% | **3.09±1.3498** |
| 10th | 39 | 21.667% |
| 12th | 35 | 19.444% |
| Graduate | 51 | 28.333% |
| Post Graduate | 23 | 12.778% |
| Professional | 11 | 06.111% |
| ***\*Source: Primary Data*** |

**Result and Discussion**

The maternal anthropometry was recorded in this study. Figure-1 shows the height class distribution sampled pregnant women of Bilaspur Chhattisgarh. The results reveal that 47.78% of sampled pregnant women fall in a height class between 151cm – 160cm, 38.33% of sampled pregnant women fall in a height class between 161cm – 170cm, 11.11% of sampled pregnant women fall in a height class between above 170cm, and 2.78% of sampled pregnant women fall in a height class between less than 150cm respectively. Figure-2 shows the weight class distribution of sampled pregnant women of Bilaspur Chhattisgarh. The majority (38.89%) of sampled pregnant women fall in a weight class between 51kg-55kg, 27.22% of sampled pregnant women fall in a weight class between 46kg-50kg, 19.44% of sampled pregnant women fall in a weight class between 56kg-60kg, 9.44% of sampled pregnant women fall in a weight class less than 45kg, and 3.33% of sampled pregnant women fall in a weight class above 56kg respectively. These results are in consistent with that of Maduforo, et.al., (2013).

**Fig-1.** the **Distributional of Maternal Height** of sampled pregnant womenin Bilaspur Chhattisgarh (*n=180*).

**Fig-2.** the **Distributional of Maternal Weight** of sampled pregnant womenin Bilaspur Chhattisgarh (*n=180*).

Table-2 shows that the distribution of Body Mass Index (BMI kg/m2) of sampled pregnant womenin Bilaspur Chhattisgarh. It was revealed that 68.88% sampled pregnant womenin Bilaspur Chhattisgarh has a normal BMI (between 20.01-25.0kg/m2), 02 pregnant women were suffering from Obese Grade-I Obese Grade-I, 01 pregnant women was suffering from Obese Grade-II. 17.22% sampled pregnant women of the study has low weight, 9.44% pregnant women were classified as CED- Grade-I, 2.22% pregnant women were classified as CED- Grade-II, and 0.556 % pregnant women were classified as CED- Grade-II respectively. The results depicts that maximum sampled pregnant women has a normal BMI. Several studies have confirmed that taking normal dietary intake by the women during pregnancy period maintains normal BMI (Schieve, et.al., 2001; Mehta, et.al., 2011;Voerman, et.al., 2019)

**Table-2.** the Distribution of Body Mass Index (BMI kg/m2) based on chronic energy deficiency in sampled pregnant women in Bilaspur Chhattisgarh (*n=180*).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.No** | **BMI(kg/m2)** | **Energy Deficiency** | **Frequency** | **Percentage** |
| **01** | ≤16.0(kg/m2) | CED Grade III | 01 | 0.556% |
| **02** | 16.01- 17.00(kg/m2) | CED Grade II | 04 | 2.222% |
| **03** | 17.01-18.5(kg/m2) | CED Grade I | 17 | 9.444% |
| **04** | 18.51- 20.0(kg/m2) | Low Weight Normal | 31 | 17.222% |
| **05** | 20.01-25.0(kg/m2) | Normal | 124 | 68.889% |
| **06** | 25.01 - 30.0(kg/m2) | Obese Grade-I | 02 | 1.111% |
| **07** | ≥30.01(kg/m2) | Obese Grade-II | 01 | 0.556% |
|  | **Total** | **180** | **100.00%** |

Table-3 shows the dietary food intake per day by sampled pregnant women of Bilaspur Chhattisgarh. The sampled pregnant women of Bilaspur Chhattisgarh used to take different diets which include cereals, pulses, nuts, fruits, milk, sugar, fats, meat and eggs. The mean values of dietary food intake shows that all the sampled pregnant women used to take their diet in normal amount as per RDA amount per day of NIN (1998). As per the diet chart for the intake of diet by the sampled pregnant women was 241.25gms of cereals, 32.49 gms of pulses & nuts, 43.67 gms of leafy vegetable, 37.88 gms of other vegetables, 59.64 gms of roots & tubers, 53.41 gms of fruits, 216.33 ml of milk , 32.26 gms of sugar, 49.20 gms of fats, and 40.25 gms of meat & eggs. Normal dietary intake is necessary for women during pregnancy period (Lee, et.al., 2018; Jouanne, et.al., 2021)

