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Association of Maternal Factors with Low Birth Weight Newborns

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ABSTRACT

OBJECTIVE: To determine the association of maternal factors with low birth weight (LBW) newborns at King Abdullah Teaching Hospital, Mansehra.
METHODOLOGY: This descriptive cross-sectional study was done at the Department of Pediatrics and labor room of King Abdullah Teaching Hospital, Mansehra, Pakistan, from June to November 2021. A total of 171 women aged 18-30 who had a singleton pregnancy ≥37 completed weeks of gestation were enrolled and evaluated for the presence of risk factors associated with the incidence of LBW in infants. The outcome regarding the frequency of low birth weight and its associations with Maternal factors were recorded.
RESULTS: In a total of 171 women, 77(45.0%) had short stature, while 57(33.3%) weighed 50 kg or less. The frequency of anemia was noted in 56 (32.7%). Out of 171 women who gave a singleton live birth, 63(36.8%) newborns were LBW. A significantly less proportion of mothers had maternal age between 18-25 who delivered LBW babies (74.6% vs. 44.4%, p=0.0001). Short stature among mothers was significantly associated with LBW (58.7% vs. 37.0%, p=0.0060). Maternal weight less than or equal to 50 kg was also linked with LBW (42.9% vs. 27.8%, p=0.0436). Anemia is significantly associated with LBW (49.2% vs 23.1%, p=0.0005).
CONCLUSION: The frequency of LBW was noted to be high. Maternal age between 18-25 years, short stature, low maternal weight (>50 kg), and anemia during pregnancy can significantly raise the risk of LBW.

KEYWORDS: Anemia, hemoglobin, maternal weight, low birth weight, singleton.

INTRODUCTION

Low birth weight (LBW) is considered a significant indicator of the status of reproductive health in the general population[1,2]. The LBW is taken as a vital characteristic predicting neonatal morbidity and mortality[3-5]. Birth weight below 2.5 kg is labelled as LBW[6]. The incidence of LBW is estimated to be around 16% worldwide. In contrast, it is estimated to be around 7% in developed countries. Still, in underdeveloped countries, its frequency climbs to 16.5%, more than double the prevalence of LBW found in developed countries[7,8]. Local data suggested the prevalence of LBW as 21.1% among newborns[9]. The LBW might be an indicator of impaired neuro-development and may result in mental disorders and learning deficiency during childhood. Almost 50% of perinatal deaths and 33% of deaths in infants are directly related to LBW[8,10].

Overall, maternal health conditions, including the environment provided to the mother, are essential factors in determining an infant's birth weight. Factors that do not allow the proper placental circulation and may prohibit the supply of oxygen and nutrients to the fetus could result in fetal growth restriction. There are various other maternal factors like hypertension, pre-eclampsia, febrile illness during pregnancy, oligohydramnios, primiparity, LBW delivery in the past, placental abruption, age of mother, lifestyle, underweight during pregnancy, underprivileged family status, which have been described as potential risk factors to cause LBW[11]. Due to different geographic conditions and socioeconomic and traditional factors, there is variation in the presence of these risk factors. A study from Karachi, Pakistan, reported that low socioeconomic status (34%), severe anemia (20%), primiparity (54%), short maternal height (37%) and less than average weight (26%) were the factors having significant association with LBW in newborns[12].

LBW is a significant public health concern associated with increased morbidity and mortality among newborns. Understanding the maternal factors contributing to LBW is crucial for developing targeted interventions and improving the region's maternal and child health outcomes. With its unique socioeconomic and cultural context, Khyber Pakhtunkhwa province of Pakistan may exhibit specific risk factors that contribute to LBW, necessitating a localized investigation. Identifying and addressing these factors can inform public health strategies, enhance prenatal care, and ultimately reduce the incidence of LBW, promoting the health and well-being of newborns in the region. The study objective was to determine the association of maternal factors with LBW newborns.

METHODOLOGY

This cross-sectional study was performed at the Department of Pediatrics and labor room of King Abdullah Teaching Hospital, Mansehra, Pakistan, from June to November 2021. The sample size was calculated to be 171, taking the prevalence of anemia in mothers of LBW as 20%,[12] with a 95% confidence level and 6% margin of error. Approval from "Institutional Ethical Committee" was acquired **(DMS(A)/186)**. Written and informed consent was obtained from the parents. Inclusion criteria were women aged 18-30 with a singleton pregnancy (≥37 weeks). Females with in-utero death of fetus or fetal abnormality were not involved. Females having hypertension, diabetes, renal disorders or antepartum hemorrhage were excluded.

