Research Article

Determinants of low birth weight in a rural area of Tamil Nadu, India: a case–control study

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Abstract

Background: Birth weight of a child is an important indicator for reproductive health and general status of the population. Low birth weight (LBW) is considered as the single most predictor of infant mortality, especially of deaths within first month of life.

Objectives: To find out the socio-demographic and maternal factors related to LBW.

Materials and Methods: A case–control study was conducted in Kancheepuram district, Tamil Nadu, India, from January 2013 to September 2014. A total of 222 study participants, which included 111 cases and 111 controls, were interviewed using a structured questionnaire. Study variables included sociodemographic factors and maternal factors related to LBW. Modified BG Prasad Classification (April 2013) based on monthly per capita income was used to ascertain the socioeconomic status of the study participants. Data were entered in Microsoft Excel 2013 and were analyzed using SPSS software, version 16. Odds ratio (OR) was calculated. Multiple logistic regression analysis was done to adjust for confounders.

Results: After adjusting for confounders, the significant risk factors associated with LBW were mother's age less than 19 years [OR (95% CI) = 6.10 (1.47–25.23)], interpregnancy interval <2 years [OR 5.34 (1.50–19.05)], gestational age <37 weeks [OR 3.57 (1.88–14.34)], weight of the mother <45 kg [OR 6.10 (1.47–25.23)], and anemia [OR 3.08 (2.58–5.76)].

Conclusion: The study emphasizes the need for improving maternal health, quality and utilization of antenatal care, weight gain during pregnancies, prevention, and proper management of risk factors such as anemia, along with improving socioeconomic and educational status of mothers.

KEY WORDS: Low birth weight, sociodemographic factors, maternal factors, reproductive health

Introduction

Birth weight of a child is an important indicator for reproductive health and general status of the population. Low birth weight (LBW) is considered to be the single most predictor of infant mortality, especially of deaths within first month of life.[1] Birth weight is an important determinant of perinatal, neonatal, and postnatal outcomes.[2,3] LBW according to the WHO is birth weight of less than 2,500 g, the measurement being taken preferably within the first hour of life before significant postnatal weight loss has occurred.[4] LBW babies are broadly of two types: first, those born before 37 weeks (preterm) and second, those who have intrauterine growth retardation (IUGR).[5]

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LBW infants represent a significant health problem worldwide. The first authoritative estimates of mean birth weight and prevalence of LBW were produced by the WHO in 1979 and updated in 1982.[6] Over 20 million babies are born each year weighing less than 2,500 g worldwide, resulting in LBW of 15.5%; 95.6% of LBW babies are born in developing countries.[7] In India, according to the National Family Health Survey-3 (NFHS-3), prevalence of LBW babies is 21.5%; the prevalence being slightly higher in rural areas (22.1%) than in urban areas (20%) and this almost remained static for last one decade.[8] In India, 29% of infant mortality rate is associated with LBW.[9] Birth weight of the baby is influenced by many factors such as maternal age, maternal education, maternal weight, gestational weight gain, gestational hemoglobin percentage, hypertension, maternal height, socioeconomic condition, birth interval, and inadequate antenatal (ANC) care.[10]

LBW babies are more likely to die in infancy, and many also have irreversible cognitive impairments and increased risk of developing noncommunicable diseases later in

adulthood.[11] According to the fetal origin of disease hypothesis, also known as Barker's hypothesis, undernutrition at critical stages in fetal growth can cause an increased risk of adult degenerative diseases of hypertension, diabetes mellitus, hyperlipidemia, and syndrome X.[12,13]

The 34th World Health Assembly of the WHO adopted the goal of reducing the incidence of LBW to less than 10% as part of the global strategy of "Health for All" by the year 2000.[14] Reduction of LBW incidence is one of the major goals of the "World fit for Children" plan adopted by the United Nations General Assembly in 2002.[7] The mortality due to LBW can be reduced if the risk factors are detected and managed early. Hence, this study was carried out to find the maternal factors associated with LBW so that appropriate strategies can be formulated to tackle the problem.

