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A STATISTICAL ANALYSIS OF FACTORS IMPACTING ON THE WEIGHT OF NEWBORN BABY IN BARAMATI

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ABSTRACT:
The World Health Organization (WHO) defines Low birth weight (LBW) babies is those born with birth weights under 2.5 kg and preterm babies are those born before 37 weeks of gestation. Low birth weight is an important indicator of newborn health and is associated with an increased risk of various health problems and complications for the infant. The mother's socioeconomic status, biological immaturity, high parity, short stature, low pregnancy weight for height, low gain in weight during pregnancy, poor nutritional status, smoking, certain infectious agents, chronic diseases, complications of pregnancy, and a history of unsuccessful pregnancies are among the factors the committee on maternal nutrition has listed as being significant in the incidence of low-birth-weight infants and the associated neonatal mortality. The aim of this research paper is to investigate the various factors, including maternal age, previous pregnancy history, medical complications, and socioeconomic status, that are associated with the weight of new born baby in Baramati. To visualize data we used exploratory data analysis techniques. Using Chi square test of independence we conclude that living area, gross monthly income, mother's working status pregnancy period, mother's weight before delivery, iron supplement, eating vegetable and milk etc. are significant variable for baby's birth weight.

Keywords: Low Birth weight, Antenatal Care Visits, Maternal mortality.

INTRODUCTION:

India accounted for roughly 17% of all maternal and newborn deaths and stillbirths worldwide, according to a WHO, UNICEF, and UNFPA study published earlier this year titled "Improving maternal and newborn health and survival and reducing stillbirth progress report 2023". Among that 24 thousand deaths are maternal death, 2 lakh 97 thousand are stillbirth and 4 lakh 68 thousand are neonatal death. Indian women's maternal health status was found to be worse than that of women in other affluent nations. One of the most crucial elements of the Government of India's Family Welfare Programme has been the promotion of maternal and child health. According to national family health survey (NFHS-5)(2019-21) in the five years preceding the survey, 90% of last pregnancies in Maharashtra ended in a live birth, with miscarriage being the most common type. Abortion accounts for 4% of all pregnancies, with unplanned pregnancy (43%) and complications (17%) being the main reasons for seeking abortions. The most common methods used for abortions are medicines (57%), manual vacuum aspiration (11%), and other surgical methods (26%). A large majority of abortions were performed in the private health sector, while 16% were performed in the public health sector.A baby's birth weight is an essential health indicator and is impacted by various variables. According to their weight at delivery, babies should be categorised according to rules provided by the World Health Organization (WHO). The health and nutritional state of the infant are evaluated using these categories. These are the weight categories:

A) Low Birth Weight (LBW): Regardless of gestational age, a newborn is considered to have a low birth weight if they weigh less than 2.5 kg at the time of birth.

B) Very Low Birth Weight (VLBW): Regardless of gestational age, a newborn is considered to have a very low birth weight if they weigh less than 1.5 kg at delivery.
C) Extremely Low delivery Weight (ELBW): Regardless of gestational age, a newborn is considered to have an ELBW if they weigh less than 1 kg at delivery.

Low birth weight, particularly very low and extremely low birth weight, may increase the risk of health issues and the need for specialized treatment. It's crucial to remember that a newborn's birth weight is not the primary consideration when determining how healthy they are. The wellbeing of a baby is also significantly influenced by characteristics including gestational age, mother health, and other elements. To establish the proper care and monitoring required for babies, healthcare professionals combine these criteria. For this study, a new-born baby's weight was classified into two categories: 0 for less than or equal to 2.5kg and 1 for greater than 2.5 kg.

OBJECTIVES

- Is there any association between the number of antenatal care visits and a newborn baby's weight?
- Is there significant between mean birth weights of new born baby in different category?
- Investigate the various factors, including maternal age, previous pregnancy history, medical complications, and socioeconomic status, that are associated with the new born baby's weight.

MATERIALS & METHODS

For this study we collected primary data of 430 women's who recently delivered her baby from public hospital in Baramati. Face-to-face interviews were conducted using a standardized questionnaire. The Baramati Public Health Centre served as the survey's location. The cross-sectional study's data collection period ran from October 2022 to January 2022.Software such as R and MS-Excel were used to undertake statistical analysis.

The study included only women who are permanent residents of Baramati or have lived in Baramati. This study ensures that they have recent experience with antenatal care.

The outcome variable of the study is the newborn baby's weight. A baby's birth weight is an essential health indicator and is impacted by various variables. According to their weight at delivery, babies should be categorized according to rules provided by the World Health Organization (WHO).

