IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 20, Issue 11 Ser.7 (November. 2021), PP 17-22
www.iosrjournals.org

Determination of the Glycemic Status of Low birth weight (LBW) Babies.

Kundu NK[1], Siddique AB[2], Bari I[3], Uddin MB[4]

[1]*Dr. Nitish Kumar Kundu, Assistant Professor, Department of Paediatrics, Pabna Medical College, Pabna, Bangladesh*

[2]*Prof. Dr. A.B.Siddique, Professor and head (rtd.), Department of Paediatrics, Rajshahi Medical College, Rajshahi, Bangladesh*

[3]*Prof. Dr. Iqbal Bari, Professor and Head (rtd.), Department of Paediatrics , Rajshahi Medical College, Rajshahi, Bangladesh*

[4]*Prof. Dr. Md Belal Uddin, Professor and Head, Department of Paediatrics, Rajshahi Medical College, Rajshahi, Bangladesh*

Corresponding Author: Dr. Nitish Kumar Kundu

Abstract

Introduction: *Glucose is essential in the neonatal fuel economy. It is necessary for adequate nutrition as well as cerebral energy metabolism since it is the preferred substrate that accounts for approximately all of the oxygen use in the brain. Low birth weight babies have a variety of problems, including hypoglycemia, hyperglycemia, hyperbilirubinemia, intraventricular hemorrhage, recurrent apnea, septicemia, and intrauterine hypoxia. Seizures, brain malfunction, motor developmental delay, and osmotic diuresis are all possible outcomes of this condition. Seizures can occur as a result of birth asphyxia or as a result of hypoglycemia, cerebral hemorrhage, septicemia, or hyperbilirubinemia.*

Aim of the study: *The aim of the study was to compare the glycemic status of LBW neonates with that of normal neonates*

Methods: *This was a hospital based prospective study conducted at Rajshahi Medical College Hospital during a period of 5 months, from August 2005 to December 2005. A total of 70 neonates were selected for the study. Among them 30 full-term babies were selected for the control group, and 40 low-birth weight babies were selected for the study group. Blood samples were collected from the neonates within 48 hours of birth, at different intervals.*

Result: *Maximum amount of the study group participants were male. Majority of the study group (27.50%) were from the oldest age group of 24-48 hours, while in the control group, majority (30%) were from the youngest age group of 0-3 hours. The Mean ±SD blood glucose level of the study group was 3.75±1.23 (mmol/L), and in the control group it was 4.78±0.97 (mmol/L). 6.67% of the control group and 5% of the study group were hypoglycemic, while 3.33% of the control group and 5% of the study group were hyperglycemic. The difference of mean blood glucose levels based on mode of delivery among the LBW babies were not statistically significant, while the difference was statistically significant based on the complications faced during or after pregnancy.*

Conclusion: *Hypoglycemia is more frequent in the first 3-6 hours of life in both full-term and pre-term infants. Preterm low birth weight newborns are especially sensitive to hypoglycemia from the first hour of life.*

Keywords: *Hypoglycemia, Hyperglycemia, Glucose, Low birth weight*

Date of Submission: 10-11-2021 Date of Acceptance: 26-11-2021

I. Introduction

Low Birth weight is a weight of less than 2,500 gram at birth.[1] They are two categories: (a) Preterm baby (also called premature baby). (b) Small for date baby (Small for gestational age) may be full term but are under weight. Low birth weight is due to prematurity, poor intrauterine growth or both. Prematurity and Intrauterine Growth Retardation are associated with increased neonatal morbidity and mortality.[2] Low birth weight infants differ in their prognosis on the basis of prematurity, maternal and environmental factor. So, while dealing with Low birth weight Babies these factors should be taken into consideration. Glucose is one of the major substrates for fetal metabolism. Under normal conditions (ie, normal maternal glucose levels), virtually all of the glucose used by the fetus is supplied from the maternal circulation via facilitated diffusion across the placenta.[3] This results in a fetal blood glucose concentration of approximately 70% of the maternal value. The relative dependence of the fetus on a constant supply of maternal glucose necessities significant changes in

