Research Article

Study of maternal risk factors for low birth weight neonates: a case–control study

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Abstract

Background: Low birth weight (LBW) is an important indicator of reproductive health and general health status of population. Weight at birth is directly influenced by general level of health status of the mother. The maternal risk factors are biologically and socially interrelated; most are, however, modifiable, which vary from one area to another, depending on geographic, socioeconomic, and cultural factors.

Objectives: This study was undertaken to evaluate maternal risk factors associated with LBW neonates.

Materials and Methods: A case–control study was conducted in a tertiary care government hospital in Solapur, Maharashtra. A total of 220 cases (vaginal delivery or cesarean delivery) and 220 controls who delivered a live-born singleton baby without congenital malformation enrolled within 1 day of delivery. Mothers who had multiple births were excluded. All babies were weighed within 24 h after the birth. The information was gathered from the maternal health records and interviewing the mothers of these infants.

Results: The mean age of mothers in case group was 22.6 years and that of controls was 23.92 years. Mean weight gain during pregnancy of mothers in case group was 4.2 kg and that of controls was 5.9 kg. Mean weight of the newborn of cases and controls was 1664.97 and 2548.35 g, respectively. Spacing <2 years between this and last pregnancy, pregnancy-induced hypertension, tobacco exposure, lower socioeconomic status (class IV+V), prepregnancy weight <45 kg, late antenatal care (ANC) registration were identified as significant risk factors for LBW neonates. Significant association was found between maternal education (illiterate/primary), prematurity, cesarean delivery, age of mother <20 or >30 years, height <145 cm, maternal occupation (laborer), nuclear family, primigravida, anemia, inadequate ANC, and LBW.

Conclusion: Health education, socioeconomic development, maternal nutrition, and increasing the use of health services during pregnancy are all important factors for reducing LBW.

KEY WORDS: Low birth weight, maternal risk factors, case–control study

Introduction

The birth weight of an infant is the single most important determinant of its chances of survival, healthy growth, and development. Low birth weight (LBW) in babies continues to remain a major public health problem worldwide, especially in the developing countries. The prevalence of LBW in India is 28% of all live births. As per the WHO (World Health Organization) estimation approximately 25 million LBW babies are born each year, consisting 15% of all live birth, approximately 93% of them in developing countries.[1] Across the world, neonatal mortality is 20 times more likely for LBW babies compared to heavier babies (≤2.5 kg).[2]

LBW is the result of preterm birth, intrauterine growth restriction, or a combination of both pathophysiologic conditions. There are numerous factors contributing to LBW, both maternal and fetal. Weight at birth is directly influenced by

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general level of health status of the mother. Maternal environment is the most important determinant of birth weight, and factors that prevent normal circulation across the placenta cause poor nutrient and oxygen supply to the fetus, restricting the growth of fetus. The maternal risk factors are biologically and socially interrelated; most are, however, modifiable. It is not essential that all the factors should be present in a given area. The factors vary from one area to another, depending on geographic, socioeconomic, and cultural factors. The mortality of LBW can be reduced if the maternal risk factors are detected early and managed by simple techniques. Thus, it is necessary to identify factors prevailing in a particular area responsible for LBW.[3]

Keeping in view the points early mentioned, this study was designed with the objective to study maternal risk factors associated with LBW neonates.

Materials and Methods

The present case–control study was conducted in a tertiary care government hospital in Solapur, western Maharashtra. The study data were collected between March 1, 2012 and May 31, 2012 through interviews with the mothers, abstraction of medical records, and anthropometric assessment.

The WHO definition of LBW was used, that is, birth weight <2,500 g.[4] Eligibility criteria for cases were the following: to deliver a live newborn weighing less than 2,500 g. To be eligible as a control, mothers should have delivered a single newborn weighing more than 2,499 g.

Mother of babies with birth weights of more than 2,499 g who were born consecutively after each case constituted the control group. Controls were identified from birth records as the next eligible delivery of a non-LBW baby after a woman delivered an LBW baby. A total of 220 cases (vaginal delivery or cesarean delivery) and 220 controls of age 18–35 years who delivered a live-born singleton baby through without congenital malformation were enrolled within 1 day of delivery.