In this study we considered following variables as independent variables related to a mother's health and variables related to awareness of antenatal care are to be considered independent variables. Mother's age, mother's education, living area, family type, number of members in the family, number of employed family members, Gross monthly household income, mother's working status, mother's working type, marriage month, husband's age, mother's age at the marriage, nature of daily work, place for ANC, etc. are socio-economic and demographic variables that are to be considered independent variables for study. Also, there are some independent variables related to awareness of antenatal care, like iron supplements taken during pregnancy, media exposure, consumption of alcohol, awareness about ANC visits, knowledge about danger signs of pregnancy, etc. Some of the variables, like mother's HB, mother's weight before delivery, ultrasound examination (USE), type of earlier delivery, new-born baby's sex, pregnancy period until delivery, etc., are considered independent variables. Exploratory data analysis, Chi square test and proportion test these tools are used to analyze the data. The data were analyzed using MS excel and R-software.

STATISTICAL ANALYSIS

DESCRIPTIVE STATISTICS:

Brief informative coefficients known as descriptive statistics are used to sum up a particular data set, which may be a sample of a population or a representation of the complete population.

Table1: Mean birth weight of new born baby according to status of their education

Status of Education	Mean birth weight(gm)
No Education	2818.69
Primary Education	2846.44
Graduation	2853
Post graduate	3155.143

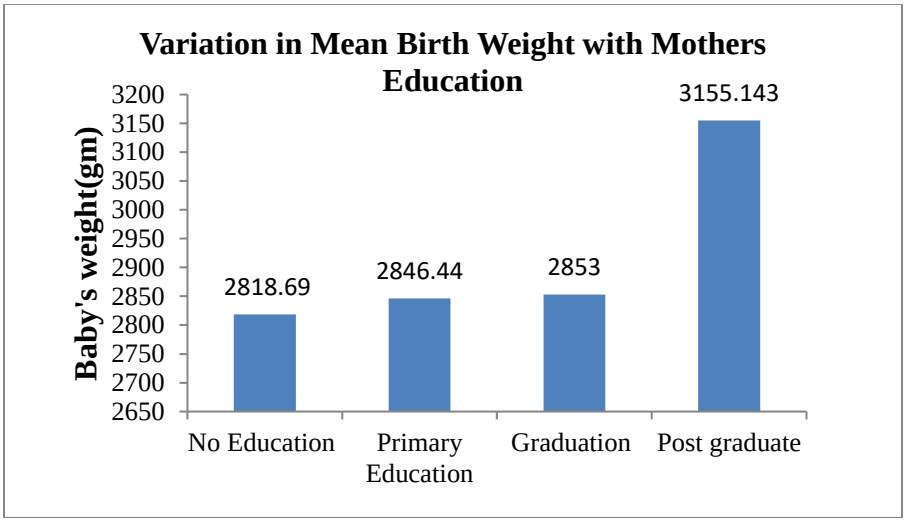

Figure1: Variation in Mean Birth Weight with Mothers Education

The histogram shows a significant correlation between maternal education and birth weight, with post-graduation education resulting in higher birth weights. Conversely, mothers without education have the lowest birth weight, indicating a need for increased maternal and antenatal care awareness.

