



ORIGINAL ARTICLE

Blood Glucose Level in Low Birth Weight Babies in First 48 Hours of Life

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Abstract

Background: Transient hypoglycemia in the early neonatal period is a common adaptive phenomenon as the newborn changes from the fetal state of continuous transplacental glucose consumption to intermittent nutrient supply following cessation of maternal nutrition at birth. This adaptation is well established in term appropriate for gestational age babies but is not established in low birth weight babies. **Objective:** this study was undertaken to evaluate glycemic status of the low birth weight babies and impact of early feeding. **Methodology:** This prospective observational study was done in the department of Pediatrics and department of obstetrics, Rangpur Medical College Hospital, Rangpur, Bangladesh from September 2005 to February 2006 for a period of six (6) months. Blood sugar was estimated at birth (cord blood) and then from capillary blood at 2 hours, 4 hours, in between 12 to 24 hours and in between 24 to 48 hours. The capillary blood was obtained by heel prick. Venous sample was sent to the college laboratory for confirmation if the blood sugar was less than 2.6 mmol/L (47 mg/dL). **Result:** In the first 48 hours, the blood glucose levels were lowest at 2 hours after delivery and the level gradually increased with increasing postnatal age in low birth weight babies. Birth weight had a positive correlation with blood glucose levels of low birth weight babies. The overall incidence of hypoglycemia in low birth weight babies were 31.8%, among them 77.1% asymptomatic and 22.9% symptomatic. The mean blood glucose levels were significantly high in early feed group than the delayed feed group babies ($p < 0.05$). **Conclusion:** The blood glucose levels is lowest at 2 hours after delivery and the level gradually increases with increasing postnatal age in low birth weight babies which is a positive correlation with blood glucose levels of low birth weight babies. [*Journal of Current and Advance Medical Research 2018;5(1):33-38*]

Keywords: Low birth weight; blood glucose level; hypoglycemia

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Introduction

One of the most metabolic problems encountered in neonates is hypoglycemia. Generally, neonatal hypoglycemia is not a medical condition, but a manifestation of the newborn's ability to adapt from the fetal state of continuous transplacental glucose consumption to the extrauterine pattern of intermittent nutrient supply¹. With the abrupt cessation of maternal nutrition at birth, transient neonatal hypoglycemia in the first 2 to 4 postnatal hours is almost always universal².

The maintenance of normoglycemia in newborns depends upon adequacy of glycogen stores, maturation of glycogenolytic and gluconeogenic pathways and an integrated endocrine response³. In the term healthy newborn, this dynamic process is self-limiting and is not considered pathologic as the term neonate has the unique capacity to sustain normoglycemia and achieve successful metabolic adaptation, even in a fasting state, via the breakdown and mobilization of endogenous glycogen in the liver and kidney, hepatic synthesis of glucose from other substrates and production of alternative cerebral fuels such as ketone bodies through fatty acid mobilization³⁻⁵. Infants born prematurely or following intrauterine malnutrition may develop abnormally low plasma glucose concentration for a prolonged period as a result of failure to adapt a metabolic and endocrine response^{1,6}.

The overall prevalence depends on birth weight, gestational age and intrauterine growth retardation. One Malaysian study showed that hypoglycemia was seen 34.2% in small for gestational age (SGA) and 27.1% in appropriate for gestational age (AGA) infants⁷. More than 95% of low birth weight (LBW) babies are born in developing countries. In Bangladesh about 30 percent of infants are born with low birth weight⁸.

Glucose is an essential nutrient for the brain. Abnormally low levels (hypoglycemia) can cause encephalopathy and have the potential to produce long-term neurological sequel. The level at which this potential for long term injury is reached is controversial⁹⁻¹⁰. The increased incidence of LBW makes such studies vital to formulation of recommendation for prevention and treatment within 48 hours of life to reduce neonatal mortality rate³. A huge number of LBW babies born in Bangladesh. In With this background, this preset study was undertaken to evaluate glycemic status of the low birth weight babies and impact of early feeding.

Methodology

This prospective observational study was done in the department of Pediatrics and department of obstetrics, Rangpur Medical College Hospital, Rangpur from September 2005 to February 2006. The study protocol was approved by the Review Board of Bangladesh College of Physician & Surgeon and ethical clearance was obtained from the institution ethical board. All term and preterm healthy low birth weight newborns delivered during the study period were included at birth. Low birth weight babies with any illness, LBW babies born to diabetic mother, maternal tocolytic therapy with beta-sympathomimetic agents and thiazide diuretics, LBW babies born with sepsis risk factor, babies need NICU admission and receiving intravenous fluid were excluded from the study. During the study period, a total of 163 newborns were enrolled according to inclusion criteria. Each baby was screened for exclusion criteria. Informed consent was taken from the parents of the babies included in the study. Babies were selected prospectively using a random number table. A detailed history was taken and through clinical examination was done in each case and information's were recorded in a questionnaire. Septicemias, hypothermia, perinatal asphyxia that may affect the glycemic status as well as features of hypoglycemia were cautiously excluded from history and clinical examination in subsequent follow up. Gestational assessment was done by the New Ballard Score. Weights of the infants were taken using baby weighing scale machine graduated from 0 to 20 kg with the capacity to measure 1/20th of kilogram.

