

Determining the Maternal Risk Factors Contributing to the Birth of Low Birth Weight Newborn: A Case-Control Study

PRIYA RANI¹, BATOOL HASSAN², MAHTAB MEMON³, OAM PARKASH⁴, NAILA BAI⁵, FAIQA HASSAN⁶

¹ER Consultant Paediatrics, ChildLife Foundation (CLF), Paediatric Emergency NICH Karachi Pakistan

²Senior Medical Officer, SMBB Institute of Trauma, Karachi Pakistan

³Consultant Paediatrician, Civil Hospital Dadu Pakistan

⁴Senior Registrar Paediatrics, Muhammad Medical College and Hospital Mirpurkhas Pakistan

⁵Consultant Paediatrician, Rural Health Center Islamkot Pakistan

⁶Senior Registrar Paediatric, Memon Medical Institute Hospital Karachi Pakistan

Corresponding Author: Priya Rani, Email: priyaassrani7@gmail.com

ABSTRACT

Aim: To determine the maternal risk factors contributing to the birth of low birth weight newborn

Study design: A case-control study

Place and Duration: This study was conducted at ChildLife Foundation (CLF), Paediatric Emergency NICH Karachi Pakistan from August 2021 to January 2022.

Methodology: A total of 920 mothers were included in the study that delivered the baby during the mentioned time frame, out of which 460 were cases and 460 controlled mothers for the comparative analysis of risk factors. All the newborns weighing less than 2500 grams of weight were considered as respective cases for the study. Newborns that weight more than 2500 grams were included in the control groups

Results: The mean weight of newborn cases was 2.07 ± 0.45 kilograms and 3.14 ± 0.36 kilograms in the newborn control group. However, the mean gestational age of the cases was 37.2 ± 1.48 , and the control was 38.3 ± 1.23 weeks. Whereas mothers of 37.2% of cases and 38.7% of control had no education background, 76% of cases had low HB levels, and 68.7% of cases had less than 24 months of the birth interval were related to low birth weight. There was no direct association between maternal hypertension and low birth weight among newborns observed in the present study.

Conclusion: The present study concluded that maternal low HB levels, poor socioeconomic status, low BMI, poor educational background and close birth spacing have a strong association with LBW among newborns. The country's child and maternal health care services should be prioritized to address these issues.

Keywords: Childbirth, Infant mortality, Low birth weight, Neonatal mortality, Parental risk factors.

INTRODUCTION

Children with low weight at the time of birth can cause serious health issues and lead to mortality. The World Health Organization (WHO) has defined this Low birth weight (LBW) as a child's birth weight of less than 2.5 kg, irrespective of gestational age. (1) This definition is mostly based on epidemiological findings and is designed for use in international comparative health statistics. Low birth weight (LBW) is a profound indicator of a country's overall health & development. In Southeast Asia, over a third of newborns have a low birth weight. Low birth weight has a variety of causes, all of which are subjective by the interaction of biological and socio-demographic factors. Unfortunately, according to UNICEF, Pakistan has the utmost rate of LBW babies in the region of South Asia. (2)

Low birth weight affects 16 percent of the global population, 19 percent in low development countries (LDCs) and developing nations, and 7% in developed countries. LBW is a well-known cause of newborn morbidity and mortality, with long-term effects such as nutritional and developmental deficits. (3) Preterm birth or intrauterine development restriction can cause LBW. Intrauterine growth restriction is the most common cause in poor Asian countries, and socioeconomic and maternal variables impact it before and during pregnancy. (4) Furthermore, maternal stress during pregnancy contributes to low-birth-weight babies. Preterm birth and previous low-weighted birth were strongly linked with low birth weight in Kenya. (5) A study undertaken in Karachi's urban areas, on the other hand, found no link between low birth weight and prenatal depression. In Pakistan, however, poor nutritional conditions and a lack of sufficient prenatal care are the leading causes of low birth weight. (6) Low birth weight newborns have a higher mortality risk than babies of normal weight. Neonatal sepsis and respiratory distress syndrome are the leading causes of death in LBW. With a lower birth weight, the risk of complications from LBW increases. Pakistan has one of the highest rates of LBW in the world, from 19 percent in cities to 32 percent in rural regions. This high frequency contributes to high newborn mortality and stunting rates in children under the age of five, estimated to be 58 per 1000 live births and 44%, respectively. (7) Due to its negative

health repercussions, LBW has hampered Pakistan's progress toward achieving Millennium Development Goal 4 and is anticipated to impact its ability to fulfill the Sustainable Development Goals relating to health & nutrition. In Pakistan, data on the risk factors for LBW in term babies is sparse, particularly in rural areas. (8) Given the substantial morbidity and mortality associated with LBW, a better knowledge of the risk factors is essential. This study aimed to identify risk variables for LBW in term newborns in Pakistan that contribute significantly to newborn low birth weight.

