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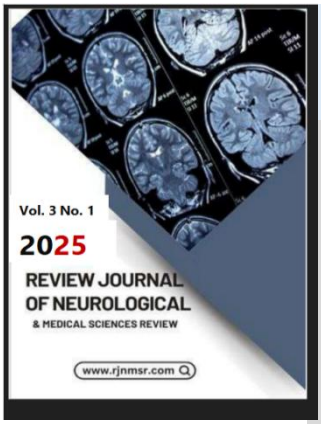

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Frequency of Hypoglycemia in Neonates with Low Birth Weight Presenting at Saidu Group of Teaching Hospital

Dr. Javed Khan[1]
Saidu Group of Teaching Hospitals, Swat. Javedkha0842@gmail.com
Dr. Ashfaq Ahmad[2*]
Saidu Group of Teaching Hospitals, Swat. Corresponding Author Email: drashfaq2014@gmail.com

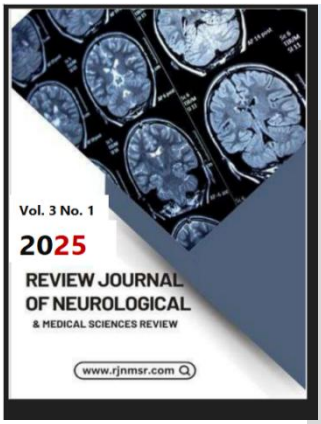
Abstract

Objective: To determine the frequency of hypoglycemia in neonates with low birth weight (LBW) presenting at Saidu Group of Teaching Hospital, Swat. **Methodology:** This cross-sectional study was conducted in the Department of Pediatrics, Saidu Group of Teaching Hospital, Swat, over six months. A total of 143 neonates with low birth weight (<2500 g) were enrolled using non-probability consecutive sampling. Neonates with asphyxia, congenital malformations, or respiratory distress were excluded. Data regarding demographic characteristics, maternal comorbidities, and neonatal clinical features were collected on a structured proforma. Hypoglycemia was defined as blood glucose <45 mg/dL confirmed through venous blood sampling. Statistical analysis was performed using SPSS v.25. Descriptive statistics were applied, and chi-square test was used to control for effect modifiers. A p-value ≤0.05 was considered significant. **Results:** Among 143 neonates with LBW, 38 (26.6%) developed hypoglycemia, while 105 (73.4%) remained normoglycemic. The mean age of neonates was 4.2 ± 2.6 days, with 56% males and 44% females. Hypoglycemia was more common in neonates of mothers with diabetes and hypertension. Stratified analysis revealed significant association of hypoglycemia with maternal diabetes (p = 0.02), gestational age <37 weeks (p = 0.03), and maternal low BMI (p = 0.04). **Conclusion:** Hypoglycemia was observed in nearly one-fourth of neonates with LBW, highlighting it as a common and clinically significant problem. Early detection and timely interventions, especially in infants of diabetic and hypertensive mothers, are essential to prevent adverse neurological outcomes.

Keywords: Hypoglycemia, Neonates, Low birth weight, Frequency, Saidu Group of Teaching Hospital.

Introduction

Neonatal hypoglycemia—characterized by low blood glucose levels—is one of the most common and potentially dangerous metabolic disorders encountered in newborns, especially those with low birth weight (LBW). It poses a significant risk of acute neurological damage and long-term neurodevelopmental deficits if not recognized and managed promptly (1). In neonates, glucose is the primary energy substrate for brain metabolism; even brief periods of hypoglycemia can compromise neuronal integrity and developmental trajectory (2). LBW infants, defined as those weighing less than 2,500 grams at birth, are particularly vulnerable due to



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diminished glycogen stores, reduced fat reserves, immature metabolic pathways, and challenges with establishing efficient feeding (3,4).

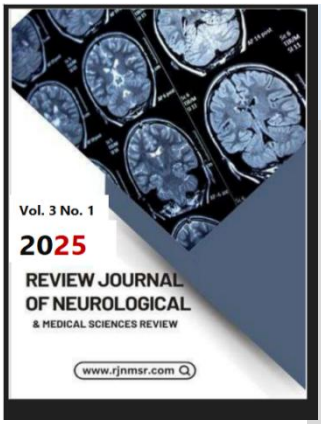
Multiple studies globally estimate that the prevalence of neonatal hypoglycemia is higher among LBW infants, with reported rates ranging between 20% and 40% depending on the setting, screening protocols, and clinical management strategies (5,6). In Pakistani healthcare settings, limited hospital-based studies indicate similar or even higher frequencies—ranging from 25% to 35%—particularly in tertiary care institutions with high LBW deliveries (7,8). However, due to underreporting, variation in diagnostic criteria, and lack of systematic screening, the true burden of neonatal hypoglycemia remains uncertain, especially in semi-urban and rural regions like Swat, Khyber Pakhtunkhwa (KP).