Materials and Methods

This study was conducted in Kancheepuram district, Tamil Nadu, India. The estimated sample size for case–control study was 222 [95% confidence interval (95% CI), power 80%, cases to controls ratio of 1, exposure among controls 9.5%, odds ratio (OR) 3.09],[15] which was calculated using the Epi Info software, version 2.3.1. Four primary health centers (PHCs) and one government hospital (GH) from three blocks of Kancheepuram district, Tamil Nadu, providing obstetric care were approached, and data regarding birth weight of babies born between January 1, 2012 and December 31, 2012 were collected. The total number of deliveries in the selected PHCs and GH was 1537; of which, 208 were LBW babies. Cases and controls were selected on the basis of birth weight of the babies. Mothers who delivered babies with birth weight less than 2.5 kg, by any mode of delivery, were selected as cases, and the consecutive mothers who delivered babies with birth weight more than or equal to 2.5 kg, by any mode of delivery, were selected as controls. The details of all LBW babies born during January 1, 2012 and December 31, 2012 (208) and their controls (208) were noted down.

The details of the mothers were collected from the registers, which included address, phone number, hemoglobin of the mother, history of pregnancy-induced hypertension (PIH) and gestational diabetes mellitus. The registers had incomplete address for many mothers. Among them, mobile numbers were available for few mothers who were contacted and their locations were found. For those mothers who could not be contacted on mobile phone also, the Anganwadi worker in that particular area was contacted to get the information and few mothers were traced in this manner. Mothers who could not be traced (37 cases and 24 controls) and who were unavailable in their houses (9 cases and 14 controls) in spite of two visits, and mothers who were not residents of Kancheepuram district 23 cases and 31 controls) were excluded from the study.

Interview of the selected participants was held with a pretested and predesigned questionnaire by means of house visits to assess the sociodemographic factors and maternal characteristics that are associated with LBW. The sociodemographic variables included the age of the mother, religion, caste, mother's education and occupation, per capita income of the family, housing condition, place of cooking, and fuel used for cooking. The maternal factors included age at child birth; parity; spacing between children; ANC, intranatal, and postnatal events; and maternal anthropometry. The study was carried out till the estimated sample size was achieved. The study was approved by the ethical review committee of the institute. Participant information sheet was given to the participants and written informed consent was obtained from each participant before data collection.

Statistical Analysis

Data were entered in Microsoft Excel 2013 and were analyzed using SPSS software, version 16. OR and CI were calculated, and *p*-value of <0.05 was considered to be statistically significant. Multiple logistic regression analysis was done to adjust for confounders.

Results

Table 1 shows that the majority of cases (80; 72.1%) and controls (83; 74.8%) belonged to 20–25 years age group. However, 12 (10.8%) cases and 4 (3.6%) controls were below 19 years of age. Maximum mothers (106; 47.6%) were educated up to high school. The literacy level was higher among controls 57 (51.4%) as compared to cases 49 (44.2%). Occupational status of the mothers showed that 98 (88.3%) and 101 (91%) among the cases and controls, respectively, were housewives. Maximum participants among cases (45; 40.5%) and controls (39; 35.2%) belonged to social class 3 and 2, respectively, as per modified BG Prasad Classification (April 2013).

Table 2 shows that among the determinants of LBW studied, mothers of age less than 19 years [OR (95% CI) = 3.24 (1.01–10.38)], mothers who were illiterate [8.12 (1.11–59.21)], social class 5 [6.44 (1.45–28.2)], interpregnancy interval less than 2 years [4.11 (2.29–7.38)], intake of Iron and Folic Acid (IFA) tablets for less than 100 days [1.96 (1.03–3.72)], mothers who had less than four ANC visits [2.94 (1.10–7.84)], primiparity [2.33 (1.21–4.51)], gestational age at the time of delivery less than 37 weeks [3.06 (1.06–8.81)], anemia (Hb <9 g/dL) [2.23 (1.03–5.04)], PIH [8.54 (1.05–69.50)], and weight of the mother less than 45 kg [6.51 (1.85–22.91)] were significantly associated with LBW.

