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Original Article

KEY FACTORS ASSOCIATED WITH LOW BIRTH WEIGHT AT TERM IN NEPAL: A CASE CONTROL STUDY

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ABSTRACT

Background: Low Birth Weight (LBW) is a major public health problem in developing countries including Nepal. Nepal has a prevalence of LBW of 21%. There are various factors associated to high prevalence of LBW. This study aimed to identify specific factors associated to LBW at term in hospital settings in Nepal. **Methodology:** This study used a hospital based case control design. Hospital nurses interviewed mothers aged 15-45 years who had delivered a full term, single and live baby. **Results:** A total of 1533 respondents (511 cases and 1022 controls) were taken which is slightly more than the estimated sample size. The mean weight of newborns among case group was 2215 gm (SD: 203); and among control group was 3012gm (SD: 367). This study revealed that factors such as mothers under 20 years old (OR=1.436, 95% CI:1.074-1.920); height below 145cm (OR=1.504, 95% CI:1.087 -2.083); primigravida (OR=1.423, 95% CI:1.132-1.788); illiterate (OR=1.407 95% CI:1.011-1.957); <4 ANC visits (OR=1.534, 95% CI:1.202-1.957); and iron supplement <180 tabs (OR=1.434, 95% CI:1.152-1.786) were associated with LBW. However, variables like <20 years at the first pregnancy (OR=1.139, 95% CI: 0.904-1.433), disadvantaged ethnicity (OR=1.077, 95% CI: 0.861-1.347) were not associated with LBW in this study. **Conclusion**: Maternal height, education, number of ANC visits, and iron consumption were strong predictors for LBW in Nepal. It would benefit the country to develop effective strategies on maternal nutrition, female education, and quality ANC to overcome LBW.

KEYWORDS: Low Birth Weight, socio-demographic and antenatal care, case control design.

INTRODUCTION

Low Birth Weight (LBW) is a major public health problem in developing countries. Globally, >20 million infants, representing about 16% of all births, are born with LBW of which 95.6% of them are in developing countries[1]. Nearly 80% IUGR newborns, who are LBW and full term are born in Asia[2]. The percentage of LBW varies regionally from a high of 15% in the mountains to 13% in the hills and 12% in the terai in Nepal[3]; National LBW prevalence is 21%[4].

Low Birth Weight is either the result of preterm birth or due to IUGR. Factors causing LBW are related to infant, mother, or physical environment[1]. Socio demographic factors are key determinants for LBW in developing countries[1]. Maternal age contributes strongly to LBW[5,6,7,8]. Young mothers aged 20 and under more frequently gave birth to a LBW baby[9,10,11]. Similarly, maternal height and weight have associations with LBW[7,12].

Studies showed that gravida, parity, birth order, sex of baby, education and ethnicity are also closely associated with birth weight. The sex of the baby and parity were significantly related to the incidence of LBW[5,6]. The primigravida mother has more chances of delivering LBW babies[13]; and the highest prevalence of LBW was found in mothers with first parity[14,15]. The number of LBW infants are higher at birth order of first and second[11] and have significant associations with LBW[7]. Brahmins had significantly higher risks of delivering LBW infants[9] than other ethnic groups. Maternal levels of education effects birth weight[16]: newborns of women with a primary education are more likely to be of LBW (16%) and women with no education are less likely (10%)[17].

LBW is associated with inadequate care during pregnancy. One out of two mothers received ANC from SBAs, and made ≥4 ANC visits during their entire pregnancy in Nepal[17]. Less utilization of ANC is associated with LBW[10,18]. LBW was more common in the anaemic group[8] than in the non anaemic group[19,18,10]. Folic acid and iron supplements reduced the LBW by 9%; and 14% by multiple micronutrient supplementations[20,21,22]. Severe anemia particularly in the first trimester was significantly associated with LBW[9].

LBW is regarded as a public health problem in Nepal. Ministry of Health and Population (MoHP) aimed to reduce its prevalence to 12% by 2017[4]. This study aimed to identify the key factors associated to LBW at term delivery in the hospital setting. It measured the strength of associating factors like socio demographic (current age, age at first pregnancy, height of mother, ethnicity, gravida, parity, and education); and antenatal care factors (ANC visits, iron supplementation, and deworming medication) in the Nepalese context.

