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Association of Maternal Factors with Low Birth Weight in Selected Hospitals of Nepal

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ABSTRACT

Background: The high prevalence of low birth weight remains a major public health problem around the world. Nepal has prevalence of it as high as 21%. Because of poor dietary intake, majorities of Nepalese women have low body mass index and are anaemic that results in poor pregnancy outcome.

Methods: This hospital based case-control study was carried out in four hospitals of Nepal from August 2012 to September 2013. It sought the association of factors to low birth weight like maternal height, weight, and body mass index, food intake, past history of low birth weight, and preterm delivery. Total sample of 1533 were taken, among them 511 were cases and 1022 were controls.

Results: Total of 1533 mothers were interviewed across four hospitals. The study revealed mean height, weight and body mass index of mothers were 150cm (SD:6.6), 49kg (SD:6.8), and 21.5kg/m^2 (SD:3) respectively. On crude odds analysis, mothers with height <145cm had 1.5 times (CI:1.1-2.1), weight <45kg had 2.4 times (CI:1.9-3.1), body mass index <18.5kg/m^2 had 2.2 times (CI:1.6-2.9), food taken <2 times had 2 times (CI:1.4-2.9) higher chance of delivering low birth weight babies respectively. On adjusted OR analysis, height <145cm (AOR=0.5, CI:0.3-0.9); weight <45kg (AOR=0.5, CI:0.3-1.0) history of low birth weight (AOR=5.1, CI:2.1-12.8) were associated to current low birth weight.

Conclusions: The study concluded that the chances of delivering low birth weight were higher among mothers who are thin, short, low body mass index, less food intake, had history on low birth weight and preterm birth. Among them, a past history on low birth weight was the strongest predictor in this study.

Keywords: case control; food intake; low birth weight; maternal anthropometry; past obstetric history

INTRODUCTION

Care during pregnancy is crucial to save a life of newborn globally. Four million neonates die each year, and they are mostly in low-income countries.[1] Birth weight is affected to a great extent by mothers own foetal growth, diet and body composition at conception. Low Birth Weight (LBW) and preterm deliveries accounts for 27%.[2] In many countries, maternal nutritional factor account for delivering >50% of LBW babies.[3] Prevalence of LBW for Nepal is 21%[4]; 18% women fall below the standard level of BMI (18.5kg/m^2); 35% are anaemic[5] because of poor dietary practices.[6] A few LBW descriptive studies conducted among preterm deliveries in Nepal, which did not show the determinants of LBW at term with comparison on case and controls in my knowledge. Hence, this study aimed to identify the association of birth weight at term with maternal anthropometry; food intake; past obstetric history of LBW and preterm.

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METHODS

It is a hospital based case-control study, carried out in four hospitals of Nepal: Seti Zonal Hospital in Kailali; Tribhuvan University Teaching Hospital (TUTH) and Paropakar Maternity & Women's (Birthing Unit) hospital in Kathmandu, and Dhulikhel Hospital in Kavre. Hospitals were selected purposively to represent a broad and comprehensive geographical scope from far western plain to central hills; and took into account locations where all citizens could access services. Mothers were recently delivered women (within 12 hours) who completed 37 weeks of gestation, singleton and delivered a live baby. Mothers who gave birth of baby <2500 gm were termed case; and those ≥2500gm were termed control. For every case, two subsequent eligible controls were taken.

The sample size was calculated[7-9] based on the LBW prevalence of 0.15 from four hospitals;[8,9,10,] with 1.5 anticipated OR for LBW; 1:2 allocation ratio; 80% power; and 5% alpha. Hence, it calculated that cases were equal to 493, control equal to 986 with a total sample size was1479. We interviewed 1533 (4% more than sample size) to consider none response, but all mothers agreed for the interview.

The questionnaire was developed mentioning clear instructions, and was pretested in TUTH, Maharajgunj. At least 3 to 4 hospital nurses (working on the maternity ward) were trained on administering the structured questionnaire and interviewing technique. They interviewed recently delivered mothers (within 12 hours), having full term, singleton before discharge. Mothers were able to give interview within 12 hours of delivery. Data was collected from August 2012 to September 2013.

