Research Article

An epidemiological study on sociodemographic and antenatal factors associated with low birth weight in a tertiary care hospital of Kolkata, West Bengal

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ABSTRACT

Background: Birth weight is a critical determinant of child survival and growth and a valuable indicator of maternal health, nutrition, and quality of life. Antenatal care (ANC) provides an array of available medical, nutritional, and educational interventions intended to reduce the incidence of low birth weight (LBW). **Objective:** This study was done to find out the sociodemographic and antenatal factors associated with LBW among babies delivered in a tertiary care health facility in Kolkata. **Materials and Methods:** It was a cross-sectional institution based observational study conducted from November 2016 to October 2018 among 410 postnatal mothers in the postnatal ward of the Department of Obstetrics and Gynaecology, Medical College, Kolkata, West Bengal. Data were obtained by interview method along with record analysis (medical and hospital records). Dependent variable was LBW (<2.5 kg). Ethical clearance was obtained from Local Ethics Committee of All India Institute of Hygiene and Public Health Kolkata and Medical College, Kolkata. **Results:** Out of 410 babies, 112 (27.3%) were LBW. Out of 112 LBW babies, 59 (52.7%) were preterm (<37 weeks); 51(45.5%) were term (37–42 weeks), and 2 (1.8%) were post-term (>42 weeks). Multi-variable logistic regression showed LBW to be significantly associated with poor economic status (below middle class), mothers who belonged to nuclear family, delayed registration (≥12 weeks), anemia in pregnancy, pregnancy-induced hypertension, gestational diabetes mellitus, weight gain in kg less than normal (i.e., below 9 kg), and poor consumption of specific nutritional supplements. **Conclusion:** Poor economic status and inadequate ANC continue to remain the most important factors for LBW. A good quality ANC package will ensure prevention of LBW babies.

KEY WORDS: Low Birth Weight; Preterm Baby; Small for Date Baby; Antenatal Care

INTRODUCTON

Birth weight is not only a critical determinant of child survival, growth, and development but also a valuable indicator of maternal health, nutrition, and quality of life.[1] Thus, survival chances of a new-born are directly proportional to the birth weight (lower the birth weight, lower the chances of survival, and vice versa). Birth weight reflects the health status of the mother during adolescence and pregnancy and also quality of antenatal care (ANC).[2] It helps in detecting babies born with high risk of mortality hence requiring special care immediately after birth.

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Overall, it is estimated that 15–20% of all births worldwide are low birth weight (LBW), representing more than 20 million births a year.[3] LBW is a global problem, particularly in developing countries. The goal is to achieve a 30% reduction in the number of infants born with a weight lower than 2500 g

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by the year 2025.[4] LBW is the strongest determinant of infant morbidity and mortality in India. National family health survey-3 mentions that among children for whose birth weight were reported, 22% suffered from LBW, this being slightly higher in rural areas (23%) than in urban areas (19%).[5] Nearly 40% of all LBW babies in the developing world are born in India.[6]

According to the World Health Organization, a newborn is said to have LBW if it weighs <2500 g within 1 hour of birth, irrespective of the gestational age.[7] Very LBW infants weigh 1500 g or less and extremely LBW infants weigh 1000 g or less.[8]

A LBW baby may be either preterm or small for date baby (SFD baby). Preterm baby is one, born after 28 completed weeks and before 37 completed weeks of gestation regardless of birth weight. This comprises 30% of all LBWs in India. If care is taken, such a child will catch up the growth and will be normal within 2 years.[9] SFD baby is a new-born with a birth weight below the 10th percentile, who is smaller and lighter than what it should have been for that pregnancy period due to failure in the intrauterine growth. The baby may be born preterm, term, or after full term. This comprises 70% of all LBWs in India.[9]

Social causes are poverty, illiteracy, ignorance, poor standard of living, lack of knowledge on family planning, early marriages, passive smoking, strenuous work during pregnancy, etc. LBW has a strong positive correlation between both preterm birth, intrauterine growth restriction, and low socio-economic status which shows that families of low socio-economic status have higher rates of maternal undernutrition, anemia, and illness; inadequate prenatal care; drug misuse; obstetric complications; and maternal history of reproductive inefficiency (abortions, stillbirths, premature or LBW infants).[10]

Poor ANC has long been endorsed as a means to identify mothers at risk of delivering a preterm or growth-retarded infant. Proper ANC provides an array of available medical, nutritional, and educational interventions intended to reduce the incidence of LBW. These include early registration of pregnancy, at least four antenatal visits to a health facility covering the entire period of pregnancy, thorough antenatal check-up including measurement of blood pressure, weight gain in kg, and laboratory investigations, for example, Hb%, postprandial blood sugar, tetanus toxoid immunization, and consumption of specific nutritional supplements, for example, iron-folic acid (IFA), calcium, and Vitamin D_3 tablets during pregnancy.