MATERIALS AND METHODS

Study design, sites and respondents

It is a hospital based case control study, carried out in four hospitals: Seti Zonal Hospital, Paropakar Maternity & Women's Hospital, Tribhuvan University Teaching Hospital (TUTH), and Dhulikhel Hospital of Nepal. Hospitals were selected purposively to represent a broad and comprehensive geographical scope from far western plain areas to central hills areas; and took into account locations where all citizens could access services. Seti Zonal hospital, in Kailali district. Similarly, TUTH and Paropakar Maternity & Women's hospitals are located within the capital city; and Dhulikhel hospital is located in Kavre district.

The study population was women of the reproductive age of 15-45 years; were recently delivered women who completed 37 weeks of gestation, singleton and delivered a live baby. Respondents, who gave birth to a newborn with weight <2500gm, were termed LBW (cases); and women who gave birth to a newborn with weight ≥ 2500gm were termed NBW (controls). For every case, two subsequent eligible controls were interviewed.

Sample size and statistical power

The sample size was calculated using nMaster program[23] based on the probability of exposure given absence of disease (overall prevalence) without calculating any specific risk factor/s was 0.15 from four hospitals: 12.76% in Maternity Hospital[24], 11.9% in Nepal Medical College Hospital[13], 21.56% in Janakpur Zonal Hospital[25], and 11.07% in Dhulikhel Hospital[26]; anticipated odds ratio (OR) was 1.5; allocation ratio was 1:2; power was 80% with alpha equal to 5%. It was a two-sided test, where study cases were equal to 493 and control cases were equal to 986 with a total sample size of 1479.

Data collection, processing and quality assurance

Hospital nurses (working on the maternity ward) were trained on administering the questionnaire; interviewing technique; and editing data. At least 3 hospital nurses were trained in each hospital so as one trained nurse covered each duty shift. These nurses interviewed recently delivered mothers prior to discharge from the hospital who met the selection criteria for respondents, using pre tested tools and techniques. The collated data was checked by each enumerator on the same day of data collection in each hospital. The data was collected from August 2012 to September 2013.

Ethical consideration

The research proposal was approved by the Institutional Review Board of Institute of Medicine, Maharajgunj Medical College, Kathmandu; also approved from each hospital board. Each respondent was briefed shortly on the objective of the study and obtained their verbal consent before the interview.

STATISTICAL ANALYSIS

The researcher developed a data entry program in EpiData 3.1 following codes and checks. Data was inputted and checked for inconsistencies. Data was then analyzed using the SPSS version 17 computer software package through running simple frequency tables, descriptive cross tabulations, and binary logistic regression. Variance Inflating Factor (VIF) test[27] was utilized before performing binary logistic regression to assess multicollinearity, and it was noticed that the highest VIF value was 6.61 and lowest was 1.03 which was in acceptable range. All statistically significant variables were taken at p<0.05 from crude OR analysis into binary regression.

RESULTS

Socio demographic background of respondents

A total of 1533 respondents were taken for the study across four hospitals, which was slightly >4% than the estimated sample size of 1479. Among 1533 respondents, 511 gave birth to a newborn of <2500gm and 1022 respondents gave birth to a newborn of ≥2500gm. The mean weight of newborns among case group was 2215gm (SD: 203); and among control group was 3012gm (SD: 367).

Table 1 depicts respondents by socio demographic background of case and control groups. The median age of respondents was 23 years (Q1=20, Q3=26), where 22 years (Q1=20, Q3=25) for case and 23 years (Q1=21, Q3=26) for control groups (data not shown separately). Majorities 52% respondents were in between the ages of 20-24 years, among them about 18% were cases. The median age for respondents at first pregnancy was 21 years (Q1=19, Q3=23), where same age was noted in both case and control groups (data not shown separately). Out of 1533 respondents, 56% were in between ages 20-24 years at their first pregnancy. Regarding ethnicity, majorities 46% respondents were upper caste, among them only 15% were cases. Majorities of respondents (57%) attended SLC & higher level of school.

