Prevalence, Risk Factors and Short-Term Outcomes of Low Birth Weight Infants Born during Covid Pandemic - A Prospective Case Control Study

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ABSTRACT

Introduction: Low birth weight (LBW) is a global health problem since it is associated with various short term and long term adverse outcomes. This study aimed to determine the prevalence, risk factors, and short-term outcomes of LBW infants born in Covid era in Pokhara Academy of Health Sciences(PoAHS).

Materials and methods: A prospective case–control study was done in PoAHS among the neonates born during the study period of June 15, 2021 to December 15, 2021 via convenience sampling in the ratio of 1:2.Stillbirth, intrauterine foetal demise (IUFD) multiple pregnancies and neonates with major congenital/chromosomal anomalies were excluded. The total sample size for the study was 423; 141 cases and 282 controls.

Results: The prevalence of LBW was 97.8 per 1000 live births. The mothers with LBW deliveries had significantly lower body weight and height, gained less weight in pregnancy and did not consume adequate nutritious food. They belonged to lower socioeconomic status,were exposed to smoking and did hard physical work during pregnancy. Covid 19 infection increased the odds of LBW deliveries AOR 9.007(95% CI 2.135-37.994) p=0.03. Preterm LBW infants were more likely to be admitted in NICU and had increased risk of mortality(p= 0.046).

Conclusion: Nutritional, environmental, socioeconomic and maternal health related factors were associated with LBW which must be prioritized to reduce the prevalence of LBW and improve the outcome.

Keywords: Covid 19; low birth weight; nutrition; outcome; socioeconomic factors

INTRODUCTION

The first weight of a newborn obtained after birth is birth weight. A new born with a birth weight of less than 2500 gm is defined as a low birth weight (LBW) by the World Health Organization (WHO).[1] This is irrespective of the gestational age of the newborn. Nearly 15 % of babies born worldwide are low birth weight.[2] LBW infants in which small for gestational age (SGA), intrauterine growth retardation(IUGR), and prematurity are included, are associated with increased risk of mortality and contribute to 40% to 60% of newborn mortality, globally.[3] Intellectual disability and learning disability are associated with LBW along with other short and long-term morbidities. The causes of LBW are numerous. Low socioeconomic status is positively correlated with both prematurity and IUGR. It is associated with higher rates of maternal under nutrition, anemia, in adequate prenatal care, drug misuse, obstetric complications and various maternal diseases. The etiology also involves the complex interaction

between fetal, placental, uterine, and maternal factors. The risk factors tend to overlap in pre-term birth and IUGR.

Despite the vast progress in medical sciences and conduction of many health programs targeted toward maternal and neonatal health, there has been no significant change in the magnitude of LBW. Progress in reducing LBW has been stagnant since 2000(22.9 million in 2000 and 20.5 million in 2015).[2] This might be further aggravated by the Covid 19 pandemic. The United Nations Global Strategy for Women's, Children's, and Adolescent Health Strategy 2016 to 2030 aims to reduce the neonatal mortality rate to 12 per 1000 births.[4] Since LBW is an important cause of neonatal mortality, it is essential to evaluate its prevalence, risk factors, and outcomes to achieve this aim. The main modifiable risk factors of LBW have to be understood and the interrelationships between maternal, socioeconomic, nutritional, and environmental factors need to be identified according. This article is the first of its kind in this region in the Covid era. The determination of prevalence and identification of risk factors, short term outcomes in the Gandaki region, will help the policymaking to be focused on the reduction of modifiable risk factors. This in the long run will decrease the prevalence of LBW along with reduction of mortality and morbidity. This will have maximum contribution to reducing childhood morbidity and mortality. Hence, forth this research was designed to identify these risk factors and their interrelationships in this region so that attainable and sustainable interventions can be designed.