Table 2: Mean birth weight of new born baby according to living area

Area	Mean birth weight(gm)
Rural	2490
Urban	3040.83

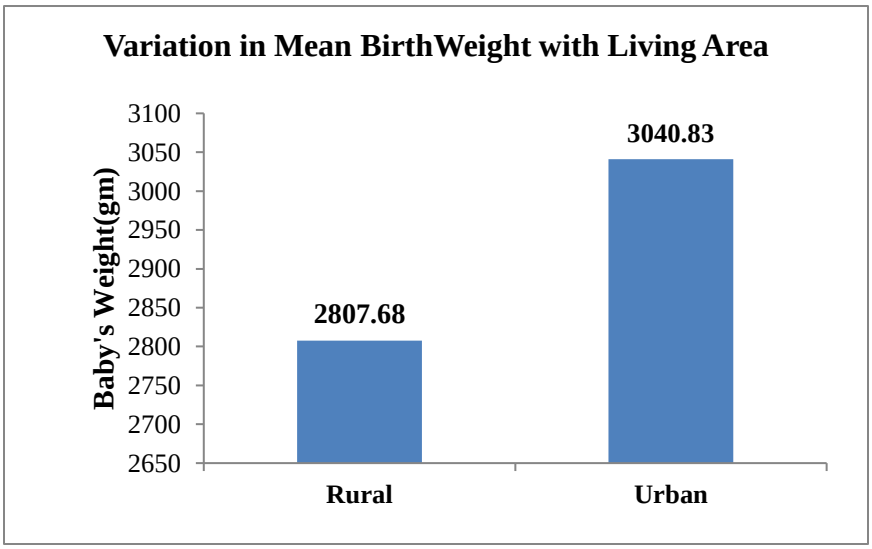

Figure 2: Variation in Mean Birth Weight with Living Area

The study reveals a significant difference in birth weight between rural and urban areas, with rural areas having a lower average birth weight of 2490 grams, and urban areas having a higher mean birth weight of 3040.83 grams.

Table 3: Descriptive statistics of weight of new born baby according to family type

Family Type	Mean birth weight(gm)	S.D	Maximum	Minimum
Joint	2836.02	461.64	4000	1234
Nuclear	2954.45	489.69	4050	1500

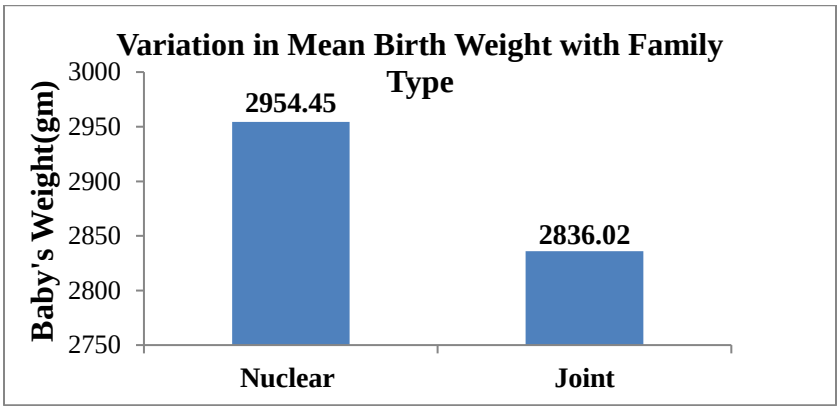

Figure 3: Variation in Mean Birth Weight with Family Type

The mean birth weight of newborns in joint families is 2836.02 grams, while in nuclear families it is higher at 2954.451613 grams. Nuclear families have a higher standard deviation (489.69 grams) compared to joint families (461.64 grams), suggesting a wider range and more dispersed birth weights.

Table 4: Descriptive statistics of weight of new born baby according to monthly income

Monthly Income	Mean birth weight(gm)	S.D	Maximum	Minimum
Less than Rs.10,000	2739.98	498.47	3800	1234
More than Rs.10,000	2963.40	439.61	4050	1500

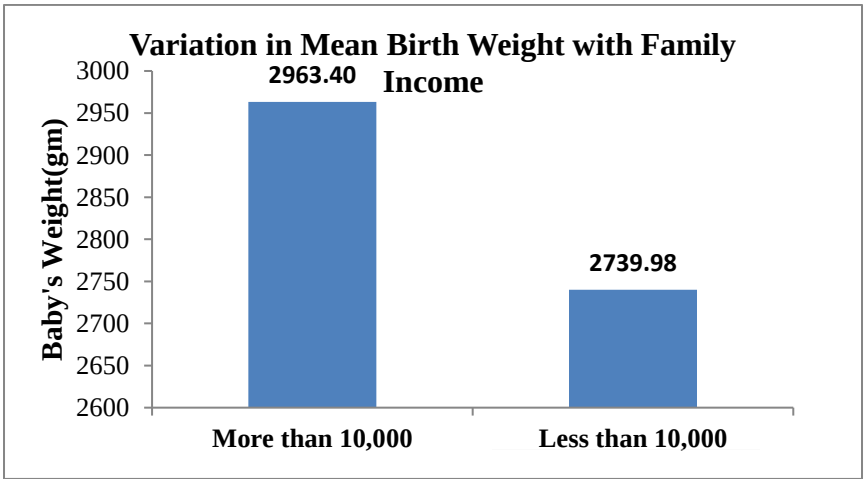

Figure 4: Variation in Mean Birth Weight with Family Income

The study reveals a difference in mean birth weight between families with monthly incomes less than Rs. 10,000 and those with higher incomes, with higher-income families having slightly higher average birth weights. This highlights the importance of considering family income in maternal and infant health assessment and planning interventions.

