

Original Article

Blood Glucose Level Status in Low Birth Weight (LBW) Neonates

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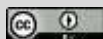
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ABSTRACT

Introduction: LBW may occur when an infant is born too prompt. According to severity, newborns can be categorized into three groups, such as very low birth weight baby (<1.5kg), extremely low birth weight baby (<1kg) & low birth weight baby (<2.5kg). Blood glucose levels are lowermost in the first 2-3 hours after birth and steadily rise as the enzyme systems for glycogen breakdown and glucose synthesis begin to operate. Hypoglycaemia could be a widespread problem causing increased morbidity and mortality. **Methods and materials:** A prospective study was carried out in the Department of Paediatrics, Rajshahi Medical College Hospital (RMCH), Rajshahi, Bangladesh from January 2018 to June 2018. A total of 110 neonates with proper documentation were confirmed as the study population.

Result: Out of sixty-seven normal birth weight neonates (n=67), two (2,2.98%) and three (3,4.5%) neonates were found hypoglycemic and hyperglycemic respectively & the rest sixty-two (62,92.5%) were normoglycemic and out of forty-three low birth weight baby (n=43), about one-fourth (11,25.6%) were hypoglycemic, one (1,2.3%) was hyperglycemic & the majority of neonates (31,72.1%) were normoglycemic. The mean normoglycemic, hypoglycemic and hyperglycemic levels were 4.74 ± 0.05 , 1.84 ± 0.03 and 8.07 ± 0.8 respectively and the relationship of glycemic status with birth weight was significant ($p=0.046$). **Conclusion:** The incidence of hypoglycemia is more evident in low birth weight

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neonates in comparison to normal birth weight neonates. The most common symptom was the refusal of feeding followed by cyanosis, limpness & jitteriness. The birth weight of neonates showed a significant correlation with their glycemic status.

Keywords: LBW, Hypoglycaemia, Neonates, Glycemic status

INTRODUCTION

Low birth weight (LBW) is termed as an infant born weighing 5.5 pounds (2.5kg) or less. LBW may occur when an infant is born too early ^[1]. According to severity newborns can be classified into three groups, such as very low birth weight neonates (<1.5kg), extremely low birth weight neonates (<1kg) & low birth weight neonates (<2.5kg) ^[2]. Small for gestational age (SGA) neonates may be premature (born before 37 weeks of pregnancy), full term (37 to 41 weeks) or post-term (after 42 weeks of pregnancy) ^[3]. If the baby's gestational age findings after birth match the calendar age, the baby is said to be appropriate for gestational age (AGA) & AGA neonates have lower ranges of difficulties and death than neonates who are small or large for their gestational age ^[4]. Intrauterine growth restriction (IUGR) is associated with an increased risk of premature birth; increased morbidity among premature neonates, and a low Apgar score. Hypoxic brain injury and its long-term sequels ^[5]. More than 20 million infants representing 15.5 per cent of all births are born with low birth weight (LBW), 95.6 per cent of them born in developing countries globally. In Bangladesh, both the growth rate and LBW rate are quite high (1.49,36%) ^[6]. LBW has been related to higher possibilities of infection, malnutrition and handicapped conditions during childhood (including cerebral palsy), mental deficits and problems

related to behavior and learning during childhood ^[7]. Neonatal hypoglycemia is a common metabolic disease due to the incapability to retain glucose homeostasis. It has been reported to be more common in infants of diabetic and toxemic mothers, in infants of low birth weight, and smaller twins ^[8]. There are no precise symptoms and the condition may be entirely asymptomatic. However, some symptoms that may like occur are cyanosis, apnea, apathy and refusal to feed, tachypnea, seizure, limpness, jitteriness and tremors ^[9]. Numerous factors incline the low-birth-weight baby to hypoglycemia. Carbohydrate metabolism is extremely disturbed, and low birth weight neonates are highly prone to hypoglycemia as a consequence of reduced glycogen reserves and decreased capacity for gluconeogenesis. Oxidation of free fatty acids and triglycerides is reduced, which limits alternate fuel sources ^[10]. Hyperinsulinism (HI) excess sensitivity to insulin, and incomplete catecholamine discharge during hypoglycemia suggest an abnormality of counter-regulatory hormone mechanisms during periods of hypoglycemia ^[11]. Hypothermia may potentiate the problem of hypoglycemia ^[12]. Hypoglycaemia could be a widespread problem causing increased morbidity and mortality ^[13]. Almost one-third of our neonates were pre-term neonates and premature infants have reduced glycogen stores, increasing their risk of hypoglycemia ^[14]. Blood glucose levels