regulation of glucose metabolism at birth following the abrupt interruption of umbilical glucose delivery. Although the exact trigger is unknown, a number of physiologic changes equip the newborn for maintenance of glucose homeostasis.[4] However, it has been estimated that term infants have only enough hepatic glycogen to maintain the glucose supply for about 10 hours. It may be expected that the process would be different in an infant born prematurely, because the endocrine and enzyme control of intermediary metabolism are not fully developed in the preterm infant. Disturbance of glucose homeostasis may result when this adaptation fails or is incomplete. Hypoglycemia is one of the most common metabolic problem encountered in new born. Hypoglycaemia due to glycogen depletion secondary to catecolamine release and to an unexplained hyperinsulinaemic state is often seen in low birth weight babies. It is known to be associated with brain dysfunction and motor developmental retardation. Glucose, like oxygen, is essential for normal brain cell function. It cannot now be disputed that hypoglycemia causes brain damage or that effective management of hypoglycemia protects from this neural damage.[5] There is an association between hypoglycemia and abnormal neurological manifestations.[6] Moderate Hypoglycemia (<2.2 mmol/L) in preterm infant, is associated with reduced mental and motor development scores.[1]Thus, for example, in 1960 Haworth and Coodin found and incidence of 51% of severe mental retardation among 35 children who had recurrent 'idiopathic' hypoglycemia when aged less than 6 months. In 1984, Soltesz et al in a review of outcome of 18 children who had hyperinsulinaemic hypoglycemia found that the incidence of severe mental retardation had been reduced to 15%. They concluded that this improved outcome resulted from early identification, correct diagnosis and effective management of the hypoglycemia. In another study shows there are chance of transient Neonatal hyperglycemia in low birth weight baby.[7] Hyperglycemia in newborn babies is usually a transient phenomenon which may result in glycosuria with osmotic diuresis, intraventricular hemorrhage, dehydration, dyselectrolytemia and rarely long-term complication like persistant diabetes mellitus and mental retardation. The pathogenesis of this hyperglycemia is uncertain and may include failure to suppress endogenous glucose production, an attenuated insulin release or a decrease in end-organ sensitivity to insulin. Moreover, studies suggested a diminished insulin response to an intravenous glucose load within the first 24 hours of birth in the babies of comparable birth weights leading to higher risk of Hyperglycemia. From the discussion it is clear that knowledge on the glycemic status of newborn babies and its relationship with clinical presentation is very important. In this study an attempt is made to evaluate the glycemic status of newborn babies. The aim of the study was to find out the incidence of neonatal hypoglycemia or hyperglycemia, associated risk factors, clinical correlation and comparison between the blood glucose level in term normal weight neonate and low birth weight neonates.

II. Objective

General Objective

- To find out the glycemic status of low birth weight babies.

Specific Objectives

- To compare the glycemic status of LBW neonates with that of normal neonates
- To find out any correlation between clinical presentation and biochemical findings.

III. Methods

This was a hospital based prospective study conducted at the Department of Paediatrics, and Department of Gynaecology & Obstetrics, in Rajshahi Medical College Hospital during a period of 5 months, from August 2005 to December 2005. A total of 70 neonates were determined as the sample size, with 40 neonates from the low birth weight category as the study group, and 30 babies of the normal birth weight category as the control group. Study sample selection and result analysis was done by standard method. Blood samples were collected from the neonates within 48 hours of birth, and the blood samples were collected in multiple occasions, as 1 primary and 3 follow up samples. A detailed history and thorough clinical examinations were done in each case and information were recorded as per the proforma given in Data Collection sheet. Proper informed consent was taken from the legal guardians of each participant to include their infant under study and purpose of the study was explained. Ethical approval was obtained from the Institutional Ethics Committee.

Inclusion Criteria

Case:

- Low birth weight baby (Preterm or SGA) delivered by NVD or LUCS
- Age of patient- 0 - 48 hours.

Control:

- Normal healthy full-term baby
- Age of patient- 0 - 48 hours

Exclusion Criteria

- Neonate having gestational age less than 28 weeks.
- Neonates having birth weight <1kg
- Severely morbid patients