METHODOLOGY

The study population was all the women who delivered the babies during the study duration. A total of 460 cases were included in the study. Similar numbers of controls were also studied for the comparative analysis of risk factors leading to lower birth weight. We took the mothers of same age group in both cases and controls. All the newborns weighing less than 2500 grams of weight were considered as respective cases for the study. Newborns that weight more than 2500 grams were included in control groups. The mother's gestational age was determined from the first day of her previous menstrual cycle. Although this would not be the case for unregistered pregnancies, which account for more than half of the observations, some mothers may have obtained estimations of gestational age determined from ultrasound measurements taken at antenatal visits. Twins and triplets were excluded from the study to measure the other prevalent risk factors in the present study.

The hospital ethical committee approved the study before proceeding with the research. Verbal consent was also taken from the mothers before starting the study. Data was collected through a designed questionnaire and antenatal cards. Data were analyzed using SPSS version 17. Categorical data were investigated using percentages, whereas continuous variables were studied using standard deviation and mean. The Chi-square test was used to compute inferential statistics (p -values < 0.05 were significant).

RESULTS

This study comprised 920 babies, with 460 cases and controls in each group. There were no dropouts in this study. Cases had birth weights ranging from 1850 to 2450 grams, while controls ranged from 2500 to 4800 grams. The mean weight of newborn cases was 2.07 ± 0.45 kilograms and 3.14 ± 0.36 kilograms in the newborn control group. However, the mean maternal age of the mother was 27.5 ± 1.29 in cases and 25.7 ± 2.62 in the control group. In comparison, the Birth interval in cases was 10.2 ± 1.9, while the control group had a birth interval of 16.6 ± 2.4 months (As shown in Table 1).

The present study observed that majority of mothers, approximately 37.2% of cases and 38.7% of control, had no education background, 22.1% of cases and 21.3% of control had completed middle education, and only 9.3% of cases and 13.2% of controls had completed graduation and above. The mothers' poor educational background was directly associated as a risk factor for the low birth weight of the child (p-value= <0.01). However, the birth interval < 24 months was also a contributing factor to the child's low birth weight as observed that 68.7% of mother cases

gave birth to a second child with a lower interval than the first child. The hemoglobin (HB) levels that could affect the mother and child's health were found to be a significant contributor to the low birth weight as 76% had low HB levels, while only 16.3% of control had low HB levels (p-value = < 0.001). In the present study, body mass index was also significantly associated with LBW children, as 92% of control had normal BMI; on the other hand, only 38.2 % of cases had normal BMI. Source of income also directly impacted the mother's health; thus, it was also a significant risk factor in LBW newborns, as shown in Table2.

Table-1: Background characteristics distribution among controls and cases

Characteristics	Cases (Mean ± SD)	Controls (Mean ± SD)
Maternal age (years)	27.5 ± 1.29	25.7 ± 2.62
Gestational age (week)	37.2 ± 1.48	38.3 ± 1.23
Maternal weight (kg)	63.6 ± 2.4	67.8 ± 5.9
Neonatal weight (kg)	2.07 ± 0.45	3.14 ± 0.36
Birth Interval (months)	10.2 ± 1.9	16.6 ± 2.4
Monthly Income (Rupees)	28000 ± 8786	53833 ± 9042