Table 5: Descriptive statistics of weight of new born baby according to working status of mother

Working Status	Mean birth weight(gm)	S.D	Maximum	Minimum
Non Working	2833.639	481.7581	4000	1234
Working	2985.055	441.8459	4050	1789

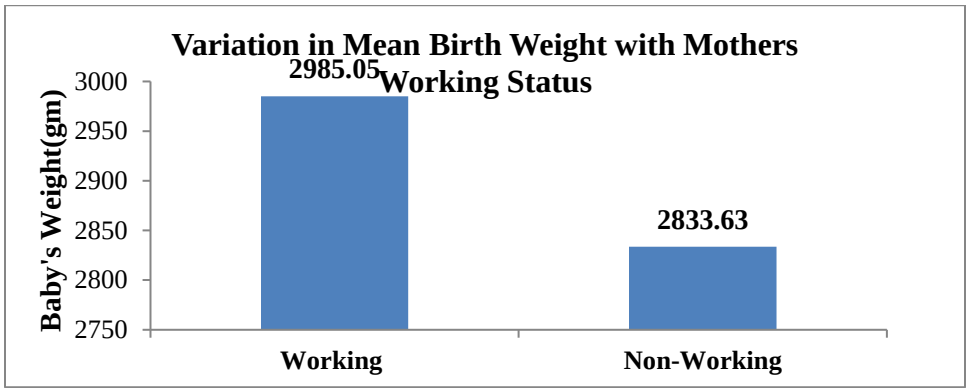

Figure 5: Variation in Mean Birth Weight with Family Income

The study reveals a significant difference in birth weights between non-working and working mothers, with working mothers having slightly higher birth weights. This highlights the importance of considering a mother's working status in maternal and infant health assessment and intervention planning.

Table 6: Descriptive statistics of weight of new born baby according to Days Iron Supplement Taken

Meal	Mean birth weight(gm)	S.D	Maximum	Minimum
Less than 3 Months	2758.23	501.23	4050	1234
More than 3 Months	2930.91	453.89	4000	1490

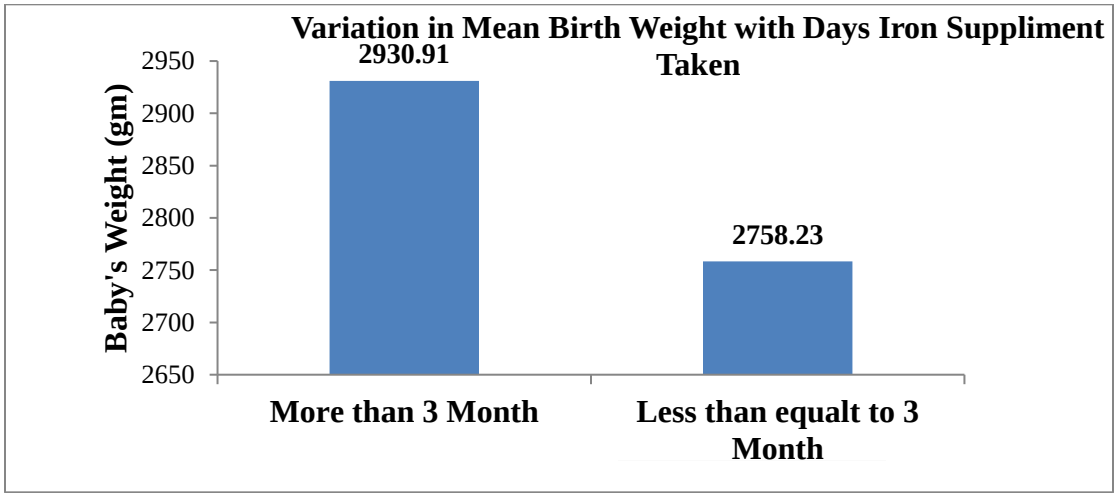

Figure 6: Variation in Mean Birth Weight with Days Iron Supplement Taken

The study reveals a difference in birth weights between newborns of mothers who started iron supplements before and after 3 months, with those starting later having slightly higher birth weights. This suggests a potential association between timing and birth weight outcomes.

