Original Article

Correlates of Low Birth Weight: A Hospital-Based Study From Gangtok, India

Global Pediatric Health
January-December 2014: 1–5

DOI: 10.1177/2333794X14562229
gph.sagepub.com
SAGE

Ankur Barua, MD, PhD[1], Jayant Hazarika, MBBS, DCH, DNB[2], and Sudip Dutta, MD[2]

Abstract

Background. Low birth weight is the single most important factor that determines the chances of child survival. A recent annual estimation indicated that nearly 8 million infants are born with low birth weight in India. The infant mortality rate is about 20 times greater for all low birth weight babies. *Methods*. A matched case–control study was conducted on 130 low birth weight babies and 130 controls for 12 months (from August 1, 2007, to July 31, 2008) at the Central Referral Hospital, Tadong, East District of Sikkim, India. Data were analyzed using the Statistical Package for Social Sciences, version 10.0 for Windows. Chi-square test and multiple logistic regression were applied. A *P* value less than .05 was considered as significant. *Results*. In the first phase of this study, 711 newborn babies, borne by 680 mothers, were screened at the Central Referral Hospital of Sikkim during the 1-year study period, and the proportion of low birth weight babies was determined to be 130 (18.3%). *Conclusion*. Multiple logistic regression analysis, conducted in the second phase, revealed that low or middle socioeconomic status, maternal underweight, twin pregnancy, previous history of delivery of low birth weight babies, smoking and consumption of alcohol during pregnancy, and congenital anomalies had independent significant association with low birth weight in this study population.

Keywords

preterm, intrauterine growth, retardation, multiple logistic regression

Introduction

Low birth weight (LBW) is an important guide to the level of care needed for individual babies. There is a strong and significant positive correlation between maternal nutritional status and the length of pregnancy as well as birth weight. A high percentage of LBWpoints to deficient health status of pregnant women, inadequate prenatal care, and the need for improved care of the newborn. The survivors among them are at high risk of developing malnutrition, recurrent infection, and neuro-developmental handicaps.[1,2] Thus, LBW has become one of the most serious challenges in maternal and child health in both developed and developing countries. It is the single most important factor that determines the chances of child survival. The neonatal mortality rate is about 20 times greater for all LBW babies than for other babies.[1]

The objectives of this study were (*a*) to determine the proportion of LBW babies born at the Central Referral Hospital (CRH) of East Sikkim and (*b*) to identify the correlates associated with LBW among the babies born at the CRH of East Sikkim.

Materials and Methods

Sikkim is a small beautiful state of India in the Eastern Himalayas with steep mountains and deep valleys. Sikkim is the 22nd state of the Indian Union. The population of Sikkim is 0.54 million according to the 2001 census, and Sikkim is composed of 4 districts and 452 villages. Eighty-seven percent of the population of Sikkim lives in rural areas. As against a decadal growth rate of 21.54% at the national level, the population of

[1]International Medical University, Kuala Lumpur, Malaysia
[2]Sikkim-Manipal Institute of Medical Sciences, Gangtok, India

Corresponding Author:
Ankur Barua, Department of Community Medicine, International Medical University, No 126, Jalan Jalil Perkasa 19, Bukit Jalil, 57000 Kuala Lumpur, Malaysia.
Email: ankurbarua26@yahoo.com

Sikkim has grown by 33.06% over the period 1991 to 2001. The sex ratio of Sikkim at 875 females to 1000 males is lower than the national average of 933. Female literacy of the state rose to 61.46% from 46.76% in 1991 (according to the RHS Bulletin, March 2007, of the Ministry of Health and Family Welfare). Although there were only 15 primary health centers (PHCs) and 6 subcenters functioning in 1979, substantial increase in the establishment of subcenters and PHCs has been made through the years. There are now 24 PHCs and 147 subcenters functioning throughout the state. The construction 100-bed community health centers at Singtam, Namchi, Gyalsing, and Mangan have been completed and are functioning. The STNM Hospital at Gangtok has been upgraded to 300 beds from 250 beds. To ease the congestion in the outpatient department clinics, a new emergency cum outpatient department complex has been added to the old building. The construction of an apex 500-bed Central Referral Hospital at Tadong, Gangtok, also has been completed and is now fully functional.

Study Design

In the first phase, a hospital-based cross-sectional study on screening was conducted among the neonates delivered within the study period in order to identify those who were having LBW. In the second phase, a matched case–control study was conducted to identify the risk factors of LBW. In this phase, the cases were compared with their corresponding controls.

The setting was the Central Referral Hospital, Tadong, East District of Sikkim, India. The study period was 12 months (from August 1, 2007 to July 31, 2008).