Table-2: Statistical features and frequency distribution of LBW risk factors

Variable and Characteristics		Cases (n=460) Number (%)	Controls (n=460) Number (%)	P-value
Mother Education	Illiterate	171 (37.2)	178 (38.7)	< 0.01
	Primary	56 (12.1)	21 (4.6)	
	Middle	102 (22.1)	98 (21.3)	
	Matric	77 (16.7)	65 (14.1)	
	Intermediate	11 (2.3)	37 (8.0)	
	Graduation and above	43 (9.3)	61 (13.2)	
Birth Interval	<24 months	316 (68.7)	290 (63.0)	< 0.001
	>24 months	144 (31.3)	170 (37)	
Family Income	< 25000	65 (14.1)	46 (10)	< 0.001
	>25000	395 (85.9)	414 (90)	
Source of Income	Father	427 (92.8)	398 (86.5)	< 0.006
	Mother	1 (0.2)	4 (0.86)	
	Both	32 (7)	58 (12.6)	
HB	Normal	110 (24)	385 (83.6)	< 0.001
	Low	350 (76)	75 (16.3)	
BMI	Normal	176 (38.2)	423 (92)	< 0.001
	Low	284 (61.7)	37 (8.04)	
Hypertension	Yes	36 (7.8)	32 (7)	< 0.001
	No	424 (92.1)	428 (93)	
Maternal Height	< 150 cm	32 (6.95)	9 (1.95)	< 0.001
	>150 cm	428 (93)	451 (98)	

DISCUSSION

Low Body Weight (LBW)in children is a serious public issue that affects newborns in developing countries. It is a high priority since it is the most important predictor of newborn morbidity & mortality(9). According to a study based on the Indonesia Demographic and Health Survey data, the prevalence of LBW was 10.2 %. (10)A study conducted on a sample of 1863 births in Muzaffarabad, Azad Kashmir, found a frequency of 10.04 % of LBW. (11) The study conducted in Lyari General Hospital showed the prevalence of 10.6% of LBW newborns. (12) According to the World Bank's definition of least developed nations, including Indonesia, Cambodia, Jordan, Colombia, Pakistan, Nepal, Uganda, Zimbabwe, and Tanzania, LBW births.(13) Many studies have been conducted to identify the low birth weight of neonates to rectify the situation and minimize the overall impact on children's health.

This study recognized a range of adaptable maternal factors associated with the LBW of neonates in Pakistan.These factors involved illiteracy, low income, BMI & hemoglobin levels, lack of nutrition and the birth interval of fewer than 24 months.Various authors have found many maternal risk factors directly involved with the birth of low-weight babies. Education plays a very important role in terms of mother and child health. According to previous studies, educated women are 33 percent less likely to have an LBW infant, and maternal education has a 33 percent protective effect against LBW. (14) It has been observed that

mothers who are in their teenage years were more likely to have a low birth weight child than mothers who were older than 25 years. A study in Jordan found thatlesser age mothers could not maintain their health, thus directly affecting newborn health and weight. (15) A related study conducted in Pakistan exhibited that mothers under 25 years of age had a higher percentage of LBW newborns, especially those under 20 years of age. (16) Nusrat et al. 2003 showed that Maternal malnutrition, maternal age, poverty, close birth spacing, hypertension, and prenatal per vaginum bleeding during pregnancy are all variables that contribute to low birth weight. (17)Our study observed that mothers who are not graduated were more probable to deliver a low birth weight child than graduated mothers. Another study also supported this study that observed illiterate mothers were more likely to have LBW newborns (p= 0.025). (16) The present study suggested that mothers with low-income backgrounds were more likely to deliver the low birth weight child as they lack proper nourishment, low prenatal care, low HB levels, and poor perceived health. A similar study in Nepal observed that low-income resources had directly contributed to the mother's health and baby's weight. (18)

BMI was calculated using maternal height and weight at term. According to readings from adjacent countries, pre-pregnancy body weight, BMI, and weight gain throughout pregnancy had a substantial impression on birth weight. (19) Birth weight is also affected by unfavorable obstetric history; however, our study did not have this variable. Our findings show that the birth weight of

neonates born to healthy mothers differs from babies born to mothers with poor socioeconomic, health, and nutritional situations.

CONCLUSION

The present study concluded that maternal low HB levels, poor socioeconomic status, low BMI, poor educational background and close birth spacing have a strong association with LBW among newborns. The country's child and maternal health care services should be prioritized to address these issues.

