Original Research Article

# Evaluating the risk factors correlated with low-birth-weight babies: A clinical case control study

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## Abstract

**Background:** A most vital determinant for survival in newborns and healthy development and growth is the birth weight (weight at the birth). Determination of risk factors that can lead to low birth weight in newborns is vital to avoid such cases. **Aim:** The present clinical case-control study was conducted to assess the risk factors correlated with low-birth-weight (LBW) babies among the females. **Material and methods:** The present case-control clinical study included 60 females who delivered low-birth-weight infants and singleton babies which were compared to 60 control females having singleton babies having normal birth weight to assess the associated risk factors. **Results:** Morbid condition during pregnancy had Odds ratio (OR) of 1.43 and 95% CI of 1.18-1.95 which was significant with $p<0.05$. BMI has also had a significant association with OR of 1.57 and 95% CI of 1.16-2.13. Birth interval <24 months, Weight <40kg, Height <145cm, Rural Residence, and unfavorable previous pregnancy outcomes all showed significant association with low-birth-weight in the study subjects, with $p<0.05$, OR of 1.66, 1.84, 1.91, 2.17, and 2.49 respectively, and 95% CI of 1.25-2.19, 1.17-2.95, 1.34-2.94, 1.61-2.59, and 1.73-3.83 respectively. Calcium supplementation, iron/folic acid supplementation (<100 vs <100), tetanus toxoid immunization, ANC visit, registration time, maternal tobacco consumption, marital age of mother, mother's rest and sleep, and socioeconomic status showed significant association with the low-birth-weight with $p<0.05$ and $z^2$ of 1.17, 2.55, 0.68, 1.77, 0.07, 3.53, 1.55, 0.31and 5.57 respectively. However, no significant association was seen between low-birth-weight and maternal occupation and maternal education with respective p-values of 0.08 and 0.66 and the $z^2$ of 1.11 and 7.79 respectively. **Conclusion:** The present study concluded that a strong and significant correlation was seen of prenatal care and bio-demographic variables for the determination of the birth weight in an infant. Also, demographics and socio-economic factors have a significant correlation with prenatal care which is the behavioral factor that can be correlated with the low-birth-weight in infants.

**Keywords:** Birth weight, Low birth weight, Maternal risk factor, Preterm,Risk factors.



### Introduction

WHO (World Health Organization) defines Low birth weight as the weight less than 2.5 kg at birth in an infant. LBW (Low-birth weight) is also defined as less than 2500 grams birth weight by the international agreement. With the assessment done within the first 4 hours of the birth, the birth weight less than 2500 grams is considered as low-birth weight. Within 4 hours is considered as significant time as after 4 hours significant postnatal weight loss is seen. Low-birth weight can lead to complications like childhood morbidity and mortality, infant morbidity and mortality, and neonatal morbidity and mortality. Globally, mortality rates in neonates are 20 times higher in low-birth-weight subjects compared to normal-weight subjects of weight >2.5 kg. Birth weight along with being a critical factor for child growth, development, and survival, also is a vital indicator of the maternal quality of life, nutrition, and maternal health[1].

Globally, the incidence of LBW is nearly 16% with a varying range of 7% in the developed countries and 19% in the non-developed countries. The highest incidence of LBW is reported in South East Asia with 31%, 7% in East-Asia and Pacific, 14% in Sub-Sahsubjectsaran Africa, and 15% in East and North Africa. The highest incidence is seen in Asia with 75%.

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India has a high burden of LBW with every fourth reported baby is Low-birth weight posing a high burden on the healthcare sector in India. In India alone, annually, 1 million low-birth-weight and 2.7 million preterm neonates are born. As per WHO, nearly 25 million low-birth-weight infants are born every year and 95% are born in the developing countries only[2].With the improvement in the living standards and healthcare facilities, there has been a significant reduction in the morbidity and mortality rates of low-birth eight subjects in the past few years, especially, in the developed countries. Recently, the main focus lies in reducing the morbidity and mortality rates in developing countries for low-birthweight infants. However, in developed countries, low-birth weight incidence has markedly reduced due to increased health funds and improved healthcare facilities. On the other hand, in developing countries like India, there is a challenging situation concerning the complications and survival of low-birth weight infants due to fewer funds and comprised state of the health care sector in India[3].