are lowest in the first 2-3 hours after birth and gradually rise as the enzyme systems for glycogen breakdown and glucose synthesis begin to operate. This fall and rise of glucose occur in the first hours of life irrespective of feedings ^[15]. The American Academy of Pediatrics and the WHO recommend that neonatal blood glucose screening be reserved for newborns who are at risk or symptomatic and conclude that universal hypoglycemia screening is inappropriate, unnecessary, and potentially harmful ^[16]. So this study was commenced to find out the incidence of neonatal hypoglycemia or hyperglycemia, clinical correlation and comparison between the blood glucose level in term normal weight neonates and low birth weight neonates.

OBJECTIVES

General objectives:

- To compare the glycemic status of LBW neonates with that of normal neonates

Specific objectives:

- To find out the glycemic status of low-birth-weight neonates.
- To determine the blood glucose level in LBW neonates.
- To find out any correlation between clinical presentation and biochemical findings.

METHODS AND MATERIALS

A prospective study carried out in the Department of Pediatrics, Rajshahi Medical College Hospital (RMCH), Rajshahi, Bangladesh from January 2018 to June 2018. A total of 110 neonates (N=110) with proper documentation were confirmed as the study population. Data were collected using the predesigned semi-

structured questionnaire. Capillary blood was collected by heel prick after proper aseptic measure for screening by using glucometer by strips method. Venous sample was sent to the laboratory for confirmation by glucose oxidase method, if the capillary blood sugar was less than 2.5 mmol/L. Here, babies were normoglycemic (2.5 – 6.9 mmol/L), hypoglycemic (<2.5mmol/L) & hyperglycemic (>6.9mmol/L) included in the study. Ethical clearance was taken from the hospital. Informed written consent was taken from the parents of the children.

Data analysis:

The study coordinators performed random checks to verify data collection processes. Completed data forms were reviewed, edited, and processed for computer data entry. Frequencies, percentages, and cross-tabulations were used for descriptive analysis. The data analysis was performed using Statistical Package for the Social Sciences (SPSS) Version 17.0. The significance level of 0.05 was considered for all tests.

Inclusion Criteria

- Neonate 0 to 48 hrs of age.
- Low birth baby (1.5-2.4kg).
- Normal weight term baby.

Exclusion Criteria:

- Neonate having gestational age less than 28 weeks.
- Neonate having birth weight less than 1.5 kg.
- Infant of diabetic mother and neonates with congenital malformation.

RESULTS

Among the study population (N=110), most of the neonates had normal weight

(67,60.9%) & around two-fifths of the neonates (43,39.1%) had low birth weights and of forty-three low birth weight neonates (n=43), most them (33,76.7%) were preterm neonates & ten (10,23.3%) were IUGR neonates. Based on gestational

age expressed in terms (weeks), out of one-hundred ten neonates (N=110), seventy-seven (77,70%) and thirty-three (33,30%) were terms and pre-term neonates respectively (**Table I**).

Table- I: Distribution of the neonates based on Weight & Gestational age expressed in terms (weeks) (N=110)

Weight of neonate	(N, %)
Term Normal weight (2.5 – 4.0kg) Mean±SD: 3.0±.08	67,60.9%
LBW (<2.5 kg) Mean±SD: 1.8±.35	43,39.1%
IUGR	10,23.3%
Pre term	33,76.7%
Gestational age expressed in terms (weeks)	(N, %)
Term baby (37 – 42)	77,70.0%
Pre-term baby (28 - <37)	33,30.0%

Out of sixty-seven normal birth weight neonates (n=67), two (2,2.98%) and three (3,4.5%) neonates were found hypoglycemic and hyperglycemic respectively & the rest sixty-two (62,92.5%) were normoglycemic and out of forty-three low birth weight baby (n=43), about one-fourth (11,25.6%) were hypoglycemic, one (1,2.3%) was

hyperglycemic & the majority of neonates (31,72.1%) were normoglycemic. The mean normoglycemic, hypoglycemic and hyperglycemic levels were 4.74 ± 0.05 , 1.84 ± 0.03 and 8.07 ± 0.8 respectively and the relationship of glycemic status with birth weight was significant ($p=0.046$) (**Table II**).

