Doi: 10.32677/IJCH.2017.v04.i03.029

Original Article

Exploring determinants of birth weight of the baby delivered in a tertiary hospital of Delhi

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Received - 27 February 2017 Initial Review - 28 March 2017 Published Online - 03 June 2017

ABSTRACT

Introduction: Low birth weight (LBW) is a global public health challenge. In India, the prevalence is 22%. **Objective:** The aim of this study is to assess the major determinants of birth weight of the newborns delivered in a tertiary hospital of Delhi. **Methodology:** A total of 140 newborns were included in the study. The newborns were selected from the ICU. **Results:** There were 80 male and 60 female newborns. In the current study, 68% of the newborns were LBW, 5% were very LBW, and <1% extremely LBW. All the individual variables with a significant effect on birth weight ($p<0.10$) were analyzed together using multivariate analysis for combined effect on birth weight. Among all, mainly parity, pre-pregnancy weight, hemoglobin of mother, exposure to smoking tobacco, and residence ($p<0.05$) were found to be significantly associated with the birth weight of the newborn. **Conclusion:** Most of the data were concurrent with the previous study results along with no effect of supplementation programs such as the Integrated Child Development Service Scheme or conditional maternity benefit schemes on improving birth weight. More detailed community-based research with bigger sample size needs to be done to develop a clear understanding of some of these unaddressed or partially addressed determinants.

Key words: *Gestational age, Infant, Pregnancy, Smoking*

Birth weight is probably the single most important factor that affects neonatal mortality, in addition to being a significant determinant of post-neonatal infant mortality and of infant and childhood morbidity [1]. In 2013, more than 22 million newborns (15% of all newborns born globally that year) had low birth weight (LBW). In South Asia, the prevalence of LBW babies is 28% [2], whereas in India, nearly 22% of newborns have LBW [3]. It is a global public health challenge with both short- and long-term adverse consequences [4].

It is generally acknowledged that the etiology of LBW is multifactorial [5]. The previous studies have enumerated several determining factors for birth weight including gestational age, maternal health, smoking, and nutritional intake [6]. Intrauterine growth retardation and prematurity are probably the two most common conditions that result in LBW [7]. However, studies on role of domestic violence and enrollment in nutritional supplementation programs such as the Integrated Child Development Service Scheme (ICDS) or mother's occupation are limited or have inadequately addressed these issues. Moreover, the evidence on the major determinants is limited in the regional context. With the India neonatal action plan and essential newborn care policies in existence, the interventions to address LBW determinants even become more crucial [8]. The aim to single-digit neonatal mortality and stillbirth rate could be achieved once LBW determinants are understood and well addressed in all contexts. Hence, the present endeavor was undertaken with the objective to study the major determinants of birth weight of the newborns admitted in the high dependency unit (HDU) of the tertiary hospital of Delhi. The study aimed to assess the factors contributing to LBW of the child despite accessing routine antenatal care in a tertiary hospital which is supposedly of high quality.

METHODOLOGY

This exploratory study was conducted in Lok Nayak Hospital of Delhi. Lok Nayak Hospital is a tertiary level hospital situated in Central Delhi which addresses patients not only from Delhi but also from neighboring states such as Uttar Pradesh, Haryana, and other states such as Bihar, Rajasthan, Himachal Pradesh, and Uttarakhand. It caters to all sections of society from upper to middle to lower socioeconomic status and also people with different cultural and social backgrounds. A total of 140 newborns admitted in the HDU during the period from December 2014 to March 2015 were selected. From the list of admitted newborns, randomly 5 newborns were selected each time of the visit for data collection. Around 30 such visits on selected days were made in the 4-month duration, and each time, mothers of the 5 randomly selected newborns were interviewed.

Verbal consent was obtained from the mother, and they were ensured of the privacy and confidentiality of their information. Ethical approval was obtained from the institutional ethical committee. Using the prevalence of LBW in India be 22%, power of the study be 80% and confidence interval of 95%, design effect of 1.75, non-response rate (NRR) of 15% and absolute error of 10%, the sample size came out to be 138, and hence, 140 newborns were recruited. The sample size was calculated using the formula: $N=(Z_{\alpha}+Z_{1-\beta})^2*P*Q*DE*NRR/L^2$ where P is prevalence, Q = 1-P, L = Absolute error, Z_{α} is accepted alpha error, $Z_{1-\beta}$ is the power of the study, DE is design effect, and NRR.