In India, owing to the lack of women empowerment, poor status concerning education and health of the female child, and nutrition neglect, there is a high incidence of mortality and morbidity in low-birth-weight infants. Increased low- birth weight incidence in India can also be attributed to maternal infections, complicated pregnancy, medical diseases, poor obstetrics history, fewer antenatal visits, malnutrition in pregnancy, the inadequate gap between pregnancies, and early marriages[4]. The present case-control clinical study included 60 females who delivered low-birth-weight infants and singleton babies which were compared to 60 control females having

singleton babies having normal birth weight to assess the associated risk factors.

**Materials and methods**

The present case-control clinical study included 60 females who delivered low-birth-weight infants and singleton babies which were compared to 60 control females having singleton babies having normal birth weight to assess the associated risk factors. The study was carried out atDepartment of Paediatrics, Dr. Vasantraopawar medical college and research centre, Nashik, Maharashtraafter obtaining clearance from the concerned Ethical committee. The study population was comprised of females and neonates admitted to the Institute. After explaining the detailed study design, informed consent was taken from all the study subjects.The inclusion criteria for the study were females who delivered singleton term-baby who was living and had weight less than 2500 grams as assessed within 4 hours of the birth. The controls for the study were made with the females who delivered singleton term-baby who was living and had weight more than 2500 grams as assessed within 4 hours of the birth. The exclusion criteria for the study were subjects who delivered a baby of weight more than 4 kgs, preterm babies, babies with congenital anomalies, and the subjects who were not willing to participate in the study.

The study included a total of 120 females within the age range of 19-38 years and the mean age of24.6±3.42 years. These 120 subjects were divided into two groups of 60 subjects each contributing the cases and controls for the study. All the subjects were given performed structured questionnaire assessing the pregnancy diseases (including eclampsia, tuberculosis, heart diseases, hypertension, night blindness, and anemia), sociodemographic variables (gender of baby, geographic area, family type, parent's educational status, socioeconomic status, occupation, and religion), and maternal factors [interpregnancy interval, calcium supplementation (500 mg), iron supplementation (60 mg daily), ANC check-up, parity, BMI, height, weight, and age].The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA and t-test for results formulation. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at $p<0.05$.

**Results**

The present case-control clinical study included 60 females who delivered low-birth-weight infants and singleton babies which were compared to 60 control females having singleton babies having normal birth weight to assess the associated risk factors. The study included a total of 120 females within the age range of 19-38 years and the mean age of 24.6±3.42 years. These 120 subjects were divided into two groups of 60 subjects each contributing the cases and controls for the study. The demographic characteristics of the study subjects are listed in table 1. The majority of the study subjects were primipara with 61.66% (n=37) subjects in both cases and controls followed by second para in 36.66% (n=22) subjects in both the groups. Majority of the study subjects were in range of 20-25 years with 55% (n=33) subjects followed by 25% (n=15) subjects in age 25-20 years, 8.33% (n=5) subjects below 20 years, 6.66% (n=4) subjects in 30-35 years and 5% (n=3) subjects in age >35 years in both cases and controls. For gestational age, the majority of 26.66% (n=16) subjects were at the gestational age of 39 weeks followed by 40 weeks in 23.33% (n=14) subjects for both groups (Table 1).