The newborn was classified depending on gestational age and birth weight as follows term intrauterine growth retardation (IUGR), preterm appropriate for gestational age (AGA) and Preterm IUGR according to Battagli and Lubchenco percentile chart. After enrollment of the newborn, with all aseptic precaution blood samples were taken from cord (as basal) at birth and then from capillary blood at 2 hours, 4 hours, in between 12-24 hours and in between 24-48 hours. The capillary blood was obtained by heel prick. The cord and capillary blood glucose were measured by using "Accu-Chek-Active"-glucometer using the details of the procedure as mentioned by the manufacturer. Venous sample was sent to the college laboratory for confirmation if the blood sugar was less than 2.6 mmol/l (47 mg/dl). A blood glucose level less than 2.6 mmol/l irrespective of age, gestational age and birth weight was considered as hypoglycemia. Symptoms of hypoglycemia if associated were recorded. Infants were considered as asymptomatic

hypoglycemia if low blood glucose level (< 2.6 mmol/l) was not associated with clinical signs. Neonates with hypoglycemia were managed as per the standard protocol. All infants were started breast feeding or expressed breast milk as soon as possible as per hospital policy (based on baby friendly hospital policy). Maintenance feeding was given 2 hourly with direct breast feeding or expressed breast milk by cup and spoon or NG tube if the baby cannot suck adequately. Based on baby friendly hospital initiative, all newborns were stayed with mother and skin to skin contact was practiced to encourage breast feeding. Newborns were separated from mother only in cases of maternal illness and until she is transferred to the ward. Formula feeds were given only if mother remains unavailable beyond 2 hours or if breast milk was not adequate as the study population was high risk group to develop hypoglycemia. Time of onset of breast feeding was recorded in each case. Early feeding is defined as initiation of feeding within 1 hour of delivery and “delayed feeding” as initiation of feeding beyond 1 hour of delivery. No prelacteal feeding feeds were given. Blood glucose levels were analyzed with regard to distribution, variations with age, mode of delivery, birth weight, time of initiation of first feeding, IUGR vs AGA, preterm IUGR vs term IUGR, and frequency of hypoglycemia with or without symptoms at different sampling times. Unpaired Students ‘t’ test and repeated analysis of variance were applied where necessary for statistical analysis using the SPSS (12.0 version) statistical package.

Result

A total of 163 low birth weight babies were included as study group according to the inclusion criteria. Twelve newborns were dropped out due to incomplete follow up, developed early onset septicemia in subsequent follow up and parents having no interest to continue the study. Finally 151 newborns were completed the study and final analysis included these newborns. Out of 151 newborns, 64(42.4%) were term IUGR, 16(10.6%) were preterm IUGR and 71(47.0%) were preterm AGA.

The mean ± SD of birth weight and gestational age was 1780±269.7 gram and 36.09 ± 5.47 weeks respectively in the study population. The mean ± SD of blood glucose levels in study population were 4.05±0.61 mmol/L at birth (cord), 2.31±0.34 mmol/L at 2 hours, 2.95±0.36 mmol/L at 4 hours, 3.13±0.50 mmol/L at 12-24 hours and 3.42 ± 0.57 mmol/L at 24-48 hours of age after birth. Repeated analysis of variance showed significant difference

between blood glucose levels at birth, 2 hours, 4 hours, 12-24 hours and 24-48 hours of age (p=0.005) (Table 1).

Table 1: Mean ± SD blood glucose levels (mmol/l) in study population at different sampling time

Age (hours)	Mean ± SD of blood glucose level (mmol/L)
At birth	4.05 ± 0.61
2 h	2.31 ± 0.34
4 h	2.95 ± 0.36
12 to 24 h	3.13 ± 0.50
24 to 48 h	3.42 ± 0.57

In the first 48 hours, the lowest blood glucose levels were found at 2 hours after delivery and the level gradually increased with increasing postnatal age (Figure 1).