Table 7: Descriptive statistics of weight of new born baby according to Awareness about ANC

Awareness about ANC	Mean birth weight(gm)	S.D	Maximum	Minimum
Yes	2924.98	464.23	4050	1490
No	2690.88	473.59	3716	1234

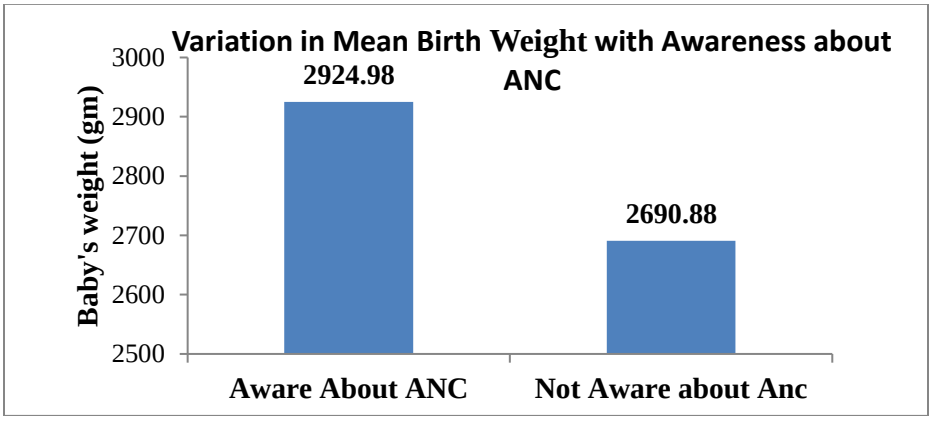

Figure 7: **Variation in Mean Birth Weight with Awareness about ANC**

Mothers aware of ANC services have a slightly higher birth weight, with a mean of 2924.98 grams, compared to those not aware of ANC services.

Table 8: Descriptive statistics of weight of new born baby according to Pregnancy Period

Pregnancy Period	Mean birth weight(gm)	S.D	Maximum	Minimum
40 Weeks	2980.18	428.15	4050	1745
Before 37 Weeks	2554.65	451.24	3490	1490
23 to 28 Weeks	1911.33	588.71	2300	1234

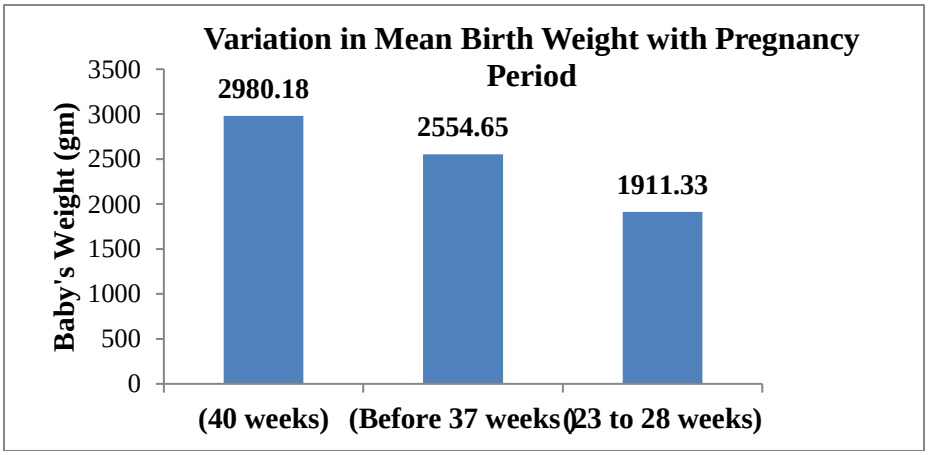

Figure 8: Variation in Mean Birth Weight with Pregnancy Period

The study reveals significant differences in mean birth weights based on pregnancy duration. Babies born after a full-term 40-week pregnancy have the highest mean weight, followed by those born before 37 weeks and those between 23 and 28 weeks. Variability is lower for babies after 40 weeks,

suggesting a more consistent range. However, babies between 23 and 28 weeks have the highest variability, possibly linked to increased risks of premature birth.

Table 9: Descriptive statistics of weight of new born baby according to Days Iron Supplement Taken

Mothers HB	Mean birth weight(gm)	S.D	Maximum	Minimum
Less than 11 gm	2877.5	468.87	4050	1234
More than 11 gm	2881.38	489.42	3800	1490