Mothers who had multiple births, were seriously ill, and those who could not stand were excluded. A pilot study was conducted on 50 cases and 50 controls to check the feasibility of the pro forma. Sample size was also calculated based on the findings of the pilot study. Formula for sample size was $n = [(2pq)(Z_\alpha + Z_\beta)]/(p_1 - p_0)$.[2] All babies were weighed within 1 h after birth. The data were entered into a standardized questionnaire after verbal consent was obtained from the mother. The data information was gathered from the maternal health records and interviewing the mothers of these neonates.

Study variables included maternal age, height, prepregnancy weight, education, occupation, socioeconomic status, type of family, parity, interval between birth of the newborn baby and the previous delivery, antenatal care (ANC) during current pregnancy, and iron and folic acid tablets consumed during pregnancy.

History was asked regarding consumption of tobacco or exposure to tobacco in any form regularly. History of abortion was classified as ever/never had abortion. Birth interval between the current and last pregnancy was taken as a continuous variable. Total numbers of ANC visits for the current pregnancy were categorized as ≥4 visits and <4 visits, based on the WHO and United Nations International Children's Emergency Fund (UNICEF) criteria that women should have ≥4 ANC visits with an appropriate health care provider.

Adequate antenatal care was considered when the pregnant women was registered at any time, had at least four antenatal checkups, had adequately vaccinated against tetanus, and had consumed at least 100 tablets of iron and folic acid. Gestational age was calculated from the first day of the last menstrual period reported by the mother.

Illness developed during pregnancy was also recorded; these include pregnancy-induced hypertension (PIH), eclampsia/preeclampsia, Rhesus problem, infections and others. Baby characteristics included sex and the birth weight. Physical examination was conducted after the interview was over. The available health records were also reviewed.

The investigations such as hemoglobin, Blood group, VDRL, and urine sugar and albumin were recorded from the case sheets. Socioeconomic status as suggested by BG Prasad classification was adopted and modified as per All India Consumer Price Index.

Table 1: Comparison of basic variables of mothers between cases and controls

Variable	Cases (mean±SD)	Control (mean±SD)
Age (years)	22.6±2.92	23.92±2.89
Height (cm)	148.06±6.26	152.62±5.31
Prepregnancy weight (kg)	45.58±7.91	51.35±6.3
Weight gain in pregnancy (kg)	4.2±1.2	5.9±1.5
Birth spacing (months)	18.3±5.1	22.2±6.2
Weight of newborn (grams)	1664.97±465.06	2548.35±298.53

Results

The mean age of mothers in case group was 22.6 years and that of controls was 23.92 years. Majority of the cases and controls belonged to 20–29 years age group. Mean weight gain during pregnancy of mothers in case group was 4.2 kg and that of controls was 5.9 kg. Mean weight of the newborn of cases and controls was 1664.97 g and 2548.35 g, respectively [Table 1].

Tables 2 and 3 summarize the distribution of various socioeconomic and maternal factors among cases and controls. Mothers with spacing <2 years between present and last pregnancy have 3.19 times risk of delivering LBW babies. Similarly, risk of delivering LBW babies is almost 2.87 times among the mothers with PIH. Tobacco exposure, lower socioeconomic status (Class IV+V), prepregnancy weight <45 kg, and late ANC registration have been identified as significant risk factors for LBW neonates (odds ratio >2). The proportion of illiterate/primary educated and laborer

Table 2: Socioeconomic determinants of low birth weight

Variable	Cases (%) (*n* = 220)	Control (%) (*n* = 220)	Odds ratio (95% CI)	*p*-Value
Age (years) <20/>30 years	40 (18.18)	24 (10.90)	1.81 (1.05–3.13)	0.03
Lower socioeconomic status (class IV + V)	212 (96.36)	202 (91.81)	2.36 (1.00–5.55)	0.043
Maternal occupation (farm laborer)	48 (21.81)	32 (14.54)	1.63 (1.00–2.68)	0.048
Maternal education (illiterate/primary)	68 (30.90)	44 (20)	1.78 (1.15–2.77)	0.008
Nuclear family	59 (26.81)	40 (18.18)	1.64 (1.04–2.59)	0.029
Tobacco exposure	32 (14.54)	14 (6.36)	2.50 (1.29–4.83)	0.005

