Research Article

# A study on influence of maternal, fetal, and social factors on birth weight of neonates in a tertiary hospital, Ahmedabad

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**Abstract**

**Background:** Low birth weight (LBW) continues to be a significant public health problem globally and is associated with risk factors. A baby's weight at birth is a strong indicator of maternal and newborn health and nutrition.

**Objective:** To study the influence of various maternal, fetal, and socioeconomic factors on the birth weight of babies.

**Materials and Methods:** This is a hospital-based cross-sectional study. Of 2,966 babies born alive in the hospital, 1,062 babies were randomly selected for study. The relevant information of the sampled babies and their mothers were recorded on a pretested pro forma, and the results were analyzed.

**Result:** Among the maternal factors, mother's age, nutritional status, antenatal care, birth order, hemoglobin level, physical activity during pregnancy, bad obstetric history, and pregnancy-induced complications are significantly associated with the incidence of LBW. Among the fetal factors, gestational period and multiple births are significantly associated with the incidence of LBW. Sex of the baby is not found as a factor for LBW babies. Socioeconomic status and education of mother have a significant role in the association of LBW babies. However, rural and urban areas were not found to be significant.

**Conclusion:** Health education regarding proper maternal nutrition, antenatal care, and family and social support will reduce LBW in new born.

**KEY WORDS:** Birth spacing, low birth weight (LBW), normal birth weight (NBW)

## Introduction

Low birth weight (LBW) is found to persist an important public health issue worldwide and is related to a range of both short-term and long-term consequences. LBW is defined by the WHO as weight at birth less than 2,500 g (5.5 lb), regardless of gestational age.[1] In India, nearly 28% of new borns show LBW.[2]

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A baby's weight at birth is a strong indication of the health and nutrition of the mother and newborn. Being undernourished in the womb increases the risk of death in the early months and years of a child's life.[3] The risk factors involved in LBW are maternal age at pregnancy, pregnancy spacing, multiple pregnancies, infection, underlying chronic medical conditions, nutritional, lifestyle, work-related health and psychological health including early indication of labor.[4]

Experts opine that the rates of LBW babies could be reduced to not more than 10% in all parts of the world.[5] Main attention is given in recent years to prevent LBW babies through good prenatal care and intervention programs.[6] It is, thus, very important to study the risk factors associated with LBW. This study aims to analyze various maternal, fetal, and social factors influencing birth weight of newborn.

## Materials and Methods

This study was carried out in the obstetric ward of civil hospital, Ahmedabad, India. A total of 2,966 babies were born alive in the hospital, of which 1,062 babies were randomly selected for the study. The relevant information of the sampled babies and their mothers was recorded on a pretested pro forma. In the ward, neonates were weighed on a lever balance preferably 12 h after their birth, and the weights were recorded. Mother's height was measured on a scale up to the accuracy of 0.5 cm and weight recorded on a spring balance weighing machine up to the accuracy of 500 g. Each pro forma was completed by interviewing the mother, examining the baby, and utilizing the hospital records. The various maternal, social, environmental, and fetal factors studied were: age of mother, parity, height and weight (to access nutritional status), work during pregnancy, mother's education, previous obstetrics history, history of the previous child birth, and socioeconomic status as per modified Kuppuswamy scale. Data thus collected during the study were analyzed using $\chi^2$-test and *z*-test.

## Result

A total of 2,966 babies were born alive in hospital during the study period, of which 1,062 (35.8%) babies were included in the study, and the influence of various factors on birth weight were analyzed. The birth weight of 1,062 babies varied from 1,000 g to 4,200 g. Percentage of LBW and normal birth weight (NBW) babies were 39.94% and 60.06%, respectively.

Maternal factors and birth weight are shown in Table 1. Of 1,062 babies, 486 (45.76%) babies were born to mothers of 22–24 years of age. Higher percentages of LBW babies (76.39% and 82.14%) were born to mothers of younger age group (15–19 years) and elderly mothers (35–39 years), respectively, while the lowest percentage of such babies were born to mothers in the age group of 25–29 years of age indicating that child bearing age of 25–29 years to be suitable for fair chance of NBW babies ($\chi^2$ = 38.69, *df* = 4). Undernourished mothers accounted for 594 (55.93%) of LBW babies. These mothers give birth to a significantly higher percentage (65.31%) of LBW babies when compared with nutritionally normal mothers (32.69%).

It was observed that 968 (91.14%) babies were born to mothers who received antenatal care. The percentage of LBW babies in this group was (47.4%) when compared with the group who did not receive antenatal care (87.23%). The difference was significant (*z* = 10.50). Among mothers who received antenatal care, the percentage of LBW babies increased from 11.82 for those registered during the first trimester to 64.59 for those registered during the third trimester of pregnancy. The gradient so observed was significant ($\chi^2$ = 109.78, *df* = 2). Of 1,062 babies, 339 (31.26%) babies were the first born child in the family; of the remaining 723 babies, 325 (44.95%) exhibited birth spacing of 2–3 years. The increase in the birth spacing from 1 to 2 years to more than 3 years was associated with the significant reduction in the frequency of LBW babies from 74.78% to 37.63% ($\chi^2$ = 46.8, *df* = 2).