Table- II: Distribution of the neonates based on Glycemic status (N=110)

Glycemic status	Normal birth weight (%) (n=67)	Low birth weight (%) (n=43)	Mean±SD	p-value
Normoglycemic (2.5 – 6.9 mmol/L)	62,92.5%	31,72.1%	4.74 ± 0.05	<0.046 ^S
Hypoglycemic (<2.5mmol/L)	2,2.9%	11,25.6%	1.84 ± 0.03	
Hyperglycemic (>6.9mmol/L)	3,4.5%	1,2.3%	8.07 ± 0.8	

*P-value was calculated by chi square test. | *P-value was significant at <0.05.

Two (2,3.0%) out of sixty-seven normal birth weight neonates (n=67) were diagnosed as hypoglycemia before 6 hours of age, whereas eleven (11,25.6%) out of

forty-three low birth weight neonates (n=43) were diagnosed as hypoglycemia in between 6-12 hours of age (**Table III**).

Table- III: Distribution of neonates based on glycemic status with age (N=110)

Age (in hrs)	Glycemic status	Normal birth weight baby(n=67) (%)	Low birth weight baby(n=43) (%)
< 3 hrs			
	Hypoglycemia	1,1.5%	6,14.1%
	Normoglycemia	63,94.0%	37,86.04%
	Hyperglycemia	3,4.5%	0
3-6 hrs			
	Hypoglycemia	2,3.0%	7,16.3%
	Normoglycemia	64,95.5%	36,83.7%
	Hyperglycemia	1,1.5%	0
6-12 hrs			
	Hypoglycemia	1,1.5%	11,25.6%
	Normoglycemia	66,98.5%	33,76.7%
	Hyperglycemia	0	1,2.3%
12 -24hrs			
	Hypoglycemia	0	4,9.3%
	Normoglycemia	67,100.0%	38,88.4%
	Hyperglycemia	0	1,2.3%
24 hrs to 48 hrs			
	Hypoglycemia	0	1,2.3%
	Normoglycemia	67,100.0%	41,95.3%
	Hyperglycemia	0	1,2.3%

Out of sixty-seven normal birth weight neonates (N=67), hypoglycemia was present in about one-fifth of the neonates (13,19.4%) & absent in most of the patients (54,80.6%) and out of forty-three low birth weight neonates (n=43) hypoglycemia was present in one-fourth of the neonates (11,25.6%) & absent in thirty-two neonates (32,74.4%). There was no significant association between the

body weight of neonates with signs of hypoglycemia (**Table IV**).

Table- IV: Association between Body weight of neonate and Sign of hypoglycemia (N=110).

Variables	Normal weight (%) (2.5 – 4 kg) (n=67)	LBW (%) (<2.5 kg) (n=43)	P-value
Sign of hypoglycemia			
Present	13,19.4%	11,25.6%	0.49 ^{NS}
Absent	54,80.6%	32,74.4%	

Based on the type of low birth weight neonates (n=43), preterm SGA was found in eight neonates (8,18.6%), preterm AGA was found in most of the neonates (25,58.1%) and term IUGR was found in ten neonates (10,23.2%) (Table V).

Table- V: Distribution of neonates based on Type of low birth weight (n=43)

Type of low birth weight	(n,%)
Preterm SGA	8,18.6%
Preterm AGA	25,58.1%
Term IUGR	10,23.2%

Based on clinical presentation most common symptom was feeding difficulty (7,6.3%), followed by cyanosis (5,4.5%),

limpness (5,4.5%), & jitteriness (4,3.6%) etc (Table VI).