Table 3: Maternal determinants of low birth weight

Variable	Cases (%) (*n* = 220)	Control (%) (*n* = 220)	Odds ratio (95% CI)	*p*-Value
Height <145 cm	56 (25.45)	38 (17.27)	1.63 (1.02–2.59)	0.036
Prepregnancy weight <45 kg	134 (60.90)	92 (41.81)	2.16 (1.48–3.17)	<0.0001
Spacing <2 years between present and last pregnancy	102 (83.60)	91 (61.48)	3.19 (1.78–5.72)	<0.0001
Primigravida	98 (44.54)	72 (32.72)	1.65 (1.12–2.43)	0.0109
Late ANC registration	168 (76.36)	135 (61.36)	2.03 (1.34–3.07)	0.0006
Inadequate ANC	88 (40)	64 (29.09)	1.62 (1.09–2.41)	0.016
Bad obstetrics history	6 (2.72)	4 (1.81)	1.51 (0.42–5.44)	0.52
Prematurity	67 (30.45)	42 (19.09)	1.85 (1.19–2.88)	0.0057
PIH	36 (16.36)	14 (6.36)	2.87 (1.5–5.5)	0.0009
Anemia	191 (86.81)	172 (78.18)	1.83 (1.10–3.04)	0.017
Cesarean delivery	96 (43.63)	126 (57.27)	0.57 (0.39–0.84)	0.004

Table 4: Mean weight of newborn of cases and controls in different studies

Studies	Cases	Controls
Shah et al.[6]	2.09±0.3 kg	2.95±0.32 kg
Deshpande Jayant D et al.[3]	1864.97±465.06 g	2848.35±298.53 g
Present study	1664.97±465.06 g	2548.35±298.53 g

mothers were significantly higher among the LBW newborn. The ANC experience of the mothers (ANC registration and antenatal care) in the control group was significantly better than that of cases. Mothers who had bad obstetric history showed no poor outcome in their present pregnancy. Anemia and height less than 145 cm were significantly more common among the mothers of LBW babies. Anemia was one of the common problems found in this study from rural area. Approximately 86.81% of mothers who delivered LBW babies were anemic. In this study, it was found that most of mothers from rural area started attending ANC clinics in their 6–8 months of gestation. Significant association was found between maternal education (illiterate/primary), prematurity, cesarean delivery, age of mother <20 or >30 years, height <145 cm, maternal occupation (laborer), nuclear family, primigravida, anemia, inadequate ANC and LBW. No association was found between bad obstetrics history and LBW.

Discussion

In this study, the mean age of mothers in case group was 22.6 years and that of controls was 23.92 years, which is comparable with those found in the study conducted by Deshpande Jayant et al.[3] in which mean age of mothers in case group was 22.7 years and that in the control group 22.28 years. In the study conducted by Singh et al.,[5] mean age of mothers in case group was 24.68 years and that of controls was 25.15 years.

Mean weight gain during pregnancy of mothers in case group and that of controls was 4.2 and 5.9 kg, respectively, was observed in this study. Deshpande Jayant et al.[3] found the mean weight gain in pregnancy of mothers in case group was 4.9 kg and that in control group was 6.9 kg.

Our findings of mothers with spacing <2 years between present and last pregnancy suggest that have 3.19 times risk of developing LBW babies, which is more than the findings of the study conducted by Nagargoje et al.[7] The authors found that mothers with spacing <2 years between this and last pregnancy had 1.81 times risk of developing LBW babies. Similar risk (odds ratio = 3.63) was observed in study conducted by Jawarkar et al.[8]

The risk of delivering LBW babies was found to be approximately 2.87 times among the mothers with PIH in the present study, which is less than that observed by Deshpande Jayant et al.[3] (odds ratio = 4.09) and Singh et al.[5] (odds ratio = 8.546).

In our study, tobacco exposure, lower socioeconomic status (class IV + V), prepregnancy weight <45 kg, and late ANC registration were identified as significant risk factors for LBW neonates (odds ratio >2). These findings are in agreement with those of Deshpande Jayant D et al.[3] who also found tobacco exposure (odds ratio = 6.36), lower socioeconomic status (class IV + V) (odds ratio = 1.68), prepregnancy

weight <45 kg (odds ratio = 4.41), and late ANC registration (odds ratio = 2.18) as significant risk factors.