A total of nine LBW babies were born to mothers having a hemoglobin (Hb) level of less than 6 g %. It was observed that higher was the level of maternal hemoglobin (9%–12%), lower was the percentage of LBW babies (44.33%); ($\chi^2$ = 23.48, *df* = 2).The LBW babies born to mothers who performed heavy work during pregnancy was 83.53%, while LBW babies born to mothers with light work was 20.39%. Increased physical activity during pregnancy significantly increased the chance of LBW babies ($\chi^2$ = 254.77, *df* = 2).

Mothers showing bad obstetric history gave birth to 76.76% LBW babies, whereas mothers with normal obstetric history gave birth to 46.95% LBW babies, which differed significantly. About 88.18% of LBW babies were born to mothers showing obstetric problems during last pregnancy in comparison with 39.23% LBW babies born to mothers with no problems. The difference was significant.

All the babies (127) born before 32 weeks of gestational period were of LBW. As the gestational period increased, the percentage of LBW babies significantly reduced ($\chi^2$ = 474.96, *df* = 3). The percentage of LBW babies was significantly higher (88.88%) in multiple births compared with single birth (50.28%); (*df* = 5.10) as shown in Table 2. It was observed that 53.44% of female babies showed LBW in comparison with 48.51% of male babies. However, the difference was not significant.

Socioeconomic factors and birth weight are shown in Table 3. The percentage of LBW babies born to mothers residing in urban and rural areas were 51.48% and 46.66%, respectively. The difference was not significant. The illiterate mothers gave birth to 82.08% LBW babies, whereas the mothers with education intermediate and above gave birth to 24.84% of LBW babies; with increase in mother's education, a significant reduction in percentage of LBW babies was observed ($\chi^2$ = 165.72, *df* = 4). The mothers from lower socioeconomic status gave birth to the highest percentage (72.75%) of LBW babies in comparison with mothers from upper middle socioeconomic status (22.01%). It was observed that, with the improvement in socioeconomic status, the percentage of LBW babies reduced significantly ($\chi^2$ = 172.37, *df* = 2)

## Discussion

Birth weights predict survival, growth, and development of a baby; reflect health and nutritional status of mother during pregnancy; and help in identifying "at-risk" infants.[7] This study reports that younger and elder mothers carried higher risk of LBW babies, and suitable age for having fair chances of having normal birth weight babies was 25–29 years. Other studies [8–10] confirm this observation. However, the studies[11] fail to support it.

**Table 1:** Maternal factors and birth weight

| Factors | No. of babies, ($n$ = 1,062) | Percentage of babies with birth weight (g) | | | |
|---|---|---|---|---|---|
| | | <2,500 | 2,500–3,000 | 3,000–3,500 | >3,500 |
| Age (years) | | | | | |
| 15–19 | 72 | 76.39 | 18.06 | 5.55 | 0 |
| 20–24 | 486 | 50.82 | 34.78 | 12.96 | 1.44 |
| 25–29 | 337 | 42.73 | 40.36 | 15.43 | 1.48 |
| 30–34 | 139 | 51.8 | 35.85 | 7.91 | 1.44 |
| 35–39 | 28 | 82.14 | 14.28 | 3.57 | 0 |
| Nutritional status | | | | | |
| Normal | 468 | 32.69 | 43.17 | 21.58 | 2.56 |
| Undernourished | 594 | 65.31 | 29.29 | 5.07 | 0.33 |
| Antenatal care | | | | | |
| Not received | 94 | 87.23 | 11.7 | 1.07 | 0 |
| Received | 968 | 47.4 | 37.7 | 13.46 | 1.44 |
| 1st trimester | 93 | 11.82 | 45 | 35.48 | 8.6 |
| 2nd trimester | 457 | 38.94 | 43.76 | 16.19 | 1.11 |
| 3rd trimester | 418 | 64.59 | 29.66 | 5.5 | 0.25 |
| Birth spacing in years, ($n$ = 723) | | | | | |
| 1–2 | 119 | 74.78 | 20.16 | 5.06 | 0 |
| 2–3 | 325 | 52 | 34.46 | 12 | 1.54 |
| >3 | 279 | 37.63 | 42.29 | 17.92 | 2.16 |
| Hemoglobin level (g) | | | | | |
| <6 | 9 | 0 | 0 | 0 | 0 |
| 6–9 | 550 | 56.18 | 34.72 | 8.36 | 0.74 |
| 9–12 | 503 | 44.33 | 36.77 | 16.89 | 2 |
| Physical activity during pregnancy | | | | | |
| Light | 304 | 20.39 | 48.68 | 28.28 | 2.65 |
| Moderate | 430 | 47.67 | 42.09 | 8.83 | 1.41 |
| Heavy | 328 | 83.53 | 14.34 | 2.13 | 0 |
| Obstetric history | | | | | |
| Bad | 142 | 76.76 | 23.24 | 0 | 0 |
| Normal | 920 | 46.95 | 37.28 | 14.23 | 1.54 |
| Pregnancy-induced complications | | | | | |
| Present | 254 | 88.18 | 10.62 | 1.2 | 0 |
| Absent | 808 | 39.23 | 43.19 | 15.84 | 1.74 |

