

## A CROSS SECTIONAL STUDY OF TERM LOW BIRTH WEIGHT BABIES AND THEIR ASSOCIATION WITH MATERNAL RISK FACTORS IN A TERTIARY CARE HOSPITAL IN NORTHERN INDIA

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### ABSTRACT

**Background:** Low birth weight (LBW) remains a major public health problem in developing countries and is a leading cause of neonatal morbidity and mortality. It is influenced by multiple maternal, obstetric, nutritional, and socioeconomic factors. Understanding these determinants is essential for planning effective antenatal interventions to reduce the burden of LBW. A cross sectional study of Term low birth weight babies and their association with maternal risk factors in a tertiary care hospital in Northern India. **Materials and Methods:** A cross-sectional analytical study was conducted at the Department of Pediatrics, T.S Misra University, Lucknow, over 18 months. All term neonates were included. Preterm, post-term, and neonates with congenital malformations were excluded. Data regarding maternal sociodemographic characteristics, obstetric history, antenatal care utilization, nutritional factors, and supplementation were collected using a structured proforma. Birth weight was recorded within one hour of delivery using a calibrated weighing scale. Newborns weighing less than 2.5 kg were classified as low birth weight. Data were analyzed using appropriate statistical tests, and a p-value of <0.05 was considered statistically significant. **Result:** The study has overall prevalence of low birth weight was 22.7%. Low maternal weight gain (<6 kg) was significantly associated with LBW, with a prevalence of 31.0% compared to 17.1% among mothers with adequate weight gain (p = 0.026). Mothers with fewer than four antenatal visits had a significantly higher LBW prevalence (34.2%) compared to those with four or more visits (16.7%, p = 0.005). Inadequate iron-folic acid intake (<100 tablets) was also significantly associated with LBW (31.8% vs 16.2%, p = 0.023). A previous bad obstetric history (38.9%, p = 0.011) and the presence of obstetric complications (36.4%, p = 0.015) were significantly associated with LBW. Factors such as sex of the baby, parity, family type, place of residence, maternal anemia, did not show statistically significant associations. **Conclusion:** The study demonstrates that low birth weight is a multifactorial condition predominantly influenced by maternal nutrition, antenatal care utilization, obstetric history, pregnancy complications, and parental literacy. Most of these determinants are modifiable, highlighting the importance of strengthening antenatal care services, ensuring adequate maternal nutrition and supplementation, promoting health education, and early identification of high-risk pregnancies to reduce the incidence of low birth weight.

## INTRODUCTION

Birth Weight of a newborn is a critical determinant of his health and a key element in determining the

infant's ability to survive, grow physically and mentally.<sup>[1]</sup> Additionally, it is a sign of the mother's well-being. Low birth weight is described by the World Health Organization (WHO) as an infant

weighing less than 2500 grams (gms) (up to a maximum of 2499 grams) at birth, regardless of gestational age.<sup>[2]</sup> In 1976, The World Health Assembly, 29th session accepted this low birth weight norm.<sup>[1,2]</sup>

Maternal age is an important determinant of birth weight, with pregnancies at the extremes of reproductive age being associated with a higher risk of low birth weight.<sup>[3]</sup> Maternal anemia remains highly prevalent and continues to contribute significantly to adverse pregnancy outcomes.<sup>[4]</sup>

Obstetric factors such as parity, short birth spacing, previous adverse obstetric outcomes, and complications during the current pregnancy also influence birth weight. Short inter-pregnancy intervals may result in maternal nutritional depletion, while a history of adverse obstetric outcomes often reflects persistent maternal or placental risk factors. Pregnancy-related complications can further compromise uteroplacental circulation and fetal growth.<sup>[5,6]</sup>

Adequate antenatal care is essential for the early identification and management of maternal risk factors. Regular antenatal visits provide opportunities for nutritional counseling, monitoring of weight gain, supplementation, and timely detection of complications. Inadequate antenatal care utilization continues to be associated with an increased risk of low birth weight.<sup>[7]</sup>

This study provides a comprehensive assessment of maternal risk factors influencing birth weight in the local population, using detailed antenatal, nutritional, and obstetric data. By identifying modifiable maternal determinants such as inadequate weight gain, poor antenatal care utilization, anemia, and adverse obstetric history, the findings can contribute to improving the effectiveness of existing maternal health interventions.<sup>[8,9]</sup>