Table- VI: Distribution of neonates based on Clinical presentation of neonates (N=110)

Clinical presentation	(N,%)
Jitteriness	4,3.6%
Limpness	5,4.5%
Apnoea	2,1.8%
Convulsion	1,0.9%
Hypotonia	4,3.6%
Cyanosis	5,4.5%
Feeding difficulty	7,6.3%

DISCUSSION

Neonatal hypoglycemia is a common and neglected problem in many parts of the developing world. Our results show that there was a significant relationship between the gestational age and weight of the neonates and between the glycemic level of neonates with gestational age and signs of hypoglycemia. Neonatal hypoglycemia and hyperglycemia can cause serious adverse effects and long-term complications, which can easily be prevented by measuring blood glucose in high-risk groups. This study was conducted in the Department of Pediatrics at Rajshahi Medical College Hospital. In this current content, the mean birth weight was found 3kg. A contradictory study carried out in Brazil found that an infant was born with a birth weight of ≥ 4.5 kg^[17]. Another study carried out in Ghana found a bit lower 2.5 kg^[18]. Based on gestational age expressed in terms (weeks), out of one-hundred ten neonates (N=110), seventy-seven (77,70%) and thirty-three (33,30%) were term and pre-term neonates respectively depicted in the

current study. A related article showed that preterm neonates were 49.2% and term neonates were 50.8% ^[19]. Another article suggested that 22.3% of preterm birth occurred in mothers who had hyperglycemia ^[20]. In this study, 25.6% of low birth weight neonates were hypoglycemic and 2.3% were hyperglycemic. A recent study in India showed the overall incidence of hypoglycemia at 25.2% which was similar to our findings ^[21]. Another study in Nepal showed, 41% of newborn infants had mild (<2.6 mmol/l) and 11% moderate hypoglycemia ^[22]. The incidence of hypoglycemia in low-birth-weight neonates in another finding was 30% ^[23]. Out of 67 normal-weight neonates, two (2,2.9%) developed hypoglycemia. A previous Bangladeshi study showed that the incidence of hypoglycemia in low-birth-weight neonates was 31.8% ^[24]. A previous study showed that 38% of uncomplicated term infants experienced mild (<2.6 mmol/l) and 8% moderate to severe (<2.0 mmol/l) hypoglycemia during the first 48 hours ^[25]. Two (3.0%) out of sixty-seven normal birth weight neonates (n=67) were diagnosed with hypoglycemia before 6 hours of age, whereas eleven (11,25.6%) out of forty-three low birth weight neonates (n=43) were diagnosed as hypoglycemia in between 6-12 hours of age. Another related article revealed that in the 1st 48 hours, the blood glucose levels were lowest at 2 hours after delivery and the level gradually raised with increasing postnatal age in low-birth-weight neonates ^[24]. A study demonstrated in Bangladesh found that hypoglycemia was present in 33.3% of infants of diabetic mothers which was significantly higher than in infants of non-diabetic mothers (5.6%) within 3

hours of age ($p<0.05$) ^[19]. 50% of infants of diabetic mothers were hypoglycemic at 4 hours of age depicted in one study, whereas hypoglycemia was present in 40% of infants of diabetic mothers during 1st three days of life stated in another analysis ^[26,27]. Based on the type of low birth weight neonates (n=43), preterm SGA was found in eight neonates (8,18.6%), preterm AGA was found in most of the neonates (25,58.1%) and term IUGR was found in ten neonates (10,23.2%) found in this analysis. An analysis carried out in Bangladesh found that hypoglycemia was found in 50.0% of preterm IUGR, 35.9% of term IUGR and 23.9% of preterm AGA infants ^[24]. The Malaysian study showed that hypoglycemia was seen in 34.2% of SGA and 27.1% inappropriate for AGA infants ^[28]. Based on clinical presentation most common symptom was the refusal of feeding (7,6.3%), followed by cyanosis (5,4.5%), limpness (5,4.5%), & jitteriness (4,3.6%). A related article carried out in Imphal, Manipur found out that, jitteriness was the most common clinical feature observed followed by the refusal of feeding, lethargy, weak cry, cyanosis& hypotonia ^[29].

CONCLUSION

Hypoglycemia is a state in which the blood sugar level is lower than the standard range. In pregnancy, hypoglycemia is the biggest concern among mothers. The frequency of hypoglycemia is more evident in low-birth-weight neonates in comparison to normal birth weight neonates. In current content, the most common symptom was the refusal of feeding followed by cyanosis, limpness & jitteriness. The birth weight of neonates

showed a significant correlation with their glycemic status.

RECOMMENDATIONS

A multi centered study in the divisional/tertiary hospitals of whole Bangladesh may be done. Multi-disciplinary approach of research work can make a study more precise and authentic in this regard.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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