EpiData 3.1 was used for data entry following codes and checks. Data was input and checked for inconsistencies; analyzed using the SPSS version-20 computer software package through running simple frequency tables, descriptive cross tabulations, and binary logistic regression. Variance Inflating Factor (VIF) test[11] was utilized to assess multicollinearity, and result showed the highest and lowest VIF value were 6.61 and 1.03 respectively, which was in acceptable range (<10.0). Those variables which were significant in crude OR ($p<0.05$) were transferred to the binary logistic regression analysis.

The research was approved by the Institutional Review Board of Institute of Medicine, Maharajgunj; also from respective hospital boards. Each respondent was briefed shortly on objective of the study and taken verbal consent before interview. The collated data was kept confidential.

RESULT

Among 1533 samples, 33% were cases and 67% were controls. Out of 1533 mothers, 1430 (93%) had weight recorded in ANC card; 533 (35%) had history of delivering LBW and preterm. Hence, analysis was done based on those numbers. The mean height of mothers was 150cm (SD:6.6); weight was 48.9kg (SD:6.8); BMI was 21.5kg/m^2 (SD:3.1); and intake of food per day during pregnancy was 2 times (SD:0.4). Out of 1533 mothers, 170 (11%) had height <145cm, among them 42% were cases. Out

Table 1. Mothers by their anthropometry; food intake and restriction; history of LBW and preterm.

Variables	Case	Control	Total	Odds Ratio		Adjusted Odds Ratio	
	Number (%)	Number (%)	Number (%)	(lower-upper limits)	P-value	(lower-upper limits)	P-value
Height (cm)	n=511	n=1022	n=1533				
<145	71 (41.8)	99 (58.2)	170	Ref		Ref	
≥145	440 (32.3)	923 (67.7)	1363	1.5 (1.1-2.1)	0.01	0.5 (0.3-0.9)	0.02
Mean height	150.0 (SD:6.2)	151.0 (SD:6.7)	150.0 (SD:6.6)				
Weight (kg)	n=467	n=963	n=1430				
<45	169 (47.7)	185 (52.3)	354	Ref		Ref	
≥45	298 (27.7)	778 (72.3)	1076	2.4 (1.9-3.1)	0.00	0.5 (0.3-1.0)	0.05
Mean weight	47 (SD:6.8)	50 (SD:6.7)	48.9 (SD:6.8)				
BMI (kg/m^2)	n=467	n=963	n=1430				
<18.5	102 (47.9)	111 (52.1)	213	Ref		Ref	
≥18.5	365 (30.0)	852 (70.0)	1217	2.2 (1.6-2.9)	0.00	0.7 (0.3-1.5)	0.37
Mean BMI	20.9 (SD:2.9)	21.8 (SD:3.1)	21.5 (SD:3.1)				

Food intake/ day (times)	**n=511**	**n=1022**	**n=1533**				
1-2	68 (48.6)	72 (51.4)	140	Ref		Ref	
>2	443 (31.8)	950 (68.2)	1393	2.0 (1.4-2.9)	0.00	0.8 (0.4-1.7)	0.57
Mean food intake/day (times)	1.9 (SD:0.4)	2.0 (SD:0.4)	2.0 (SD:0.4)				
Restriction of food	**n=511**	**n=1022**	**n=1533**				
No	432 (32.3)	902 (67.7)	1334	Ref		Ref	
Yes	79 (39.7)	120 (60.3)	199	0.7 (0.5-1.0)	0.04	1.4 (0.7-2.6)	0.37
History of LBW	**n=151**	**n=382**	**n=533**				
No				Ref		Ref	
Yes	17 (68.0)	8 (32.0)	25 (4.7)	0.2 (0.1-0.4)	0.00	5.1 (2.1-12.8)	0.00
History of pre term	**n=151**	**n=382**	**n=533**				
No				Ref		Ref	
Yes	12 (54.5)	10 (45.5)	22 (4.3)	0.3 (0.2-0.8)	0.00	2.4 (0.9-6.4)	0.08

of 1430 mothers, 354 (25%) had weight <45kg, among them 48% were cases. Out of 1430 mothers, 213 (15%) had BMI <18.5kg/$m^{2;}$ among them 48% were cases. Out of 1533 mothers, 140 (9%) had food 1-2 times/day, among them 49% were cases; 199 (13%) had food restriction and among them, 40% were cases. Out of 533 mothers, 25 (5%) had history of LBW and among them 68% were cases; and 22 (4%) mothers had history of preterm, among them 55% were cases.