IV. Results

The present study had 30 control group and 40 study group participants. In the control group, 57% were female and 43% were male. In the main study group, among 40 participants, 68% were male and 33% were female. The participants were divided into five different groups based on their age in hours. In the study group, 25% were less than 3 hours old, 10% were between the age of 3 to 6 hours, 15% were between the age of 6-12 hours, and 22.50% were between the age of 12-24 hours. The highest percentage of the study group (27.50%) were between the age of 24 to 48 hours. In the control group, the youngest age group had 30% of participants, 10% were between 3-6 hours old. The highest percentage of the control group (26.67%) were between the age of 6-12 hours. The mean weight of the control groups full term neonates was 2900.16 gm, whereas the mean weight for the study groups LBW babies was 1800.25 gm. The mean gestational week of the control group was 39 weeks, and in the study group, it was 35.4 weeks. Table 4 described the Mean±SD values of blood glucose levels in both control and study group, according to their birth age. Blood glucose levels were lower in all age range of the study group compared to the control group. Statistical significance was observed among participants of all age groups, except for the participants within the age group of 6-12 hours. The blood glucose levels were monitored for all 70 neonates in the first 48 hours of life. Both groups had 90% participants with normal blood glucose levels. In the control group, 6.67% (n=2) participants were hypoglycemic, and 3.33% (n=1) were hyperglycemic. In the study group, among the 40 LBW neonates, 90% had normal glucose levels, 5% were hypoglycemic and 5% were hyperglycemic. Blood glucose levels of both the study and the control groups were cross referenced with various perinatal factors. Comparing the participants with their mode of delivery, 12 participants of the control group and 32 participants of the study group had normal vaginal deliveries (NVD). The Mean±SD blood glucose levels were 4.55±0.86 (mmol/L) in the control group and 3.57±1 in the study group. 18 patients in the control group and 8 patients from the study group had caesarean delivery (LUCS). The Mean±SD blood glucose levels were 4.84±0.91 (mmol/L) in the control group and 3.94±1.67 in the study group. Comparing the place of delivery, the Mean±SD blood glucose levels were 4.99±0.64 (mmol/L) in the 22 control group participants who had deliveries at hospital, and 3.58±1.1 in the 30 study group who had deliveries at the hospital. The average blood glucose levels were 4.7±1.12 (mmol/L) in the 8 control group participants who had deliveries at home and 3.94±1.67 in the 10 study group participants who had deliveries at the home. In total, 27 from the total 70 participants faced complications during birth, 9 among the control group participants and 18 among the study group. In the control group, 3 participants faced Antepartum hemorrhage (APH) during birth, with mean blood glucose level of 4.77±0.51 (mmol/L), while 6 participants faced preeclampsia (PET) with mean blood glucose level of 4.88±0.15 (mmol/L). In the study group, 8 participants faced APH with mean blood glucose level of 3.59±0.85 (mmol/L), while 10 participants faced PET complications with mean blood glucose level of 2.87±0.54 (mmol/L). The difference of mean blood glucose levels based on mode of delivery among the LBW babies were not statistically significant, while the difference was statistically significant based on the complications faced during or after pregnancy.

Table 1: Sex distribution of babies (n = 70)

Gender	Control Group (n=30)		Study Group (n=40)	
	Frequency	Percentage	Frequency	Percentage
Male	13	43%	27	68%
Female	17	57%	13	33%

Table 2: Distribution of age range of control and study group babies (n = 70).

Age (hour)	Study Group (n=40)		Control Group (n=30)	
	Frequency	Percentage	Frequency	Percentage
A = 0 – 3 hours	10	25%	9	30.0%
B = 3 – 6 hours	4	10%	3	10.0%
C = 6 –12 hours	6	15%	8	26.67%
D = 12 – 24 hours	9	22.50%	6	20.0%
E = 24 – 48 hours	11	27.50%	4	13.33%

Table 3: Distribution of mean weight and gestational age of neonates (n = 70).

Neonate	Mean weight (gm)	Mean gestational age (weeks)
Control Group baby (n = 30)	2900.16	39
Study Group baby (n = 40)	1800.25	35.4

Table 4: Mean blood glucose level in neonate in first 48 hours of age.

Age (hours)	Blood glucose in control group (n=30) (mmol/L)		Blood glucose in study group (n=40) (mmol/L)		P-Value
	Mean	±SD	Mean	±SD	
A = 0 -3 (n = 9 : 10)	5.43	0.79	4.81	1.12	<0.05
B = 3-6 (n = 12 : 14)	4.1	1.08	3.14	0.83	<0.01
C = 6-12 (n = 20 : 20)	4.21	1.09	4.08	0.86	>0.05
D = 12-24 (n = 26 : 29)	4.74	0.42	3.55	0.94	<0.01
E = 24-48 (n = 30 : 40)	5.4	0.37	4.6	1.17	<0.01

Table 5: Classification of blood glucose level in neonate in first 48 hours of life.

Blood Glucose Classifications	Control Group (n=30)		Study Group (n=40)	
	Frequency	%	Frequency	%
Normoglycemic (2.2-7.0 mmol/L)	27	90	36	90
Hypoglycemic (<2.2 mmol/L	2	6.67	2	5
Hyperglycemic (> 7.0 mmol/L)	1	3.33	2	5
Total	**30**	**100**	**40**	**100**

Table 5: Various perinatal factor of blood glucose level estimation of studied neonate.