LBW is a major public health problem caused by factors that are potentially modifiable. The health of the child is closely related to the mother's health; we will get a healthy child only when the mother is healthy. Therefore, identification of maternal risk factors associated with LBW is essential to guide program planning and organizing care for mothers and their newborns. With this backdrop, the study was planned and undertaken to find out the sociodemographic and antenatal factors associated with LBW among babies delivered in a tertiary care health facility in Kolkata.

MATERIALS AND METHODS

This was a cross-sectional institution based observational study conducted from November 2016 to October 2018 in the postnatal ward of the Department of Obstetrics and Gynaecology, Medical College, Kolkata, West Bengal. Ethical clearance was obtained from the Local Ethics Committee of All India Institute of Hygiene and Public Health Kolkata and Medical College, Kolkata. The study population included all the mothers who delivered babies during the period of data collection from May 2017 to April 2018 (total = 12,337) except sick postnatal mothers and those mothers who did not give their written informed consent to participate were excluded from the study.

Sample size calculation was based on LBW proportion of 33.6%[11] using standard formula: $N = (Z_{\alpha/2})^2 pq/L^2$ as 343. Taking a 20% non-response, the total sample size was 412. Out of 12,337 mothers who delivered during our study period, 412 mothers were selected by "simple random sampling" with the help of random numbers generated by R-software. During the study, two mothers did not give consent to be included in the study. Hence, our final sample size was 410.

A predesigned and pre-tested structured schedule was used to collect data regarding sociodemographic, economic, and antenatal characteristics of the mother by interview method along with record analysis (medical and hospital records) of mothers. The dependent variable in this study was LBW and independent variables were:

1. Sociodemographic and economic characteristics of mother: Current age in completed years, religion (Hindu/Muslim/Others), caste (ST/SC/OBC/General), residence (Rural/Urban), marital status (Married/Widow/Divorced), type of family (Nuclear/Joint), predominant stay during antenatal period (Parental Home/In-laws Home), education (Illiterate/Primary/Middle/Secondary/Higher-secondary), and occupation and per capita income (modified BG Prasad Scale – January 2017).[12]
2. Antenatal characteristics of mother: Time of registration, total number of antenatal visits, place of first antenatal visit (Government/Private), anemia in pregnancy (Present/Absent), pregnancy-induced hypertension (Gestational hypertension/Pre-eclampsia/Eclampsia), gestational diabetes mellitus, weight gain, consumption of IFA, calcium and Vitamin D_3 tablets, consumption of IFA tablets-adequate (≥100 tablets) and inadequate (<100 tablets), adequate consumption (Score 0), inadequate consumption (Score 1); consumption of calcium and Vitamin D_3 tablets-adequate (≥100 tablets) and inadequate (<100 tablets), adequate consumption

(Score 0), Inadequate consumption (Score 1); specific nutritional supplements-this variable was computed by adding consumption of IFA, and calcium and Vitamin D_3 tablets (minimum attainable score = 0 and maximum attainable score = 2).

Statistical Package for the Social Sciences version 16[13] was used for the analysis of data. Measures of central tendency and dispersion were used to summarize numerical data and proportions to summarize categorical variables. Association of different sociodemographic, economic, and antenatal characteristics of the mothers on birth weight of babies was elicited by bivariate and multivariable binomial logistic regression. Odds ratio with 95% confidence interval was computed. Explanatory variables found to be statistically significant ($P < 0.05$) in bivariate logistic regression were entered into multivariable logistic regression.

RESULTS

Table 1 shows that the mean birth weight was 2.56 kg (± standard deviation = 0.67) and mean gestational age was 38.39 weeks in the study. Among 410 babies, 225 (54.9%) were baby boys and 185 (45.1%) were baby girls. The proportion of LBW was 27.3%. Out of 112 LBW babies, 59 (52.7%) were pre-term (<37 weeks); 51 (45.5%) were term (37–42 weeks), and 2 (1.8%) were post-term (>42 weeks).

Majority of the mothers in the study were married (98.0%), homemaker (90.5%), Hindu (80.7%), general caste (68.5%) belonging to the nuclear family (68.5%), and residing in rural areas (59.3%). Maximum mothers were in the age group of 21–25 years (63.7%) with education up to secondary level (59.0%) belonging to socioeconomic Class II–IV (98.8%). Among the mothers, 32.2% were illiterate.

