

# Maternal profile of mothers giving birth to low birth weight babies: A hospital based cross-sectional study

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## ABSTRACT

**Background:** Low birth weight (LBW) is a significant public health problem that affects millions of infants worldwide. The World Health Organisation (WHO) defines LBW as a birth weight of less than 2500 grams. LBW is a global public health problem that affects approximately 15.5% of all births worldwide. LBW is a complex and multi-factorial condition that results from a combination of genetic, environmental, and maternal factors. Maternal factors play a critical role in determining the birth weight of infants. **Objective:** To determine the various maternal factors associated with low birth weight. **Materials and methods:** This study was a hospital based cross-sectional study conducted among 238 randomly selected term neonates of the postnatal ward of department of Pediatrics, Assam Medical College and Hospital for a period of 2 months. Data were collected with the help of interview technique using predesigned and pretested questionnaires. Data were statistically analysed using chi square test. **Results:** Among 238 mothers, 46.64% (n=111) had LBW babies. Higher proportions of LBW were found in mothers under 20 years (p=0.049) and weighing less than 45.0 kg (p=0.028). Maternal height (p=0.3009) showed no association. LBW was more prevalent with 1-year birth spacing (p=0.006), BMI  $\leq$  18 kg/m<sup>2</sup> (p=0.049), anemia (p=0.036), and among upper lower class of modified Kuppuswamy scale (p=0.042). **Conclusion:** Early maternal age, low maternal weight and BMI, maternal anemia, shorter inter-pregnancy intervals and lower socioeconomic status were found to be significant contributors of LBW. These findings highlight the importance of addressing maternal health and socio-economic factors to reduce the incidence of low birth weight deliveries.

**Keywords:** Gestational weight gain, anemia, birth interval, maternal health.

Low birth weight (LBW) is a significant public health problem that affects millions of infants worldwide. The World Health Organisation (WHO) defines LBW as a birth weight of less than 2500 grams<sup>1</sup>. LBW is a global public health problem that affects approximately 15.5% of all births worldwide<sup>2</sup>. The incidence of LBW varies widely across countries, with the highest rates observed in low- and middle- income countries. Infants are born with low weight either because they are premature (<37 weeks gestation at birth) and/or because they suffered intrauterine growth retardation. The majority of LBW infants in developing countries are intra uterine growth retardation (IUGR)<sup>3</sup>. LBW babies are at increased risk for various health problems,

including respiratory distress, hypoglycaemia, and sepsis. LBW is also associated with long-term developmental and health outcomes, such as poor academic performance, chronic diseases, and early mortality.

Low birth weight infants are prone to have difficulties in cognition, attention, and neuro muscular functioning<sup>4</sup>. Child who have low birth weight have immature immune function are also prone to have increased risk of disease, lower IQ and cognitive disabilities which could affect their performance in school, job opportunities as adults and may develop chronic illness like diabetes and coronary heart disease in adulthood<sup>5</sup>.

LBW is a complex and multi-factorial condition that results from a combination of genetic, environmental, and

**Received:** 29<sup>th</sup> April 2023, **Peer review completed:** 4<sup>th</sup> August 2023, **Accepted:** 7<sup>th</sup> August 2023.

Dutta A, Sonowal BB, Dhungel L. Maternal profile of mothers giving birth to low birth weight babies: A hospital based cross-sectional study. The New Indian Journal of OBGYN. 2024; 10(2): 314 - 19.

maternal factors. Maternal factors play a critical role in determining the birth weight of infants. During the fetal phase, growth depends on the nutritional condition of the mother, indicating that pregnant women should not only have a healthy weight gain pattern but also consume essential nutrients. For many women in the developing world however, economic, social and cultural factors make it difficult for them to obtain the necessary food and health care, which are closely interrelated<sup>6,7</sup>.