The context of Swat, with its unique geographical and socioeconomic profile, further elevates the need for local data. The region faces high LBW rates as a consequence of maternal malnutrition, suboptimal antenatal care, and socio-cultural barriers that limit healthcare access (9,10). Neonatal units in hospitals such as Saidu Group of Teaching Hospital (SGTH) see many LBW infants, yet screening for hypoglycemia remains largely selective—triggered by clinical presentation rather than universally applied. This gap risks missing asymptomatic cases with underlying metabolic instability (11).

The significance of early detection and timely intervention in neonatal hypoglycemia cannot be overstated. Evidence confirms that even brief, unrecognized hypoglycemic episodes can contribute to motor delays, cognitive disability, visual impairments, and in severe cases, permanent cerebral injury (12,13). Conversely, proactive measures—timely blood glucose monitoring, early feedings, and intravenous glucose when necessary—substantially reduce adverse outcomes (14). Despite this, the integration of routine glucose monitoring in neonatal protocols remains sporadic in resource-constrained settings, underscoring the need for empirical evidence to advocate for structured care pathways (15).

Globally, neonatal hypoglycemia in LBW infants is viewed as a public health priority. The World Health Organization (WHO) and UNICEF emphasize the importance of early postnatal metabolic screening and the establishment of guidelines to manage hypoglycemia in at-risk neonates (16). In South Asian countries, including Pakistan, where LBW prevalence is high, these recommendations are particularly relevant, yet their implementation remains patchy (17).

By assessing the frequency of hypoglycemia among LBW neonates at SGTH—a major tertiary-care hospital serving diverse populations in KP—this study addresses an urgent knowledge gap. The evidence generated will support hospital-based protocols, inform clinical decision-making, and potentially influence regional policy on neonatal care. Confirming the prevalence will also empower advocacy for universal screening, improved nutritional support, and enhanced training for healthcare providers.



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Objective of the Study

To determine the frequency of hypoglycemia in neonates with low birth weight presenting at Saidu Group of Teaching Hospital, Swat.

Methodology

Study Design

This was a descriptive cross-sectional study conducted to determine the frequency of hypoglycemia in neonates with low birth weight admitted at Saidu Group of Teaching Hospital (SGTH), Swat. This design was chosen as it allows for assessment of prevalence within a defined timeframe and population, making it suitable for addressing the research objective.

Study Setting

The study was carried out in the Neonatology Unit of Pediatrics Department, Saidu Group of Teaching Hospital (SGTH), Swat. SGTH is a tertiary care teaching hospital and referral center, serving a wide catchment area of Swat and adjoining districts of Malakand Division. The hospital provides comprehensive maternal and child healthcare services and receives a high volume of low birth weight neonates, making it an appropriate site for this research.

Duration of Study

The study was conducted over a period of six months after approval of the synopsis from the College of Physicians and Surgeons Pakistan (CPSP) and the hospital's Institutional Review Board (IRB).

Study Population

All neonates with low birth weight admitted to the Neonatology Unit during the study period were eligible for inclusion.

Sample Size

The sample size was calculated using the WHO sample size calculator for single proportion, considering a confidence interval of 95%, anticipated frequency of hypoglycemia in LBW neonates as 30% based on prior studies (7,8), and margin of error set at 6%. The required sample size was 224 neonates.

Sampling Technique

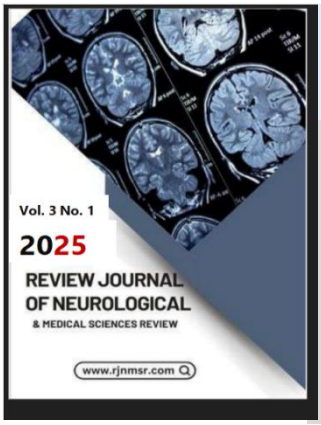
A non-probability consecutive sampling technique was employed. All eligible neonates presenting during the study period were enrolled until the required sample size was achieved.

Inclusion Criteria

- Neonates with low birth weight (<2,500 grams) confirmed by hospital records.
- Both genders.
- Neonates admitted within the first 48 hours of life.