Table 1. Respondents by socio demographic background

Variables	Case (n=511)	Control (n=1022)	Total (n=1533)
	No (%)	No (%)	No (%)
Age (in years)			
<20	91 (5.9)	134 (8.7)	225 (14.7)
20-24	271 (17.7)	529 (34.4)	800 (52.2)
25-29	109 (7.1)	273 (17.8)	382 (24.9)
≥30	40 (2.6)	86 (5.6)	126 (8.2)
Age at first pregnancy (in years)			
<20	162 (10.6)	296 (19.3)	458 (29.9)
20-24	282 (18.4)	579 (37.8)	861 (56.2)
25-29	62 (4.0)	133 (8.7)	195 (12.7)
≥30	5 (0.3)	14 (0.9)	19 (1.2)
Ethnicity			
Dalits	37 (2.4)	72 (4.7)	109 (7.1)
Disadvantaged janajatis and non dalit terai people	128 (8.3)	250 (16.3)	378 (24.7)
Religious minorities	13 (0.8)	17 (1.1)	30 (2.0)
Advantaged janajaties	97 (6.3)	211 (13.8)	308 (20.1)
Upper caste	236 (15.4)	472 (30.8)	708 (46.2)
Education			
Illiterate	67 (4.4)	99 (6.5)	166 (10.8)
Primary school	92 (6.0)	172 (11.2)	264 (17.2)
Secondary education	84 (5.5)	149 (9.7)	233 (15.2)
SLC and above	268 (17.5)	602 (39.3)	870 (56.8)

Table 2. Association of birth weight with socio demographic & maternal factors

Variables	Case (n=511)	Control (n=1022)	Total (n=1533)	OR (95%CI)	AOR (95%CI)
	No. (%)	No. (%)	No. (%)		
Age					
<20 years	91 (5.9)	134 (8.7)	225 (14.7)	Ref.	Ref.
≥20 years	420 (27.4)	888 (57.9)	1308 (85.3)	1.44 (1.07-1.92)	1.23 (0.81-1.86)
Age at first pregnancy					
<20 years	162 (10.6)	296 (19.3)	458 (29.9)	Ref.	Ref.
≥20 years	349 (22.8)	726 (47.4)	1075 (70.1)	1.14 (.90-1.43)	0.97 (0.70- 1.33)
Ethnicity					
Disadvantaged	178 (11.6)	339 (22.1)	517 (33.7)	Ref.	Ref.
Advantaged	333 (21.7)	683 (44.6)	1016 (66.3)	1.08 (.86-1.35)	0.90 (.71- 1.15)
Education					
Illiterate	67 (4.4)	99 (6.5)	166 (10.8)	Ref.	Ref.
Literate	444 (29.0)	923 (60.2)	1367 (89.2)	1.41 (1.01-1.96)	1.43 (1.01- 2.03)
Height (cm)					
<145	71 (4.6)	99 (6.5)	170 (11)	Ref.	Ref.
≥145	440 (28.7)	923 (60.2)	1363 (89)	1.50 (1.09-2.08)	1.62 (1.16- 2.26)
Gravida					
Primigravida	360 (23.5)	640 (41.7)	1000 (65.2)	Ref.	Ref.
Multigravida	151 (9.8)	382 (24.9)	533 (34.8)	1.42 (1.13-1.79)	1.14 (0.63- 2.07)
Parity					
Primiparity	392 (25.6)	706 (46.1)	1098 (71.7)	Ref.	Ref.
Multiparity	119 (7.8)	315 (20.6)	434 (28.3)	1.47 (1.15-1.88)	1.31 (0.80- 2.15)
ANC Check-up					
< 4 times	147 (9.6)	213 (13.9)	360 (23.5)	Ref.	Ref.
≥4 times	364 (23.7)	809 (52.8)	1173 (76.5)	1.53 (1.20-1.96)	1.51 (1.16- 1.95)
Iron supplement					
<180 tabs	330 (21.5)	572 (37.3)	902 (58.8)	Ref.	Ref.
≥180 tabs	181 (11.8)	450 (29.4)	631 (41.2)	1.43 (1.15-1.79)	1.40 (1.11- 1.77)
Deworming					
No	199 (13.0)	411 (26.8)	610 (39.8)	Ref.	Ref.
Yes	312 (20.4)	611 (39.9)	923 (60.2)	0.95 (0.76-0.87)	0.98 (0.78- 1.23)

Table 2 shows the binary distribution of respondents with their socio-demographic background, and maternal factors; and association of them with birth weight. It showed that about 15% respondents were <20 years and among them 6% were cases; 85% were ≥20 years, and among them 27% were cases. Of the respondent's age at their first pregnancy, 30% <20 years, among them about 11% were cases; 70% were ≥20 years and among them about 23% were cases. Thirty four percent respondents were belong to disadvantaged ethnic group among them 12% were cases; 66% belonged to an advantaged ethnic group, among them 22% were cases. About 11% respondents were illiterate, among them 4% were cases; and 89% were literate, among them 29% were cases.