Understanding the maternal factors that contribute to LBW can guide healthcare professionals in developing targeted interventions to reduce the burden of LBW. Determining various maternal factors responsible for LBW can help in promoting healthy maternal behaviours, such as improving access to prenatal care, encouraging proper nutrition, and increasing awareness of maternal health issues. Furthermore significance of this study lies in its potential to provide crucial insights into maternal risk factors associated with LBW and ultimately improving maternal and neonatal health outcomes.

The present study was aimed to estimate the occurrence of low birth weight in a tertiary care teaching centre and determine the various maternal factors that were associated with low birth weight of the neonates.

**Materials and methods**

This was a hospital based cross-sectional study carried in the postnatal ward of department of Paediatrics, Assam Medical College & Hospital for a period of 2 months from 1<sup>st</sup> October to 30<sup>th</sup> November 2022.

Sample size: Considering 95% confidence interval with absolute precision of 5% and assuming 15.8% of newborn have low birth weight with reference to a study done by Scaria et al<sup>8</sup>, sample size for the study was calculated by the formula  $4pq/d^2$  (where p=prevalence of LBW, q=100-p, d=allowable error) and rounded off to be 213. Minimum sample size was 213 and we have taken 238 as the sample size. All neonates of postnatal ward with gestational age of  $\geq 37$  weeks along with their mothers were included in the study. Neonates with congenital malformation, those shifted to neonatal intensive care unit and neonates whose parents denied for consent were excluded. Ethical clearance was obtained from institutional ethics committee of Assam Medical College & Hospital, Dibrugarh.

Methodology -

- Neonates fulfilling the inclusion criteria were identified. Informed and written consent were taken from the parents / guardian after explaining

properly about the study. These cases were then enrolled in the study.

- After enrolment of the case a detailed history was taken including maternal history, family history, history of present pregnancy including Hb level in first trimester, maternal physical parameters (Pre-gestational weight, height, pre-gestational BMI), events during labour and information regarding the baby.
- All the required information were entered in the pre-designed proforma.

Statistical analysis: The statistical analysis of data was performed using the computer program, Statistical Package for Social Sciences (SPSS for Windows, version 20.0. Chicago, SPSS Inc.) and Microsoft Excel 2010. Discrete data are expressed as number (%) and are analysed using chi square test. For all analyses, the statistical significance was fixed at 5% level (p value <0.05).

**Results**

Out of 238 mothers, 111(46.64%) mothers were found to have delivered LBW babies. In the study it was found that out of total 13 mothers below 20 years, 10 mothers delivered LBW babies and 3 delivered babies with normal birth weight. In the age group 20-30 years, 95 mothers gave birth to LBW babies and 120 mothers gave birth to babies with normal birth weight. Mothers whose age was above 30 years, 6 of them gave birth to LBW babies and 4 mothers gave birth to babies with normal birth weight. Thus, it was observed that in this study that proportion of LBW is significantly higher among mothers whose age was less than 20 years (p=0.049) (table 1).

**Table 1: Distribution of LBW babies and normal birth weight babies with maternal age**

Maternal age	Number of mother of LBW babies		Number of mother of normal BW babies		P value
	n	%	n	%	
<20 years	10	76.92	3	23.08	0.049
20-30 years	95	44.19	120	55.81	
>30 years	6	60	4	40	

In this study the weight of the mothers were divided as < 45.0 kg, 45.9-54.9kg and  $\geq 55.0$ kg. It was observed that 77.78% (7) mothers in the first group delivered LBW babies and 22.22% (2) mothers delivered babies with normal birth weight. Out of 162 mothers from the second group, 49.38% (80) mothers gave birth to LBW babies and the rest 50.62% (82) mothers gave birth to babies with normal birth weight. In the third group, 35.82% (24) mothers gave birth to LBW babies and 64.18% (43) mothers gave birth to babies with normal birth weight. Hence the proportion of LBW babies is

observed to significantly higher among mothers weighing less than 45.0kg(p=0.028) (table 2).