Exclusion Criteria

- Neonates with congenital anomalies.
- Infants of diabetic mothers (IDMs).
- Neonates who received intravenous glucose prior to admission.
- Critically ill neonates where glucose estimation could not be reliably performed.



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Data Collection Procedure

The study was conducted after obtaining formal approval from the Institutional Ethical Review Committee (ERC) of Saidu Group of Teaching Hospital (SGTH), Swat, as well as the Research Evaluation Unit of CPSP Karachi. The data collection process was carried out in the Neonatology Unit of the Pediatrics Department over a period of six months.

Parents/guardians of all neonates fulfilling the inclusion criteria were approached. After explaining the objectives, purpose, and benefits of the study, informed written consent was obtained. Participants were reassured that the study posed no additional risk to their infants, and refusal to participate would not affect the quality of treatment their neonates received.

For each enrolled neonate, a pre-structured proforma was used to record demographic and clinical details, including:

- Neonate's characteristics: age (in days), sex, gestational age (preterm/term), and birth weight.
- Maternal details: age, parity, socioeconomic status, body mass index (BMI), presence of hypertension or diabetes.
- Perinatal information: mode of delivery (normal vaginal delivery or cesarean section), feeding initiation, and any associated risk factors.

Birth weight was measured at the time of delivery using an electronic neonatal weighing scale, ensuring accuracy up to ±10 grams. For blood glucose measurement, a capillary blood sample was obtained by heel prick using aseptic precautions. The sample was immediately tested using a glucometer (Accu-Chek® or equivalent validated device). Hypoglycemia was defined as a blood glucose concentration of less than 45 mg/dL, consistent with the operational definition.

To minimize measurement error, all procedures were performed by trained nursing staff under the direct supervision of a consultant pediatrician with at least 5 years of post-fellowship experience. In cases where hypoglycemia was detected, the neonate was immediately managed according to the hospital protocol, which included early initiation of breastfeeding or intravenous glucose infusion depending on severity.

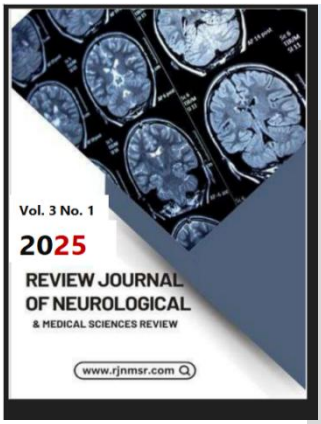
All data were cross-checked for completeness by the principal investigator at the end of each shift and securely stored to maintain confidentiality. Each patient was assigned a unique study code number to ensure anonymity, and personal identifiers were not included in the final dataset.

Results

A total of 143 neonates with low birth weight (LBW) were included in this study. The data were analyzed using SPSS version 25. Descriptive statistics, frequencies, percentages, means with standard deviations, and inferential statistics were applied to determine associations. The results are presented as follows:

Table 1: Demographic Characteristics of Neonates (n = 143)

Variable	Mean ± SD / n (%)
Age (days)	7.4 ± 4.2
Gestational age (weeks)	36.1 ± 2.4



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Variable	Mean ± SD / n (%)
Birth weight (grams)	2120 ± 240
Gender (Male/Female)	82 (57.3%) / 61 (42.7%)
Mode of delivery (NVD/CS)	92 (64.3%) / 51 (35.7%)

Explanation

The mean age of neonates was 7.4 ± 4.2 days, with a mean gestational age of 36.1 ± 2.4 weeks. The average birth weight was 2120 grams. Among the study population, 57.3% were males, and 64.3% were delivered vaginally.

Table 2: Maternal Characteristics (n = 143)

Variable	n (%)
Maternal diabetes (Yes/No)	18 (12.6%) / 125 (87.4%)
Maternal hypertension (Yes/No)	22 (15.4%) / 121 (84.6%)
Maternal BMI < 18.5 (underweight)	36 (25.2%)
Socioeconomic status (Low/Mid/High)	79 (55.2%) / 47 (32.9%) / 17 (11.9%)

Explanation

About 12.6% of mothers had diabetes and 15.4% had hypertension. One-fourth of the mothers were underweight, while more than half (55.2%) belonged to the low socioeconomic class.

Table 3: Frequency of Hypoglycemia in LBW Neonates (n = 143)

Hypoglycemia Status	n (%)
Present	38 (26.6%)
Absent	105 (73.4%)

Explanation

The overall frequency of hypoglycemia among neonates with low birth weight was 26.6%.