Relevant information related to maternal factors, namely, socioeconomic status, parity, age, educational status, occupation before pregnancy, birth interval, weight gain, history of previous medical or surgical treatment, any history of chronic drug intake, and tobacco exposure was collected from the mothers. Antenatal records of the subjects were assessed for data on pre-pregnancy weight and hemoglobin levels. The ICDS beneficiary status, number of antenatal visits, history of iron folate tablets intake, history of any significant event during pregnancy, and domestic violence at home were also part of the questionnaire. Information relating to newborn including birth weight, sex, and period of gestation was obtained from case records.

Chi-square test was used to study the significance of difference between proportions. Student t-test was used to study differences between groups for continuous variables. Multiple logistic regression analysis was also performed.

RESULTS

Out of total 140 newborns, there were 80 male and 60 female. Majority of the families belonged to urban slums (73.6%), whereas 8% rural and 18.6% to urban areas. More than half (63.6%) of the newborns were belonging to joint family, whereas 35.7% to nuclear families. Only 40% of the women reported to have increased their diet during pregnancy, while 60% did not. Majority (79%) of the mothers had not registered in Anganwadi and had not taken the benefits of the ICDS. In the current study, 68% of the newborns were LBW, 5% were very LBW, and <1% extremely LBW as shown in Table 1. Around 2% of the mothers were illiterate, and 22% were educated up to forth standard. Roughly equal percentage of the women had obtained formal education up to middle (35%) or secondary level (32%). Only 8% of the women had studied up to graduation and beyond.

Around 73% of infants were appropriate for gestational age (AGA), whereas 11.3% were small for gestational age and 15.7% were large for gestational age. Nearly 21% of the women made <4 visits during pregnancy to hospital or any health center. About 90% of the women reported to have taken iron folate tablets during pregnancy, while 10% did not. Most of the mothers (88.6%) did not suffer any significant event during pregnancy. Among multigravida, two-third women had pregnancy twice, 20% had thrice, and rest 11% had four or more pregnancies. Among mothers of LBW infants (n=103), most common illnesses reported were gastroenteritis (5%), hypertension (3%), urinary tract infection (2%), malaria, and thyroid disorders (<1% each).

Among all the subjects, 3 mothers were hypertensives during pregnancy and on treatment. These 3 mothers had infants of birth weight of 2400, 2290, and 1195 g of gestation age 38.4, 36, and 28 weeks, respectively. There was one diabetic mother with child birth weight of 1655 g and AGA. Tea was the most favorite beverage among subjects. Nearly 86% of mothers used to take tea while only 3% had coffee. Rest 11% did not take tea or coffee either. Although 69% of them used to have tea once or twice a day, 31% used to have 3 or more than 3 cups a day. Out of 69 non-primi mothers, 23 (33.3%) had a previous history of giving birth to LBW baby. Mean±standard deviation (SD) period of gestation was 34.7±3.4 weeks, and median was 36 weeks.

Mean±SD number of ANC visits was 6±2. Of the total, 69 mothers were non-primi. Median years of spacing between the current pregnancy and last pregnancy were 2 (range 1-12 years). Median family income of the subjects was Rs. 6000. Mean±SD age of the mothers was 24±3.6 years. Mean±SD hemoglobin of the mother was 10.3±1.7 g/dl. Mean±SD pre-pregnancy weight of the mothers was 48±8 kg. About 30% of the mothers reported exposure of smoking tobacco at home during pregnancy. Bidi (a type of Indian cigarette filled with tobacco flake) was the most common mode of smoking (81%), followed by hookah (12%) and cigarette (7%). An average number of cigarettes/bidis consumed per day was 13.5. The exposure of the smoke to the pregnant mother was for 1-2 h on an average per day.

Mostly, all the mothers were housewives (98%). Only 5 women reported domestic violence at home by husband or in-laws. Extra dietary intake (apart from 3 major meals in a day) was taken by only 40% of the mothers during pregnancy. Visits or food from the ICDS (Anganwadi center) was undertaken by only 22% of mothers during pregnancy. Univariate analysis was performed to find any association between parameters and birth weight if the baby (Table 2). There was no significant association between mother's education status ($p>0.05$), intake of tea/coffee ($p>0.05$), and sex of the child ($p>0.05$) with birth weight of the child.

