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Analysis of Maternal and Obstetric Factors Affecting Birth Weight of Newborn: A Hospital-Based Cross-Sectional Study

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ABSTRACT

Background and aim: Birth weight is an important child and maternal health indicator. Various maternal and obstetric factors are responsible for determining birth weight. If the birth weight of the newborn baby is less than 2,500 gm, the baby is considered a low birth weight (LBW) baby irrespective of the gestational age. The present study was conducted to determine the proportion of low birth weight babies among babies born at tertiary care hospitals and the association between maternal and obstetric factors and birth weight.

Material and Methods: The present cross-sectional study was conducted from Sept. 2021 to Oct. 2021 among 350 mothers admitted to the postnatal ward after delivery and fulfilled the inclusion criteria. Descriptive statistics and the Chi-square test were applied for analysis.

Results: In the present study, the proportion of LBW was 27.7%. In preterm (< 37 weeks) deliveries proportion of LBW was 64.4%. There was a significant association between low birth weight with gestational age, Iron and Folic Acid and calcium intake, Antenatal care visit, and birth interval. Association of low birth weight with the gender of the child, mode of delivery, maternal age, the height of the mother, maternal age at marriage, and parity was not significant.

Conclusions: Antenatal care (ANC) visit, iron and folic acid (IFA) and calcium intake, gestational age, and birth interval were important factors associated with low birth weight.

1. Introduction

Birth weight is an important factor that predicts a newborn baby's chances for survival and mental and physical development in later life. The process of healthy life starts in the womb of the mother. Mothers require good nutrition and rest, adequate antenatal care, and a clean environment to grow a healthy baby. During pregnancy, these simple steps can help prevent low birth weight and keep babies alive and growing.^[1] If the weight of the newborn baby recorded just after birth is less than 2,500 gm, irrespective of the gestational age, then the baby is considered a low birth weight (LBW) baby. (WHO, 1992)^[2] Low birth weight is closely related to fetal and neonatal mortality and morbidity, mental and physical development, and chronic diseases later in life.^[3] Babies born with LBW are more likely to have health problems and slower development from immediately after birth to later in life.^[4] The LBW is the outcome of either preterm (<37 weeks of gestation) delivery or intrauterine growth retardation (IUGR) or both.^[5] Besides this, many factors such as maternal biological factors, obstetric history, antenatal care during pregnancy, nutritional status, co-morbidity, and demographic and socio-economic factors influence birth weight. Early recognition of risk factors and

their management will reduce the incidence of low birth weight.^[6] The present study was planned to determine the proportion of LBW among newborn babies at a tertiary care hospital and find the association of various maternal and obstetric factors with low birth weight.

2. Material and methods

The present hospital-based cross-sectional study was conducted at a tertiary care hospital in the south-Central part of the Saurashtra Peninsula, Gujarat, India. The period of study was Sept. 2021 to Oct. 2021.

Ethics approval

The study was approved by the tertiary care hospital in the south-Central part of the Saurashtra Peninsula ethics research committee at the authors' affiliated institution. Consent was obtained from all participants after they were notified about the study objectives and confidentiality of the responses in the introduction section of the questionnaire.

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Study population

The mothers who delivered at the tertiary care hospital during the study period were ready to participate in the study with the newborns.

Inclusion Criteria

- Mothers with live-birth babies.
- Mothers with singleton babies.
- Mothers who give consent to participate in the study.

Exclusion Criteria

- Mothers with twin delivery.
- Mothers with stillbirth.

Sample Size

A study by Mallick A.7 showed a 17 % prevalence of low birth weight in India. The sample size was calculated by taking $p=17\%$, an absolute error of 4 %, and using the formula $n = Z^2pq / d^2$. The sample size comes out to be 338, rounded off to 350. The purpose of the study was explained, and informed verbal consent was obtained from mothers before the interview. Pretested semi-structured questionnaire was used to collect information from mothers admitted to the Post-partum ward. Case papers and available health

records were also reviewed to collect the required information. Study variables included in the study were birth weight and sex of baby, mode of delivery, mother's current age, age at the time of marriage, mother's height, ANC visit, Calcium-IFA supplements consumption, gestational age, parity, and birth interval. Babies with a birth weight of less than 2500 grams were considered low birth weight babies irrespective of gestational age. Prior ethical clearance was taken from the institutional ethics committee.