MATERIALS AND METHODS

An unmatched case-control study was done in Pokhara Academy of Health Sciences(PoAHS)after the study was approved by the Institutional Review Committee of Pokhara Academy of Health Sciences on June 15, 2021(reference number 53.2077/2078). The study population wasnewborns born at PoAHS during the study period of June 15, 2021, to December 15, 2021, selected via convenience sampling in the ratio of 1:2 of cases and controls. Singleton live newborns with birthweight of less than 2500 grams were cases and singleton live newborns of birthweight ≥2500 grams were controls. Written consent was taken from the guardians of the study population.The sample size was determined using the proportion difference approach with the assumption of 95% confidence level ($Z\ \alpha/2 = 1.96$) 80% power ($Z\beta = 0.84$), control to case ratio 1:2 (r=2), the odds ratio to be detected ≥2 and the 20% control group will be exposed. The final sample size is 423(141 cases and 282 controls).

Data was collected through face to face interview, observing medical records of the newborns, and measuring their anthropometry. Information regarding maternal weight gain, age, antenatal visit, birth weight of the neonates, co-morbidities and gestational age was taken through reviewing antenatal care(ANC) card and maternal and newborn register to avoid possible recall bias. Multiple births, stillbirths, neonates with major congenital anomalies and whose guardian failed to give consent were excluded. Birth weight was measured by study investigators using a digital non-hanging type salter scale and rounded to the nearest 10 grams.

Data was entered in SPSS version 23 and analyzed. Bivariate associations between independent variables and low birth weight was tested through chi square and the association was analyzed by calculating crude odds ratio (OR) at 95 % confidence interval through binary logistic regression. Multivariate logistic regression was examined for the relationship between independent variables and low birth weight to address the confounding effect.

RESULT

During the study period there were 3456 total live singleton deliveries.Among the 338 low birth weight deliveries. 69.2% were term and 30.8% were preterm neonates. Hence the prevalence of low birth weight was 97.8 per 1000 live births. Out of the total LBW neonates, 141 were selected as cases and for each case two normal birth weight (NBW) neonates were selected as control. Almost 2/3rdmothers of both groups belonged to age group of 20 to 29 years (Table 1) and most of the mothers (68.8 %) belonged to the urban communities. However, mothers from rural areas were more likely to give birth to LBW infants (41.1%) while comparing with NBW deliveries (26.2%). More than half of the mothers (53.9% in cases and 59.6% in control) completed secondary level of education and 2/3rd were engaged in household work as their occupation (67.1%). 30% of multiparous mothers

of LBW deliverieshad interpregnancy interval of less than 2 years which was much higher than in NBW. Among the LBW deliveries, only 43.3% had four or more ANC visits which was very less in comparison to 83% of NBW deliveries. 28.4% of mothers who delivered LBW neonates had height of less than 146 cm which was only 1.1 % in control. 57.4% of the mothersof the cases had prepregnancy weight of less than 50 kg, 21.3% did hard physical work during pregnancy, 75.2% belonged to lower socioeconomic status, 45.4% used polluted fuel for cooking, 72.3% took iron for more than 3 months and only 48.9% had adequate food intake with variety of food. Anaemia was found to be more common in mothers with LBW deliveries as 37.6% of them had haemoglobin less than 11gm/dl which was much higher than 10.6% of NBW deliveries.25.3% LBW deliveries were associated with low birth weight in previous pregnancies, 15.6% the mothers had significant maternal disease and 12.1% had Covid 19 infection or contact with Covid 19. 51.7% of the LBW neonates needed to be admitted in the NICU while only 10.3 % of normal birth weight neonates needed to be admitted in the NICU.

Table1: Distribution of mothers and neonates by sociodemographic and obstetric characteristics.