Maternal nutritional status affects the birth weight. Undernourished mothers gave birth to a higher percentage of LBW babies. Various studies[12–14] have shown a positive association between maternal nutritional status and birth weight. Mothers with poor nutrition coupled with an excessive energy expenditure during pregnancy contribute to the occurrence of LBW babies. This study revealed the significant association between physical work during pregnancy and birth weight. Similar observations were reported by others.[15–17]

Birth spacing, which helps the mother to replenish the loss occurred during previous pregnancy, was found to have a positive association with birth weight. This is in accordance with other studies.[18–20] It was observed that lower the maternal Hb level, higher was the percentage of LBW babies. This is supported through studies carried out by others.[21–23] Bad obstetric history such as abortions, still birth, birth asphyxia, etc., contributes to more number of LBW babies in comparison with normal obstetric history. This is in accordance with other study.[24] Women showing complications such as pregnancy-induced hypertension, antepartum hemorrhage, etc., during the pregnancy gave birth to more number of LBW babies in comparison with women not showing complications. This corresponds to the studies done by others.[25,26]

Provision of antenatal care, especially during early pregnancy, reduces the chances of LBW babies besides identification of at-risk mothers. This has been well demonstrated in

**Table 2:** Fetal factors and birth weight

| Factors | No. of babies, ($\mu$ = 1,062) | Percentage of babies with birth weight (g) | | | |
|---|---|---|---|---|---|
| | | <2,500 | 2,500–3,000 | 3,000–3,500 | >3,500 |
| Gestational period (weeks) | | | | | |
| <32 | 127 | 100 | 0 | 0 | 0 |
| 33–36 | 270 | 85.55 | 14.45 | 0 | 0 |
| 37–40 | 613 | 28.05 | 51.54 | 18.76 | 1.65 |
| >40 | 52 | 21.15 | 40.38 | 30.76 | 7.69 |
| Single/multiple fetus | | | | | |
| Single | 1,044 | 50.28 | 35.82 | 12.54 | 1.36 |
| Multiple | 18 | 88.88 | 11.12 | 0 | 0 |
| Sex | | | | | |
| Male subjects | 540 | 48.51 | 34.09 | 15.74 | 1.66 |
| Female subjects | 522 | 53.44 | 36.78 | 8.81 | 0.97 |

**Table 3:** Socioeconomic factors and birth weight

| Factors | No. of babies, ($n$ = 1,062) | Percentage of babies with birth weight (g) | | | |
|---|---|---|---|---|---|
| | | <2,500 | 2,500–3,000 | 3,000–3,500 | >3,500 |
| Area | | | | | |
| Urban | 942 | 51.48 | 34.62 | 12.52 | 1.38 |
| Rural | 120 | 46.66 | 41.66 | 10.83 | 0.85 |
| Mother's education | | | | | |
| Illiterate | 134 | 82.08 | 11.21 | 5.22 | 1.49 |
| Primary school | 213 | 71.36 | 23.47 | 5.16 | 0 |
| Middle school | 281 | 52.66 | 34.16 | 12.09 | 1.09 |
| High school | 269 | 33.45 | 45.35 | 18.58 | 2.62 |
| Intermediate and above | 165 | 24.84 | 56.36 | 17.57 | 1.23 |
| Socioeconomic status | | | | | |
| Upper | 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| Upper middle | 318 | 22.01 | 47.16 | 27.35 | 3.48 |
| Lower middle | 421 | 56.05 | 34.67 | 8.55 | 0.73 |
| Upper lower | 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lower | 323 | 72.75 | 24.76 | 2.49 | 0 |

this study and another study.[27] This study revealed that the incidence of LBW reduced with the increase in gestational period, as observed in another study.[21] The study showed that the incidence of LBW was significantly higher in multiple births when compared with single birth. Similar observations were reported by another study.[28] This study reports that mothers from urban area gave birth to a higher percentage of LBW babies than do mothers from rural area. It is because this study was carried out in an urban-based hospital catering to the needs of middle and lower class people. Similar observation was reported by another study.[29]

This study reports an association between mother's education and LBW babies. This is in accordance with another study.[27] This is very well demonstrated in the state of Kerala, where increase in female literacy and a substantial reduction in fertility and infant mortality rate were observed.[30] This study revealed a negative association between socioeconomic status and LBW babies. Similar observations were reported by another study.[27]

The strength of the study is that the history has been taken from the mother by interviewing her immediately after childbirth in the hospital, and the same has been verified from the hospital documents. The limitations of the study is the data of LBW babies are not the true picture of Indian standard, as the dependant population belongs to low socioeconomic status such as the urban slum and the referred cases from the peripheral hospitals.

## Conclusion

This study reveals that factors such as maternal age, nutrition, education, socioeconomic status, and antenatal care play an important role in shaping the weight of the newborn. Health

educations of prenatal and antenatal mothers regarding the above-mentioned risk factors are the only measures to prevent LBW babies and maternal and infant mortality. Mothers should be made aware of different national programs regarding maternal and child health care run by Government of India in their community.

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