**Table 1: Demographic characteristics of the study subjects**

| S. No | Characteristics | Controls (%) | Controls (n=60) | Cases (%) | Cases (n=60) |
|---|---|---|---|---|---|
| **1.** | **Parity** | | | | |
| **a)** | Primipara | 61.66 | 37 | 61.66 | 37 |
| **b)** | Second para | 36.66 | 22 | 36.66 | 22 |
| **c)** | Third para | 1.66 | 1 | 1.66 | 1 |
| **2.** | **Age range** | | | | |
| **a)** | Below 20 | 8.33 | 5 | 8.33 | 5 |
| **b)** | 20-25 | 55 | 33 | 55 | 33 |
| **c)** | 25-30 | 25 | 15 | 25 | 15 |
| **d)** | 30-35 | 6.66 | 4 | 6.66 | 4 |
| **e)** | >35 | 5 | 3 | 5 | 3 |
| **3.** | **Gestational age at birth (weeks)** | | | | |
| **4.** | 34 | 3.33 | 2 | 3.33 | 2 |
| **5.** | 35 | 3.33 | 2 | 3.33 | 2 |
| **6.** | 36 | 6.66 | 4 | 6.66 | 4 |
| **7.** | 37 | 10 | 6 | 10 | 6 |
| **8.** | 38 | 18.33 | 11 | 18.33 | 11 |
| **9.** | 39 | 26.66 | 16 | 26.66 | 16 |
| **10.** | 40 | 23.33 | 14 | 23.33 | 14 |
| **11.** | 41 | 5 | 3 | 5 | 3 |
| **12.** | 42 | 3.33 | 2 | 3.33 | 2 |

On the assessment of the maternal risk factors associated with low birth weight in the study, it was seen that morbid condition during pregnancy had an Odds ratio (OR) of 1.43 and 95% CI of 1.18-1.95 which was significant with $p<0.05$. BMI has also had a significant association with OR of 1.57 and 95% CI of 1.16-2.13. Birth interval <24 months, Weight <40kg, Height <145cm, Rural Residence, and unfavorable previous pregnancy outcomesall showed significant association with low-birth-weight in the study subjects, with $p<0.05$, OR of 1.66, 1.84, 1.91, 2.17, and 2.49 respectively, and 95% CI of 1.25-2.19, 1.17-2.95, 1.34-2.94, 1.61-2.59, and 1.73-3.83 respectively as shown in Table 2.

**Table 2: Maternal risk factors showed clinical significance with low-birth-weight**

| S. No | Risk Factor | p-value | Odds ratio (OR) (95% CI) |
|---|---|---|---|
| **1.** | **Morbid condition during pregnancy** | <0.05 | 1.43 (1.18-1.95) |
| **2.** | **BMI <18.5kg/m2** | <0.05 | 1.57 (1.16-2.13) |
| **3.** | **Birth interval <24 months** | <0.05 | 1.66 (1.25-2.19) |
| **4.** | **Weight <40kg** | <0.05 | 1.84 (1.17-2.95) |
| **5.** | **Height <145cm** | <0.05 | 1.91 (1.34-2.94) |
| **6.** | **Rural Residence** | <0.05 | 2.17 (1.61-2.59) |
| **7.** | **Unfavorable previous pregnancy outcomes** | <0.05 | 2.49 (1.73-3.83) |

For the risk factors not found to be associated with low-birth-weight in the present study, it was seen that calcium supplementation, iron/folic acid supplementation (<100 vs <100), tetanus toxoid immunization, ANC visit, registration time, maternal tobacco consumption, marital age of mother, mother's rest and sleep, and socioeconomic status showed significant association with the low-birth-weight with $p<0.05$ and $z^2$ of 1.17, 2.55, 0.68, 1.77, 0.07, 3.53, 1.55, 0.31and 5.57 respectively. However, no significant association was seen between low-birth-weight and maternal occupation and maternal education with respective p-values of 0.08 and 0.66 and the $z^2$ of 1.11 and 7.79 respectively as depicted in Table 3.