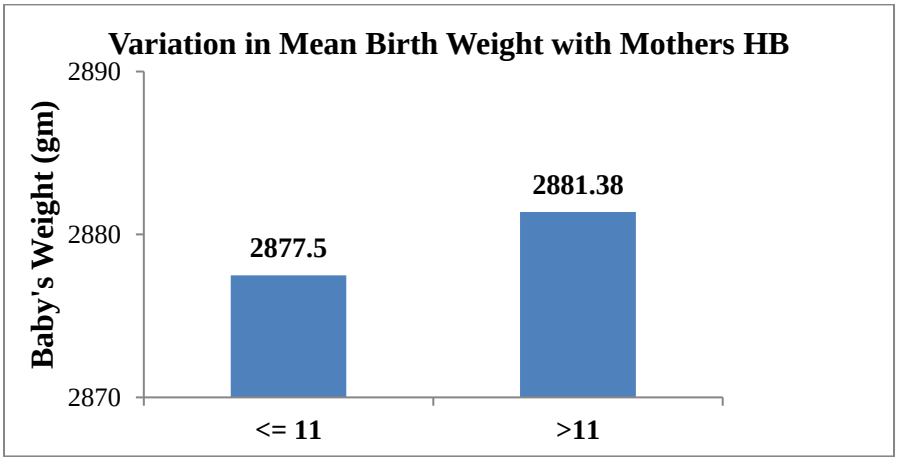

Figure 9: **Variation in Mean Birth Weight with Mothers HB**

The World Health Organization (WHO) states that a baby's birth weight is influenced by a mother's hemoglobin levels, as hemoglobin is an essential protein in red blood cells that carries oxygen to tissues and organs. Maternal anemia, characterized by low hemoglobin levels, can impact a baby's birth weight, with an average birth weight of 2877.5 grams.

Table 10: Descriptive statistics of weight of new born baby according to Sex of Baby

Sex of Baby	Mean birth weight(gm)	S.D	Maximum	Minimum
Male	2935.32	499.82	4000	1500
Female	2822.10	442.35	4050	1234

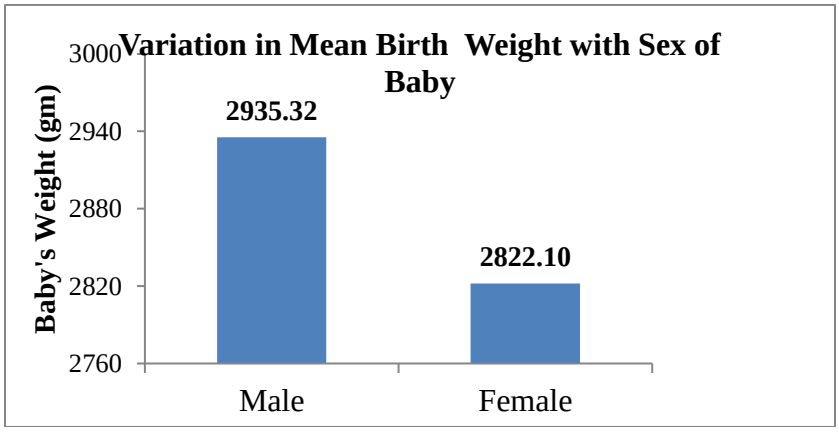

Figure 10: Variation in Mean Birth Weight with Sex of Baby

The World Health Organization (WHO) reports that male and female newborns typically weigh differently at birth, with male children weighing slightly more due to genetics and hormonal influences.

Table 11: Descriptive statistics of weight of new born baby according to Sex of Baby

Frequency of taken Nutritional Food	Mean birth weight(gm)	S.D	Maximum	Minimum
Daily	2906.04	470.12	4050	1490
Two Times in Week	2887.5	473.77	3900	1234
Weekly	2693.68	516.84	3800	2000
Very Rare	2535.38	332.84	3000	2000

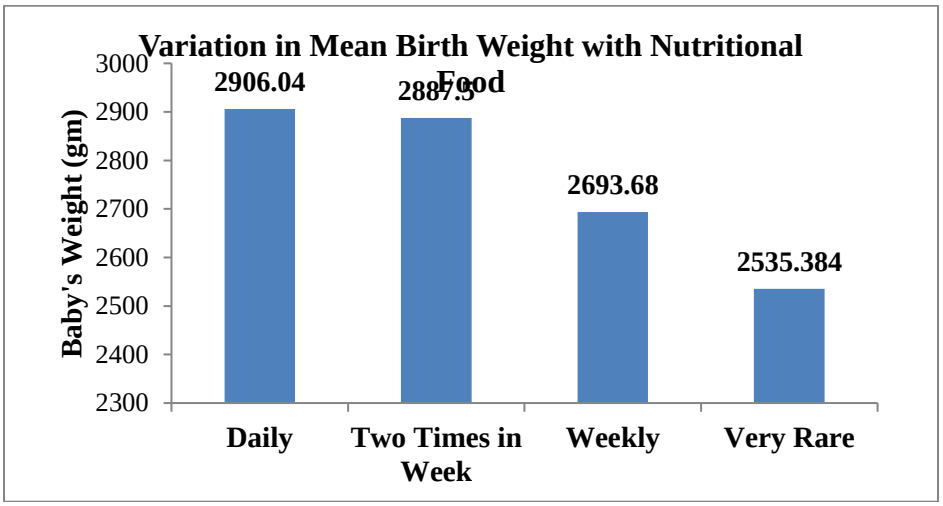

Figure 11: **Variation in Mean Birth Weight with Nutritional Food**

The study reveals a significant correlation between maternal dietary habits during pregnancy and newborn baby birth weight