**Table 2: Distribution of Low birth weight and normal birth weight on basis of weight of mother**

Weight of mother	Number of mother of LBW babies		Number of mother of normal BW babies		P value
	n	%	n	%	
< 45.0 kg	7	77.78	2	22.22	0.028
45.0 – 54.9 kg	80	49.38	82	50.62	
≥ 55.0 kg	24	35.82	43	64.18	

**Table 3: Distribution of LBW babies and normal BW babies on basis of height of mother**

Height of mother	Number of mother of LBW babies		Number of mother of normal BW babies		P value
	n	%	n	%	
140.0- 144.9cm	13	68.42	6	31.58	0.3009
145 – 149.9cm	39	44.32	49	55.68	
150 – 154.9cm	46	44.66	57	55.34	
155 – 159.9cm	13	48.15	14	51.85	
≥160cm	0	0.00	1	100	

**Table 4: Distribution of LBW babies and normal BW babies on basis of BMI of mother**

BMI of mother	Number of mother of LBW babies		Number of mother of normal BW babies		P value
	n	%	n	%	
Less than 18.0 kg/m <sup>2</sup>	8	72.72	3	27.28	0.049
18.0 to 22.9 kg/m <sup>2</sup>	81	49.69	82	50.31	
23.0 to 24.9 kg/m <sup>2</sup>	14	31.82	30	68.18	
>25 kg/m <sup>2</sup>	8	40.00	12	60.00	

**Table 5: Distribution of low birth weight and normal birth weight on basis of birth spacing**

Birth spacing	Number of mother of LBW babies		Number of mother of normal BW babies		P value
	n	%	n	%	
1 year	38	49.35	39	50.65	0.006
2 year	20	41.67	28	58.35	
3 year	1	6.25	15	93.75	

**Table 6: Distribution of low birth weight and normal birth weight on basis of maternal anemia**

Anemia	Number of mother of LBW babies		Number of mother of normal BW babies		P value
	n	%	n	%	
Present	40	57.97	29	42.03	0.036
Absent	71	42.01	98	57.99	

Maternal height was divided among five groups to compare the association with birth weight of babies as 140.0-144.9 cm, 145.0-149.9 cm, 150.0-154.9 cm, 155.0-159.9 cm and more than 160.0 cm. 68.42%(13) mothers belonging to the first group delivered babies with LBW and 31.58% (6) mothers delivered babies with normal birth weight. In the second group, 44.32% (39) mothers gave birth to LBW babies and 55.68% (49) mothers gave birth to babies with normal birth weight. Out of 103 mothers in the third group, 44.66% (46) mothers gave birth to LBW babies and 55.34% (57) mothers gave birth to normal birth weight babies. In the fourth group, 48.15% (13) mothers delivered LBW babies

and the rest 51.85% (14) mothers delivered normal birth weight babies. In the fifth group, 100% (1) mother gave birth

to normal birth weight babies. Statistical test was performed and it was found that maternal height was not associated with birth weight of the neonates (p=0.3009) (table 3).

Maternal BMI was divided among four groups as less than 18kg/m<sup>2</sup>, 18.0-22.9 kg/m<sup>2</sup>, 23.0-24.9 kg/m<sup>2</sup> and ≥25 kg/m<sup>2</sup>. It was observed that in the first group, 72.72% (8) mothers gave birth to LBW babies and 27.28% (3) mothers gave birth to normal birth weight babies. In the second group, 49.69% (81) mothers delivered LBW babies and 50.31% (82) mothers delivered normal birth babies. Out of 44 mothers in the third group, 31.82% (14) mothers gave birth to LBW babies and 68.18% (30) mothers gave birth to normal birth weight babies. Among 20 mothers in the fourth group, 40% (8) mothers delivered LBW babies and 60%(12) mothers delivered normal birth weight babies. Hence it was observed that mothers having BMI less than 18 kg/m<sup>2</sup> delivered significantly higher number of LBW babies (p=0.049) (table 4).

