Maternal Risk Factors Associated with Term Low Birth Weight in Jigme Dorji Wangchuck National Referral Hospital, Bhutan

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ABSTRACT

Aims: To investigate the association of various maternal factors and associated medical conditions during pregnancy with low birth weight (LBW) at term in neonates.

Methods: An unmatched case control study was done involving 150 cases (mothers who delivered singleton baby at term weighing less than 2500g) and 150 controls (mothers who delivered singleton baby at term weighing ≥2500g) in Jigme Dorji Wangchuck National Referral Hospital from 2018 to 2019. Consecutive and systematic sampling methods were used to select case and control respectively. Student unpaired t-test was used to test the differences between the control and case means for various factors. Odds ratios were used to assess the role of various factors on low birth weight

Results: This study found maternal height, weight gain during pregnancy, time of first antenatal visit and hypertension during pregnancy as the independent predictors of low birth weight.

Conclusions: Targeted interventions such as improving maternal weight gain during pregnancy, empowering mothers to come early for their first antenatal care and optimising gestational hypertension can help to prevent low birth weight.

Keywords: Bhutan, case control study, low birth weight, risk factors, singleton pregnancy.

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INTRODUCTION

Low birth weight (LBW) has been defined by the World Health Organization (WHO) as weight at birth of less than 2500 grams. LBW babies have approximately 20 times higher risk of dying compared to normal weight babies.[1] It attributes to 15-20 percent of all live births and about 95.6 percent of them in developing countries.[2] One in every seven live births suffered from LBW which translates to more than 20 million infant worldwide.[3]

Reducing the prevalence of low birth weight has already been recognised as an important public health priority. In 2012, WHO endorsed seven global nutritional targets of which the third target calls for a 30% reduction in prevalence of LBW by 2025.[4] LBW new-borns have a higher risk of dying within the first 28 days of life. Those who survive are more likely to suffer from stunted growth and lower intelligence quotient (IQ) in childhood.[5] LBW babies have increased rates of coronary heart disease and other non-communicable diseases like stroke, hypertension and diabetes in their adult life.[6]

The studies done elsewhere have identified maternal characteristics such as maternal age, parity, body mass index (BMI), socioeconomic status, maternal anaemia, hypertension, smoking and number of antenatal care (ANC) visits as predictors of LBW at term. However, the maternal risk factors identified in other regions may or may not be directly applicable to Bhutanese mothers. Thus, this study was specifically conducted with an aim to identify risk factors present

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in Bhutanese mothers who delivered babies with LBW.

METHODS

The present study was an unmatched case control study carried out at the birthing centre and maternity ward in the department of obstetrics and gynecology, Jigme Dorji Wangchuck National Referral Hospital (JDWNRH), Thimphu. JDWNRH is a tertiary hospital which conducts over 4000 deliveries annually. Mothers who delivered babies with birth weights of less than 2500g were included as cases in our study. Cases with birth weight ≥2500g were included in control group. For the selection of controls, average delivery per month in the same hospital was calculated. From 336 deliveries, 10 were cases and 326 were controls. Controls were sampled systematically every 2nd interval (326/150=2) from the delivery of LBW. The ratio between case and control was kept at 1:1. All women of reproductive age group (15-49 years) who delivered in JDWNRH were the target population. Those who delivered at term gestation to a live singleton baby during the study period comprised the study population. Multiple pregnancy, babies with congenital anomalies and Intra-uterine foetal death were excluded from the study

Birth weight was measured in gram using pretested and pre-calibrated weighing machine (SECA354 baby weighing scale) within one hour after birth to avoid postnatal weight loss. Informed consent was obtained and a structured interview questionnaire was administered within 24 hours of hospital stay. The Maternal Child Health (MCH) handbook was used to collect information on antenatal conditions.

Pre-processing of the data was done using MS Excel and the analysis using SPSS Version 17. Besides descriptive statistics, Student unpaired t-test (to test the differences in means), Pearson Chi-square or Fisher's Exact test (to test the association between two attributes and difference in proportions), unadjusted odd ratios (univariate analysis to assess the risk factors), multiple logistic regression model (to assess the role of independent predictors) and Hosmer-Lemeshow statistic (to test the goodness of fit of the logistic model) were used for analysis. Alfa error set at 0.05. The study was approved by Bhutan's Research Ethics Board of Health (REBH) and administrative clearance was obtained from JDWNRH.

