Assessment of Risk Factors Associated with Low-Birth-Weight Neonates in a Tertiary Care Teaching Hospital: A Case-Control Study

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Authors' contributions:

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Background: Low birth weight (LBW) is still a significant public health problem globally and is associated with a range of both short- and long-term consequences. Overall, it is estimated that 15% to 20% of all births worldwide are low birth weight, representing more than 20 million births a year.
Objective: We aimed the study to assess the risk factors associated with low-birth-weight neonates in a rural tertiary care hospital.
Methodology: A prospective observational Case-Control Study was conducted in the Department of Pediatrics (Neonatal Intensive Care Unit) and Department of Obstetrics and Gynecology, Dhiraj Hospital, Vadodara with the sample of 240 women who were admitted for the delivery. The patient

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interview was done based on the questionnaires (Proforma).

Results: Area of residence, Parent's education, Anaemia among pregnant women, Mid upper arm circumference (MUAC) less than 23 cm, Maternal age, and antenatal visits <4 were found as significant risk factors associated with low birth weight in the study. Study findings suggest that 91.3% of cases were from rural areas compared to 71% of controls from the same area. Similarly, Anaemia though prevalent in both case and control groups was seen as a significant predictor more in the case group. Other factors such as parity, spacing between babies, and consumption of drugs and alcohol by pregnant others were also recorded but were protective of LBW.

Conclusions: The study concluded that delay age of first pregnancy, lacking iron/folic acid supplementation, not taking nutritional food during pregnancy, anemia and other factors were independently associated with LBW.

1. INTRODUCTION

Low birth weight (LBW) is defined by the World Health Organization (WHO) as weight at birth less than 2500 g (5.5 lb.). Low birth weight is still a significant public health problem globally and is associated with a range of both short- and long-term consequences. Overall, it is estimated that 15% to 20% of all births worldwide are low birth weight, representing more than 20 million births a year. There is considerable variation in the prevalence of low birth weight across regions and within countries; however, the great majority of low-birth-weight births occur in low- and middle-income countries and especially in the most vulnerable populations. Nearly 50 % of all infant deaths occur in the Neonatal period and the common cause for this LBW. [1-2] India is a developing country with maternal malnutrition and low birth weight posing significant healthcare problems in recent studies. Moreover, the WHO has targeted to decrease the prevalence of LBW babies by 30% by 2025. [3] In childhood low birth weight babies present with higher risks of stunting, lower IQ, or even neonatal mortality. In adulthood, these babies may also face adult overweight and obesity, it has also been linked to hypertension and diabetes. [4-6] We have observed that very few studies have been carried out on this topic in the Gujarat state of India, where the risk factors associated with low-birth-weight neonate is very high in a different population (Mother's) of various factor like malnutrition, anemia, smoking, low socioeconomic status, maternal age, low educational status & other comorbid condition. Along with this study, we are also planning to find out the incidence of LBW neonates, and identify the morbidity problems of low-birth-weight neonates. So, we had done this study at Dhiraj General Hospital, Sumandeep Vidyapeeth, Vadodara Gujarat to assess the risk factor associated with low-birth-weight neonates in a rural tertiary care hospital.

2. METHODOLOGY

This was a prospective observational case-control study conducted for six months in the Department of Pediatrics (Neonatal Intensive Care Unit) and Department of Obstetrics and Gynecology, Dhiraj General Hospital, Vadodara. In our study, Inclusion criteria for cases are subjects having a birth weight between 1500-2500 grams or equal to 2500 grams, inborn neonates both preterm and full-term & for Controls are Normal birthweight (≥2500 grams). Exclusion criteria are stillborn babies, outside deliveries, and parents who do not give consent. Cases and controls were both selected based on inclusion and exclusion criteria. The data from the neonate's and mothers' medical records were taken from the hospital and recorded in predesigned and prevalidated proforma. Information was collected by PI from the patient's medical record file and if needed in a face-to-face interview with the parents of the subjects. A proforma will be used, to assess risk factors of low birth weight which includes: Socio-demographic data such as age, gender, marital status, education, Data of past obstetrics history. The presence of co-morbidities like anemia, sickle cell disease, etc. will be assessed. Immediate data of newborns. The data was entered in an excel sheet and calculated by Kelsey's method. P-value will be calculated to assess the difference between cases and controls and P≤0.05 is considered as significant. The odds ratio will be calculated to find the strength of association and will be presented with a confidence interval.