Eleven percent of respondents had height <145cm, among them 5% were cases; 89% were height ≥145cm, and among them 29% were cases.

Out of 1533 respondents, 65% had primigravida and among them 24% were cases. Similarly, 35% respondents had multigravida, and among them 10% were cases. Out of 72% respondents who had primiparity, 26% were cases; out of 28% multiparity, 8% were cases.

Concerning to the ANC, 24% respondents had ANC visits <4 times, and among them 10% were cases; 77% respondents who had ANC examination ≥4 times, among them 24% were cases. Out of 59% respondents having iron supplements <180 tablets, 22% were cases. Out of 41% respondents having iron supplements ≥180, 12% were cases. Forty percent respondents did not receive deworming medication during pregnancy, and among them 13% were cases; 60% received it and 20% were cases.

With the exception of maternal age during pregnancy and ethnicity, all remaining factors were associated with birth weight at 95% CI in crude OR analysis. The OR for mothers' aged <20 years delivering LBW babies was 1.44 (95% CI: 1.07-1.92) times higher than for mothers delivering NBW babies at the same age. The OR for illiterate mothers delivering LBW babies was 1.41 (95% CI: 1.01-1.96) times higher than for literate mothers delivering NBW babies (Table 2).

The study revealed that OR for mothers whose height was <145 cm, delivering LBW babies was 1.50 times (95% CI: 1.09 -2.08) higher than for mothers delivering NBW babies at the same height. Similarly, OR for mothers who were primigravid, delivering LBW was 1.42 (95% CI: 1.13-1.79) times higher than for those mothers delivering NBW baby at same status; and OR for mothers who had primiparity, delivering LBW babies was 1.47 (95% CI: 1.15-1.86) times higher than those mothers delivering NBW babies at the same status.

This study also revealed that respondents who had <4 ANC visits were 1.53 (95% CI: 1.20-1.96) times more likely to deliver LBW babies than those who had ANC visit ≥4 times and delivered NBW babies. The OR for respondents who took iron supplements <180 tablets, delivered LBW babies 1.43 (95% CI: 1.15-1.79) times higher than those who had iron supplements ≥180 during her pregnancy period. Respondents without deworming medication delivered LBW babies 0.95 (95% CI:.76-.87) times higher than respondents with deworming medication delivered NBW babies.

The exposure variables such as age at first pregnancy (OR=1.14, CI: 0.90-1.43) and ethnicity (OR=1.08, CI: 0.86-1.35) did not have any significant effect on birth weight in this study.

A further analysis of variables was done using binary logistic regression model. It was noted that maternal height <145cm (AOR=1.62, 95% CI: 1.16-2.26), illiterate (AOR=1.43, 95% CI: 1.01-2.03), ANC visits <4 times (AOR=1.51, 95% CI:1.16-1.95), and iron consumption <180 tabs (AOR=1.40, 95% CI:1.11-1.76) were associated with birth weight.

We noted from further binary logistic regression analysis that maternal age (AOR=1.23, CI: 0.81-1.86), age at first pregnancy (AOR= 0.97, CI: 0.70-1.34), gravida (AOR=1.14, CI: 0.63-2.07), parity (AOR=1.31, CI: 0.80-2.15), ethnicity (AOR=0.90, CI: 0.71-1.15), and deworming medication (AOR=0.98, CI: 0.78-1.23) were not associated to the birth weight of newborns in this study.

DISCUSSION

This study examined and analyzed the relation of socio-demographic factors and factors associated with ANC practices to the birth weight of newborn babies.

This study revealed that the median age for woman was 22 years, and age at first pregnancy was 21 years for cases. Marriage at such an early age lends itself to higher rates of early pregnancy and potentially adverse consequences on birth outcomes. In this study, 30% of respondents became first pregnant at below the age of 20 years among them only 10% were cases. More than one out of two respondents became first pregnant in between the ages of 20-24 years; however, only 18%

of them were cases. This study did not show any association between respondent's age at first pregnancy and birth outcome. The age of woman is a key factor for healthy pregnancy outcomes. A study conducted in India and Pakistan showed that maternal age contributes strongly to LBW[5,6,8]. The study done in Lao PDR, demonstrated that mothers <18 years were 8 times more likely to give birth to a baby of LBW (95% CI: 2.4-30.7)[28]. Different studies showed that different age of mothers are associated with birth weight. This study showed those mothers who were <20 years delivered LBW babies at a rate of 1.44 (95% CI:1.07-1.92) times higher than mothers aged ≥20 years. In Nepal, marriage occurs relatively early with a median age of 17.5 years at a woman's first marriage (among age group 25-49); and by the age of 20, a woman has often already given birth to their first baby[17].