In the present study, significant association was found between maternal education (illiterate/primary), prematurity, cesarean delivery, age of mother <20 or >30 years, height <145 cm, maternal occupation (laborer), nuclear family, primigravida, anemia, inadequate ANC, and LBW. But no significant association could be established between LBW and maternal education and maternal age in study conducted by Paramita et al.[9] and in study conducted by Kaur et al.[10]; this association was found to be significant. Joshi et al.[11] found that maternal education (illiterate), maternal occupation (laborer), inadequate use of antenatal care, and maternal age (≤20) factors were highly significant in association with LBW while parity (P1) was not associated with LBW. Hayat et al.[12] showed a significant association between maternal age, maternal educational status, anemia, inadequate use of antenatal care, and LBW in their study. Syed and Kamathi[13] observed a statistically significant association between maternal height (≤145 cm) and LBW. Negi et al.[14] observed a significant association between bad obstetrics history, premature delivery, and LBW ($P < 0.05$). But in the present study, no association could be established between bad obstetrics history and LBW. Deshpande Jayant D et al.[3] found no association with cesarean delivery, nuclear family, and LBW

Conclusions

Significant association was found between maternal education (illiterate/primary), prematurity, cesarean delivery, age of mother <20 or >30 years, height <145 cm, maternal occupation (laborer), nuclear family, primigravida, anemia, inadequate ANC, and LBW. No association was found between bad obstetrics history and LBW. Women from lower socioeconomic status are more susceptible to poor diet and infection and more likely to undertake physically demanding work during pregnancy. Early diagnosis and treatment of pregnancy-induced hypertension and any other antenatal complication is important for prevention of LBW.

Recommendations

Importance of appropriate nutrition, risk of teenage pregnancy, importance of adequate antenatal care, and early registration of pregnancy are important for pregnant woman, which can be given through information, education, and communication (IEC) activity. Motivation of pregnant mothers for spacing of more than 2 years between two successive pregnancies should be maintained and exposure to tobacco should be avoided by pregnant women. So health education, socioeconomic development, maternal nutrition, and increasing the use of health services during pregnancy are all important for reducing LBW.

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References

1. Park K. *Park's Textbook of Preventive and Social Medicine*, 21st edn. Jabalpur, India: Banarsidas Bhanot Publishers, 2011. pp. 493–6.
2. UNICEF and WHO. *Low Birth Weight, Country, Regional and Global Estimates*. The United Nations Children's Fund and World Health Organization, 2004.
3. Deshpande Jayant D, Phalke DB, Bangal VB, Peeyuusha D, Sushen B. Maternal risk factors for low birth weight neonates: a hospital based case–control study in rural area of western Maharashtra, India. NJCM 2011;2(3):394–98
4. World Health Organization. *International Classification of Diseases*, ninth revision, vol. 1 Geneva: World Health Organization, 1977.
5. Singh LCG, Chouhan CR, Sidhu MK. Maternal factors for low birth weight babies. MJAFI 2009;65(1):10–12.
6. Shah UP, Parikh SB, Bala DV. Effect of different maternal factors on birth weight in the Odhav ward of Ahmedabad Municipal Corporation—a case–control study. Healthline 2013;4(1):58–62.
7. Nagargoje MM, Chaudhary SS, Deshmukh JS, Gupta SC, Misra SK. A case control study for risk factors of low birth weight in Nagpur city of Maharashtra. IJCH 2010 Jul–2011 Jun;22(1): 4–7.
8. Jawarkar AK, Lokare PO, Dore S. Study of socio-demographic and maternal determinants influencing birth-weight. J MGIMS 2012;17(ii):28–33.
9. Paramita S, Sharma N, Benjamin AI. Risk factors for low birth weight: a case control study in Ludhiana, Punjab. IJMCH 2009;11:1–4.
10. Kaur S, Upadhyay AK. Srivastava DK, Srivastava R, Pandey ON. Maternal correlates of birth weight of newborn: a hospital based study. IJCH 2014;26(02):187–91.
11. Joshi HS, Srivastava PC, Agnihotri AK, Joshi MC, Shalini C, Vipul M. Risk Factors for low birth weight (LBW) babies and its medico-legal significance. J Indian Acad Forensic Med 32(3);212–15.
12. Hayata H, Khan PS, Hayat G, Hayat R. A study of epidemiological factors affecting low birth weight. Eastern J. Med. 2013;18:13–15.
13. Syed W, Kamathi VC. Maternal short stature: a risk factor for low birth weight in neonates. J Med Allied Sci 2012;2(2):62–5.
14. Negi KS, Kandpal SD, Kukreti M. Epidemiological factors affecting low birth weight. J K Science 2006;8(1):31–4.

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