Total of 7 variables as mentioned in the table, were analyzed using bivariate analysis, all variables were found to be associated with LBW in crude OR @ 95%CI with p-value <0.05. The height of mothers <145cm had 1.5 (CI:1.1-2.1) times higher chance of delivering LBW babies than height ≥145cm. The mothers <45 kg had 2.4 (CI:1.9-3.1) times higher chance of delivering LBW than with weight ≥4 5kg. Similarly, mothers with BMI<18.5kg/m^2 had 2.2(CI:1.6-2.9) times higher chance of delivering LBW babies than with BMI≥18.5 kg/m^2. Mothers who took meals <2 times/day had 2.0 (CI:1.4-2.9) times higher chances of giving LBW than having meals ≥2 times/ day. The study revealed that no restricted food during pregnancy (OR=0.7, 95% CI: 0.5-1.0); no past history of LBW (OR=0.2, 95% CI:0.1-0.4), and no preterm (OR=0.3, 95% CI:0.2-0.8) had odds below 1and effect on current LBW. It showed that the history on LBW (AOR:5.1, CI:2.1-12.8) was statistically significant to LBW. The maternal height <145cm was significant (p=0.02) but not seen associated to LBW in AOR. The independent samples t test showed that height (t= -3.27, p=.001, @95% CI: -1.85 & -0.46), weight (t= -7.02, p=.000, @95% CI: -3.40 & -1.92), and BMI (t= -9.63, p=.000, @95% CI: -5.29 & -3.20) of mother; and food intake (t= -2.76, p=.006, @95% CI: -0.10 & -0.02) were significant to LBW.

DISCUSSION

The study is resourceful for current ongoing community and institution based interventions to address the issues based on the evidences for causing LBW, specifically for planners and managers to be considered for planning to improve maternal health and reduce LBW rate. This study examined the association of maternal factors with LBW. All aforesaid 7 maternal factors were statistically significant to LBW in crude OR analysis. Mothers with height <145cm give 1.5 times more LBW babies than height ≥145cm. A short stature is reflection of chronic malnutrition and considered to be risk for child bearing. We found that weight <45kg and BMI <18.5kg/m^2 were strongly associated to LBW. Different studies shows different critical limits of maternal weight, height, and BMI were 45kg, 152cm, 20kg/m^2 respectively for prediction of LBW,[12] others considered cut off value for maternal weight as <40kg,[13] <45kg,[14] <48kg;[15] for height was <145cm,[13,14] <140cm;[16] and BMI was <18.5kg/m^2,[14] 20.5kg/m^2,[17] respectively. The maternal height, weight and BMI are potential predictors for LBW,[18] and were measured in the first trimester of pregnancy.[12] A low pre pregnancy BMI, as with short stature is associated with poor birth outcomes and obstetric complications. Height and BMI are two anthropometric indices to assess the nutritional status of women. Among the different studied variables, maternal height, weight, and nutritional status have significant associations with LBW, and maternal weight to be the best surrogate

measures of LBW.[14, 19] In our study, the height <145 cm, weight <45 kg, and BMI <18.5 kg/m^2 were statistically significant in OR analysis but were not shown association on regression binary logistic analysis. Our study found that mothers having <2 times food intake/day give 2 times more chances of LBW; and mothers with no food restriction during pregnancy is adversely associated to LBW. The practice of restricting certain food items during pregnancy is common believing that it will help the mother avoid a difficult delivery caused by a large baby in Nepal.[6,20] Maternal nutritional factors both before and during pregnancy account for 50% of cases of LBW in developing countries.[21]

This study revealed significant association between history of LBW and preterm with current delivery of LBW baby. Because of limited birth spacing and poor health gain, mothers give LBW babies. Past history of adverse pregnancy outcomes were found to be significantly associated with LBW in present pregnancy;[8, 22] and might be expected since the factors that led to the previous LBW baby might still exist.[23, 24]

CONCLUSIONS

The study concluded that the chances of LBW was higher among those mothers who were short (height <145cm), thin (weight<45kg), BMI<18.5kg/m^2; and who restricted food during pregnancy; who had history of LBW and preterm. The highest chances of LBW were seen among mothers who had past history of LBW. Hence, a substantial proportion of LBW could be reduced by improving maternal nutrition and antenatal care at home and institution level.