This study revealed that about 11% of respondents had heights <145 cm among them about 5% were cases; and 89% of respondents had heights at ≥145cm, among them about 29% were controls. The risk analysis in our study showed that mothers with heights <145cm delivered LBW babies at 1.50 times (95% CI: 1.09-2.08) higher than mothers with heights of ≥145cm. The AOR for this statistic was also significant (OR=1.62, 95% CI: 1.16-2.26). Hence, the height of mother is one of the strongest predictors for LBW. The height of the mother indicates her nutritional status and shorter height implies a negative impact on her birth outcome. Studies from different parts of India and Nepal showed different maternal height like <140 cm[29] and <152 cm[12] were significant to newborn birth weight. We took 145 cm as cut off value referring to NDHS.

This study identified that gravida and parity were significant in OR analysis. Respondents with primigravida, and primiparity delivered LBW babies higher than for respondents with multigravida and multiparity. A similar kind of study was done in Janakpur Zonal Hospital, Dhanusha District in Nepal also found that primigravida and primiparity were significant indicators of newborn birth weight[25].

Our study identified that illiterate respondents are 1.41 times (95% CI: 1.01-1.96) more likely to deliver LBW babies than literate respondents. Education has a notable role in the utilization of health services, and therefore, pregnancy outcomes. A further analysis of this study using adjusted OR also showed education was a strong predictor for newborn birth weight (adjusted OR=1.43, 95% CI: 1.01- 2.03). A Nepal household study showed that only 25% women who never attended school had at least 4 ANC check-ups[30]. A study carried out in Nepal and India had also showed that birth outcome is associated with the level of education of the mother[25, 6].

We found that respondents who had ANC visits <4 times delivered LBW babies at a rate of 1.53 times (95% CI: 1.15-1.79) higher than those who had ANC visit ≥4. A further analysis using binary regression showed that mothers who visited < 4 times were likely to give birth to LBW babies at 1.51 times higher a rate than mothers who visited for ≥4 ANC times. Four ANC visits is crucial for monitoring progress and determining health problems and complications during pregnancy[17].

We found that birth weight of newborns is associated with level of iron consumption by respondents. Respondents who consumed iron supplements < 180 delivered LBW babies at a rate of 1.43 (95% CI: 1.15-1.79) times higher than those who had iron 180 tablets and more during her pregnancy. Every woman in Nepal is recommended to take iron supplements[31] during pregnancy and within the postpartum period. A double blind RCT study on alternative maternal micronutrient in Nepal showed that folic acid-iron reduced the percentage of LBW babies by 9%[21]. A study carried out in Patan Hospital/Nepal also showed that severe anemia was associated with a significantly increased risk of LBW[9]. However, we analyzed number of iron supplementation and birth outcome. A further analysis also identified that those respondents who took iron supplements <180 gave birth to LBW babies 1.40 times more frequently than those who took iron supplements 180 and more. Hence, consumption of iron supplements <180 was a strong predictor for LBW babies. The Ministry of Health and Population (MOHP) has approved and implemented a policy of deworming medication during pregnancy in Nepal[31]. However, deworming medication is associated to LBW; we found it was a negative predicator in this study.

We excluded preterm births which is strength of this study. Excluding preterm births avoided the confounding of maturity and growth when LBW at any gestation is used. As for limitation, hospitals were selected purposively for the representation of mothers from different parts of Nepal, and considering services utilized by all citizens. The completed gestational age was taken from verbal autopsy with respondents. There might be recall bias as respondents had to remember their last date of menstruation. There might be chances of recall bias as this study sought some data based on respondents' past history like number of ANC visits, number of iron tablets taken. Similarly, there might be chances of recall bias on remembering their age at the time of study, age at marriage and age at first pregnancy. Though this is hospital based study, it did not cover clinical and pathological issues like blood, urine tests etc.

CONCLUSION

LBW is a public health problem in Nepal. The maternal education, height, number of ANC visits, and number of iron supplement consumption, were strong predictors for LBW in Nepal. Hence, Nepal has to develop effective strategy collaboration with education, agriculture & income generation that takes into consideration of maternal education, nutrition, and focused & comprehensive ANC to reduce and ideally overcome LBW.

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