Statistical analysis

Collected data were entered in MS office Excel 2010 format. Data analysis was carried out using version 21.0 of SPSS, and the results were presented in tables and diagrams. The proportion was used to summarize categorical data, and the Chi-square test was applied to find an association between variables. The p-value of less than 0.05 is statistically significant with a confidence level of 95 %.

3. Results

In the present study, the proportion of LBW was 27.7% (Fig. 1). All newborns' mean birth weight was 2713 ± 433 gm, ranging from 1490 gm to 4200 gm. The mean birth weight of LBW babies was 2223 ± 236 grams and of NBW babies was 2901 ± 332 grams.

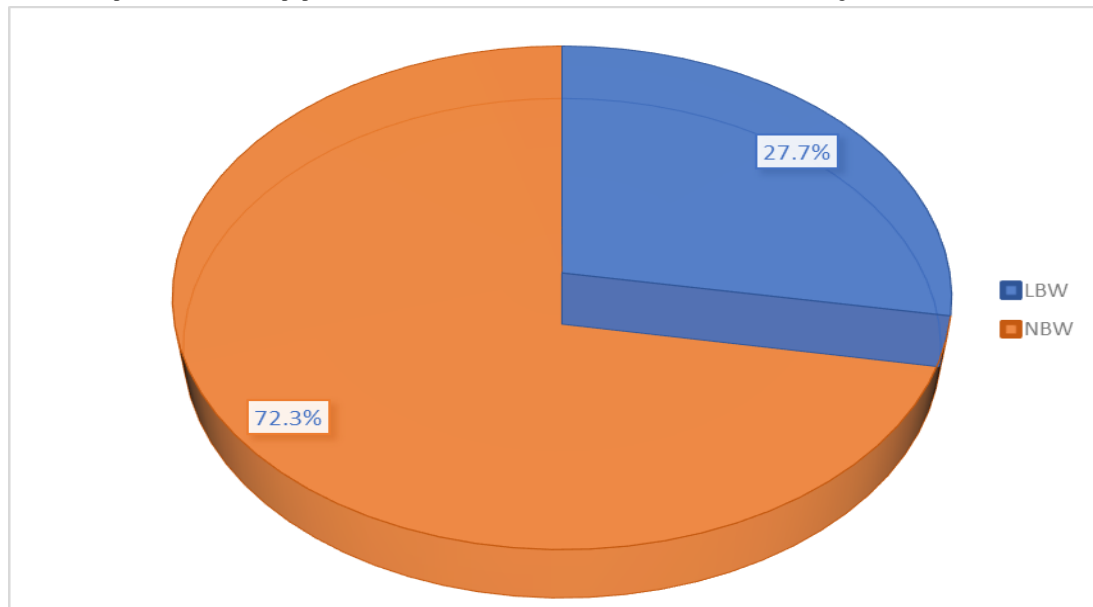


Fig. 1. Pie diagram showing the proportion of low birth weight (n=350).

Table 1 shows that among 350 babies, 174 (49.7%) were baby boys, and 176 (50.3%) were baby girls. The proportion of low birth weight in male babies was 25.9% and in female babies was 29.5%. Out of 350, 212 (60.6%) newborns were delivered by normal vaginal delivery and 138 (39.4%)

newborns by cesarean section. The percentage of low birth weight in normal vaginal delivery was 31.1%. There was no statistically significant association of low birth weight with the sex of the newborn ($p=0.441$) and mode of delivery ($p=0.077$).

Table 1. Association of low birth weight with the gender of baby and mode of delivery (n=350).

Variable	Total (no.)	Birth weight		Chi-square	P-value
		LBW no. (%)	NBW no. (%)		
Gender of newborn					
Male	174	45(25.9%)	129(74.1%)	0.593	0.441

Female	176	52(29.5%)	124(70.5%)		
Mode of delivery					
Normal vaginal delivery	212	66(31.1%)	146(68.9%)	3.135	0.077
Cesarean section	138	31(22.5%)	107(77.5%)		

Table 2 shows the association of low birth weight with maternal age, marriage age, and mother height. Maternal age ranged from 19 years to 38 years. The mean age of mothers at delivery was 24.5 years. Most mothers (53.1 %) were from age 21 to 25 years old. The percentage of low birth weight was 33.3% among mothers of age ≤ 20 years and 18.2 % among mothers of age > 30 years. It shows that the proportion of LBW decreased when the age

of mothers increased. The percentage of low birth weight was 35.7% among women married at age < 18 years and 26.6% among women married at age ≥ 18 years. About 42.9% of mothers with a height < 145 cm gave birth to LBW babies. In the present study, no statistically significant association was found between low birth weight with maternal age at delivery ($p=0.159$), maternal age at marriage ($p=0.327$), and height of mother ($p=0.062$).