RESULTS

The total sample size of 300 mothers comprising of 150 cases and 150 controls were included in the study. Case and control group means were found to statistically differ for maternal weight, height, weight gain, antenatal visits and fetal birth weight but not with the maternal age [Table-1].

Table-1: Means between case and control groups using unpaired Student -t test

Variables	Mean ± Standard deviation		Significance (2-tail, p<0.05)
	Case	Control	
Maternal height(cm)	151.91 ± 6.80	155.35 ± 5.49	0.000
Pre-pregnancy weight(kg)	53.49 ± 8.89	56.17 ± 9.25	0.011
Maternal age (years)	27.49 ± 5.15	27.43 ± 4.89	0.918
Weight gain (kg)	8.53 ± 7.57	11.40 ± 6.57	0.001
Birth weight (grams)	2284.82 ± 203.58	3318.82 ± 336.98	0.000
Total ANC visits	6.53 ± 1.59	7.95 ± 1.22	0.000

Case and control groups included highest percent of housewives i.e. 74.67% and 48% respectively compared to other professions. Control group included 22% of the mothers who were civil servants and case group only 10%.

The univariate analysis of risk factors in terms of odds ratios showed significant association with time of ANC visit (2.0, p<0.005), gestational hypertension (12.76, p<0.0001), haemoglobin (3.55, p=0.003) and anaemia (4.64, p=0.018) but gravida, smoking habit, alcohol consumption and chewing betel did not show it [Table-2].

Table -2: Univariate analysis of maternal risk factors associated with low birth weight (n=300)

Variable		Case	Control	OR	p-value (p<0.05)
First ANC visit	≥13 weeks <12 weeks	63 87	39 111	2.0	0.005
Gravida	Primgravida multigravida	81 69	78 81	1.21	0.817
Hb at booking (g/dl)	<11 ≥11	25 125	8 142	3.55	0.003
Hypertension	Yes No	31 119	3 147	12.76	0.000
Anemia	Yes No	13 137	3 147	4.64	0.018
Smoking	Yes No	1 149	3 147	0.32	0.622
Alcohol	Yes No	9 141	4 146	2.32	0.256
Chewing betal nut	Yes No	49 101	64 86	0.65	0.095

Multiple logistic regression analysis was done to assess the adjusted odds ratios. Logistic model included the outcome LBW as the dependent variable, and time of first ANC visit, maternal height, maternal age, pre-pregnancy weight, weight gain during pregnancy, gestational hypertension, booking haemoglobin, anaemia, smoking habit, alcohol consumption, chewing betal nut, education level, ethnicity and gravida as independent variables. The multiple logistic regression analysis indicated that time of first ANC visit (OR = 2.159, p=0.042), gestational hypertension (OR=16.9, p=0.002), maternal height (OR = 0.922, p=0.024) and weight gain during pregnancy (OR= 0.915, p=0.044), played a significant role in determining the outcome. Except the above said four determinants of the outcome, others variables as indicated by the regression coefficients were found to be statistically non significant in the regression model. Surprisingly the risk factors anaemia (OR=2.403) and haemoglobin (OR=1.634) which were found to be significant in the univariate analysis did not turn out be significant in the multiple regression analysis. Odds ratios for the factors, maternal height (0.922) and weight gain during pregnancy (0.915) were found to be less than one indicating that they play a protective role as their values increase. Thus, for an increase in the maternal height by 1 cm reduces the odds for LBW by 7.78% [Table-3].

Table-3: Multiple logistic regression analysis for low birth weight

Characteristics	Adjusted Odds Ratio	95%CI	p- value
Time of first ANC visit	2.159	1.265- 3.358	0.042
Maternal height (cm)	0.922	0.860- 0.989	0.024
Weight gain during (kg)	0.915	0.838-0.997	0.044
Gestational hypertension	16.904	2.805 – 101.870	0.002

Anemia	2.403	0.254 – 22.745	0.445
Booking Hb(g/dl)	1.634	0.321 – 8.326	0.260
Maternal age(years)	1.0	0.948-1.131	0.38
Smoking	0.883	0.045- 17.521	0.935
Pre-pregnancy weight(kg)	0.986	0.942- 1.032	0.541
Alcohol	2.746	0.473 – 15.941	0.260
Chewing betel nut (Doma)	0.734	0.364 – 1.479	0.387
Gravida	0.420	0.070-2.527	0.343
Education level			
No schooling	3.052	0.649- 14.355	0.158
Primary	1.184	0.244 – 5.751	0.834
Secondary	0.666	0.195 – 2.280	0.518
Degree (reference)			
Ethnicity			
Ngalop	0.841	0.038 – 18.564	0.913
Sharchop	1.775	0.078 – 40.426	0.719
Lhotsham	2.64	0.112 – 62.009	0.546
Others (reference)			

DISCUSSION

This study attempts to study the maternal risk factors associated with low birth weight babies delivered at term gestation in our national referral hospital.