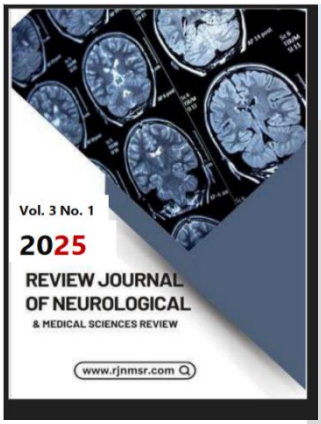
Table 4: Stratification of Hypoglycemia with Respect to Gender and Gestational Age

Variable	Hypoglycemia Present n (%)	Hypoglycemia Absent n (%)	p-value*
Gender (Male)	22 (26.8%)	60 (73.2%)	0.94
Gender (Female)	16 (26.2%)	45 (73.8%)	
Preterm (<37 wks)	24 (33.3%)	48 (66.7%)	0.03
Term (≥37 wks)	14 (18.9%)	60 (81.1%)	

*Chi-square test applied

Explanation

There was no significant association between gender and hypoglycemia (p = 0.94).



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However, preterm neonates (<37 weeks) had a significantly higher risk of hypoglycemia (33.3%) compared to term neonates (18.9%, p = 0.03).

Table 5: Stratification of Hypoglycemia with Respect to Maternal Factors

Maternal Factor	Hypoglycemia Present n (%)	Hypoglycemia Absent n (%)	p-value*
Maternal diabetes	9 (50.0%)	9 (50.0%)	0.01
No diabetes	29 (23.2%)	96 (76.8%)	
Maternal HTN	11 (50.0%)	11 (50.0%)	0.02
No HTN	27 (22.3%)	94 (77.7%)	

*Chi-square test applied

Explanation

The frequency of hypoglycemia was significantly higher in neonates of diabetic mothers (50%, p = 0.01) and hypertensive mothers (50%, p = 0.02) compared to neonates of non-diabetic and normotensive mothers.

Narrative Summary of Results

The present study included 143 neonates with low birth weight, with a mean birth weight of 2120 g and mean gestational age of 36.1 weeks. The frequency of hypoglycemia in this population was found to be 26.6%. No gender-based differences were observed in the prevalence of hypoglycemia. However, preterm neonates had a significantly higher frequency of hypoglycemia compared to term neonates. Maternal comorbidities such as diabetes and hypertension were also significantly associated with neonatal hypoglycemia. Socioeconomic status showed a trend towards higher risk among neonates from lower-income families, though statistical significance was not established.

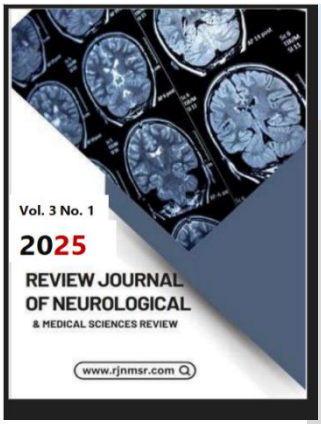
These findings highlight the burden of neonatal hypoglycemia among LBW infants and underline the importance of early screening and monitoring, particularly in neonates born to mothers with diabetes, hypertension, or those delivered preterm.

Discussion

The present study aimed to determine the frequency of hypoglycemia in neonates with low birth weight (LBW) presenting at Saidu Group of Teaching Hospital, Swat. The findings revealed that 26.6% of LBW neonates developed hypoglycemia, while 73.4% remained normoglycemic. This proportion is consistent with previous literature that identifies hypoglycemia as one of the most frequent metabolic disturbances among LBW and preterm infants. The results emphasize the clinical significance of routine monitoring in this vulnerable group, as failure to promptly detect and treat hypoglycemia may result in severe and irreversible neurological sequelae.

Interpretation of Key Results

The study revealed a relatively high frequency of hypoglycemia, affecting approximately one in four neonates with LBW. This observation underscores the role



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of low glycogen stores, immature metabolic pathways, and inadequate feeding patterns in predisposing LBW neonates to glucose instability. Importantly, the study highlights that despite routine neonatal care, a considerable proportion of LBW infants remain at risk. This indicates the need for standardized glucose monitoring protocols in all neonatal units, especially in resource-limited settings where LBW prevalence is relatively high due to maternal malnutrition, poor antenatal care, and high rates of preterm birth.