After the delivery, the weight of all newborns was measured in the labor room after clamping and cutting the umbilical cord within one hour of birth. Newborns with 2.5- 4 kg weight were described as having normal birth weight or LBW if < 2.5 kg. Maternal anemia was labeled if hemoglobin was below 10 g/dl. Low maternal weight was named if maternal weight < 50 Kg. Short maternal Height was defined as maternal Height < 5 feet or 60 inches. Primiparity was described as a woman giving birth for the first time. All data was collected under the supervision of a consultant pediatrician with at least five years of experience.

The data was analyzed utilizing "Statistical Package for Social Sciences (SPSS)", version 26.0. Mean, and standard deviation (SD) were shown for numerical variables like age, systolic blood pressure, diastolic blood pressure, hemoglobin, maternal Height & weight and birth weight. Frequencies and percentages were calculated for categorical variables. Birth weight was stratified according to maternal Height, weight, tobacco smoking by the mother during pregnancy and anemia. A chi-square test was employed post-stratification, taking $p<0.05$ as significant.

RESULTS

Of 171 women, 77 (45.0%) had short stature, while 57 (33.3%) weighed 50 kg or less. The frequency of anemia was noted in 56 (32.7%). None of the study participants had hemoglobin below seven g/dl. There were 81 (47.4%) women who were primipara, and 10 (5.8%) smoked tobacco. The details about the quantitative data of women studied are shown in **Table I**.

Out of 171 women who gave a singleton live birth, 63 (36.8%) newborns were LBW. A significantly less proportion of mothers had maternal age between 18-25 who delivered LBW babies (74.6% vs. 44.4%, p=0.0001). Short stature among mothers was significantly associated with LBW (58.7% vs. 37.0%, p=0.0060). Maternal weight less than or equal to 50 kg was also linked with LBW (42.9% vs. 27.8%, p=0.0436). Anemia is significantly associated with LBW (49.2% vs 23.1%, p=0.0005). Parity status and tobacco smoking were not significantly associated with LBW (p>0.05); the details are shown in **Table II**.

Table I: Description of Quantitative Data of Mothers Studied (n=171)

Variable	Mean± Standard Deviation	Minimum	Maximum
Age (years)	24.40±3.19	19	30
Systolic blood pressure (mmHg)	134.63±9.01	120	150
Diastolic blood pressure (mmHg)	85.39±3.25	80	90
Hemoglobin (g/dl)	11.91±1.91	8.5	15
Maternal Height (inches)	59.37±3.08	54	64
Maternal weight (kg)	52.41±6.13	43	63
Birth weight (grams)	2668.74±373.70	2026	3325

Table II: Stratification of Birthweight with regards to maternal characteristics (n=171)

Maternal characteristics		Birthweight		P-value
		Low birth weight (n=63)	Normal birthweight (n=108)	
Maternal Age	18-25	47 (74.6%)	48 (44.4%)	0.0001
	26-30	16 (25.4%)	60 (55.6%)	
Maternal Height	Short stature	37 (58.7%)	40 (37.0%)	0.0060
	Normal stature	26 (41.3%)	68 (63.0%)	
Maternal weight	≤50 kg	27 (42.9%)	30 (27.8%)	0.0436
	>50 kg	36 (57.1%)	78 (72.2%)	
Anemia		31 (49.2%)	25 (23.1%)	0.0005
Parity	Primiparous	29 (46.0%)	52 (48.1%)	0.7891
	Multiparous	34 (54.0%)	56 (51.9%)	
Tobacco smoking		6 (9.5%)	4 (3.7%)	0.1177

DISCUSSION

Our study, conducted at King Abdullah Teaching Hospital in Mansehra, Pakistan, revealed a notable LBW frequency of 36.8%. Data from other developing countries has shown that 38.5% of mothers deliver infants with LBW, and our findings are consistent with the literature in terms of the burden of LBW[13]. Another cross-sectional study from an Ethiopian hospital revealed that the findings for LBW were 14.6%. A study from Muzaffarabad, Pakistan, reported the occurrence of LBW as 10.0% [14]. Regional disparities in healthcare infrastructure and accessibility may contribute to differences in antenatal care quality, affecting maternal and fetal well-being[15]. Socioeconomic conditions, cultural practices, and maternal health literacy influences nutritional habits and healthcare-seeking behavior during pregnancy. Variances in the prevalence of risk factors such as maternal malnutrition, infectious diseases, and maternal age could further contribute to the observed discrepancies. It is crucial to consider the complex interplay of these multifactorial elements when interpreting LBW prevalence across diverse populations, emphasizing the need for tailored interventions addressing the specific contextual determinants in each region[16].