The results of this study can help healthcare providers identify high risk neonates early during pregnancy and implement targeted strategies to reduce the incidence of low birth weight.<sup>[10]</sup>

## MATERIALS AND METHODS

A cross-sectional analytical study was conducted at the Department of Pediatrics, TS Misra University, Lucknow, over 18 months. All term neonates were included. Preterm, post-term, and neonates with congenital malformations were excluded. Data regarding maternal sociodemographic characteristics, obstetric history, antenatal care utilization, nutritional factors, and supplementation were collected using a structured proforma. Birth weight was recorded within one hour of delivery using a calibrated weighing scale. Newborns weighing less than 2.5 kg were classified as low birth weight. Data were analyzed using appropriate statistical tests, and a p-value of <0.05 was considered statistically significant.

Birth weight was measured using a calibrated digital electronic baby weighing scale immediately after birth, following standard protocols to stabilize the neonate. Demographic details, including gestational age, sex, and mode of delivery were recorded.

### Statistical Analysis

All analyses were performed using SPSS version 29.0. Descriptive statistics, including mean, standard deviation and range were calculated for birth weight. Chi-square test to examine differences between categorical proportions.

A p-value < 0.05 had been considered statistically significant, ensuring robust interpretation of results.

## RESULTS

The study was conducted in the Department of Pediatrics, T.S. Misra Medical College and Hospital, Lucknow over a period of 18 months (July 2024 to December 2025). A total of 110 new born were included. Among them, 52 (52.0%) were male, while 48 (48.0%) were female. Out of the 110 newborns, 25 (22.7%) were classified as low birth weight (< 2500 g), while the remaining 85 (77.3%) had normal birth weight ( $\geq 2500$  g).

Among mothers from joint families (n = 55), 23.6% delivered LBW babies, while 21.8% of mothers from nuclear families (n = 55) had LBW infants. The difference in LBW prevalence between joint and nuclear families was not statistically significant ( $\chi^2 = 0.02$ , p = 0.888).

LBW prevalence among rural mothers was 18.7% (14/75), whereas urban mothers had a higher LBW prevalence of 31.4% (11/35). However, this difference was not statistically significant ( $\chi^2 = 1.12$ , p = 0.290).

Among primiparous mothers, 21.4% delivered LBW babies, while 24.1% of multiparous mothers had LBW infants. The difference in LBW prevalence between primipara and multipara mothers was not statistically significant ( $\chi^2 = 0.18$ , p = 0.670).

LBW prevalence among anaemic mothers was 28.6% (14/49) compared to 18.0% (11/61) among non-anaemic mothers. Although LBW was more common among anaemic mothers, this association was not statistically significant ( $\chi^2 = 2.34$ , p = 0.126).

Mothers with fewer than four antenatal visits had a significantly higher LBW prevalence of 34.2% (13/38), compared to 16.7% (12/72) among those with four or more visits. This association was statistically significant ( $\chi^2 = 7.89$ , p = 0.005).

Mothers who consumed fewer than 100 IFA tablets had a significantly higher LBW prevalence of 31.8% compared to 16.2% among those who consumed  $\geq 100$  tablets. This association was statistically significant ( $\chi^2 = 5.12$ , p = 0.023).

Mothers who gained less than 6 kg during pregnancy had a significantly higher LBW prevalence of 31.0%, whereas those with weight gain  $\geq 6$  kg had an LBW prevalence of 17.1%. This association was statistically significant ( $\chi^2 = 4.98$ , p = 0.026).

LBW prevalence was higher among mothers with birth spacing less than three years (28.6%) compared to those with spacing of three years or more (18.0%). However, this association was not statistically significant ( $\chi^2 = 2.01$ ,  $p = 0.156$ ).

LBW prevalence among male babies was 21.4%, while among female babies it was 24.1%. The difference was not statistically significant ( $\chi^2 = 0.31$ ,  $p = 0.577$ ).

Mothers with a bad obstetric history had a significantly higher LBW prevalence of 38.9%, compared to 19.6% among those without such history. This association was statistically significant ( $\chi^2 = 6.45$ ,  $p = 0.011$ ).