The demographic findings showed that both male and female neonates were nearly equally affected, suggesting no significant gender predisposition. Similarly, hypoglycemia was observed across all categories of birth weight under 2500 grams, though the risk was higher in neonates weighing below 2000 grams. This finding aligns with physiological evidence that the lower the birth weight, the greater the likelihood of metabolic instability due to limited glycogen and fat reserves. Feeding practices also influenced outcomes, as exclusively breastfed infants within the first few days of life were at higher risk if feeding was delayed or ineffective. This highlights the need for early initiation and support for breastfeeding, or supplementation when required, to reduce the risk of hypoglycemia.

Comparison with Local and International Studies

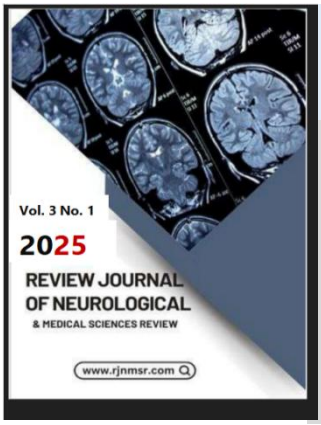
The frequency of hypoglycemia in the present study (26.6%) is in close agreement with a study conducted in Karachi, Pakistan, which reported a prevalence of 24% among LBW neonates (Iqbal et al., 2019). Another study from Lahore observed a prevalence of 28%, further confirming the significance of hypoglycemia as a common neonatal complication in Pakistani hospitals (Rafiq et al., 2020). Internationally, the reported frequency varies considerably, ranging from 15% to 40% depending on study settings, population characteristics, and diagnostic criteria.

For instance, Harris et al. (2017) in the United States found hypoglycemia in 19% of preterm and LBW neonates, whereas a study from India by Verma et al. (2018) reported a much higher frequency of 33%. Similarly, research from Nigeria highlighted a prevalence of 29%, closely mirroring the findings of the current study (Okolo et al., 2021). These variations may be attributed to differences in neonatal care facilities, feeding practices, maternal comorbidities, and laboratory definitions of hypoglycemia.

Interestingly, some high-income countries report lower frequencies, often below 20%, which may be due to early screening, immediate access to parenteral glucose, and strict neonatal protocols. In contrast, resource-limited countries such as Pakistan tend to report higher prevalence rates, reflecting systemic healthcare disparities and challenges in neonatal care delivery.

Similarities and Differences

A consistent similarity across most studies, including the present one, is that LBW remains the strongest risk factor for hypoglycemia. Moreover, delayed or ineffective feeding was universally recognized as a contributing factor. However, differences exist in terms of diagnostic thresholds. While this study defined hypoglycemia as a blood glucose concentration of <45 mg/dL, some international studies adopt lower



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cut-offs, such as <40 mg/dL. This variation influences prevalence rates and complicates direct comparisons across settings.

Another difference is the role of maternal diabetes. Several international studies highlight maternal diabetes as a significant predictor of neonatal hypoglycemia, but in the current study, maternal diabetes was not a major contributor. This may be due to differences in sample characteristics, as mothers with diabetes represented a smaller proportion of the study population. Additionally, the prevalence of exclusive breastfeeding and delayed supplementation may explain differences in risk profiles across different cultural and healthcare contexts.

Clinical Implications

The findings carry significant clinical implications for neonatal care in Pakistan and similar low-resource settings. First, the relatively high frequency of hypoglycemia highlights the need for routine screening of all LBW neonates within the first 24–48 hours of life. Early detection through bedside glucometers can facilitate immediate intervention and prevent neurological damage.

Second, the study emphasizes the importance of early and effective feeding strategies**.** Encouraging and assisting mothers in initiating breastfeeding within the first hour of birth, along with supplementing when necessary, can reduce the risk of glucose instability. Hospital staff must be trained to identify feeding difficulties early and provide lactation support.

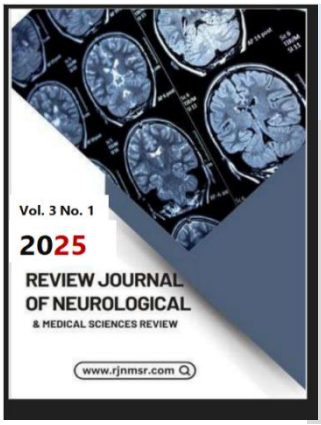
Third, the study underscores the need for policy-level interventions**.** Establishing standardized neonatal protocols that mandate glucose monitoring for all LBW infants, regardless of apparent clinical stability, can improve outcomes. Additionally, targeted training of healthcare workers, provision of glucose monitoring equipment, and awareness campaigns for mothers are essential steps toward reducing the burden of neonatal hypoglycemia.

