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A PROSPECTIVE COHORT STUDY ON INCIDENCE AND RISK FACTORS FOR LOW BIRTH WEIGHT AMONG INSTITUTIONAL DELIVERIES IN KATHMANDU, NEPAL

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ABSTRACT

Background: Low birth weight (LBW) in developing countries are mainly due to preterm delivery and intrauterine growth retardation. Among other causes of low birth weight, maternal factors are predominant. **Aim:** This study aimed to identify how strongly maternal risk factors associated to low birth weight. **Method and Materials**: The study used cohort prospective design among 700 pregnant women attended in antenatal care outdoor patient in Paropakar Maternity Women's hospital with 6 months follow up. **Results**: Among 700 respondents, 23 (3%) were lost in follow up. Out of 677 mothers, 151 (22%) gave birth of LBW. The mean birth weight was 2724gm. The mean maternal weight was 48kg, height was150cm and BMI was 21.2kg/m2. The cumulative incidence of LBW in the cohort was 22%. Mothers with weight <45kg had 11 times higher risk of giving of LBW babies (RR=10.92, CI: 7.90-15.08); BMI <18.5kg/m^2 had 3 times higher risk of giving LBW babies (RR=3.08, CI:2.30-4.12). Mothers without having past history of LBW, and preterm delivery were 0.3 times, and 0.44 times chances of giving LBW babies respectively. There are positive association of LBW with primigravida (RR=1.09), and primiparity (RR=1.41), however, it could not reach statistically significant. **Conclusion:** The study concluded that maternal weight <45kg is the strongest risk factor for LBW. Other maternal risk factors were weight <45kg, BMI<18.5kg/m^2, mothers without past history of LBW, and preterm are also statistically significant to LBW.

KEYWORDS: Low birth weight, cohort, hospital-based, maternal anthropometry

INTRODUCTION

Birth weight of newborn is an important indicator of the children's susceptibility to the risk of childhood illnesses and chances of survival. Children whose birth weight <2500gm, is a low birth weight (LBW)[1]. There are nearly 80% of all intrauterine growth retardation (IUGR) newborns who are LBW and full term are born in Asia[2]. Incidence rate of more than 15% for LBW indicate a major public health problem[2]. In Nepal, the national coverage of LBW is 21%[3]. However, it varies regionally from a high of 15% in the mountains to 13% in the hills and 12% in the terai[4]. Ministry of Health and Population (MoHP)/Nepal has set goal to reduce neonatal mortality rate

(NMR) from the current 33 to 15 per 1000 by 2017[5]; and has targeted to reduce percentage of new born weighing less than 2500gm to 12by 2017[3].

Low birth weight is the consequences of health status of mother. It is from either the result of preterm birth (more than 37 weeks of gestation), and or due to intrauterine growth retardation (IUGR); with many factors affect the duration of gestation and of foetal growth, and thus the birth weight relating to the chain of infant, mother, and physical environment[1]. In Developing countries, IUGR is more common with various reasons.

Hence, this study aimed to identify risk factors for LBW; it hypothesized that the maternal anthropometry, food restriction, past history on delivering LBW and preterm, gravida, parity, times of ANC visits, and iron supplementation are potential risk factors for LBW. It examined how strongly each of these risk factors is associated to LBW.

MATERIALS AND METHODS

Study design, place and duration: This study was quantitative eand designed as cohort prospective. It was carried out in Maternity Paropakar and Woman's Hospital, a central specialized referral hospital, in Kathmandu, Nepal. It was carried out from April to September 2014.

Sample size and sampling method: A total of 700 samples were taken using Fleiss with CC approach[6,7]. The sample size was calculated with two-sided significance level (1-alpha) was 95%; power (1-beta) was 80; ratio of sample size, unexposed/exposed was 4.