Table 3 shows that after adjusting for confounders using multivariate logistic regression analysis the significant risk factors associated with LBW were mother's age less than 19 years [6.10 (1.47–25.23)], interpregnancy interval <2 years [5.34 (1.50–19.05)], gestational age <37 weeks [3.57 (1.88–14.34)], weight of the mother <45 kg [6.10 (1.47–25.23)], and anemia [3.08 (2.58–5.76)].

Table 1: Sociodemographic characteristics of the study participants (*n* = 222)

Variables	Cases, *n* (%)	Controls, *n* (%)
Age (years)		
£19	12 (10.8)	4 (3.6)
20–25	80 (72.1)	83 (74.8)
26–30	16 (14.4)	24 (21.6)
>30	3 (2.7)	0 (0.0)
Education		
Illiterate	9 (8.1)	6 (5.4)
Primary	5 (4.5)	2 (1.8)
Middle	23 (20.7)	8 (7.2)
High school	49 (44.2)	57 (51.4)
Higher secondary	21 (18.9)	25 (22.5)
Graduate and above	4 (3.6)	13 (11.7)
Occupation		
Daily wage laborer	13 (11.7)	10 (9)
Housewife	98 (88.3)	101 (91)
Social classa		
1 (Upper)	12 (10.8)	29 (26.1)
2 (Upper middle)	27 (24.3)	39 (35.2)
3 (Lower middle)	45 (40.5)	34 (30.6)
4 (Upper lower)	19 (17.2)	6 (5.4)
5 (Lower)	8 (7.2)	3 (2.7)
Total	111 (100)	111 (100)

[a]Modified BG Prasad Classification (April 2013).

Table 2: Determinants of low birth weight (*n* = 222)

Variables	Odds ratio (95%CI)	*p*-Value (<0.05)
Age of the mother (<19 years)	3.24 (1.01–10.38)	**0.04**
Education of the mother (illiterate)	8.12 (1.11–59.21)	**0.04**
Occupation of the mother (Daily wage laborer)	1.33 (0.55–3.29)	0.66
Socioeconomic status (class 5)	6.44 (1.45–28.2)	**0.01**
Type of house (kutcha)	0.86 (0.29–2.59)	0.80
Place of cooking (living room)	1.66 (0.79–3.5)	0.17
Fuel used for cooking (wood)	0.86 (0.24–3.01)	0.82
Inter pregnancy interval (<2 years)	4.11 (2.29–7.38)	**0.003**
Intake of IFA tablets (<100 tablets)	1.96 (1.03–3.72)	**0.04**
Antenatal visits (<4 visits)	2.94 (1.10–7.84)	**0.03**
Gestational age (<37 weeks)	3.06 (1.06–8.81)	**0.03**
Parity (primi)	2.33 (1.21–4.51)	**0.01**
Pregnancy-induced hypertension	8.54 (1.05–69.50)	**0.04**
Anemia (<10 g/dL)	2.23 (1.03–5.04)	**0.02**
Gestational diabetes mellitus	1.51 (0.24–9.23)	0.451
Height (<145 cm)	2.50 (0.98–6.3)	0.06
Weight (<45 kg)	6.51 (1.85–22.91)	**0.004**

Table 3: Determinants of low birth weight using multivariate logistic regression analysis (*n* = 222)

Variables	Adjusted OR (95%CI)	*p*-Value (<0.05)
Age of the mother(<19 years)	**6.10 (1.47–25.23)**	**0.01**
Education of the mother (illiterate)	2.98 (0.82–10.74)	0.09
Socioeconomic status (class V)	1.47 (0.42–5.71)	0.54
Interpregnancy interval (<2 years)	**5.34 (1.50–19.05)**	**0.01**
Antenatal visits (<4 visits)	2.19 (0.53–8.96)	0.27
Complications (anemia, PIH, GDM)	1.66 (0.64–4.29)	0.29
Gestation(<37 weeks)	**3.57 (1.88–14.34)**	**0.04**
Parity (primi)	2.69 (0.48–14.89)	0.25
Weight (<45 kg)	**6.10 (1.47–25.23)**	**0.01**
Alcohol intake	1.44 (0.68–3.04)	0.33
IFA (<100 tablets)	1.79 (0.73–4.39)	0.20
PIH	5.25 (0.82–45.8)	0.99
Anemia	**3.08 (2.58–5.76)**	**0.01**

PIH, pregnancy-induced hypertension; GDM, gestational diabetes mellitus.