Table 12: Descriptive statistics of weight of new born baby according to Sex of Baby

Type of Delivery	Mean birth weight(gm)	S.D	Maximum	Minimum
Normal	2807.78	453.53	4000	1234
Cesarean	2940.39	485.15	4050	1490

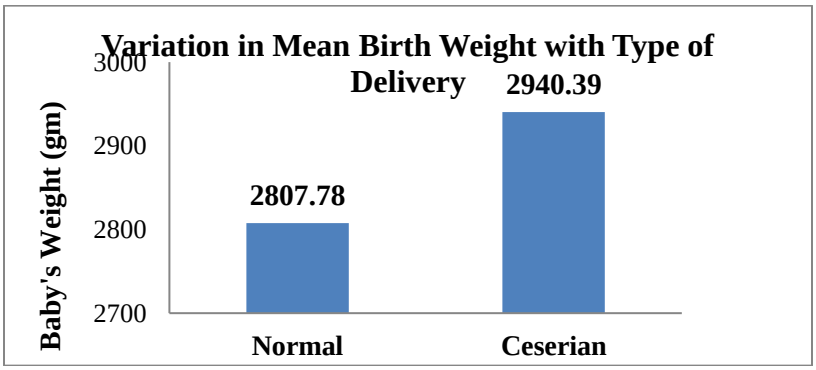

Figure 12: **Variation in Mean Birth Weight with Type of Delivery**

The data shows a significant difference in mean birth weight between normal and cesarean deliveries. Normal babies have a mean birth weight of 2807.78 grams, with a standard deviation of 453.53 grams. Cesarean babies have a higher mean birth weight of 2940.39 grams, with a standard deviation of 485.15 grams.

CHI SQUARE TEST FOR NEW BORN BABY WEIGHT

Null Hypothesis (H_0): There is no association between the new born baby weight and different categories.

Alternative Hypothesis (H_1): There is association between the new born baby weight and different categories.

Table 13: CHI-SQUARE TESTS OF INDEPENDENCE FOR BABY'S WEIGHT

	New Born Baby's Weight			χ^2 Cal	p-value
Selected Variables	Category	< = 2.5 kg	>2.5 kg		
Living Area	Rural	89	210	10.484	0.001204
	Urban	19	112		
Family Type	Joint	75	200	1.5816	0.2085
	Nuclear	33	122		
Gross Monthly Income	Below 5000	32	27	29.065	7e-08
	Greater than 5000	76	295		
Mother's Working Status	Non-Working	86	216	5.5063	0.01895
	Working	22	106		
Mother's Age at the marriage	<=18 years	57	108	11.856	0.0005748
	>18 years	51	204		
Vegetarian Only	No	87	246	0.58008	0.4463
	Yes	21	76		
Aware about ANC	No	35	50	13.484	0.0002406
	Yes	73	272		
Go For ANC	No	22	22	14.697	0.0001263
	Yes	86	300		
Media Exposure	No	36	47	17.045	3.65e-05
	Yes	72	275		
Pregnancy period	40 weeks	54	278	58.632	1.901e-14
	Before 37 weeks	54	44		
Mothers Weight Before Delivery	< 50	23	24	14.528	0.03965
	>=50	85	298		
Iron Supplement	<6 Month	62	220	3.7992	0.05128
	>= 6 Month	46	110		
Eating Vegetable and Milk	Daily and 2 times in Week	90	305	10.975	0.0009237
	Rarely	17	17		
Child Order	1	33	188	23.304	1.383e-06

	2 and more	74	134		

The p-value of 0.001204 is less than the common significance level of 0.05. The study found a significant association between newborn baby weight and living area, suggesting a difference in distribution between rural and urban areas. The p-value is 0.2085. It represents the probability of obtaining the observed results under the null hypothesis that there is no association between family type and the baby's weight. The usual significance threshold of 0.05 is substantially larger than the p-value of 0.00000007.