After the dietary intake was calculated the pregnancy outcomes of sampled pregnant women was recorded. The results of pregnancy outcome and neonatal anthropometry are represented in Tabe-4. The neonatal anthropometry was recorded for the each live birth. It was reported that 5.56% neonates has a birth weight below 2kg, 21.11% neonates has a birth weight between 2.01-2.29kg, 44.44% neonates has a birth weight between 2.6-3.00kg, 21.11% neonates has a birth weight between 3.01-.3.59kg, and 7.75% neonates has a birth weight between 3.60-4.0kg. In treatment group 1.11% of the neonates has a birth weight below 2kg, 11.11% neonates has a birth weight between 2.01-2.29kg, 41.11% neonates has a birth weight between 2.6-3.00kg, 45.56% neonates has a birth weight between 3.01-.3.59kg, and 1.11% of the neonates has a birth weight between 3.60-4.0kg. **Table-3.** Dietary food intake per day by sampled pregnant women of Bilaspur Chhattisgarh (*n=180*)

Table-3-Dietary food intake per day by sampled pregnant women of Bilaspur Chhattisgarh obtained through food frequency questionnaire

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Food Group** | **Dietary Intake** | **Mean Intake(gms)** |
| **01** | **Cereals** | Rice, Millets & Wheat | 241.25±17.30 |
| **02** | **Pulses and Nuts** | Pulses, legumes, Dry Beans & Nuts | 32.49±5.86 |
| **03** | **Vegetables**  | Leafy vegetable | 43.67±5.25 |
| Other Vegetables | 37.88±4.94 |
| Roots & Tubers | 59.64±6.64 |
| **04** | **Fruits** | Fruits | 53.41±5.19 |
| **05** | **Milk**  | Milk, Curd, Paneer etc | 216.33±20.21 |
| **06** | **Sugar** | Sugar & Jaggery | 32.26±4.60 |
| **07** | **Fats** | Oil, Butter & Ghee | 49.20±7.33 |
| **08** | **Meat and Eggs** | Meat, Egg, Chicken & Fish | 40.25±9.25 |

The results show that maximum neonates record normal birth weight. The length of the neonates reported a significant variation. Neonatal head circumference is an important aspect of neonatal anthropometry. In the present study we observed a significant variation in the neonatal head circumference of sampled neonates. The maximum neonates record the neonatal head circumference between 30.1-33.00cm and 33.1-36.00cm. Ponderal index (PI) is a measurement of a neonatal weight relative to their height. It’s used to assess physical growth and diagnose fetal growth disorders. PI is also known as the corpulence index or Rohrer's index. The results of Ponderal index (g x 100/cm3) was calculated and presented in Table-4. It was observed that 47.78% of neonates has a Ponderal Index between 2.41-2.80(g x 100/cm3), 42.22% of neonates has a Ponderal Index between 2.1-2.40(g x 100/cm3), 5.56% of neonates has a Ponderal Index between ≤2.0 (g x 100/cm3), and 4.44% of neonates has a Ponderal Index between ≥2.81 (g x 100/cm3) respectively.

**Table-4.** Pregnancy outcome and Neonatal Record of Control Group (n=90) and Treatment Group (n=90) of pregnant patients of Bilaspur Chhattisgarh

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.No** | **Variable** | **Items** | **No’s** | **Percentage** |
| **01** | **Mode of Delivery** | Normal  | **68** | 37.78% |
| Caesarian | **112** | 62.22% |
| **02** | **Gestational Age (in weeks)** | ≤37 Weeks | **24** | 13.33% |
| 37.1-42 Weeks | **144** | 80.00% |
| ≥42 Weeks | **12** | 6.67% |
| **03** | **Pregnancy Outcome** | Live | **166** | 92.22% |
| Death | **14** | 7.78% |
| **04** | **Neonatal Sex** | Male | **88** | 48.89% |
| Female | **92** | 51.11% |
| **05** | **Neonatal Birth Weight (kg)** | ≤2kg | **10** | 5.56% |
| 2.01-2.59kg | **38** | 21.11% |
| 2.6 - 3.00kg | **80** | 44.44% |
| 3.01-3.59kg | **38** | 21.11% |
| 3.60-4.0kg | **14** | 7.78% |
| **06** | **Neonatal Length (cm)** | ≤40 cm | **6** | 3.33% |
| 40.01 - 45.59cm | **38** | 21.11% |
| 45.60 - 50.00cm | **86** | 47.78% |
| 50.01 - 55.00cm | **50** | 27.78% |
| **07** | **Neonatal Head Circumference (cm)** | ≤30 cm | **6** | 3.33% |
| 30.1-33.00cm | **74** | 41.11% |
| 33.1-36.00cm | **90** | 50.00% |
| ≥36.1cm | **10** | 5.56% |
| **8** | **Ponderal Index (g x 100/cm3)** | ≤2.0 | **10** | 5.56% |
| 2.1-2.40 | **76** | 42.22% |
| 2.41-2.80 | **86** | 47.78% |
| ≥2.81 | **8** | 4.44 |