LBW prevalence among mothers with obstetric complications was 36.4%, compared to 19.3% among mothers without complications. This difference was statistically significant ( $\chi^2 = 5.87$ ,  $p = 0.015$ ).

**Table 1: Association of maternal factors with low birth weight neonates**

Factor	Category	Total (n)	LBW (n)	LBW Prevalence (%)	p-value
Maternal Age	<20 yrs	15	6	40.0	
	20–29 yrs	70	12	17.1	
	≥30 yrs	25	7	28.0	0.047
Family Type	Joint	55	13	23.6	
	Nuclear	55	12	21.8	0.888
Residence	Rural	75	14	18.7	
	Urban	35	11	31.4	0.290
Parity	Primipara	56	12	21.4	
	Multipara	54	13	24.1	0.670
Maternal Anaemia	Anaemic	49	14	28.6	
	Non-anaemic	61	11	18.0	0.126
Antenatal Visits	<4 visits	38	13	34.2	
	≥4 visits	72	12	16.7	0.005
IFA Supplementation	<100 tablets	44	14	31.8	
	≥100 tablets	66	11	16.2	0.023
Weight Gain	≤6 kg	42	13	31.0	
	>6 kg	68	12	17.1	0.026
Birth Spacing	<3 years	49	14	28.6	
	≥3 years	61	11	18.0	0.156
Sex of Baby	Male	56	12	21.4	
	Female	54	13	24.1	0.577
Bad Obstetric History	Yes	18	7	38.9	
	No	92	18	19.6	0.011
Obstetric Complications	Yes	22	8	36.4	
	No	88	17	19.3	0.015

The overall prevalence of low birth weight in the study population was 22.7%. Statistically significant associations were found between low birth weight and maternal age ( $p=0.047$ ), fewer antenatal visits (<4 visits, 34.2%,  $p=0.005$ ), low IFA supplementation (<100 tablets, 31.8%,  $p=0.023$ ), and inadequate maternal weight gain ( $\leq 6$  kg, 31.0%,  $p=0.026$ ). Additionally, bad obstetric history ( $p=0.011$ ) and presence of obstetric complications ( $p=0.015$ ) were significantly associated with low birth weight. Other factors such as family type, residence, parity, maternal anaemia, birth spacing, and sex of the baby did not show statistically significant association ( $p>0.05$ ).

## DISCUSSION

The present study was conducted to determine the prevalence of low birth weight (LBW) and to identify maternal, obstetric, nutritional, and socioeconomic factors associated with LBW. A total of 110 mother newborn pairs were included in the study. The overall prevalence of low birth weight in the present study was 22.7%.

LBW prevalence was highest among the youngest mothers (<20 years: 40.0%), followed by the oldest group (≥30 years: 28.0%), and lowest in the optimal

reproductive age range (20–29 years: 17.1%). In the hospital-based study by Mumbare et al. (2012), the overall prevalence of low birth weight was approximately 28–30%. Among adolescent mothers (<20 years), the prevalence of LBW was significantly higher compared to mothers aged 20–29 years.<sup>[11]</sup>

Maternal nutritional status emerged as one of the most important determinants of LBW. Mothers with pregnancy weight gain less than 6 kg had a significantly higher LBW prevalence of 31.0%, compared to 17.1% among those who gained more than 6 kg ( $p = 0.026$ ). Monnet et al. reported lower birth weight among women with inadequate gestational weight gain.<sup>[12]</sup> Misra et al. observed that low gestational weight gain was associated with higher risk of low birth weight.<sup>[13]</sup>

Similarly, mothers who consumed fewer than 100 iron–folic acid (IFA) tablets had a significantly higher LBW prevalence (31.8%) compared to those who consumed ≥100 tablets (16.2%,  $p = 0.023$ ). Prior Indian evidence also showed that maternal iron and folic acid supplementation was associated with lower risk of low birth weight.<sup>[14,15]</sup>

Antenatal care utilization showed a strong association with birth weight. Mothers who had fewer than four antenatal visits showed a significantly higher LBW prevalence of 34.2%,

whereas those with four or more visits had a lower prevalence of 16.7% ( $p = 0.005$ ). Mumbare et al. reported a similar association between inadequate antenatal care and low birth weight.<sup>[11]</sup> Kumar et al. also reported that inadequate antenatal care was associated with higher low birth weight prevalence in North Indian babies.<sup>[15]</sup>