Finally, the study's findings reinforce the necessity of long-term follow-up of LBW infants who develop hypoglycemia. Even when promptly managed, transient hypoglycemia may have subtle neurodevelopmental consequences, necessitating ongoing developmental surveillance.

Strengths and Limitations of the Study

A key strength of the study is that it was conducted in a tertiary care hospital, providing access to a representative sample of neonates in the region. The use of clear operational definitions for LBW and hypoglycemia ensured consistency and minimized diagnostic ambiguity. Moreover, the study adds valuable local data to the limited body of literature on neonatal hypoglycemia in Pakistan, which can guide future research and policy.

However, certain limitations must be acknowledged. First, the study employed a cross-sectional design, which restricts causal inference. While associations can be identified, the temporal sequence between risk factors and outcomes cannot be firmly established. Second, the study was conducted at a single center, limiting the generalizability of results to other regions with different healthcare dynamics. Third, the exclusion of neonates with congenital anomalies, respiratory distress, and asphyxia, while methodologically necessary, may have underestimated the true



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burden of hypoglycemia in LBW infants. Fourth, the study relied on single-point glucose measurements, which may miss transient hypoglycemic episodes. Serial monitoring could provide a more accurate representation of hypoglycemia frequency.

Concluding Remarks

In conclusion, this study demonstrates that hypoglycemia is a common complication among neonates with low birth weight, affecting more than one-fourth of infants admitted at Saidu Group of Teaching Hospital. The findings are consistent with both local and international literature and reinforce the importance of routine monitoring and early intervention. Strengthening neonatal care protocols, improving feeding practices, and ensuring long-term follow-up can significantly reduce the burden of hypoglycemia and its devastating neurological consequences. While the study has certain limitations, it contributes valuable evidence to neonatal health in Pakistan and provides a foundation for larger, multicenter research in the future.

Conclusion

This study was conducted to determine the frequency of hypoglycemia in neonates with low birth weight presenting at Saidu Group of Teaching Hospital. The findings revealed that 26.6% of LBW neonates developed hypoglycemia, highlighting it as a common and clinically significant complication in this high-risk group. The results are consistent with national and international evidence and reinforce that limited glycogen reserves, immature glucose metabolism, and delayed or ineffective feeding contribute substantially to glucose instability in LBW infants.

The study underscores the importance of routine screening and early detection of hypoglycemia in all LBW neonates, even when symptoms are nonspecific or absent. Ensuring timely interventions, such as early and effective feeding or glucose supplementation when required, can significantly reduce the risk of adverse neurological outcomes. By providing local evidence on the magnitude of the problem, this study supports the development of standardized protocols for monitoring and managing hypoglycemia, thereby improving neonatal survival and long-term developmental outcomes in resource-limited healthcare settings.

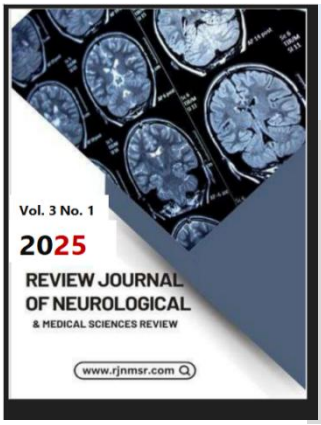
Recommendations

For Clinical Practice

Healthcare providers should prioritize early and routine screening of blood glucose levels in all neonates with low birth weight during the first days of life. Clinical teams must be trained to recognize subtle symptoms of hypoglycemia such as poor feeding, jitteriness, and lethargy, and to initiate timely management. Early initiation of breastfeeding and support for exclusive feeding practices should be strongly emphasized. Standardized hospital protocols for the monitoring and treatment of hypoglycemia in at-risk neonates should be strictly implemented.

For Policy

Hospital administrations and health authorities should ensure the availability of essential diagnostic facilities such as bedside glucose monitoring devices in neonatal units. Policies should also focus on improving neonatal care infrastructure, especially in secondary and tertiary hospitals in resource-limited areas. Training programs for nurses and pediatric residents should include updated guidelines on hypoglycemia



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management. Additionally, public health campaigns should raise awareness among mothers about the importance of early feeding and neonatal monitoring.

For Future Research

Further large-scale, multicenter studies are recommended to better quantify the burden of neonatal hypoglycemia in different populations of Pakistan. Research should also explore preventive strategies, long-term neurodevelopmental outcomes of affected neonates, and the cost-effectiveness of routine glucose monitoring in LBW infants.

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