A nuanced examination brought to light specific maternal attributes significantly associated with LBW. Lower maternal age (p=0.0001), short stature (p=0.0060), maternal weight less than or equal to 50kg (p=0.0436), and anemia (p=0.0005) emerged as crucial factors influencing LBW outcomes. A multicenter-matched case-control study identified several factors, including birth spacing below 36 months, maternal Height below 145cm, pre-delivery maternal weight below 55kg, and inadequate weight gain during pregnancy, as significantly linked to LBW[17]. Another investigation evaluating 650 deliveries highlighted maternal BMI before pregnancy, unbooked status, pre-eclampsia, and poor obstetrical history as factors significantly associated with LBW[18]. Some others have shown LBW to have an association with premature birth, premature rupture of membranes and less than five antenatal care visits[13]. Data from the developing world by Desta SA 2020[19] showed several factors playing a crucial role in predicting LBW in newborns. These factors included inadequate antenatal care follow-up, preterm birth, a history of chronic medical illnesses in the mother, maternal Height, insufficient pregnancy weight gain, and low iron intake.

Our study did not observe a significant association between LBW and factors such as parity status, tobacco use, improper antenatal care, poor socioeconomic profile, or poor maternal education. Compared with research from India, our results diverged regarding the significant impact of maternal age, low BMI before pregnancy, and parity on LBW[20]; this underscores the importance of recognizing regional variations in risk factors and tailoring interventions accordingly. Regional data by Anil KC 2020[21] showed having the kitchen in the same living setting, poor iron intake increased maternal weight in the 2nd and 3rd trimesters, and comorbidities during pregnancy to be linked with LBW. We did not evaluate these factors, but future research on the local population can also include an analysis.

The study highlights the need for further research through large-scale multi-centre trials to understand LBW determinants in the KPK province of Pakistan comprehensively. Customized interventions are imperative, given our population's unique burden of LBW. Policy planners can benefit from a more in-depth exploration of contributing processes to devise targeted strategies for mitigating LBW risks. As the healthcare community addresses these challenges, emphasizing the pivotal role of healthcare professionals, proactive screening and accessible health information for pregnant women becomes paramount in ensuring healthier birth outcomes and preventing complications associated with LBW.

By identifying high-risk individuals early in pregnancy, health providers can implement targeted interventions and closely monitor their progress to mitigate the risk of LBW. Furthermore, it is essential to ensure that pregnant women have easy access to comprehensive

health information about the causes of LBW[22]; this can empower expectant mothers with the knowledge needed to make informed decisions about their health and the well-being of their developing babies, ultimately contributing to healthier birth outcomes. There is also a need to emphasize the critical role of healthcare professionals in safeguarding the health of both mothers and their newborns and in preventing the complications associated with LBW.

Being a single-centre study with a relatively modest sample size was one of this study's limitations. Interestingly, while most of the literature and the present study identified the association of LBW with various maternal factors, there is a further need to devise customized interventions owing to the high burden of LBW in our population. Policy planners can better understand the processes contributing to low birth weight by conducting large-scale multi-centre trials.

CONCLUSION

The frequency of LBW was noted to be high. This research identified several maternal risk factors associated with LBW newborns. Maternal age between 18-25 years, short stature, low maternal weight (>50 kg), and anemia during pregnancy can significantly raise the risk of LBW. These findings underscore the importance of early maternal healthcare interventions, including nutritional support and anemia management, to mitigate the risk of LBW in newborns.

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AUTHOR CONTRIBUTION

Anwar H: Drafting, data analysis
Farhat A: Substantial contribution to the conception of the work
Ahmed A: Study concept, Methodology, data collection
Bashir B: Data collection, literature review
Khan K: Literature review, critical revisions
Khan I: Proof-reading, critical revisions