3. RESULT

A total of 240 subjects were enrolled in the. The analysis included 80 cases and 160 controls. In our study, the maternal age varied from 19 to 36 years with the mean age in cases be 22.69 ± 3.37 and in control to be 24.41 ± 3.43 years. For a better understanding of our data, we distributed the age groups into groups 1 with less than 20 and greater than 30 years of age as very young or older females may give birth to babies with lower birth weight. We then considered mothers between the ages of 20-30 years as group 2.

In our study, we found that Cases have 18.8% (N= 15) of mothers belonging to the exposure group 1 and 81.3 % (N=65) of mothers belonging to non-exposure group 2. Similarly, for controls, we found that 10%(N=16) of controls belonged to the exposure group that is very old or very young mother's and 90% (N=144) belonged to non-exposure group 2. More controls are belonging to the adequate age group between 20-30 the difference can be considered as significant and hence maternal age is a risk factor for low birth weight in babies.

The area of residence of cases and controls showed a significant difference. Out of the 80 cases, 91.3 % (N= 73) belonged to the rural region and only 8.8% (N=7) belonged to the urban region. From the 160-control group, 71.3% (N=114) belonged to the rural region as compared to the 28.8% (N=46) belonging to the urban region. Since the hospital is a tertiary care hospital more patients belonging to the rural region visit

In case the percentage of the population with a father's education equal to Secondary and less than Secondary was 88.8% (N= 71) and the percentage with Higher than secondary schooling was 11.3% (N=9). In the case of control, 78.8% (N=126) had education till secondary or less than secondary level and 21.3% (N=34) have an education higher than secondary. As this was a tertiary care hospital, parents with education levels greater than secondary level were less. There were more cases of Low-birth-weight babies with Father having education less than secondary but it was not a statistically significant value. In case the percentage of the population with a mother's education equal to Secondary and less than Secondary was 96.3% (N= 77) and the

percentage with Higher than secondary schooling was 3.8% (N=3). In the case of control, 84.4% (N=135) had education till secondary or less than secondary level and 15.6% (N=17) have an education higher than secondary. As this was a tertiary care hospital, parents with education levels greater than secondary level were less. There were more cases of Low-birth-weight babies with the mother having education less than secondary and it was a statistically significant value.

Based on the Kuppuswamy scale the Socioeconomic background of parents was decided. The lower socio-economic background had 98.8% (N=79) cases as compared to 87.5% (N=140) of control. [7] Whereas classes above upper-lower had more percentage of control as compared to cases. Anthropometric Data of the mothers like a weight is collected over pregnancy trimester wise and the records are often not collected accurately we collected MUAC for the mothers. [8] Based on the mid-upper arm circumference measured using measuring tape the mothers were classified into 2 groups, one having MUAC less than 23 cm and the other more than 23 cms. Mother's having MUAC less than 23 cm are more likely to deliver low birth weight infants due to their lower nutritional status. The results for MUAC in our study are statistically non-significant. [9,10]

Tobacco chewing, bidi smoking, and alcohol abuse is a practice that generally leads to risk to the fetus. Based on the maternal habits of these substance abusers the subjects were divided into consumers and non-consumers. 96% of 240 participants did not consume tobacco/alcohol or any other form of drugs during the study. 2.5 % of cases were consumers compared to the 5.6% of the control group. The data was not statistically significant for a proper conclusion. It was recorded that Cases consisted of 57.5% (N=46) male babies and 42.5% (N=34) female babies. Out of the 160 controls, 61.3% (N=144) were male babies and the remaining 38.8% (N=96) were females. Our study proves that low birth weight can cause several such neonatal illnesses in the short- term and other long-term consequences not recorded in this study. The majority of the patients in both cases and the control group were discharged after undergoing full treatment. Still, 3 patients belonging to the case group were discharged against medical advice due to the longer hospital stay that is needed for low-birth-weight babies.