Birth spacing was compared with birth weight of the neonates. 49.35% (38) neonates born out of birth spacing of 1 year were LBW and 50.65% (39) neonates were found to have normal birth weight. Among the neonates born out of birth spacing 2 years, 41.67% (20) were LBW and the remaining 58.35% (28) were having normal birth weight. 93.75% (15) babies born out of birth spacing of 3 years were having normal birth weight and rest 6.25%(1) babies were born with LBW. Hence it was observed that LBW was more prevalent among pregnancy having birth spacing of 1 year (p=0.006) (table 5).

Maternal anemia was compared with birth weight of babies. The cut-off for considering anemia being present was taken as Hb level below 9 gm/dL. 57.97% (40) mothers having anemia gave birth to LBW babies while 42.03% (29) mothers with anemia gave birth to normal birth weight babies. On the other hand, 42.01% (71) mothers with normal Hb level gave birth to LBW babies and 57.99% (98) mothers with normal Hb level gave birth to normal birth weight babies. Thus, it was observed that mothers with anemia gave birth to significantly higher number of LBW babies (table 6) (p=0.036).

In the upper middle class, 37.50% (3) mothers delivered LBW babies and 62.50%(5) mothers delivered normal birth weight babies. Among the lower middle class group, 47.50% (19) mothers gave birth to LBW babies and 52.50% (21) mothers gave birth to normal birth weight babies. 61.29% (76) mothers belonging to the upper lower class delivered LBW babies and 38.71% (48) mothers delivered normal birth weight babies. In the lower class group, 37.14% (13) mothers gave birth to LBW babies and 62.86% (22) babies gave birth to normal birth weight babies. Thus, LBW babies were significantly more among the lower socioeconomic status (table 7) (p=0.042).

**Table 7: Distribution of low birth weight and normal birth weight on basis of socioeconomic status**

Socioeconomic status	Number of mother of LBW babies		Number of mother of normal BW babies		P value
	n	%	n	%	
Upper	0	0.00	0	0.00	0.042
Upper middle	3	37.50	5	62.50	
Lower middle	19	47.50	21	52.50	
Upper lower	76	61.29	48	38.71	
Lower	13	37.14	22	62.86	

**Discussion**

In this study out of 238 neonates, a total of 111(46.64%) neonates were found to be having low birth weight. This study found a high prevalence of low birth weight among neonates, with maternal age, weight, pre-gestational BMI, pregnancy spacing, anemia, and socioeconomic status being significant risk factors. Maternal height, on the other hand, was not found to be significantly associated with neonatal birth weight. These findings are consistent with previous studies conducted in different parts of the world and highlight the need for targeted interventions to address these modifiable risk factors and improve neonatal health outcomes. Further research is needed to better understand the complex interplay between these factors and to identify effective interventions for reducing the burden of low birth weight.

Maternal age was found to be significantly associated with low birth weight (LBW) in the current study. The prevalence of LBW was higher among neonates born to mothers aged less than 20 years compared to those born to mothers aged between 20-30 years and above 30 years. Similar findings were reported by Azimul et al<sup>9</sup>, who found a significant association between LBW and early maternal age (<20 years) in their study. Additionally, Desta et al<sup>10</sup> conducted a study in Italy and reported that maternal age was a strong predictor for LBW. Similarly, Domple et al<sup>11</sup> conducted a study in Mumbai and found that more than half

of the mothers (55.94%) belonged to the age group between 19 and 23 years, indicating a high prevalence of LBW in this age group.