Method of data collection: Enumerators, who were trained on study tools and techniques, interviewed 700 cohorts of pregnant women using pre tested tool. The study involved pregnant women with cohort of reproductive age of 15-45 years, who attended in antenatal care outpatient door (ANC OPD). They were interviewed firstly at ANC OPD; and then followed-up until after delivery.

Ethical approval and patient consent: This study was approved by Institutional Review Board of Institute of Medicine, Maharajgunj Medical College, Kathmandu, Nepal; and also from Research Committee, Paropakar Maternity and Women's Hospital Development Board, Kathmandu, Nepal. Verbal consent from each pregnant woman was taken before interview. They were interviewed in their comfortable time in OPD and followed up until after delivery. After interview, each of them was informed on newborn care; and to consult provider if any danger signs occurred after delivery.

Inclusion and exclusion criteria: Pregnant women from second trimester were included in this study.

STATISTICAL ANALYSIS

Data entry program was developed following strict procedures, codes and checks. Collated data were edited before entry; entered data were cleaned and checked for any kind of inconsistencies. Data were entered into standardized data entry mask developed in EpiData and analyzed it using the SPSS version 17 computer software package through running simple frequency tables, and descriptive cross tabulations for risk estimation.

RESULTS

General Findings

Out of 700 mothers, 23 were lost in follow-up after delivery. Out of 677 mothers, 151 (22%) gave birth of LBW babies and 526 (88%) gave birth of normal birth weight (NBW) babies. The mean birth weight for an overall was 2724gm (SD:347), which varies for LBW babies was 2272gm (SD:207) and for NBW babies was 2854gm (SD:259).

An average weeks for pregnant woman to come in hospital at first time for antenatal care (ANC) examination was 16(SD:7). Out of 677 mothers, 149 (22%) weighed <45kg, 129 (19%) had height <145cm, 41 (6%) had BMI <18.5 kg/m2, and 593 (88%) had no any restriction on food during pregnancy. An overall mean for maternal weight was 48kg (SD:3), for height was 150cm (SD:6), for maternal BMI was 21kg/m² (SD:2). Out of 677 mothers, 430 (64%) were primigravida, 221 (33%) were primiparity, 41 (6%) had <4 ANC visits, and 226 (33%) took iron tabs <180.The mean iron consumption was 185 tabs (SD:57).Out of 483mothers, 247 (51%) had no previous history of delivering LBW. Out of 247 mothers, 236(96%) had no history of delivering preterm.

Incidence and Risk estimates of exposed factors

The cumulative incidence of LBW in the cohort was 22%. The table#1 shows risk estimation for maternal anthropometry, food restriction and past obstetric history.

Maternal weight <45kg, BMI<18.5 kg/m^2 were highly significant with p-value<0.05. Mothers with weight <45kg and BMI <18.5 kg/m^{2}had 11 and 3 times respectively higher risk of giving LBW babies. Mothers without having past history of delivering LBW babies and preterm delivery was 0.3 and 0.44 times respectively to give chance of LBW at this delivery. There is positive association of maternal height <145cm and LBW but could not reach to statistically significant (Table 1).

Table 1. Risk estimates of maternal anthropometry, food restriction and obstetric history factor to LBW

Maternal risk factors	Newborn weight			P value	RR for LBW
	LBW	NBW	Total		
	No. (%)	No. (%)	No. (%)		
Weight (kg)	N=151	N=526	N=677		
<45	114 (76.5)	35 (23.5)	149	0.000	10.92 (7.90-15.08)
≥45	37 (7.0)	491 (93.0)	528		Ref
Height (cm)	N=151	N=526	N=677		
<145	33 (25.6)	96 (74.4)	129	0.320	1.19 (0.85-1.66)
≥145	118 (21.5)	430 (78.5)	548		Ref
BMI (kg/m^2)	N=151	N=526	N=677		
<18.5	25 (61.0)	16 (39.0)	41	0.000	3.08 (2.30-4.12)
≥18.5	126 (19.8)	510 (80.2)	636		Ref
Food restriction	N=151	N=526	N=677		
No	133(22.4)	460(77.6)	593	0.837	1.05 (0.68-1.62)
Yes	18(21.4)	66(78.6)	84		
History on LBW	N=97	N=386	N=483		
No	52 (21.1)	195 (78.9)	247	0.000	0.30 (0.18-.50)
Yes	45 (19.1)	191 (80.9)	236		Ref
History of preterm	N=52	N=195	N=247		
No	47 (19.9)	189 (80.1)	236	0.042	0.44 (0.23-0.88)
Yes	5 (45.5)	6 (54.5)	11		Ref