**Table3: Maternal factors showing no significant association with low-birth-weight**

| S. No | Risk Factor | p-value | $Z^2$ |
|---|---|---|---|
| 1. | Calcium supplementation day (<100 vs <100) | <0.05 | 1.17 |
| 2. | Iron/folic acid supplementation days (<100 vs <100) | <0.05 | 2.55 |
| 3. | Tetanus toxoid immunization (complete or not) | <0.05 | 0.68 |
| 4. | ANC visit (<3 or >3) | <0.05 | 1.77 |
| 5. | Registration Time (<12 or >12) | <0.05 | 0.07 |
| 6. | Maternal tobacco consumption | <0.05 | 3.53 |
| 7. | Marital age of mother (<18 or >18) | <0.05 | 1.55 |
| 8. | Mothers rest and sleep (<10 or >10) | <0.05 | 0.31 |
| 9. | Maternal occupation | 0.08 | 1.11 |
| 10. | Socioeconomic status | <0.05 | 5.57 |
| 11. | Mother's education | 0.66 | 7.79 |

## Discussion

The present case-control clinical study included 60 females who delivered low-birth-weight infants and singleton babies which were compared to 60 control females having singleton babies having normal birth weight to assess the associated risk factors. The study included a total of 120 females within the age range of 19-38 years and the mean age of 24.6±3.42 years. These 120 subjects were divided into two groups of 60 subjects each contributing the cases and controls for the study. The majority of the study subjects were primipara with 61.66% (n=37) subjects in both cases and controls followed by second para in 36.66% (n=22) subjects in both the groups. Majority of the study subjects were in range of 20-25 years with 55% (n=33) subjects followed by 25% (n=15) subjects in age 25-20 years, 8.33% (n=5) subjects below 20 years, 6.66% (n=4) subjects in 30-35 years and 5% (n=3) subjects in age >35 years in both cases and controls. For gestational age, the majority of 26.66% (n=16) subjects were at the gestational age of 39 weeks followed by 40 weeks in 23.33% (n=14) subjects for both groups. These demographics were comparable to the studies of Joshi HS et al[5] in 2005 and Yadav S et al[6] in 2008 where authors assessed subjects with comparable demographics as in the present study.Concerning the maternal risk factors associated with low birth weight in the study, it was seen that morbid condition during pregnancy had an Odds ratio (OR) of 1.43 and 95% CI of 1.18-1.95 which was significant with $p<0.05$. BMI has also had a significant association with OR of 1.57 and 95% CI of 1.16-2.13. Birth interval <24 months, Weight <40kg, Height <145cm, Rural Residence, and unfavorable previous pregnancy outcomes all showed significant association with low-birth-weight in the study subjects, with $p<0.05$, OR of 1.66, 1.84, 1.91, 2.17, and 2.49 respectively, and 95% CI of 1.25-2.19, 1.17-2.95, 1.34-2.94, 1.61-2.59, and 1.73-3.83 respectively. These results were consistent with the studies of Roy S et al[7] in 2009 and Rizvi S et al[8] in 2007 where a significant association was between low birth weight and mentioned risk factors was shown by the authors.

For the risk factors not found to be associated with low-birth-weight in the present study, it was seen that calcium supplementation, iron/folic acid supplementation (<100 vs <100), tetanus toxoid immunization, ANC visit, registration time, maternal tobacco consumption, marital age of mother, mother's rest and sleep, and socioeconomic status showed significant association with the low-birth-weight with $p<0.05$ and $z^2$ of 1.17, 2.55, 0.68, 1.77, 0.07, 3.53, 1.55, 0.31and 5.57 respectively. However, no significant association was seen between low-birth-weight and maternal occupation and maternal education with respective p-values of 0.08 and 0.66 and the $z^2$ of 1.11 and 7.79 respectively. These findings were in agreement with the findings of Megabiaw B et al[9] in 2012 and Mekie M et al[10] in 2019 where similar risk factors were found to be associated with low-birth-weight infants as in the present study.

## Conclusion

Within its limitations, the present study concluded that a strong and significant correlation was seen of prenatal care and bio-demographic variables for the determination of the birth weight in an infant. Also, demographics and socio-economic factors have a significant correlation with prenatal care which is the behavioral factor that can be correlated with the low-birth-weight in infants. The present study had a few limitations including a small sample size, shorter monitoring period, and geographical area biases. Hence, more longitudinal studies with a larger sample size and longer monitoring period will help reach a definitive conclusion.

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