The study also identified maternal weight as a significant risk factor for LBW, with 77.78% (7) of mothers who had LBW neonates weighing less than 45.0kg. Azimul et al<sup>9</sup> also found maternal weight as a significant risk factor for LBW. In a study done by Shakya et al<sup>12</sup> in Nepal found maternal weight <45kg to be significantly associated with LBW. Another study conducted by Joshi et al<sup>13</sup> in Gujarat observed that prevalence of LBW was higher in mothers with maternal weight less than 40kg (68.42%). Mumbare et al<sup>14</sup> conducted a study in Nasik and found that pre-delivery weight ≤55kg was significantly associated with low birth weight.

The present study provides evidence that maternal height is not significantly associated with neonatal birth weight. This finding is consistent with previous studies conducted by Azimul et al<sup>9</sup>, Joshi et al<sup>13</sup>, Negi et al<sup>15</sup>, which also found no significant association between maternal height and birth weight. However, contrary to these findings, some studies conducted by Desta et al<sup>10</sup>, Shakya et al<sup>12</sup>, Mumbare et al<sup>14</sup> have reported a significant association between maternal height and birth weight.

In this study pre-gestational maternal BMI was found to be significantly associated with low birth weight of the neonates with increased prevalence of LBW (72.72%) among mothers with BMI less than 18 kg/m<sup>2</sup>. In a study conducted by Zhifei et al<sup>16</sup> in Africa, pre-delivery maternal BMI was found to be significantly associated with LBW. Another study conducted by Deshmukh et al<sup>17</sup> in Nagpur found similar result with maternal BMI significantly associated with LBW.

In this study pregnancy with lower birth spacing was found to significantly associate with LBW. In a study conducted by Azimul et al<sup>9</sup>, pregnancy interval less than 2 years was significantly associated with LBW. Joshi et al<sup>13</sup> observed that a decrease in LBW percentage was associated with increasing inter pregnancy interval.

This study found a significant association between maternal anemia and low birth weight (LBW). This result is consistent with the findings of previous studies conducted by Azimul et al<sup>9</sup>, Deshmukh et al<sup>17</sup>, Joshi et al<sup>13</sup>, Mumbare et al<sup>14</sup>, Hayat et al<sup>18</sup>, Deshpande et al<sup>19</sup>.

Additionally, lower socioeconomic status was found to be significantly associated with LBW in this study, which is in line with the findings of other studies, such as those conducted by Joshi et al<sup>13</sup>, Deshmukh et al<sup>17</sup>, Kramer et al<sup>20</sup>,

Hirve et al<sup>21</sup>. These results suggest that maternal anemia and lower socioeconomic status are important risk factors for LBW and should be addressed in efforts to reduce the incidence of LBW.

Limitations: The study has some limitations that need to be considered. Firstly, the study was conducted in a single hospital setting, which may limit the generalizability of the findings to the larger population. Secondly, the sample size of the study was relatively small, with only 238 neonates included, which may have limited the statistical power of the analysis. Thirdly, the study design was cross-sectional, which precludes the establishment of causality between the risk factors and LBW. Fourthly, the study did not consider some potential confounding factors, such as the use of drugs and tobacco during pregnancy, which could have affected the findings. Finally, the study did not assess the quality of prenatal care received by the mothers, which could have affected the neonatal outcomes.

#### Conclusion

The maternal profile of low birth weight babies is an important public health concern that requires a comprehensive approach to address the underlying causes. Adequate weight gain during pregnancy, regular ante-natal visits, and proper intake of iron and folic acid are crucial factors in ensuring healthy pregnancy outcomes. Educating mothers regarding pregnancy can also contribute significantly to reducing the incidence of low birth weight babies. Preventing adolescent marriage and short inter-pregnancy intervals are additional factors that can significantly reduce LBW.

In conclusion, addressing the maternal profile of low birth weight babies requires a multi-faceted approach that prioritizes the health and well-being of mothers and their babies. By implementing evidence-based strategies that focus on prevention, education, and access to healthcare, we can work towards reducing the incidence of LBW babies and improving maternal and child health outcomes.

**Conflict of interest:** None. **Disclaimer:** Nil.

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