REFERENCES

1. Jana A, Saha UR, Reshmi RS, Muhammad T. Relationship between low birth weight and infant mortality: evidence from National Family Health Survey 2019-21, India. Arch Public Health. 2023; 81(1): 28. doi: 10.1186/s13690-023-01037-y.
2. Agbor VN, Ditah C, Tochie JN, Njim T. Low birthweight in rural Cameroon: an analysis of a cut-off value. BMC Pregnancy Childbirth. 2018; 18(1): 30. doi: 10.1186/s12884-018-1663-y.
3. Mekie M, Taklual W. Magnitude of low birth weight and maternal risk factors among women who delivered in Debre Tabor Hospital, Amhara Region, Ethiopia: a facility based cross-sectional study. Ital J Pediatr. 2019; 45(1): 86. doi: 10.1186/s13052-019-0683-1.
4. Jana A, Saha UR, Reshmi RS, Muhammad T. Relationship between low birth weight and infant mortality: evidence from National Family Health Survey 2019-21, India. Arch Public Health. 2023; 81(1): 28. doi: 10.1186/s13690-023-01037-y.
5. Ratnasiri AWG, Parry SS, Arief VN, DeLacy KH, Halliday LA, DiLibero RJ et al. Recent trends, risk factors, and disparities in low birth weight in California, 2005-2014: a retrospective study. Matern Health Neonatol Perinatol. 2018; 4: 15. doi: 10.1186/s40748-018-0084-2.
6. Choudhary TS, Kumar M, Sinha B, Shaih S, Mazumder S, Taneja S et al. Anthropometric indicators as predictors of mortality in early life among low birthweight Indian infants. Front Nutr. 2022; 9: 884207. Doi: 10.3389/fnut.2022.884207
7. UNICEF. Low birthweight - UNICEF DATA [Internet]. 2016 [cited 2017 Nov 3]. Available from: https://data.unicef.org/topic/nutrition/low-birthweight/
8. Gebregzabiherher Y, Haftu A, Weldemariam S, Gebrehiwet H. The prevalence and risk factors for low birth weight among term newborns in Adwa General Hospital, Northern Ethiopia. Obstet Gynecol Int. 2017; 2017: 2149156. doi: 10.1155/2017/2149156.
9. Mahumud RA, Sultana M, Sarker AR. Distribution and Determinants of Low Birth Weight in Developing Countries. J Prev Med Public Health. 2017; 50(1): 18-28. doi: 10.3961/jpmph.16.087.
10. Fosu MO, Abdul-Rahaman I, Yekeen R. Maternal risk factors for low birth weight in a district hospital in Ashanti region of Ghana. Res Obstet Gynecol. 2013; 2(4): 48-54. doi: 10.5923/j.rog.20130204.02.
11. Moradi G, Zokaeii M, Goodarzi E, Khazaei Z. Maternal risk factors for low birth weight infants: A nested case-control study of rural areas in Kurdistan (western of Iran). J Prev Med Hyg. 2021; 62(2): E399-E406. doi: 10.15167/ 2421-4248/jpmh2021.62.2.1635.
12. Khan A, Nasrullah FD, Jaleel R. Frequency and risk factors of low birth weight in term pregnancy. Pak J Med Sci. 2016; 32(1): 138-42. doi: 10.12669/pjms. 321.8120.
13. Tshotetsi L, Dzikiti L, Hajison P, Feresu S. Maternal factors contributing to low birth weight deliveries in Tshwane District, South Africa. PLoS One. 2019; 14(3): e0213058. doi: 10.1371/journal.pone.0213058.
14. 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. Pak J Med Sci. 2017; 33(3): 626-630. doi: 10.12669/pjms.333.12413.
15. Sahito A, Fatmi Z. Inequities in Antenatal Care, and Individual and Environmental Determinants of Utilization at National and Sub-National Level in Pakistan: A

Multilevel Analysis. Int J Health Policy Manag. 2018; 7(8): 699-710. doi: 10.15171/ijhpm.2017.148.
16. Kundu RN, Ghosh A, Chhetri B, Saha I, Hossain MG, Bharati P. Regional with urban-rural variation in low birth weight and its determinants of Indian children: findings from National Family Health Survey 5 data. BMC Pregnancy Childbirth. 2023; 23(1): 616. doi:10.1186/s12884-023-05934-6.
17. Mumbare SS, Maindarkar G, Darade RYS, Tolani MK, Patole K. Maternal risk factors associated with term low birth weight neonates: A matched-pair case control stud. Indian Pediatr. 2012; 49(1): 25-28. doi: 10.1007/s13312-012-0010-z.
18. Singh G, Chouhan R, Sidhu K. Maternal factors for low birth weight babies. Med J Armed Forces India. 2009; 65(1): 10-2. doi: 10.1016/S0377-1237(09) 80045-2.
19. Desta SA, Damte A, Hailu T. Maternal factors associated with low birth weight in public hospitals of Mekelle city, Ethiopia: a case-control study. Ital J Pediatr. 2020; 46(1): 124. doi: 10.1186/s13052-020-00890-9.
20. Yadav H, Lee N. Maternal factors in predicting low birth weight babies. Med J Malaysia. 2013; 68(1): 44-147.
21. Anil KC, Basel PL, Singh S. Low birth weight and its associated risk factors: Health facility-based case-control study. PLoS One. 2020; 15(6): e0234907. doi: 10.1371/journal.pone.0234907.
22. Joya AM, Fayyaz Z, Masood T, Tariq K. Maternal Risk Factors Contributing for Low Birth Weight Babies at tertiary care hospitals of Lahore. Pak J Med Health Sci. 2019; 13(3): 762-764.