Table 14: PROPORTION TESTS FOR NEW BORN BABY WEIGHT

	New Born Baby's Weight			p-value For two tailed	p-value One tailed
Selected Variables	Category	< = 2.5 kg	>2.5 kg		
Living Area	Rural	89	210	0.001204	0.0006019
	Urban	19	112		
Gross Monthly Income	Below 5000	32	27	7e-08	3.5e-08
	Greater than 5000	76	295		
Mother's Working Status	Non-Working	86	216	0.01895	0.009474
	Working	22	106		
Mother's age at the marriage	<=18 years	57	108	0.0005748	0.0002874
	>18 years	51	204		
Aware about ANC	No	35	50	0.0002406	0.0001203
	Yes	73	272		
Go For ANC	No	22	22	0.0001263	6.313e-05
	Yes	86	300		
Pregnancy period	40 weeks	54	278	1.901e-14	9.503e-15 (right tailed)
	Before 37 weeks	54	44		
Mothers Weight Before Delivery	< 50	23	24	0.0001381	6.903e-05
	>=50	85	298		
Eating Vegetable and Milk	Daily and 2 times in Week	90	305		0.0004619 (right tailed)
	Rarely	17	17	0.0009237	
Child Order	1	33	188	2.243e-06	1.121e-06 (right tailed)
	2 and more	74	134		

After statistical analysis it concludes that p value for living area, gross monthly income, mother's age at the marriage, awareness about ANC, go for ANC, pregnancy period, mothers weight Before delivery, frequency of eating vegetable and milk, child order all have proportional to baby's weight. In urban areas, a larger proportion of newborns tend to have a higher birth weight when compared to those born in rural areas.

RESULTS AND DISCUSSION:

Daily nutritional intake leads to a significantly higher birth weight of approximately 2906 grams, while only twice a week or once a week results in a slightly lower birth weight. The most significant difference is observed in mothers who consume nutritional food rarely, indicating the importance of consistent and adequate nutrition during pregnancy. A smaller proportion of birth weight is observed in the group with a monthly income of less than 5000, while a larger proportion is found in the group with an income greater than 5000. Mothers who are aware of and receive ANC (Antenatal Care) contribute to a significantly larger proportion of healthy birth weights for newborn babies compared to mothers who lack awareness and do not receive ANC. The test suggests that there is a significant association between ANC taken and baby weight. Similarly media exposure, pregnancy period, mother's weight before delivery, Iron supplement taken, frequently eating vegetable and milk, child order are all have significantly associated with new born baby's weight. . From proportion test we could conclude that Proportion of baby's weight is higher in urban area than rural area. The proportion of birth weight increases in the group of mothers whose pregnancy period is ideal, in contrast to those with preterm births. Indeed, if a mother's weight is higher, it often corresponds to a larger proportion of birth weight, as indicated by the data. Mothers who regularly consume fresh foods, vegetables, and fruits during the week tend to have a larger proportion of their baby's weight compared to mothers who infrequently consume these items. Babies born to primigravida mothers typically have a higher birth weight than those born to mothers who are experiencing their second or third delivery. The birth weight of children in families with monthly income above Rs 5000 is higher than that of families with monthly income below Rs 5000.Proportion of birth weight is higher in the children whose mother is in working as compare to non working mother. Mother's who are aware about ANC has large birth weight of her baby.

CONCLUSION

The data suggests that family structure may influence birth weight outcomes, possibly due to differences in dynamics, resources, or healthcare access. access. This diversity in birth weight outcomes is crucial for assessing maternal and infant health and planning interventions to support families in different family structures. This highlights the importance of considering living environment and healthcare infrastructure in assessing maternal and infant health, and suggests targeted interventions for rural areas.

Therefore, we would typically conclude that there is no statistically significant association between dietary choices (both vegetarian non-vegetarian and vegetarian only) and the outcome being studied. P-value for awareness about ANC indicates that there is a strong and significant association between a women's awareness about ANC and the weight of baby. The p-value of 0.0005748 is much smaller than the common significance level of 0.05. Therefore, we would conclude that baby's weight is a highly statistically significant with mother's age. The p-value of 0.4463 is much greater than the common significance level of 0.05. We would thus generally draw the conclusion that there is a statistically significant correlation between employment status and infant weight. As a result, we would draw the conclusion that there is a very strong statistical correlation between gross monthly income and infant weight. The p-value of 0.01895 is less than the usual 0.05 criterion of significance. Similarly pregnancy period, mother's weight before delivery, iron supplement, eating vegetable and milk are significant variable for baby's birth weight.

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