Variables Number		Low Birth Weight		Normal birth weight		Total	
		Number	%	Number	%	Number	%
Maternal Age	<20	24	17	34	12.1	58	13.7
	20 to 29	93	66	194	68.8	287	67.8
	30 to 35	20	14.2	44	15.6	64	15.1
	>35	4	2.8	10	3.5	14	3.3
Residence	Urban	83	58.9	208	73.8	291	68.8
	Rural	58	41.1	74	26.2	132	31.2
Maternal education	Illiterate	11	7.8	2	0.7	13	3.1
	Read and write	7	5	13	4.6	20	4.8
	Primary	28	19.9		13.5	66	15.6
	Secondary	76	53.9	168	59.6	244	57.6
	Tertiary	19	13.5	61	21.6	80	18.9
Maternal occupation	Agriculture	20	14.2	18	6.3	38	9
	Business	11	7.8	25	8.9	36	8.5
	Service	7	5	53	18.8	60	14.2
	Household work	101	71.6	183	64.9	284	67.1
	Others	2	1.4	3	1.1	5	1.2
Socioeconomic status	Lower	106	75.2	25	8.8	131	30.9
	Middle and upper	35	24.8	257	91.2	292	69.1
Parity	Primi	80	56.7	169	59.9	249	58.9
	Multi	61	43.3	113	40.1	174	41.1
Inter pregnancy interval	< 2 years	18	30	10	8.2	29	15.6
	≥ 2 years	44	70	113	91.8	156	84.4
Type of family	Nuclear	61	43.3	118	41.8	179	42.3
	Joint/ Extended	80	56.7	164	58.2	244	57.7
Fuel used for cooking	Polluted	64	45.4	82	29.1	146	34.5
	Non-polluted	77	54.6	200	70.9	277	65.5

ANC visit	<4 visit	80	56.7	48	17	295	69.7
	≥ 4 visit	61	43.3	234	83	128	30.3
Maternal height	< 145 cm	40	28.4	3	1.1	43	10.2
	≥ 145 cm	101	71.6	279	98.9	380	89.8
Pre pregnancy maternal weight	< 50 kg	81	57.4	38	13.5	119	28.1
	≥ 50 kg	60	42.6	244	86.5	304	71.9
Hard Physical work in pregnancy	Yes	30	21.3	6	2.1	36	8.5
	No	111	78.7	276	97.9	387	91.5
Adequate food intake with variety	Yes	69	48.9	221	78.3	290	68.6
	No	72	51.1	61	21.7	133	31.4
Haemoglobin	< 11 gm/dl	53	37.6	30	10.6	83	19.6
	≥ 11 gm/dl	88	62.4	252	89.4	340	80.4
Iron intake for more than 3 months	No	39	27.7	7	2.5	46	10.9
	Yes	102	72.3	275	97.5	377	89.1
History of previous low birth weight	Yes	16	25.3	3	1.1	19	4.5
	No	47	74.6	117	41.5	164	38.8
Covid 19/contact with Covid 19	Yes	17	12.1	6	2.1	23	5.4
	No	124	87.9	276	97.9	400	94.6
Maternal disease	Yes	22	15.6	17	6	39	9.2
	No	119	84.4	265	94	384	90.8
NICU admission of the neonate	Yes	73	51.7	29	10.3	102	24.1
	No	68	48.2	253	89.7	321	75.9

Bivariate and multivariate logistic regression analyses were performed to study the association between different risk factors and the occurrence of low birth weight which have been summarized in table 2. Maternal anemia, active or passive smoking by the mother, antenatal visit of fewer than 4 times, rural residence, lower socioeconomic status, maternal height less than 146 cm, prepregnancy weight of less than 50 kg, maternal weight gain of less than 6.53 kg in 2nd and 3rd trimester, inadequate food intake during pregnancy, use of polluted fuel for cooking, presence of maternal disease, history of Covid 19 infection or contact during pregnancy, and history of previous low birth delivery were significantly associated with LBW.

The variables which were associated significantly with LBW in the bivariate model were reanalyzed with multivariate analysis. The risk of LBW tended to be 1.6 times higher in mother who were exposed to smoking either active or passive(95% CI 0.77 -3.39). mothers who were from rural communities were more likely to give birth to LBW (AOR 1.37; 95% CI 0.606-3.120) than mothers from urban communities along with mother belonging to lower socioeconomic status (AOR 17.6; 95% CI 8.23-37.63). Use of polluted fuel like firewood and kerosene increased the odds of giving a LBW birth by 1.95 times (95% CI 0.77-4.89). Maternal height of less than 146 cm (AOR 4.468; 95% CI 0.85-23.43) prepregnancy maternal weight of less than 50 kg (AOR 1.52; 95% CI 0.63-3.68) and gain in weight of less than 6.53 kg during second and third trimester (AOR 5.54; 95% CI 2.22-13.83) increased the odds of giving birth to LBW neonates.Inability to consumenutritious food (AOR 2.89; 95% CI 1.35-6,21), and hard physical work during delivery (AOR 5.77; 95% CI 1.48-22.36), presence of maternal disease(AOR 3.478; 95% CI 1.06-11.40) along with Covid 19 or its contact (AOR 9.007; 95% CI 2.13-37.99)and history of previous low birth weight(AOR5.434 95% CI 0.78-37.60)were the determinants of low birth weight. These factors were found to be significantly associated with LBW in multivariate analysis.However antenatal visit of more than 4 times lowered the risk ofdelivering low birth babies(AOR 0.2695% CI 0.12-0.56).