Table 1. General comparison of common variables between cases and controls

Group		N	Mean	SD	P-Value
Age	Case	80	22.69	3.37	**0.004**
	Control	160	24.41	3.43	
Pre Preg. Wt.	Case	80	48.85	7.89	**0.010**
	Control	160	51.74	8.62	
Wt. gain	Case	80	5.85	1.62	**0.006**
	Control	160	6.45	1.50	
MUAC	Case	80	25.98	3.95	**0.099**
	Control	160	26.86	3.73	
Anemia (Hb%)	Case	80	9.47	1.01	**0.002**
	Control	160	10.92	1.33	

Table 2. Socio-Demographic data

Factor	Group		P-value	Odds ratio	Confidence Limits	
	Case	**Control**			**Lower**	**Upper**
Maternal Age						
<20 and >30	15	16	0.057	2.08	0.97	4.45
	18.8%	10.0%				
20-30	65	144				
	81.3%	90.0%				
Area of residence						
Rural	73	114		4.21	1.8	9.82
	91.3%	71.3%	0.0001			
Urban	7	46				
	8.8%	28.8%				
Fathers' Education						
Secondary and less	71	126	0.084	2.13	0.97	4.65
	88.8%	78.8%				
Higher than secondary	9	34				
Higher than secondary	9	34				
	11.3%	21.3%				
Mother's Education						
Secondary and less	77	135	0.006	4.75	1.39	16.26
	96.3%	84.4%				
Higher than secondary	3	17				
	3.8%	15.6%				

4. DISCUSSION

The study was conducted to explore the various risk factors such as socio-demographic factors, obstetric history of the mother, and other factors that may contribute to the low birth weight in babies. Low birth weight babies have a higher risk of infant mortality and morbidity and hence it acts as a sensitive index for the nation's health and development. To observe and analyze the impact of these factors a case-control study was conducted. The study was conducted over 6 months at our tertiary care hospital. The data was collected from a total of 240 subjects who were enrolled and were inborn to maintain the accuracy of data. All the data from babies who did not match the inclusion criteria were eliminated. There was no significant difference between the case and control in terms of maternal age, parent's education, and mother's occupation. It is generally observed that children having low birth weight are more prone to hospitalization, poorer language development, disabilities, brain damage, intellectual impairment, and may be placed in special education classes and they are at an increased

risk for health-related problems such as ischemic heart disease, adult chronic condition, as well as a major risk of being in the lower socioeconomic classes. The area of residence of parents, the especially rural area being a risk factor was also consistent with the result found in a matched-pair case-control study conducted in Maharashtra by Deshpande J et al. [11] and other similar studies conducted by Hirve and Ganatra, and conclusions reached by Kramer. [12,13] Another study was saying that causation of LBW is malnutrition, heavy physical work during pregnancy, Malaria, low pre-pregnancy weight, smoking, maternal age, low educational status, hypertension, severe anemia, short pregnancy period, etc. [14-17] It has been mentioned in literature review concerning the impact of socio-demographic factors, the results for the maternal anthropometry are indicative of associations. Hence, we used mid-upper arm circumference for accurate measurements. [8] Two-thirds of the mothers in this study were anemic [18,19] Anaemia in the mother is a definite risk factor for LBW. The number of antenatal clinic visits is important because the advice received during the antenatal care about diet and weight can make a significant difference between the cases and controls. In our study, this was found to be a major risk factor. [20,21,22] In our study 20% of cases were born prematurely compared to the rest 80% born at full term as compared to control's only 6% of babies born prematurely. Using the fetal growth graph we recorded the growth of baby, which divides the development of a fetus into 3 categories - AGA, SGA, LGA, concluded that the case group had more SGA babies (37.5% in the case compared to 1.9% in the control group) i.e., the fetus was not developing properly. [23] The Control group also had slightly more male births as compared to the case group. The common diseases that the newborn faced were hyperbilirubinemia (very common), birth asphyxia, respiratory distress, feeding difficulties, hypo/hyperglycemia among others. [24] Low birth weight is still very significant despite governments' continuous efforts, but it is a condition that is preventable by proper interventions provided at the right time and some efforts from the parents. More education for mothers is needed in our society.