Table 2. Association of low birth weight with maternal age, age at marriage, and maternal height (n= 350).

Variable	Total (no.)	Birth weight		Chi-square	P-value
		LBW no. (%)	NBW no. (%)		
Mother's age at the time of current delivery (in years)					
≤ 20 years	51	17(33.3%)	34(67.7%)	5.181	0.159
21-25 years	186	58(31.2%)	128(68.8%)		
26-30 years	91	18(19.8%)	73(80.2%)		
> 30 years	22	4(18.2%)	18(81.8%)		
Age at Marriage					
< 18 years	41	14(34.1%)	27(65.9%)	0.959	0.327
≥ 18 years	309	83(26.9%)	226(73.1%)		
Maternal height (in cm)					
< 145 cm	28	12(42.9%)	16(57.1%)	3.484	0.062
≥ 145 cm	322	85(26.4%)	237(73.6%)		

Table 3 shows that the proportion of low birth weight was 54.9% among the mothers who either did not consume or consumed IFA and calcium tablets for < 100 days during pregnancy, while 18.1 % among the mothers who took IFA and calcium tablets for > 100 days. Non-consumption of IFA and calcium tablets increase the risk of low birth weight. There was a highly significant association between IFA-calcium consumption and low birth weight

($p=0.000$). We found that 32.8% of mothers with < 4 ANC visits delivered low birth weight babies. The proportion of LBW was 11% among mothers with ≥ 4 ANC visits. More no. of ANC visits decrease the chances of giving birth to a low-birth-weight baby. There was a highly significant association between no. of ANC visits and low birth weight ($p = 0.000$).

Table 3. Association of low birth weight with IFA and Calcium supplements intake and ANC visits (n=350).

Variable	Total (no.)	Birth weight		Chi-square	P-value
		LBW no. (%)	NBW no. (%)		
IFA and calcium supplements intake (in days)					
< 100 days	91	50(54.9%)	41(45.1%)	45.517	0.000
> 100 days	259	47(18.1%)	212(89.1%)		

No. of ANC visits					
< 4	268	88 (32.8%)	180 (67.2%)	14.977	0.000
≥ 4	82	9 (11%)	73 (89%)		

Table 4 shows that the percentage of low birth weight babies was 64.4 % in preterm deliveries and 4.7% in term deliveries. There was a highly significant association between gestational age and low birth weight ($p = 0.000$). In the present study, the proportion of LBW was 30.1% among primiparous mothers and 25.5% among multiparous mothers. There was no

statistically significant association between parity and low birth weight. The proportion of LBW was 45.8 % when the birth interval was < 2 years and 17% when the birth interval was > 3 years. The difference was statistically significant ($p=0.029$).

Table 4. Association of low birth weight with Gestational age, parity (n=350), and birth interval (n=175)*.

Variable	Total (no.)	Birth weight		Chi-square	P-value
		LBW no. (%)	NBW no. (%)		
Gestational age					
Preterm (< 37 weeks)	135	87(64.4%)	48(35.6%)	147.997	0.000
Term (≥ 37 weeks)	215	10(4.7%)	205(95.3%)		
Parity					
Primipara	166	50(30.1%)	116(69.9%)	0.913	0.339
Multipara	184	47(25.5%)	137(74.5%)		
Birth Interval					
<2 years	24	11(45.8%)	13(54.2%)	7.104	0.029
2-3 years	98	26 (26.5%)	72 (73.5%)		
>3 years	53	9(17%)	44(83%)		

Note: -* Only Multiparous mothers who delivered a live-born baby in a previous pregnancy were included.