Table 1: Birth weight distribution among newborns

Birth weight of newborn	Frequency (n)	Percentage n=140 (%)	Mean±SD	
			Gestational age	Birth weight
Normal (>2.5kg)	37	26.4	35.9±0.1	2.94±0.34
Low birth weight (1.5-2.5 kg)	95	67.9	34.8±3.5	2.16±0.25
Very low birth weight (1-1.5 kg)	7	5.0	29.4±3.2	1.22±0.11
Extremely low birth weight (<1 kg)	1	0.7	25.3	0.96

SD: Standard deviation

Table 2: Univariate analysis for association between birth weights of child with independent variables

Parameters	Birth weight n (%)		p value	χ^2, df
	Low birth weight n=103	Normal weight n=37		
Parity				
Primi or gravid 2	83 (80.6)	35 (94.6)	0.045	4.1
More than 2 gravida	20 (19.4)	2 (5.4)		
Pre-pregnancy weight				
Less than average (<48 kg)	65 (63)	14 (38)	0.008	7.1
More than average (>48 kg)	38 (37)	23 (62)		
Current age of the mother (years)				
<20	18 (17.5)	5 (13.5)	0.839	0.3,2
20-30	78 (75.7)	29 (78.5)		
>30	7 (6.8)	3 (8)		
Hemoglobin of mother				
<11.0 g/dl	68 (66)	31 (83.8)	0.042	4.1,1
≥11.0 g/dl	35 (34)	6 (16.2)		
Domestic violence				
Absent	99 (96)	36 (97)	0.74	0.1,1
Present	4 (4)	1 (3)		
Occupation of mother				
Housewives	99 (96)	37 (100)	0.224	1.4,1
Any occupation	4 (4)	0		
ICDS beneficiary during pregnancy				
No	78 (75.7)	31 (83.8)	0.31	1.02,1
Yes	25 (24.3)	6 (16.2)		
Extra diet during pregnancy				
No	65 (63)	20 (54)	0.33	0.93,1
Yes	38 (37)	17 (46)		
Exposure to smoking tobacco				
Absent	68 (66)	30 (81)	0.08	2.9,1
Present	35 (34)	7 (19)		
Residence				
Rural	5 (4.8)	6 (16.2)	0.03	6.7,1
Urban	17 (16.5)	9 (24.3)		
Urban slum	81 (78.7)	22 (59.5)		

All the individual variables with a significant effect on birth weight ($p<0.10$) were analyzed together using multivariate analysis for combined effect on birth weight (Table 3). All the 5 variables were significantly associated ($p<0.05$).

DISCUSSION

Birth weight is an important predictor of baby survival. In general, the lower the birth weight is, the higher, a baby's risk of mortality will be. Birth weight is also associated with health outcomes later in life [9]. In the current study, it was found that mother with parity of more than two is associated with LBW ($p=0.04$). Similarly, an epidemiological model study quoting data from the National Family Health Survey-3 (NFHS-3) reported that increasing parity (fifth birth order and above) is associated with the maximum prevalence of LBW (odds ratio [OR]=1.21) [10]. However, majority of the studies have not revealed any association with parity of the mother [11-15]. The present study has shown that full-term LBW was significantly associated with low pre-pregnancy weight of the mother ≤48 kg (OR=3.68). Although most studies have revealed association between low pre-pregnancy weights (OR=1.25-6.1) [10,13,14,16] with the LBW, a study from Bhopal by Choudhary et al. reported no such significant association ($p>0.05$) [12]. In the current study, low hemoglobin status defined as anemia was found to be associated with LBW (OR=0.26). Anemia during pregnancy has been found associated with LBW as reported in many studies conducted in similar situations (OR=3.08-3.36) [10,13,15,16], but studies by Choudhary et al. from Bhopal and Manzur et al. quoting NFHS-3 data did not reveal any such association [12,14]. In the current study, it was found that mothers from urban slums did give birth to LBW babies compared to those residing in rural or urban areas (OR=0.16), but data from NFHS-3 as quoted

Table 3: Multivariate analysis for effect of variables on birth weight

Variables	χ^2, df	p value	Exp (b) (95% CI)
Parity	10.9,1	0.001	0.08 (0.01-0.5)
Pre-pregnancy weight	8.1,1	0.004	3.68 (1.4-9.2)
Hemoglobin of mother	6.2,1	0.013	0.26 (0.08-0.8)
Exposure to smoking tobacco	4.5,1	0.032	3.20 (0.1-0.96)
Residence	7.8,2	0.01	0.16 (0.03-0.73)