Table 2 shows the association of LBW with different factors, i.e., Current age of mothers ≤20 years, backward caste, type of family (nuclear), education (below middle), economic status (below middle class), time of registration (≥12 weeks), total number of ANC visits <4, anemia in pregnancy, pregnancy-induced hypertension, gestational diabetes mellitus, weight gain in kg less than normal, and consumption of specific nutritional supplements. The factors that were found to be significant in univariate logistic regression were put into multivariable logistic regression.

In multivariable logistic regression, LBW was found to be significantly associated with economic status (below middle class), time of registration ≥12 weeks, anemia in pregnancy, pregnancy-induced hypertension, gestational diabetes mellitus, and weight gain in kg less than normal, i.e., below 9 kg, mothers who belonged to nuclear family and those who consumed specific nutritional supplements were protected against having LBW babies.

Table 1: Distribution of newborn babies according to their birth weight (*n*=410)*

Birth weight (kg)	Number	Percentage	Mean, SD, range, median, IQR
Normal (≥2.5)	298	72.7	2.56, ±0.67, 3.6 (0.7–4.3)
(2.5–3.5)	289	70.5	
(3.6–4.6)	9	2.2	
Low (<2.5)	112	27.3	2.70 (2.30–3.00)
(>1.5–2.499)	62	15.1	
Very low (1.1–1.5)	32	7.8	
Extremely low (≤1.0)	18	4.4	

*It included two pairs of twins, among which one of each pair survived.
SD: Standard deviation

DISCUSSION

The present study observed the proportion of LBW as 27.3%. A similar figure was also observed by Bhue *et al*.,[14], Varahala *et al*.[15], and Patale *et al*.,[16] as all these studies were conducted in tertiary health care centers like the current study.

This study found that out of 112 LBW babies, 59 (47.6%) were preterm (<37 weeks); study done by Dayanithi[17] found that the period of gestation of mothers <37 weeks was 25.6%. Dubey *et al*.[18] found that 37.4% of mothers had their period of gestation <37 weeks.

Our study found that mothers who belonged to the nuclear family were protected against having LBW babies which were similar to the study conducted by Kumar *et al*.,[19] a community-based study in a rural area.

In this study, LBW was found to be significantly associated with economic status (below middle class), similar results were seen in studies done by Bhue *et al*.,[14] Patale *et al*.,[16] and Bendhari and Haralkar,[20] as the study settings were the same as the current study.

There was significant association between time of registration ≥12 weeks and LBW. Similar results were seen in studies done by Sunilbala and Singh[21] ($\chi^2 = 227.25$, df = 1, $P < 0.001$) and Bendhari *et al*.,[20] (odds ratio [OR] = 2.03, 95% confidence interval [CI] = 1.34–3.07, $P = 0.0006$).

There was significant association between anemia in pregnancy and LBW. Similar findings were seen in studies done by Dubey *et al*.[18] ($\chi^2 = 39.54$, $P < 0.001$), Kumar *et al*.,[22] ($\chi^2 = 94.28$, df = 1, $P < 0.001$), Agarwal *et al*.[23], Raghunath *et al*.,[24], Sumana *et al*.[25] ($\chi^2 = 51.2$, df = 3, $P < 0.001$), and Kotabal *et al*.,[26] (OR = 8.36, CI = 3.55–19.66, $P < 0.001$). It is recommended that greater efforts should be made to increase the hemoglobin level by regular supplementation of iron and also by dietary modification.

Table 2: Association of LBW with various determinants: Logistic regression (univariate and multivariable) (*n*=410)