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REFERENCES

1. Lawn, J.E., I. Rudan, and C. Rubens, *Four million newborn deaths: is the global research agenda evidence-based?* Early Hum Dev, 2008. **84**(12): p. 809-14.
2. Lawn, J.E., S. Cousens, and J. Zupan, *4 million neonatal deaths: when? Where? Why?* Lancet, 2005. **365**(9462): p. 891-900.
3. Ramakrishnan, U., *Nutrition and low birth weight: from research to practice.* The American Journal of Clinical Medicine, 2003.
4. DoHS, *National Nutrition Policy and Strategy*, D.o.H. Services, Editor. 2004.
5. MoHP, N.E., ICF International, *Nepal Demographic Health Survey*. 2011.
6. Save, *State of the World's Newborns: Nepal*. 2002.
7. *nMaster 2.0, Biostatistics Resource and Training Centre, Department of Biostatistics, Christian Medical College,Vellore 632 002 India.*
8. Kayastha, S. and H. Tuladhar, *Study of low birth weight babies in Nepal Medical College.* Nepal Med Coll J, 2007. **9**(4): p. 266-9.
9. Yadav, D.K., U. Chaudhary, and N. Shrestha, *Risk factors associated with low birth weight.* J Nepal Health Res Counc, 2011. **9**(2): p. 159-64.
10. Singh, S.D., Shrestha S., S.B M, *Incidence and Risk Factors of Low Birth Weight babies born in Dhulikhel Hospital.* Journal of IOM, 2010. **3**(32): p. 39-42.
11. Obrian, R., *A Caution Regarding Rules of Thumb for Variance Inflation Factors.* Springer, 2007. **41**.
12. Mohanty, C., et al., *Maternal anthropometry as predictors of low birth weight.* J Trop Pediatr, 2006. **52**(1): p. 24-9.
13. Hirve, S.S. and B.R. Ganatra, *Determinants of low birth weight: a community based prospective cohort study.* Indian Pediatr, 1994. **31**(10): p. 1221-5.
14. Ojha, N. and D.S. Malla, *Low birth weight at term: relationship with maternal anthropometry.* JNMA J Nepal Med Assoc, 2007. **46**(166): p. 52-6.
15. Bisai, S., et al., *Receiver operating characteristics (ROC) curve estimation of low birth weight based on maternal early third trimester weight among Bengalee women of Kolkata, India.* Coll Antropol, 2009. **33**(3): p. 725-8.
16. Bhargava, S.K., S. Ghosh, and U.B. Lall, *A study of low birth weight infants in an urban community.* Health Popul Perspect Issues, 1979. **2**(1): p. 54-66.
17. Karim, E. and C.G. Mascie-Taylor, *The association between birthweight, sociodemographic variables and maternal anthropometry in an urban sample from Dhaka, Bangladesh.* Ann Hum Biol, 1997. **24**(5): p. 387-401.
18. MIRA, U., *Low Birth Weight Prevalence and Associated Factors in Four Regions of Nepal, A Multi-Hospital Based Study*. 2000, Unicef; MIRA.
19. Bondevik, G.T., et al., *Maternal hematological status and risk of low birth weight and preterm delivery in Nepal.* Acta Obstet Gynecol Scand, 2001. **80**(5): p. 402-8; Sen, J., A. Roy, and N. Mondal, *Association of maternal nutritional status, body composition and socio-economic variables with low birth weight in India.* J Trop Pediatr, 2010. **56**(4): p. 254-9; Shrestha, I., et al., *Correlation between gestational weight gain and birth weight of the infants.* Nepal Med Coll J, 2010. **12**(2): p. 106-9.
20. Muthayya, S., *Maternal nutrition & low birth weight - what is really important?* Indian J Med Res, 2009. **130**(5): p. 600-8.
21. Ramakrishnan, U., *Nutrition and low birth weight: from research*

to practice. the american journal of clinical nutrition, 2003.

22. Badshah, S., et al., *Risk factors for low birthweight in the public-hospitals at Peshawar, NWFP-Pakistan.* BMC Public Health, 2008. **8**: p. 197.

23. Arous, S.W.a.S., *Incidence and determinants of low birth weight in Syrian government hospitals* 2001.

24. Joshi H S, S.P.C., Agnihotri A K, Joshi M C, Chandra Shalini, Mahajan Vipul, *Risk Factors for Low Birth Weight (LBW) Babies and its Medico-Legal Significance.*