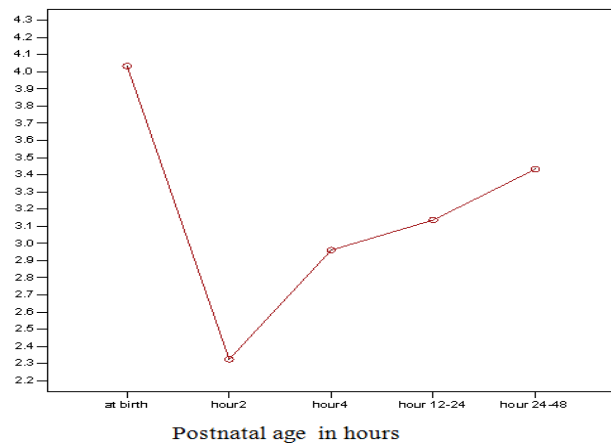


Figure 1: Line diagram showing blood glucose level in the study population in first 48 hours of life according to sampling time (The Y axis indicates the mean blood glucose level (mmol/L))

There was statistically significant difference in blood glucose levels of LBW babies with variation of birth weight at 2 (p=0.04) and 4 (p=0.04) hours of age (Table 2).

Table 2: Blood glucose (mmol/L) distribution according to birth weight (Mean ± SD)

Different Sampling Time	Birth Weight		P value
	<1.8 kg	≥1.8 kg	
At birth	4.12±0.32	3.99±0.53	0.75
2 h	2.20±0.25	2.43±0.29	0.04
4 h	2.54±0.21	3.34±0.26	0.04
12 to 24 h	3.1±0.28	3.2±0.30	0.12
24 to 48 h	3.50±0.72	3.52±0.45	0.65

P value reached by Student’s ‘t’ test

Among the 151 LBW babies, 48(31.8%) infants had low blood glucose (<2.6 mmol/L) levels. Out of 48 infants, 32 cases had hypoglycemia at 2 hours, 9 cases had hypoglycemia at 4 hours and 7 cases had hypoglycemia at 12 to 24 hours. Hypoglycemia was not found at birth and at 24 to 48 hours of age (Table 3).

Table 3: Frequency of hypoglycemia at different sampling times (n=151)

Time of sampling	Blood Glucose (mmol/L)	
	<2.6	≥ 2.6
At birth	0(0%)	151(100%)
2 h	32(21.1%)	119(78.9%)
4 h	9(5.9%)	142(94.1%)
12 to 24 h	7(4.6%)	144(95.4%)
24 to 48 h	0(0%)	151(100%)

Among the 48 hypoglycemic LBW babies, 37(77.1%) babies were asymptomatic and 11(22.9%) were symptomatic. There was no significant difference in blood glucose levels of symptomatic and asymptomatic babies (p>0.05) (Table 4). Hypoglycemia was found in 50.0% of preterm IUGR, 35.9% of term IUGR and 23.9% of preterm AGA infants. There was no significant difference in blood glucose levels of hypoglycemic

preterm IUGR, term IUGR and preterm AGA infants (Table 5).

Table 4: Distribution of hypoglycemia (< 2.6 mmol/L) with or without symptoms among the study population (n=48)

Type of Hypoglycemia	Frequency	Percent
Asymptomatic	37	77.1
Symptomatic	11	22.9

Mean ± SD of blood glucose levels were not significantly different in IUGR vs AGA low birth babies but there was significant difference in blood glucose levels of preterm IUGR vs term IUGR low birth weight babies (p=0.04) at 2 hours of delivery (Table 6).

Table 5: Distribution of hypoglycemia (< 2.6 mmol/L) among preterm IUGR, term IUGR and preterm AGA in the study population (n=99)

Type of Hypoglycemia	Frequency of hypoglycemia (%)	Blood Glucose (mmol/l)
Preterm IUGR	8(50.0%)	1.92 ± 0.18
Term IUGR	23(35.9%)	2.26 ± 0.16
Preterm AGA	17(23.9%)	2.17 ± 0.18

Statistical test was done by repeated analysis of variance; p value=0.42

Table 6 Comparison of blood glucose (mmol/l) in IUGR vs AGA and preterm IUGR vs term IUGR in the study population (Mean ± SD)

Variables (n)	Blood Glucose Levels (mmol/l) in Different Sampling Time				
	At birth	2 h	4 h	12-24 h	24-48 h
IUGR (80)	3.93±0.63	2.26±0.24	2.94±0.37	3.05±0.44	3.47±0.52
AGA (71)	4.05±0.60	2.42±0.40	2.93±0.47	3.20±0.63	3.60±0.46
P value	0.50	0.09	0.80	0.29	0.74
Preterm IUGR(16)	3.99±0.26	2.12±0.20	2.87±0.46	3.24±0.26	3.36±0.38
Term IUGR (64)	3.87±0.72	2.26±0.36	2.96±0.36	2.96±0.46	3.46±0.56
P value	0.75	0.04	0.74	0.13	0.59

Statistical analysis was done by unpaired t test

The mean±SD of blood glucose levels were significantly high in early feed group babies than the delayed feed group (p<0.05) (Table 7).