Table 3. Obstetric History

Factor		Group		P-value	Odds ratio	Confidence Limits	
		Case	Control				
MUAC							
≤23 cm		26 32.5%	33 20.6%	0.044	1.85	1.01	3.39
>23cm		54 67.5%	127 79.4%				
Anemia Group							
Anemic		69 86.3%	117 73.1%	0.022	2.31	1.12	4.76
Non- Anaemic		11 13.8%	43 26.9%				
Habits							
Drugs/smoking/Alcoholism		2 2.5%	9 5.6%	0.275	0.43	0.09	2.04
Non- consumer		78 97.5%	151 94.6%				
Antenatal Group							
≥4		62 77.5%	141 88.1%	0.032	0.46	0.23	0.94
<4		18 22.5%	19 11.9%				
Preterm delivery							
Preterm	16 20.0%	11 6.8%		0.0024	3.39	1.49	7.70

Full-term	64 80.0%	149 93.0%				
MoD						
LSCS	27 33.8%	75 47.0%	0.052	0.58	0.33	1.01
VD	53 66.3%	85 53.1%				

Table 4. Clinical representation of neonates and their immediate outcomes

	Group		P-value	Odds ratio	Confidence Limits	
	Case	Control			Lower	Upper
Gender						
Female	34 42.5%	62 38.8%	0.68	1.17	0.68	2.02
Male	46 57.5%	98 61.3%				
Weight for gestational age						
AGA	50 62.5%	155 96.8%	0.0001			
LGA	0 0.0%	2 1.3%				
SGA	30 37.5%	3 1.9%				
SNCU Admission						
No	55 68.75%	151 94.30%	0.0001	0.13	0.06	0.30
Yes	25 31.25%	9 5.63%				
Outcome						
DAMA	3 100.00%	0 0.00%	0.001			
Discharge	75 31.90%	160 68.10%				

5. CONCLUSION

Our study shows that the risk factors associated with low-birth-weight babies were most common in the population where the patient (mother) appeared from a rural area. Several factors like Anemia, undernutrition, area of residence, previous obstetrics history, insufficient antenatal visits, and poor literacy rate amongst mothers are few of them which show statistically significant result and analysis. For reducing the incidence of LBW babies, public health strategy needs to focus on better education and maternal nutrition. Different predisposing factors like socio-Demographic factors which include women's age, low level of education, obstetric factors gender-related issues like the number of children (>2), Adverse life events like previous abortion, stillbirth, parent's addiction to alcohol, and other risk factors like lack of nutritional counseling during pregnancy and ANC were associated for the development of low-birth-weight babies. Therefore, in conclusion, the field workers of the health system can be effective channels.

CONSENT

Once the cases and controls were suitable for the study and the relevant information was explained and patient information sheet and informed consent were obtained from parents.

ETHICAL APPROVAL

The study was initiated after getting approval from Sumandeep Vidyapeeth Institutional Ethics Committee (SVIEC NO: SVIEC/ON/PHAR/BNPG18/D19036).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/70818