Table2: Logistic regression output of determinants of low birth weight births

Characteristics		COR (95%CI)	p value	AOR (95% CI	p value
Parity	Primiparous	0.87 (0.582-1.321)	0.53		
	Multiparous				
Anaemia	Yes	5.059 (3.040-8.419)	0.00	0.819(0.324-2.066)	0.672
	No				
Sex of the baby	Male	0.931 (0.622-1.396)	0.731		
	Female				
Smoking (active or passive)	Yes	2.97 (1.9-4.588)	0.00	1.620 (0.774-3.390)	0.2
	No				
ANC visit	≥Four visits	0.156 (0.099-0.247)	0.00	0.263 (0.123-0.562)	0.001
	< Four visits				
Residence	Rural	1.964 (1.281-3.012)	0.001	1.375(0.606-3.120)	0.446
	Urban				
Socioeconomic status	Lower	31 (17.768 -54.55)	0.00	17(8.232-37.637)	0.000
	Upper and Middle				
Maternal height	≤145 cm	36.832 (11.14 -121.691)	0.00	4.468(0.852-23.433)	0.077
	>146 cm				
Pre-pregnancy maternal weight	<50 kg	8.668 (5.376-13.978)	0.00	1.524(0.631-3.683)	0.349
	≥50 kg				
Weight gain in second and third trimester	< 6.53 kg	16.65 (9.4-24.495)	0.00	5.547(2.224-13.838)	0.000
	≥ 6.53 kg				
Adequate food intake with variety	Yes	3.78 (2.44-5.842)	0.00	2.898(1.352-6.212)	0.006
	No				
Inter pregnancy intervals	≥ 2 years	0.20 (0.08-0.46)	0.00	0.755(0.243-2.349)	0.628
	< 2 years				
Hard physical work done during pregnancy	Yes	12.432 (5.036-30.695)	0.00	5.772(1.489-22.366)	0.011
	No				
Fuel used for cooking	Polluted (firewood and kerosene)	2.02 (1.33-3.08)	0.01	1.951(0.77-4.89)	0.155
	Unpolluted				
Presence of maternal disease	Yes	2.88 1.47-5.62	0.02	3.478(1.061-11.404)	0.04
	No				
Covid 19 infection or history of contact with Covid 19	Yes	6.3 2.4 -16.38	0.00	9.007(2.135-37.994	0.03
	No				
History of previous low birth weight	Yes	13.277 (3.69-47.69)	0.00	5.434(0.785-37.603)	0.086
	No				

[a] Total LBW babies = 62, Total babies with birth weight > 2500 gm = 123

[b] Total LBW babies = 63, Total babies with birth weight > 2500 gm = 120

Table3: Demographics and outcomes of term low birth weight infants and preterm low birth infants admitted in NICU

Variable		Preterm LBW (N=131) (80%)		Term LBW (N= 32) (20%)		C O R (95% CI)	P value
Sex	Female	59	45%	12	37.5%	1.366(0.617-3.022)	0.5
	Male	72	55%	20	62.5%		
Mode of delivery	SVD	89	67.9%	18	56%	1.648(0.749-3.628)	0.2
	Caesarean section	42	32.1%	14	44%		
Birth weight	< 1000 gm	11	8.4%	0	0		0.019
	1000 gm to 1500 gm	16	12.2%	0	0		
	>1500 gm	104	79.4%	32	100%		
Diagnosis	Sepsis	89	67.9%	17	53.1%		0.00
	RDS	33	25.2%	0	0		
	MAS	4	3.1%	11	34.3%		
	HIE	5	3.8%	2	6.25%		
Mortality	Yes	32	24.42%	3	9.37%	3.125(0.892-10.946	0.046
	No	99	73.88%	29	90.63%		