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REFERENCES

- Tchamo ME, Prista A, Leandro CG. Low birth weight, very low birth weight and extremely low birth weight in African children aged between 0 and 5 years old: a systematic review. *Journal of developmental origins of health and disease*. 2016;7(4):408-15.
- Zafar U, Zafar S, Tariq N, Rashid F, Hassan K. Frequency and Risk Factors of Low Birth Weight in Rawalpindi, Pakistan. *Journal of Rawalpindi Medical College*. 2021;25(2):202-7.
- Habib A, Greenow CR, Arif S, Soofi SB, Hussain A, Junejo Q, et al. Factors associated with low birthweight in term pregnancies: a matched case-control study from rural Pakistan. *Eastern Mediterranean health journal = La revue de sante de la Mediterranee orientale = al-Majallah al-sihhiyah li-sharq al-mutawassit*. 2018;23(11):754.
- Christian P. Nutrition and maternal survival in low and middle income countries. *Handbook of nutrition and pregnancy*: Springer; 2018. p. 401-21.
- Asmare G, Berhan N, Berhanu M, Alebel A. Determinants of low birth weight among neonates born in Amhara Regional State Referral Hospitals of Ethiopia: unmatched case control study. *BMC research notes*. 2018;11(1):1-7.
- NOOR N. Determinants of low birth weight. *Age*. 25(30):24.8.
- Saira A, Wilson LA, Ezech KO, Lim D, Osuagwu UL, Agho KE. Factors associated with non-utilization of postnatal care among newborns in the first 2 days after birth in Pakistan: a nationwide cross-sectional study. *Global health action*. 2021;14(1):1973714.
- Pusdekar YV, Patel AB, Kurhe KG, Bhargav SR, Thorsten V, Garces A, et al. Rates and risk factors for preterm birth and low birthweight in the global network sites in six low-and low middle-income countries. *Reproductive health*. 2020;17(3):1-16.
- Kim D, Saada A. The social determinants of infant mortality and birth outcomes in Western developed nations: a cross-country systematic review. *International journal of environmental research and public health*. 2013;10(6):2296-335.
- Siramaneerat I, Agushyana F, Meebunmak Y. Maternal risk factors associated with low birth weight in Indonesia. *The Open Public Health Journal*. 2018;11(1).
- Iltaf G, Shahid B, Khan MI. Incidence and associated risk factors of low birth weight babies born in Shaikh Khalifa Bin Zayad Al-Nayan Hospital Muzaffarabad, Azad Jammu and Kashmir. *Pakistan journal of medical sciences*. 2017;33(3):626-30.
- Khan A, Nasrullah FD, Jaleel R. Frequency and risk factors of low birth weight in term pregnancy. *Pakistan journal of medical sciences*. 2016;32(1):138-42.
- Mahumud RA, Sultana M, Sarker AR. Distribution and Determinants of Low Birth Weight in Developing Countries. *Journal of preventive medicine and public health = Yebang Uihakhoe chi*. 2017;50(1):18-28.
- Silvestrin S, Silva CH, Hirakata VN, Goldani AA, Silveira PP, Goldani MZ. Maternal education level and low birth weight: a meta-analysis. *Jornal de pediatria*. 2013;89(4):339-45.
- Islam MM, Ababneh F, Akter T, Khan HR. Prevalence and risk factors for low birth weight in Jordan and its association with under-five mortality: a population-based analysis. *Eastern Mediterranean health journal = La revue de sante de la Mediterranee orientale = al-Majallah al-sihhiyah li-sharq al-mutawassit*. 2020;26(10):1273-84.
- Anjum F, Javed T, Afzal MF, Sheikh GA. Maternal risk factors associated with low birth weight: A case control study. *Annals of King Edward Medical University*. 2011;17(3):223-.
- Khan N, Jamal M. Maternal risk factors associated with low birth weight. *Journal of the College of Physicians and Surgeons--Pakistan : JCPSP*. 2003;13(1):25-8.
- Bhaskar RK, Deo KK, Neupane U, Chaudhary Bhaskar S, Yadav BK, Pokharel HP, et al. A Case Control Study on Risk Factors Associated with Low Birth Weight Babies in Eastern Nepal. *International journal of pediatrics*. 2015;2015:807373.
- Chowdhury G, Bhushan A. *Fundamentals of Clinical Risk Management in Obstetrics*: Prowess Publishing; 2019.