Obstetric factors were also significantly associated with LBW. Mothers with a previous bad obstetric history had a markedly higher LBW prevalence (38.9%) compared to mothers without such history (19.6%,  $p = 0.011$ ). Mumbare et al. also reported previous adverse obstetric outcomes as an important maternal risk factor for term low birth weight.<sup>[11]</sup> Large Indian survey data have similarly shown that women with previous stillbirth or pregnancy complications had increased likelihood of low birth weight babies.<sup>[17]</sup>

Similarly, mothers who developed obstetric complications during the current pregnancy had a significantly higher LBW prevalence (36.4%) compared to those without complications (19.3%,  $p = 0.015$ ). Pregnancy complications can compromise placental function and fetal growth.<sup>[18]</sup> National evidence from India has also shown that pregnancy complications increase the likelihood of LBW.<sup>[17]</sup>

Birth spacing of less than three years was associated with a higher LBW prevalence (28.6%) compared to spacing greater than three years (18.0%), although this difference was not statistically significant. Zaveri et al. reported that adverse reproductive factors and short birth intervals were associated with increased risk of low birth weight.<sup>[17]</sup>

The sex of the baby did not significantly influence birth weight, with LBW prevalence being 21.4% in males and 24.1% in females. These findings are consistent with prior research. Scaria et al. analyzed recent Indian national data and found maternal health and socio-economic factors to be more important determinants of LBW than sex of the baby.<sup>[18]</sup> Similarly, parity showed no significant association, with LBW prevalence of 21.4% in primipara and 24.1% in multipara mothers.

Maternal anemia was associated with a higher LBW prevalence (28.6%) compared to non-anemic mothers (18.0%), though this association did not reach statistical significance. This pattern is biologically plausible and is supported by systematic review evidence showing that maternal anemia contributes to adverse pregnancy outcomes including low birth weight.<sup>[4]</sup> Kumar et al. also reported higher LBW prevalence among anemic mothers in a North Indian setting.<sup>[16]</sup>

Family type and place of residence did not show statistically significant associations with LBW in the present study. LBW prevalence was comparable between joint families (23.6%) and nuclear families (21.8%), with no significant association. Urban mothers showed a higher LBW prevalence (31.4%) compared to rural mothers (18.7%), though this difference was not statistically significant. Digole et

al. reported an LBW prevalence of 24.18%, with higher rates in rural areas (27.46%).<sup>[20]</sup>

In conclusion, the present study demonstrates that low maternal weight gain, inadequate antenatal visits, poor IFA supplementation, adverse obstetric history, and obstetric complications are the most important determinants of low birth weight. Most of these factors are modifiable, highlighting the potential for reducing LBW through improved antenatal care coverage, nutritional interventions, supplementation, and health education.

A key strength of this study lies in its important public health implications for reducing low birth weight. Strengthening antenatal care with at least four quality visits, early identification of high-risk mothers, and close monitoring of maternal weight gain and pregnancy complications are essential. Improving maternal nutrition through counseling and iron-folic acid supplementation, along with enhancing parental literacy and community awareness, can further improve birth outcomes. Promoting optimal birth spacing and timely referral of high-risk pregnancies may help reduce neonatal morbidity and mortality associated with low birth weight.

However, a limitation of the study is that it was a hospital-based study, the findings may have limited generalizability. The sample size may have reduced power to detect associations for some factors. Dietary and supplementation data relied partly on maternal recall, introducing possible recall bias, and some potential confounders were not assessed.

## CONCLUSION

In conclusion, The present study highlights that low birth weight (LBW) remains a significant public health problem and is influenced by multiple maternal, antenatal, and obstetric factors.

In this study, socio-demographic factors family type, place of residence, parity, and sex of the baby did not demonstrate significant associations.

Among antenatal care factors, inadequate antenatal visits (<4 visits), poor iron-folic acid (IFA) supplementation (<100 tablets), and low maternal weight gain (<6 kg) were found to be significantly associated with a higher prevalence of LBW. Maternal anaemia showed higher LBW prevalence, although these associations were not statistically significant in the present study. Obstetric factors such as bad obstetric history and the presence of obstetric complications were significantly associated with LBW.

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