Discussion

This case–control study was conducted among 222 participants to identify the sociodemographic and maternal factors associated with LBW. This study found that adolescent mothers (<19 years) had a higher risk of delivering LBW babies compared to older mothers after adjusting for confounders. Phalke et al.[16] in a retrospective record-based hospital study in Maharashtra, India, found that in 41.6% LBW babies, the maternal age was less than 20 years. Similar result was found in a study carried out in Kolkata by Bisai et al.,[17] which showed mothers aged less than 19 years had higher risk of an LBW delivery compared to those aged 19–28 years.

In this study, mothers' education had significant association with LBW (OR 8.12; 95% CI 1.11–59.21, $p = 0.04$). Gawande et al.[18] in their study also found that the percentage of LBW babies born to mothers who were illiterate or educated up to primary school was as high as 39.5%. In studies carried out by Dasgupta et al.[19] and Idris et al.[20], similar significant association was observed between low maternal education and LBW. Occupation of the mother did not have significant association with LBW in our study whereas studies conducted on working mothers by Ghosh et al.[21], Anand and Garg[22] found that occupation was associated with LBW. This could be possibly because most of the participants in this study were housewives. In this study, mothers belonging to lower social class had higher risk of LBW. Similarly other studies[22–25] also found significant association between socioeconomic status of mother and LBW, proving that socioeconomic status is one of the important determinant of LBW.

Primiparity was found to be significant risk factor associated with LBW in this study. Similar results were found in a study conducted in a slum area of greater Mumbai by Joshi and Pai.[26]

Anand and Garg[22] in their study conducted in Wardha also reported a similar increase in risk of LBW for primiparous women. Interpregnancy interval was found to be a significant risk factor for LBW in this study. Similar findings were also observed in other studies.[27,28]

This study found that those mothers who had received less than four ANC visits had a significant risk of having LBW. Malik et al.[29] in their study also observed that when the ANC visits were four or more, the chances of LBW were 25% less compared to unregistered mothers (35.9%). Anemia was significant risk factor for LBW in our study. This finding is in accordance with that of Palma et al.[30] who in a case–control study found that anemia was significant risk factor for LBW. Deshmukh et al.[23] found that anemia was the most significant risk factor associated with LBW in their study. Maternal weight less than 45 kg was found to be a significant risk factor for LBW in this study. Acharya et al.[31] in a hospital-based case–control study carried out in Udupi, found that a maternal weight of less than 45 kg was a significant risk factor for IUGR. Kumar[32] also in his study found that a maternal weight of less than 45 kg was associated with a higher risk of LBW.

Strengths

Even though the details of the participants were collected from hospital records, house-to-house visit was made to interview the participants.

1. All study participants were interviewed by the investigator. Hence, chance of interobserver bias was prevented.
2. The potential confounders among the determinants of LBW were adjusted using multiple logistic regression analysis and hence, the validity of the study improved.

Limitations

1. The health status of women before pregnancy has not been taken into consideration.
2. The hemoglobin values of the mothers during pregnancy were obtained from their medical records. They all reflect the hemoglobin status of the participant at one particular point in the duration of her pregnancy, which could have further improved through the course of pregnancy.

Conclusion

The significant risk factors associated with LBW after adjusting for confounders were mother's age <19 years, interpregnancy interval <2 years, gestational age <37 weeks, weight of the mother <45 kg, and anemia. Thus, the findings of this study emphasize the need for improving maternal health, quality and utilization of ANC care, weight gain during pregnancies, prevention and proper management of risk factors such as anemia and PIH, along with improving socioeconomic and educational status of mothers.

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