Study Population

All the live births that took place within the study period at the CRH of Sikkim constitute the study sample of screening for LBW in the first phase. The total number of live births during the study period was 711. The study population for the case–control model in the second phase included all the LBW neonates (n = 130) and an equal number of neonates with normal birth weight. This sample for the case–control study was later determined to be 260.

Case Definition

All the babies born with weight of less than 2500 g (up to and including 2499 g) were considered as LBW. Birth weight less than 1500 g (up to and including 1499 g) were considered as very low birth weight, whereas birth weight less than 1000 g (up to and including 999 g) were considered as extremely low birth weight.

Definition of Control Group

All the babies born with weight of more than or equal to 2500 g were considered as normal birth weight babies. An appropriate sample of these babies constituted the control group.

Sample Size Estimation

Due to feasibility constraints it was decided to include one "control" against every "case" of LBW baby. This study covered all the cases of LBW babies delivered or admitted at the CRH during the study period of 12 months.

Sample Size. At the end of the study period, the total number of cases of LBW was found to be 130. After selecting appropriate 130 controls, which were matched for sex distribution with their corresponding cases, the total study sample size was determined as 260.

Criteria for Matching

In this study, every control was matched for sex distribution with its corresponding case.

Sampling Procedure

Sampling Method. All the LBW babies who were either born at the CRH or referred there for medical attention during the study period were included as "cases" in this study. After matching according to the sex distribution of "cases," simple random sampling without replacement method was applied to select the "control group" from the normal birth weight neonates admitted at the CRH during the study period.

Inclusion Criteria. All the babies born at or referred to the CRH during the neonatal period of (0-28) days of birth, from August 1, 2007 to July 31, 2008 were included in this study.

Exclusion Criteria. All the babies who were never brought to the CRH during the neonatal period of (0-28) days of birth, from August 1, 2007 to July 31, 2008 were excluded from this study.

Criteria for Defining a Respondent. All attempts were made to collect firsthand information about the neonate from the mother as the informant. But in cases of mother

being noncooperative or suffering from severe behavioral problems or cognitive impairment, had severe hearing impairment or articulation disorder, or suffering from any terminal illness, information about the baby was collected from the father or other caregivers.

Criteria for Defining a Nonrespondent. In situations where the neonate became an orphan at the time of admission to the CRH or abandoned or left alone in the hospital with none of the parents or any caregiver ready to claim any responsibility about the baby, the neonate was considered as a nonrespondent.

Study Instruments

A face sheet containing information regarding personal details including the sociodemographic profile of respondents and clinical presentations of the mother and the neonate was used for data collection. The majority of the items in these questionnaires were based on the guidelines set by the World Health Organization (WHO) and the Indian Academy of Paediatrics. The content validity of all these questionnaires had been verified by a team of experts from the Departments of Paediatrics and Community Medicine.

As the Modified Udai Pareek Scale can estimate the socioeconomic status under rural as well as urban conditions, the researchers decided to use this scale for the assessment of the socioeconomic status of the respondents.

Weight of the neonate was recorded by using an electronic weighing machine. Maternal weight was recorded by using a normal bathroom-type weighing machine. Nutritional status of the neonate was assessed by using the WHO growth chart. Maternal nutritional status was assessed by using the body mass index (BMI). All questionnaires were translated into Nepali language by an expert in both Nepali and English language, not aware, related, or involved with any part of this study. The Nepali version of the questionnaires was retranslated back into English by another expert in both Nepali and English language, not aware, related, or involved with any part of this study. This retranslated version was compared with the original English version for its consistency in communicating the same meaning for every item in all the questionnaires.

Data Collection Procedure

The data of all the babies born in the labor room or operation theatre of the CRH or those referred from the PHCs, district hospitals, and STNM Government Hospital of Sikkim and admitted to the CRH, were collected on a preformed, structured proforma. Data collection for this project was actively supervised by the chief investigator at all times. Birth weight of all the neonates in the study population was recorded by using an electronic weighing machine. Maternal weight was recorded by using a normal bathroom-type weighing machine.

All the study instruments were pretested on 10 "cases" and 10 "controls" to determine whether they optimally suited the study requirements and acceptable to the respondents. Also, the average time of interview for each respondent was determined from this pretest. The data generated through the pretest were discarded after preliminary analysis and were never included for analysis at the end of final study.

After informed verbal consent was obtained, a brief general health check-up of the mother and the baby was conducted. Then the face sheet containing information regarding personal details and clinical presentations and sociodemographic profile of the respondents was applied. Information on socioeconomic status of the participants was collected by using the Modified Udai Pareek Scale. Clinical information of the nonrespondent babies was also collected by the investigators.