There are positive association of LBW with primigravida (RR=1.09), and primiparity (RR=1.41), however, it could not reach statistically significant. The number of ANC <4 visits, and iron supplementation <180 tabs did not show any association to LBW in this study (Table 2).

A further analysis of factors was done using binary logistics regression. Maternal weight, height, BMI, history of LBW and preterm were entered for regression analysis.

Table 2. Risk estimation of Institutional care during pregnancy factors to LBW

Risk factors	Newborn weight			P value	RR for LBW
	LBW	NBW	Total		
	No. (%)	No. (%)	No. (%)		
Gravida	N=151	N=526	N=677		
Primigravida	99 (23.0)	331 (77.0)	430	0.553	1.09 (0.81-1.47)
Multigravida	52 (21.1)	195 (78.9)	247		Ref
Parity	N=52	N=195	N=247		
Primiparity	48 (21.7)	173 (78.3)	221	0.454	1.41 (0.55-3.6)
Multiparity	4 (15.4)	22 (84.6)	26		Ref
ANC visits (times)	N=151	N=526	N=677		
<4	7 (17.1)	34 (82.9)	41	0.406	0.75 (0.38-1.50)
≥4	144 (22.6)	492 (77.4)	636		Ref
Iron (tabs)	N=151	N=526	N=677		
<180	46 (20.4)	180 (79.6)	226	0.837	0.86 (0.63-1.17)
≥180	100 (23.7)	322 (76.3)	422		Ref

It shows that maternal weight <45kg was the strongest risk factor for LBW (RR=50). Past history of delivering LBW has also positive association to current LBW (RR=7) but is not statistically significant (Table 3).

Table 3. Binary logistic regression analysis of maternal anthropometry and obstetric history
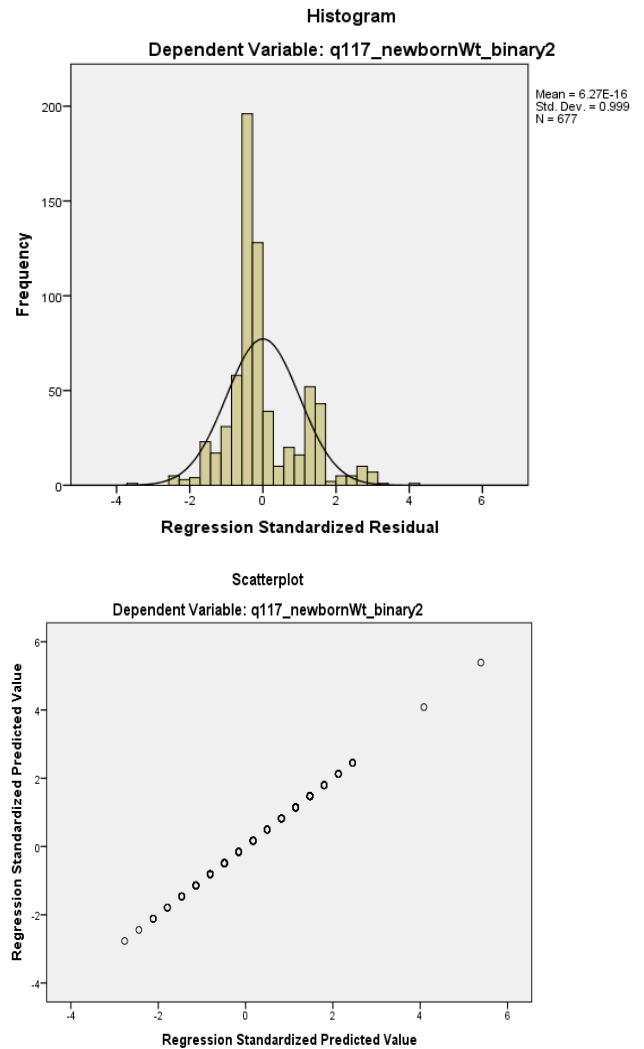
Factors	Sig.	Exp (B)	95% CI for EXP (B)	
			Lower	Upper
Maternal weight (<45/≥45) kg	0.00	50.27	28.08	90.00
Maternal height (<145/≥145) cm	0.13	0.60	0.30	1.17
BMI (<18.5/≥18.5)	0.55	0.76	0.31	1.86
History on LBW (No/Yes)	0.08	7.05	0.88	56.54
History on preterm (No/Yes)	0.64	0.62	0.08	4.58