This study indicated maternal age not associated with LBW babies. This finding is consistent with studies conducted by Bhaskar et al [12] in Nepal, Domple et al [16] and Deshpande et al[17] in India. However, mothers' age less than 20 years were found to have higher risks of delivering LBW babies.[9,14]

Maternal height and LBW was found to be significantly associated in our study. This association has been reported in other studies conducted by Bhaskar et al [12] in Nepal, Mumbare et al[19] in India and Khan et al[21] in Pakistan.

Low pre-pregnancy weight has been found to be associated with LBW babies in many studies. Study conducted by Gunawardane et al[22] found that low pre pregnancy is the best predictor of LBW in Sri Lanka. However, in our study, although there was significant difference in means of pre-pregnancy weight between case and control, logistic regression analysis didn't indicate any significant association between LBW and pre-pregnancy weight.

Time of the first ANC visit was significantly associated with LBW. Mothers who delay in making this visit were at higher risk of delivering LBW Babies. The odds for occurrence of LBW babies were found to be over two times (2.159, p=0.042) among mothers who make late ANC-visit (>12 weeks) compared to mothers who make early visit (≤ 12 weeks). Our findings are in agreement with study done by Bhaskar et al[12] who reported that third trimester ANC booking was three-fold more likely to deliver LBW babies compared to mothers who had early first ANC visit within the first trimester. However, Yadav et al[26] couldn't observe significant association between the time of first ANC and LBW.

The average weight gain during pregnancy was 8.5kg in the case group and 11.4kg in the control group. Similar finding has been reported by Domple et al[16] where the average weight gain in case was 7kg and in the control group 14kg. In our study, the odds ratio corresponding to weight gain was 0.915 indicating that increase in pre-pregnancy weight lowers the risk of LBW.

We estimated the odds ratio for the haemoglobin level by categorizing the subjects into two groups – one with level < 11g/dL and the other ≥11g/dL based on a prior study[25]. The univariate analysis indicated that the mothers with lower haemoglobin level (<11g/dL) were at higher risk (3.5 times) of delivering LBW babies compared to those who had normal/higher level of haemoglobin level (≥11g/dL). These findings are consistent with the study by Pawar et al[11] and Domple et al[16]. However, when adjusted for other

factors, multiple logistic regression analysis did not indicate significant odds ratio for haemoglobin level in relation to LBW.

Gestational hypertension is one of the most common disorders among pregnant mothers. The findings from this study indicated a significant association of LBW with the gestational hypertension. It increases the incidence of LBW babies. The findings suggested that mothers having gestational hypertension had 16 times higher risk of delivering low birth weight babies compared to those who don't have during the pregnancy. Similar findings have been reported by a number of researchers.[10,12,16,17]

The most common substance use during pregnancy was chewing Betel nut (37.7%) followed by Alcohol (4.3%) and Smoking (1.3%). Similar trend has been reported by study done by Yuka[28] in Bhutan. The observed difference between cases (44%) and controls (56%) was small and not statistically significant (p=0.387). The findings from this study did not indicate significant association of specific substance use with the occurrence of LBW babies. The multiple logistic model also did not suggest significant association of LBW with education level and ethnicity.

There are limitations in this study. This study included equal number of subjects in case and control groups. The sample size could have increased had we taken higher number of subjects in the control group. Increased sample size could have given better insights of the data and conclusive results especially with respect to socio-demographic variables.

CONCLUSIONS

Short maternal height, late ANC booking, poor weight gain during pregnancy and gestational hypertension were the major risk factors for low birth weight babies delivered at term gestation in National Referral Hospital, Bhutan. Targeted interventions such as improving maternal weight gain during pregnancy, empowering mothers to come early for their first antenatal care and optimising gestational hypertension can help to prevent low birth weight.

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