Table-5 shows the summary of binomial regression model describing the association of different attributes of sampled pregnant patients on the Neonatal Anthropometry. It was reported that maternal socio-demography (r= 0.350, p= 0.0438), maternal anthropometry(r= 0.311, p= 0.0126), maternal food intake(r= 0.433, p= 0.0001), maternal nutrient intake(r= 0.502, p= 0.0001), and maternal pregnancy outcome (r= 0.598, p= 0.0026) record a significant (*p≤0.05, p≤0.001*) association with the neonatal anthropometry. The results of this study confirm that there exists a significant association between the maternal dietary intakes of pregnant women with the neonatal anthropometry. Since the quality and quantity of the dietary intake play a vital role in improving the maternal characteristics (Yu, et.al., 2025). Lambert, et.al., (2020) revealed that if maternal characteristics are improved it directly or indirectly affects the neonatal anthropometry (as per results of present study). Conducting such studies ultimately affect the society’s pregnancy outcome. The present study is associated with several limitations. The retrospective approach of the current study led to reminding biases unavoidably. Collection of data for a particular period related to dietary intake data of pregnant women might has also influenced the precision of the present study. Thus conducting similar study taking large number of samples with randomized control trial research design can help to obtain most relevant and reliable evidences of causal relationships.

**Table-5.** Summary of binomial regression model describing the association of different attributes of sampled pregnant patients on the Neonatal Anthropometry.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S.No** | **Independent Variable (X)** | **Dependent Variable (Y)** | **R2** | **SE** | **R** | **Sig** |
| **01** | **Maternal Socio-Demography** | ***Neonatal Anthropometry*** | 0.350 | 0.172 | 0.339 | **0.0438\*** |
| **02** | **Maternal Anthropometry** | 0.311 | 0.123 | 0.295 | **0.0126\*** |
| **03** | **Maternal Food Intake** | 0.433 | 0.084 | 0.412 | **0.0001\*\*** |
| **04** | **Maternal Nutrient Intake** | 0.502 | 0.094 | 0.470 | **0.0001\*** |
| **05** | **Maternal Pregnancy Outcome** | 0.598 | 0.196 | 0.566 | **0.0026\*** |
| \* *Statistically Significant correlation at p≤0.05*\**\*Statistically Significant correlation at p≤0.001* |

**Conclusion**

The aim of the present study was to assess the relationship between maternal dietary intake and neonatal anthropometry. 180 healthy pregnant women between age group of 25 to 40 years, belonging to Bilaspur District of Chhattisgarh and available for follow ups for dietary information were selected for the present study. The study revealed that 68.88% sampled pregnant women in Bilaspur Chhattisgarh has a normal BMI (between 20.01-25.0kg/m2). The mean values of dietary food intake shows that all the sampled pregnant women used to take their diets in normal amount as per RDA amount per day of NIN (1998). It was reported that neonatal birth weight, neonatal length, neonatal head circumference and Ponderal index was within normal range for maximum newborns. The results of binomial regression model of this study confirm that there exists a significant association between the maternal dietary intakes of and neonatal anthropometry. Conducting similar study taking large number of samples with randomized control trial research design can help to obtain most relevant and reliable evidences of causal relationships.

**Conflict of Interest**

The authors declare that they have no known financial interest or personal relationship that could have appeared to influence the results reported in this research work.

**Ethical Approval:**

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

**Consent**

As per international standards or university standards, Participants’ written consent has been collected and preserved by the author(s).

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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