Whenever the participants and respondents needed any other specialist care, they were immediately referred to the corresponding specialist doctors at the CRH, run by the Sikkim-Manipal Institute of Medical Sciences, Gangtok, for a free health check-up. The information generated by the study instruments was strictly kept confidential.

Ethical Committee Clearance

The clearance from "Research Committee" and "Ethical Committee" of the Sikkim-Manipal Institute of Medical Sciences was sought before the initiation of this study. The confidentiality and anonymity of the participants and respondents were strictly kept confidential throughout this study.

Data Analysis

The collected data were tabulated and analyzed by using the statistical package SPSS (Statistical Package for Social Sciences), version 10.0, for Windows. Findings were described in terms of proportions and their 95% confidence intervals. Chi-square test was applied to compare the relationship between different variables against "cases" and "controls." To determine the independent effect of various factors on "cases" and "controls," multiple logistic regression was performed and their significance was estimated in terms of adjusted odds ratio and their 95% confidence intervals. In this study, p-value less than .05 was considered as statistically significant.

Table 1. Correlates of Low Birth Weight: Multiple Logistic Regression Analysis.

Correlates of Low Birth Weight	Category	OR (Unadjusted)	95% CI	OR (Adjusted)	95% CI	*P* Value
Marital status	Married	1.00	—	—	—	—
	Unmarried/ widowed/ separated/ divorced	2.0	1.8-2.3	1.9	0.8-6.4	.251
Maternal age group (years)	20-29	1.00	—	—	—	—
	≥30	2.4	1.2-14.3	1.6	0.5-5.0	.544
	<20	3.2	2.8-15.6	1.4	0.6-3.3	.169
Socioeconomic status	High	1.00	—	—	—	—
	Middle/low	4.7	2.8-8.1	2.5	1.1-5.0	.023*
Parity	≤2	1.00	—	—	—	—
	>2	7.3	0.9-60.5	3.3	0.3-5.0	.244
Maternal BMI	Normal	1.00	—	—	—	—
	Overweight	8.6	1.8-19.2	3.3	1.4-5.0	.197
	Underweight	14.8	2.3-12.1	5.0	3.3-10.0	.0001*
Antenatal check-up	Attended (≥3)	1.00	—	—	—	—
	Unattended (<3)	5.1	1.4-18.2	1.2	0.2-6.6	.866
Presence of twin pregnancy	Absent	1.00	—	—	—	—
	Present	8.3	1.9-37.3	3.3	1.7-10.0	.001*
Mode of present delivery	Elective LSCS	1.00	—	—	—	—
	Emergency LSCS	3.8	1.2-12.4	1.8	0.6-5.4	.837
	Normal vaginal delivery	2.9	1.6-16.8	1.1	0.6-2.5	.422
H/o previous low birth weight deliveries	Absent	1.00	—	—	—	—
	Present	10.9	2.5-48.1	5.0	0.9-10.0	.040*
Habits of mother	Absent	1.00	—	—	—	—
	Present	8.7	3.7-12.1	1.7	0.1-4.3	.029*
Presence of congenital anomaly	Absent	1.00	—	—	—	—
	Present	6.2	0.7-52.6	3.3	1.7-5.0	.003*

Abbreviations: OR, odds ratio; CI, confidence interval; BMI, body mass index; LSCS, lower segment caesarean section.
*P value <.05 was considered as significant.

Results

During the first phase of the screening survey, 711 babies were delivered live at the CRH of Sikkim during the study period, and they were further examined for LBW. The total number of LBW babies during the study period was 130 (18.3%). There were altogether 32 (4.5%) twin deliveries, and thus, a total 711 babies were borne by 680 mothers. There was no nonrespondent in this study, and complete relevant data for final analysis for this study was obtained from 680 mothers of 711 babies.

During the second phase of this study, a case–control study design was adopted and all 130 LBW babies were included as cases and 130 suitable controls were selected from the babies with normal birth weight after matching with their corresponding sex distribution.

In this total sample of 260 neonates borne by 243 mothers, there were 18 (6.9%) cases of twin deliveries. There were 5 single mothers who were either unmarried or divorced. The mean age of 243 mothers was 23.1 ± 4.3 years and their mean parity was 1.6 ± 0.8. The mean birth weight of 260 neonates in the study population was 3.4 ± 0.63 kg (Table 1). This sample comprised 122 (46.9%) preterm babies and 33 (12.7%) babies how underwent intrauterine growth retardation (IUGR).