Further regression linear was performed to see the linear regression between LBW and weight of mother. The model summary shows the adjusted R^2 is equal to 0.321 with SE of 0.343, the ANOVA shows it was significant (.000) (not shown in table). The coefficient value was also significant (Table 4).

Table 4. Linear regression of maternal weight and LBW (coefficients)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% CI for B	
	B	Std. Error	Beta			Lower	Upper
(Constant)	3.89	0.21		18.96	0.00	3.49	4.29
Maternal weight (<45/≥45)kg	-0.08	0.00	-0.57	-17.91	0.00	-0.09	-0.07

The histogram and normal distribution is perfectly shaped. The scatter plot below shows associated.

Histogram
Dependent Variable: q117_newbornWt_binary2

Mean = 6.27E-16
Std. Dev. = 0.999
N = 677

Scatterplot
Dependent Variable: q117_newbornWt_binary2

DISCUSSION

This study revealed that the mean birth weight of newborns was 2724 gm, which varies for LBW was 2272 gm and NBW babies was 2854 gm. Newborn is defined as LBW when it is less than 2500 gm[1]. Studies conducted in Janakpur zonal hospital also showed mean birth weight which was 2750 gm[8]. However, the mean birth weight was slightly higher (2966 gm) as shown by study conducted in Patan Hospital[9]. The birth weight might be varied as per respondent's resident, where she has grown up like urban versus rural. A further analysis of birth weight is required in specific to respondent's residence, background characteristics which is beyond my study.

Our study revealed that the incidence of LBW was 22% which is slightly higher the prevalence of LBW at national level (21%)[3]. This figure of incidence of LBW was not much different to the other parts of Nepal as shown by the study conducted in Nepalese infants in which incidence of LBW was 22%[10]. This study was focused at Paropakar Maternity and Women's hospital, it is central referral hospital and respondents came from different parts of Nepal not only from Kathmandu valley. Studies showed that incidence of LBW varies as 9%[11],22%[10], 29%[12]. The prospective study at Maternity Paropakar and Women's hospital showed that the incidence of LBW was 12.76%[13]. Since the cohort design is used as appropriate method for causation of LBW and risk measurement[14], we used it in this study for measurement of LBW incidence.