Out of total 338 low birth neonates born in PoAHS, 163 neonates required admission in NICU, where 131(80%) were preterm LBW and 20 % were term LBW (Table 3).Preterm LBW were more likely to have sepsis, respiratory distress syndrome and whereas term LBW were more likely to have meconium aspiration syndrome and hypoxic ischemic encephalopathy. Mortality as a short term outcome was associated more with preterm LBW in comparison with term low birth weight (p = 0.046).

DISCUSSION

This study analyzed the socioeconomic, environmental, maternal factors and co-morbidities during current pregnancy against low birth weight deliveries. Based on the findings of this study, among maternal anthropometry (height, pre-pregnancy weight and weight gain during pregnancy), maternal short stature was found to be most significantly associated with low birth weight which was consistent with a study done in India and Tanzania.[5,6] This study showed a positive link of low birth weight deliveries with pre-pregnancy maternal weight, lesser maternal weight gain and inadequate food intake during pregnancy. This correlates with other studies which linked inadequate maternal nutritional status with adverse pregnancy outcomes.[7,8] This study showed that mother's low economic status was an important risk factor for LBW which is in agreement with previous.[9,10] Similar to our study where there was a statistically significant risk of low birth weight with lesser number of ANC visits, multiple studies have shown that birth weight of babies is influenced significantly by the number of antenatal check-ups made by mother.[11,12] This study found that the use of polluted fuel for cooking was significantly associated with having LBW births which was consistent with a study conducted in China which associated the use of biomass and coal for cooking with greater risk of SGA birth.[13] Females from rural areas and who were subjected to hard physical work during pregnancy were also found to be more likely to give birth to LBW infants. The odds of giving LBW baby were found to be more among rural residents compared with urban residents (AOR = 1.375, 95%, CI: (0.6 – 3.12) which might be related with the difference in awareness about nutrition and health as well as difference in the economic condition.[14] Difference in economic conditions might also explain the

difference in which most of rural people are poor compared with urban counter parts.[15] This study showed that smoking by the mother which may be passive or active, inter-pregnancy interval of less than 2 years and presence of chronic maternal disease increased the odds of delivering LBW births which is consistent with several studies that suggested that LBW is affected by the mother's health, along with smoking short birth spacing, psychological tensions and depression.[16] Consistent with other published literature, this study also showed an increased risk of LBW if the mother had a previous history of delivering a LBW.[17] Covid 19 infection or exposure also increased the odds of giving birth to LBW infants by 9 times which was found similar to a study done in Iran.[18]

The risk of mortality as an immediate neonatal outcome was significantly associated with preterm LBW than with term low birth weight. Low birth weight is the most important indicator of infant mortality as shown by a study done in Jordan where it showed that children with LBW had a 5.16 times higher mortality rate in childhood than children with NBW.[19]

Limitations :

Pokhara Academy of Health Sciences serves mostly middle and low socioeconomic status families, and that under represent risk factors in the higher socioeconomic status which might be different. Since stillbirth, IUFD and multiple pregnancies were excluded from the study, it might not give an accurate estimate of prevalence of LBW infants as actual incidence might be significantly higher.

CONCLUSION

The prevalence of LBW in live singleton deliveries is high which contributes significantly to the almost static neonatal mortality rates and associated morbidity. Nutritional and socioeconomic maternal factors were found to be significantly associated with LBW infants along with environmental factors and maternal health. LBW infants areat increased risk for mortality and morbidity. It is necessary to screen pregnant mothers who are at risk of having infants with LBWs. Policies must be focused towards rural pregnant women and women with poor nutritional and lower socioeconomic status. They should be encouraged to obtain enough dietary intake and to have frequent ANC visits, monitor their weight and haemoglobin while addressing other social factors like physical labour, smoke exposure, fuel for cooking, infection prevention practices and increasing the inter-pregnancy interval.

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