Among the 711 total live births at the CRH, the number of neonates having birth weights more than 2500 g was 581 (81.7%). The total proportion of LBW babies during the study period was 130 (18.3%). Among the LBW babies, 112 (15.8%) neonates had birth weight between 2499 and 1500 g; 17 (2.4%) had birth weight between 1499 and 1000 g and were considered as very low birth weight babies. In this study, only 1 (0.001%) neonate was found to be less than 1000 g and was categorized as an extremely low birth weight baby.

In this study, it was found that all term babies weighed more than 1500 g. Among the preterm babies, only 1 (0.8%) had birth weight less than 1000 g, 17 (13.9%) weighed between 1499 and 1000 g, 74 (60.7%) weighed between 2499 and 1500 g, and 30 (24.6%) preterm neonates were more than or equal to 2500 g. This difference of proportions between the groups was found to be statistically highly significant. The total number of IUGR was 33 (12.7%) among the 260 live births selected for this case–control study. In this sample, it was found that all the IUGR babies weighed between 1500 and 2499 g. This difference of proportions between the 2 groups was found to be statistically significant.

From the univariate analysis, it was found that maternal age, marital status, caste, parity, smoking and consumption of alcohol during pregnancy, middle and lower socioeconomic status, twin pregnancy, h/o previous low birth weight, antenatal check-up, maternal BMI, mode of present delivery, and paternal occupation were significantly associated with low birth weight.

However, the multiple logistic regression analysis of various correlates of LBW (Table 1) revealed that low or middle socioeconomic status, maternal underweight, twin pregnancy, previous history of delivery of LBW babies, smoking and consumption of alcohol during pregnancy, and congenital anomalies had independent significant association with LBW in the study population.

Discussion

In a recent analysis of 2001, the UNICEF and the WHO had estimated the incidence of LBW neonates in India from the census report of 2001. The data revealed that the percentage of LBW neonates in India was 21.8% among a total number of 8 081 000 neonates per year.[3]

A study conducted at a rural project hospital in Haryana by Makhija et al[4] revealed that parity and antenatal care had significant association with LBW. A community-based study, conducted by Nair et al[5] in the rural areas of Udupi taluk, Karnataka state of South India, reported that primis, elderly mothers, and mothers who had not received good-quality antenatal care were found to be more at risk of having LBW babies. Other significant correlates were family custom, socioeconomic status, and environmental sanitation.[5] A study conducted during 2003 by Phung et al[6] reported that apart from marital status, ethnicity, and parity, maternal smoking is the single most important preventable risk factors for LBW.[6]

Conclusion

The first phase of this study was cross-sectional in design where 711 newborn babies, borne by 680 mothers, were screened at the CRH of Sikkim during the 1-year study period, and the proportion of LBW babies was determined to be 130 (18.3%). This was very close to the national estimate of 2001 census data that determined a prevalence rate of 21.8%.

Multiple logistic regression analysis, conducted in the second phase, revealed that low or middle socioeconomic status, maternal underweight, twin pregnancy, previous history of delivery of LBW babies, smoking and consumption of alcohol during pregnancy, and congenital anomalies had independent significant association with LBW in this study population.

Author Contributions

JH: Conceived the study and participated in its design and coordination. He also carried out the data collection and helped draft the article. *SD*: Participated in structuring the methodology, carried out the data collection, and prepared the discussion part. *AB*: Participated in structuring the methodology, carried out the statistical analysis, and prepared the final report. All authors read and approved the final article.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

1. Wardlaw T, Blanc A, Zupan J, Åhman E; United Nations Children's Fund; World Health Organization. *Low Birth Weight: Country, Regional and Global Estimates*. New York, NY: UNICEF; 2004.
2. Park K. *Park's Textbook of Preventive and Social Medicine*.18th ed. Jabalpur, India: Banarasidas Bhanot; 2005:396.
3. UNICEF Regional Office for South Asia. *Reduction of Low Birth Weight: A South Asia Priority*. Katmandu, Nepal: UNICEF Regional Office for South Asia; 2002:1-6.
4. Makhija K, Murthy GVS, Kapoor SK, Lobo J. Socio-biological determinants of birth weight. *Indian J Pediatr*. 1989;56:639-643.
5. Nair NS, Rao RSP, Chandrashekar S, Acharya D, Bhat HV. Socio-demographic and maternal determinants of low birth weight: a multivariate approach. *Indian J Pediatr*. 2000;67:9-14.
6. Phung H, Bauman A, Nguyen TV, Young L, Tran M, Hillman K. Risk factors for low birth weight in a socio-economically disadvantaged population: parity, marital status, ethnicity and cigarette smoking. *Eur J Epidemiol*. 2003;18:235-243.