This study resulted that weight <45kg and BMI<18.5kg/m^2 were statistically significant for LBW. We analysed the height of mother with cut off value of 145 cm and found that RR was greater than 1 (RR=1.19, CI: 0.85-1.66) but could not high up for statistically significant. This study on further analysis revealed that maternal weight <45kg is the strongest risk factor for LBW. Weight of newborn depends upon the health status of his/her mother. LBW could either be result of preterm or IUGR and is the chain of infant, mother, and physical environment[1]; and is associated to unfavorable perinatal outcome[15]. Nepal is not exceptional from other developing countries, where IUGR is more common to LBW with various reasons. One fourth of Nepalese women fall below the recommended cut-off point of 18.5kg/m^2 for measuring chronic energy malnutrition among non-pregnant women in Nepal[16]. BMI <18.5kg/m^2 indicates thinness or acute under nutrition. Low pre pregnancy BMI, as with short stature, is associated with poor birth outcomes. This is also problem in other developing countries. A study in Dhaka shows significant difference in means for height, weight and BMI, and were associated with birth weights[17]. The study conducted in south Delhi showed that height of <140 cms and pregravid weight of ≤35kg were associated with the occurrence of LBW[18]. Weight and height are best predictors for LBW[19,20].

A woman is considered to be at risk if her height is <145cm[21]; women with <50kg were more likely to deliver small babies[23].

The prospective study at Maternity Paropakar and Women's hospital in 2007 showed that LBW babies were 3 more common with mothers <45kg, with height <145cm, with BMI <18.5kg/m$^{2[13]}$. BMI <18.5kg/m^2 indicates thinness or acute under nutrition. Low pre pregnancy BMI, as with short stature, is associated with poor birth outcomes[21]. BMI <20kg.m^2 is risk factor for LBW[24]. One fourth of Nepalese women fall below the recommended cut-off point of 18.5kg/m^2 for measuring chronic energy malnutrition among non-pregnant women in Nepal[16]. The other studies in Nepal and India showed maternal weight and height were significantly related to the incidence of LBW[10, 25]. The study conducted in West Bengal, India showed 17.3% of the newborns had LBW; maternal height, weight to have significant associations with newborn LBW; maternal weight is the best surrogate measures of LBW[26]. Different studies recommended cut off value for maternal weight causing LBW were <48kg for Bengalese women, India[27]. However, it is seen generallly that maternal weight below 45kg, height <145 cm, and BMI <18.5kg/m^{2}are the commonest predictors for LBW.

Our study showed that absence of history on delivering LBW and preterm has adverse relationship with current LBW. In my knowledge, because of poor socio economic background, illiteracy, mothers might not have improved her health and soon become pregnant. This leads to poor outcome of pregnancy in the second time as well. Past history of adverse pregnancy outcomes were found to be significantly associated with LBW in present pregnancy in other studies [28,29,30] as well.

We found in this study that responded who were not restricted certain food during pregnancy was not significant to LBW. But, the practice of restricting and prescribing certain food items during pregnancy is common in Nepal, based on the view that restricting food during pregnancy helps the mother avoid a difficult delivery caused by a large baby in Nepal[16], and those kind of cultural beliefs common India[31]. We found that primigravida and primiparity are associated positively with LBW but are not statistically significant. Similarly, the number

of ANC visits<4, and iron supplementation <180 tabs are not associated to LBW in this study.

As far considering the wider implications of this study, key potential factors identified in the study (maternal weight and height, past history of LBW and preterm) should be focused while developing strategy for improvement. Individuals with modifiable risk factors are targets of public health actions. Stunted and wasted mothers indicate long standing malnutrition of woman. Improving in maternal nutrition and educating them could reduce in delivering LBW babies.

Concerning limitations of this study, Paropakar Maternity and Woman's hospital was chosen purposively. We did not have enough time for observation for risk factors as we had to consider the pregnant women within second trimester and onwards came in ANC OPD. Only once follow up was done with mothers. Some mothers were lost during follow up and were not able to trace them out.

CONCLUSION

The study concluded that maternal weight <45kg is the strongest risk factor shown after regression for LBW. Maternal risk factors weight <45kg, BMI <18.5kg/m^2, mother without past history of LBW, and preterm are also statistically significant to LBW. Other risk factors like maternal height <145cm, food restriction during pregnancy, primigravida and primiparity are also positively associated but could not reach statistically significant.

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CONFLICT OF INTEREST

Nil

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