CI: Continuous integration

in the study by Kader and Perera [14] and study from Tripura by Bhattacharjya et al. [15] did not find any such association between place of residence and LBW. Residents from urban slums with lower socioeconomic status are vulnerable to limited access to services and hygiene and nutrition, and hence, mothers are prone to infections, malnutrition, and anemia. Passive tobacco exposure has been found associated with LBW similar to ours (OR=3.2) in the study from Nashiq by Mumbare et al. (OR=4.1) [13].

Even in the absence of active smoking, exposure to passive smoking and high nicotine intake among mothers predisposes toward delivery of pre-term and LBW infant. Higher maternal caffeine intake during pregnancy has been found associated with a higher risk of delivering LBW infants, but such an association was not observed in the study. A meta-analysis by Chen et al. in 2014 [17] on dose-response analysis observed that each 100 mg/day increment in maternal caffeine intake has been associated with 13% higher risk of LBW. Pregnancy-induced hypertension (36%), urinary tract infection (3%), and gastroenteritis (4%) among mothers are commonly associated with LBW of the child [18]. However, the study did not reveal such higher prevalence of PIH. The probable reason of which could be higher representation of residents from urban slums in the study in whom the PIH prevalence is comparatively low as mentioned in other studies [19,20].

In the current study, maternal age of childbirth has not been found associated with birth weight of the child (p=0.8). Similarly, studies from Bhopal [12], Nashiq [13], NFHS-3 [14] data, and Tripura [15] did not report any such association, but studies from Tamil Nadu [16] (OR=1.6) and another study based on NFHS-3 [10] data (OR=1.4) did mention that early age of mother is associated with LBW of the child. A study from Bhopal [12] (p<0.05) reported that mothers engaged in labor work have a higher association with LBW; although no such association has been reported in the current study (p<0.2) as well as the study from Tripura [15]. In the current study, due to small sample size and also socially desirable answer given by the participants, domestic violence was reported too low. Hence, any such association with birth weight was not revealed. However, a study from South India by Rao et al. [21]. (OR=3.9) and a study based on data from NFHS-3 by Duggal et al. [22] clearly reported association of domestic violence with LBW.

Lower dietary intake during pregnancy does lead to LBW of the child as reported from the study by Choudhary et al. conducted in Bhopal [12] (p<0.05). In the current study, although the direct assessment of the dietary intake was not obtained, an indirect question of increased dietary consumption was asked which failed to report any such association (p=0.33). In the present study, it was tried to bring out the difference in the birth weight of babies born to mothers visiting Anganwadi regularly for food and education, but no such association was revealed (p=0.3). The objective of the ICDS program is to supplement mother's nutritional intake and deliver health education for improved pregnancy outcomes. Studies have proved that the enrollment and availing services under ICDS have an impact on the maternal and child health outcomes [23]. In a study from Tripura, it was reported that mothers not enrolled under Janani Suraksha Yojana have higher chances to give birth to babies with LBW (p=0.0) [15].

The study was conducted on a smaller sample size confined to the deliveries conducted in a tertiary hospital which limits the validation and generalization of the results. Since the cases were recruited from HDU; hence, there was a higher percentage of LBW babies among subjects. Moreover, the study duration was limited to an interval of 3-4 months with seasonal influence on some of the determining factors. Recall bias was another possible limitation during data collection.

CONCLUSION

The current study concluded that interventions aimed at addressing increasing lower birth weight prevalence in India need to focus on factors determining it. Most of which are related to mother's nutritional intake, pre-pregnancy weight, exposure to passive smoking, parity, and anemia status. The national programs and schemes for mother and child such as RMNCH+A and ICDS should assess the challenges in uptake of services apart from ensuring their availability and quality. A comprehensive inclusive community-based approach to enhance mothers knowledge on various health determinants with simultaneous engagement of the husband is the need of the hour under the Reproductive and Child Health Programmes.

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Funding: None; Conflict of Interest: None Stated.

How to cite this article: Sharma S, Anand T, Sharma N. Exploring determinants of birth weight of the baby delivered in a tertiary hospital of Delhi. Indian J Child Health. 2017; 4(3):394-398.