Characteristics	Total	LBW *n* (%)	OR (95% CI)	*P*-value	AOR (95% CI)	*P*-value
Current age (years)						
≤20	89	38 (42.7)	2.48 (1.51, 4.07)	<0.001	1.97 (0.99, 3.90)	0.052
>20	321	74 (23.1)	1		1	
Caste						
Backward (ST, SC, OBC)	129	46 (35.7)	1.80 (1.14, 2.84)	0.01	1.10 (0.57, 2.09)	0.375
General	281	66 (23.5)	1		1	
Type of family						
Nuclear	281	54 (19.2)	0.29 (0.18, 0.46)	<0.001	0.23 (0.12, 0.42)	<0.001
Joint	129	58 (44.9)	1		1	
Education						
Below middle	242	76 (31.4)	1.67 (1.06, 2.65)	0.02	1.17 (0.63, 2.17)	0.609
Middle and above	168	36 (21.4)	1		1	
Economic status						
Below middle class	211	80 (37.9)	3.18 (1.99, 5.09)	<0.001	2.73 (1.48, 5.01)	0.001
Middle class and above	199	32 (16.1)	1		1	
Time of registration						
<12 weeks	246	45 (18.3)	1		1	
≥12 weeks	164	67 (40.9)	3.08 (1.97, 4.83)	<0.001	3.06 (1.69, 5.51)	<0.001
Total no.of ANC visits						
<4	163	59 (36.2)	2.07 (1.33, 3.22)	0.001	1.34 (0.70, 2.57)	0.374
≥4	247	53 (21.5)	1		1	
Anemia in pregnancy						
Present	187	82 (43.8)	5.02 (3.10, 8.12)	<0.001	4.90 (2.66, 9.02)	<0.001
Absent	223	30 (13.4)	1		1	
Pregnancy-induced hypertension						
Present	40	23 (57.5)	4.27 (2.18, 8.35)	<0.001	2.95 (1.19, 7.34)	0.020
Absent	370	89 (24.1)	1		1	
Gestational diabetes mellitus						
Present	25	12 (48.0)	2.63 (1.16, 5.95)	0.02	5.85 (1.97, 17.41)	0.001
Absent	385	100 (26.0)	1		1	
Weight gain (in kg)						
Normal (9–11)	291	49 (16.8)	1		1	
Less than normal (<9)	119	63 (52.9)	5.55 (3.46, 8.91)	<0.001	2.72 (1.40, 5.29)	0.003
Specific nutritional supplements (↓)	-	-	0.35 (0.24, 0.50)	<0.001	0.40 (0.24, 0.67)	0.001

ANC: Antenatal care, CI: Confidence interval, AOR: Adjusted odds ratio, OR: Odds ratio, LBW: Low birth weight

The present study observed significant association between pregnancy-induced hypertension and LBW. Similar findings were seen in studies done by Varahala *et al*.[15] (χ^2 = 5.19, P = 0.02), Kumar *et al*.[22] (χ^2 = 54.93, df = 1, P < 0.001), and Bendhari *et al*.[20] (OR = 2.87, 95% CI = 1.5–5.5, P = 0.0009).

This study showed a significant association between gestational diabetes mellitus and LBW. Similar study showing association between LBW and gestational diabetes in mothers was not found in literature search. Hence, it could not be compared with.

Significant association was observed between weight gain in pregnancy less than normal and LBW. Similar findings were seen in studies done by Dubey *et al*.[18] (χ^2 = 15.11, P < 0.001), Kumar *et al*.[22] (χ^2 = 54.93, df = 1, P < 0.001), and Kotabal *et al*.[26] (OR = 41.32, CI = 5.17, 330.04, P < 0.001).

Our study also showed that mothers who consumed adequate IFA tablets during pregnancy were protected against having LBW babies. Similar results were seen in a study done by Dubey *et al*.[18] where there was a statistical significant association between consumption of IFA tablets <100 by mothers during pregnancy and LBW (χ^2 = 8.02, P < 0.004).

Strength

Efficient sampling design made the study representative of all mothers delivered in the said institution in past 1 year.

Limitations

In the study, there was a 1 time measurement of exposure and outcome, hence temporal association between LBW and antenatal factors could not be established, being an institution based study the results cannot be used for a community, and it was susceptible to biases, for example, responder bias, recall bias, interviewer bias, social acceptability bias, and selection bias.

CONCLUSION

Birth weight is the first weight of fetus or newborn obtained just after birth. It is the single most important determinant for survival, growth, and development of the infant. It reflects the health status of a mother during adolescence and pregnancy and also the quality of ANC. LBW is of great concern as the baby may be at increased risk for complications. In the present study, the proportion of LBW was 27.3% and prematurity was 30.2%. The present study states that different socio-demographic characteristics of the population are still the most important factor in causing LBW among the newborn. Out of the different factors studied, significant proportion of LBW was found in the joint families, late registration, anemia in pregnancy, pregnancy-induced hypertension, gestational diabetes mellitus, poor weight gain during pregnancy, and irregular intake of specific nutritional supplements, i.e., IFA tablets and calcium and Vitamin D_3 tablets by mothers. The mothers with normal weight gain in pregnancy between 9 and 11 kg and those with regular intake of specific nutritional supplements, i.e., IFA tablets and calcium and Vitamin D_3 tablets during pregnancy were protected against LBW.

ANC being an essential element of maternal health gives us a window of opportunity to improve birth weight and birth gestational age. A good quality, dedicated, and sincere comprehensive ANC package will ensure prevention of babies being born too early (preterm) and too small (intrauterine growth retardation).[17] Therefore, all steps must be taken at mother, family, and community level to bring forth a healthy baby from a healthy mother. These babies, when they see the light of the day, will be strong and smart, and they, in turn, will make this nation healthy and happy.

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