4. Discussion

In the present study, out of 350 live births, 97 (27.7%) babies were born with low birth weight. A study by Gogoi N et al.^[8] reported a 26 % proportion of low birth weight. Dasgupta A et al.^[9] showed 27.3%, and Sarika M et al.^[10] found a 26.9% proportion of low birth weight in their studies. We found a 25.9% LBW proportion among male babies and 29.5% among female babies. There was no significant association between the gender of the baby and birth weight. Similarly, a study by Choudhary A K et al.^[11] showed a 34.7% LBW proportion among male babies and 37.7% among female babies. Bhattacharjya H et al.^[12] observed 24.3% LBW among male babies and 23.5% among female babies. These studies also did not find a significant association between the gender of newborns and low birth weight. In our study, the proportion of LBW was high (33.3%) among mothers of age group ≤ 20 years, with no statistically significant association between maternal age and birth weight. A study by Aproova M S et al.^[6] found a higher (44.4%) LBW proportion among mothers of age ≤ 19 years compared to 20 % among mothers of age ≥ 30 years. In the present study, we found a 31.1% LBW proportion among mothers who delivered by normal vaginal delivery. In cesarean section mode, 22.5% of mothers delivered LBW babies. Bhattacharjya H et al.^[12] in their study, found 32.8 % LBW among vaginal deliveries and 17.2 % among cesarean deliveries. Of mothers who married at

age <18 years, 35.7 % delivered LBW babies. The proportion of LBW was 26.6% when mothers married at age ≥ 18 years. There was no significant association between mothers' age at marriage and low birth weight. Similarly, a study conducted by Bansal P et al.^[13] showed a 30.4 % and 21.3 % LBW proportion among mothers married at age < 18 years and ≥ 18 years, respectively, with no significant association between mothers' age at marriage and low birth weight. In the present study, the proportion of LBW was 42.9 % among mothers with height < 145 cm and 26.4% among mothers with height ≥ 145 cm. There was no significant association between maternal height and birth weight. Similarly, studies by Choudhary A K et al.,^[11] Jain S et al.,^[14] and Deka A et al.^[15] observed 37.5 %, 42.1%, and 54.5% LBW proportion respectively among mothers of height < 145 cm in their studies. The present study reported that 54.9% of mothers who consumed IFA and calcium tablets for < 100 days delivered LBW babies. Narain S et al.^[16] showed a 39 % LBW proportion among mothers who did not-consumed IFA and calcium. We found a 32.8 % LBW proportion among mothers who made < 4 ANC visits during pregnancy. The LBW proportion was 11% among mothers who had 4 or more ANC visits. The proportion of LBW decreased when mothers took more ANC care visits during pregnancy. There was a highly significant association between ANC visits and birth weight ($p=0.000$).

Gogoi N et al.^[8] observed a 23.4 % LBW proportion among mothers who made 4 or more ANC visits. A study by Toshniwal et al.^[17] observed an 83 % LBW proportion among mothers who made irregular ANC visits. Joshi H S et al.^[18] found a 61.7 % LBW proportion among mothers who did not receive antenatal care during pregnancy. In this study, 64.4% of the preterm babies were low birth weight. Association between gestational age and low birth weight was highly significant ($p=0.000$). Similarly, Jain S et al.^[14] also showed a 62.5 % LBW proportion among preterm deliveries. Bansal P et al.^[13] showed a 60.9 % LBW proportion among preterm deliveries. In our study, the proportion of LBW among primiparous mothers was 30.1%, and 22.5 % of multiparous mothers delivered LBW babies. There was no significant association between parity and low birth weight. Choudhary A K et al.^[11] showed a 35.4 % LBW proportion among primiparous mothers. The proportion of LBW was 45.8% when the interval between two deliveries was < 2 years and 17 % when the birth interval was > 3 years. The difference was highly significant. Studies by Gogoi N et al.^[8] and Joshi H S et al.^[18] showed that the LBW proportion was 18.3 % and 19.57 %, respectively, when the birth interval was ≥ 3 years.

5. Conclusion

In the present study, the chances of low birth weight increase in preterm deliveries. We also find that a mother who had consumed IFA and calcium supplements for less than 100 days, a mother who had < 4 ANC visits, and a mother who had < 2 years of the interval between two births had more chances of a low-birth-weight baby. There was a highly significant association of low birth weight with gestational age, IFA and calcium intake, ANC visit, and birth interval. We need to emphasize birth spacing, providing adequate antenatal visits and care, and consuming IFA & calcium supplements for more than 3 months.

Conflict of Interest

The authors declared that there is no conflict of interest.

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