Table 7: Comparison of blood glucose (mmol/l) in early and delayed feeding group in the study population (Mean ± SD)

Groups (n)	Blood Glucose	P value
Early feed (68)	2.4±0.16	<0.05
Delayed feed (83)	2.08±0.16	

P value was reached by unpaired t test

Discussion

At birth, with the sudden discontinuation of the nutrient and other supplies from the mother, the neonate mounts adaptive responses including mobilization of glucose and fatty acids from glycogen and triglyceride depots to meet the energy

demands. All these responses are well established in term neonates who are appropriate size for gestation. But infants born prematurely or following intrauterine malnutrition may develop abnormally low plasma glucose concentration for prolonged period as a result of the failure to mount an appropriate and adequate counter regulatory metabolic and endocrine response¹. There is a controversy over the definition of a "safe" blood glucose concentration, that is a value below which there is risk of long term neurodevelopmental impairment.

This study showed that the mean blood glucose levels (2.31 mmol/l) were significantly lower at 2 hours after delivery than any other point of first 48 hours of age and then the blood glucose levels gradually increased to reach normal levels with increasing postnatal age which is well correlated with the findings of Srinivasan et al¹¹. Srinivasan et al¹¹ showed that there was a decline in plasma glucose levels during the first 2 hours of postnatal life followed by a rise, reaching a steady-state glucose concentration by 2-3 hours after birth. Sharma et al¹² also found that mean blood glucose levels in term SGA neonates was lowest at 2 hours and then uniform increased in blood sugar levels from 2 hours onward which was also consistent with present study findings. In our study, there was statistically significant difference in blood glucose levels of LBW babies with variation of birth weight at 2 (p=0.04) and 4 (p=0.04) hours of age.

In the present study, overall incidence of hypoglycemia was 31.8% which was lower than the study conducted by Anderson et al (50%; cut of value < 2.6 mmol/l)¹³; it may be due to small sample in the present study. In our study, out of 48 hypoglycemic LBW infants, 32 had hypoglycemia at 2 hours but only 16 of those had hypoglycemic level continued in the 4 and 12-24 hours of age and require treatment. A nearly similar observation was made by Tanzer¹⁴ in the full term newborn. He found lowest blood glucose in the first 3 hours of life & out of 12 hypoglycemic infants, only 3 infants continue hypoglycemia after 3 hours. In this study, among the hypoglycemic infants, 77.1% babies were asymptomatic and 22.9% were symptomatic. This findings was similar with the findings noted by Beard and Cornblath¹⁵. There was no significant difference in blood glucose levels of symptomatic and asymptomatic babies in the present study (p>0.05). In this study, hypoglycemia was most common in preterm IUGR group (50%) than the term IUGR (35.9%) and preterm AGA (23.9%). It may be due to immaturity of glycogenolytic and gluconeogenesis enzymes along with lack of

glycogen store, associated hyperinsulinism and delayed onset of feeding.

This present study showed no significant difference in blood glucose levels of hypoglycemic preterm IUGR, term IUGR and preterm AGA infants. In the present study, the mean blood glucose levels in preterm IUGR babies were significantly low than that of the term IUGR babies (p=0.04) at 2 hours of delivery but no significant difference in blood glucose levels of IUGR and AGA infants. Lubchencho et al¹⁶ also showed that preterm IUGR had a significantly lower mean blood glucose level in the first few postnatal hours than the term IUGR (p<0.05). The mean \pm SD of blood glucose levels were significantly high in early feed group babies than the delayed feed group and early feeding influenced the subsequent blood glucose levels (p<0.05). Beard et al¹⁵ showed that early feeding of premature newborn infants prevented hypoglycemia and influenced subsequent blood glucose levels. This study findings were also well correlated with the findings of a cross sectional study of 1546 term infants and 62 preterm infants by Hawdon and Ward¹⁷. So early feeding is an important determinant of blood glucose level in low birth weight babies.

Conclusion

In the first 48 hours, the blood glucose levels were lowest at 2 hours after delivery and the level gradually increased with increasing postnatal age in low birth weight babies. Birth weight had a positive correlation with blood glucose levels of low birth weight babies in first 48 hours of age in this study. Asymptomatic hypoglycemia was more common than the symptomatic hypoglycemia among the hypoglycemic infants. Hypoglycemia was more common among the preterm IUGR babies as compared to the term IUGR and preterm AGA infants in the study population. The mean blood glucose levels were significantly high in early feed group babies than the delayed feed group and early feeding influenced the subsequent blood glucose levels.

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