Perinatal factors	Term neonate blood glucose level (mmol/L)		Low birth weight neonate blood glucose level (mmol/L)	
	Mean	±SD	Mean	±SD
Mode of delivery				
NVD (12 : 32)	4.55	0.86	3.57	1
LUCS (18 : 8)	4.84	0.91	3.94	1.67
Place of delivery				
Hospital (22:30)	4.99	0.64	3.58	1.1
Home (8:10)	4.7	1.12	4.03	1.52
Complication due to pregnancy				
APH (3:8)	4.77	0.51	3.59	0.85
PET (6:10)	4.88	0.15	2.87	0.54

Table 6: Comparison of blood glucose levels of LBW babies by perinatal factors

Perinatal factor	LBW neonates blood glucose level (mmol/L)		P-Value
	Mean	±SD	
Mode of delivery			
NVD	3.57	1	>0.05
LUCS	3.94	1.67	
Complication due to pregnancy			
APH	3.59	0.85	<0.01
PET	2.87	0.54	

V. Discussion

Birth weight is the most sensitive and dependable measure of a community's health. It is well accepted that birth weight is an essential indication of fetal and neonatal health in both the individual and population contexts. Birth weight, in particular, is significantly linked to prenatal, neonatal, and postnatal mortality, as well as infant and child illness.[8] Every year, around 18 million babies are born weighing less than 2.5kg. Approximately 95% of them are in poor nations.[9] Low birth weight causes for 60-80% of newborn mortality in underdeveloped nations.[10] Approximately four million global neonatal fatalities occur each year, with 98 percent occurring in poor countries, where the majority of babies die at home while being cared for by mothers, relatives, and traditional delivery attendants.[10] Babies with low birth weight can face severe physical and mental difficulties even after crossing the age of extreme vulnerability. It is important to recognize LBW neonates that require special care as early as possible, to increase their survivability. The present study was conducted to determine the status of blood glucose levels in selected LBW babies. It has been observed that LBW and VLBW babies are often at risk of developing glucose instability during their early neonatal period.[11,12] It is a condition that has become increasingly important with reports of up to 68% of ELBW infants during the first few weeks of life.[13] Several factors, including intravenous fluids, parenteral nutrition, stress, and medication therapy, particularly steroids, have been linked to the development of neonatal hyperglycemia.[13,14,15] Although some studies have looked at the short-term consequences of neonatal hyperglycemia, few have looked at long-term outcomes including intraventricular hemorrhage (IVH), retinopathy of prematurity (ROP), and mortality.[17,18] In our study, mean blood glucose level in full term neonate was 4.78 ± 0.97 mmol/L and in low birth weight neonate, it was 3.75 ± 1.23 mmol/L. Mean blood glucose level of low weight baby was lower than the mean blood glucose level of a full-term normal weight baby. The difference of blood glucose levels was statistically significant. These findings were similar to some other studies where the mean blood glucose level was 45.54 ± 7.78 mg/dl in preterm low birth weight babies and 55.13 ± 7.81 mg/dl in normal weight full term babies.[19,20] Blood glucose levels were measured within 48 hours of birth in this investigation. The babies were divided into four groups based on the time it took to draw blood for glucose estimation: (A) 0-3 hours (B) 3-6 hours (C) 6-12 hours (D) 12-24 hours (E) 24-48 hours. The blood glucose levels of low-birth-weight newborns of various ages were compared to the blood glucose levels of full-term babies. Except for the A and B age groups and the B and C age groups, there was no significant variation in blood glucose levels between age groups. It was observed that the mean blood glucose levels were high in the LBW babies during their first 3 hours of birth, but it decreased during their 3-6 hours of life. The mean blood glucose saw an increase again in the 6-12 hour of life, but another drop was observed at the 12-24 hours of their life. In the normal weight full-term babies, however, there was a slight decrease in blood glucose levels at 3-6 hours of life, after which, blood glucose continuously increased. This was similar to a study by Fatos Tanzer, where they observed blood glucose at birth was high and fall during 0-3 hours and rises gradually.[21,22] They also concluded that hypoglycemia which was seen in first 3 hours of life can be physiological; and early feeding appears to influence subsequent glucose value. Only four patients were found to be hypoglycemic (blood glucose level 2.2 mmol/L) in our research. Two of these were full term normal weight babies, accounting for 6.67 percent of full term babies; the other two were low birth weight babies, accounting for 5.00 percent of low birth weight neonates. Three patients, on the other hand, were determined to be hyperglycemic (blood glucose level greater than 7.00 mmol/L). One instance was a full term normal weight baby, accounting for 3.33 percent of full term normal weight babies, while two cases were low birth weight babies, accounting for 5.00 percent of low birth weight babies. One of the hypoglycemic low birth weight babies was diagnosed with septicemia, with a blood glucose level of 2.00 mmol/L, and another with birth asphyxia. This was similar to a study by Pildes.[23] Breast feeding status, maternal illness (PET), and newborn sickness were shown to have significant associations among the various perinatal variables (septicemia, birth asphyxia). Hypoglycemia was most frequently related with fetal asphyxia, septicemia, and in diabetic mother's infant. Hyperglycemia and perinatal hypoxia were discovered in a very low birth weight (VLBW) infant. Clinical signs of hypoglycemia and hyperglycemia were discovered. Clinical hypoglycemia symptoms such as jitteriness, limpness, apnea, convulsion, feeding difficulties, and so on were seen.

Limitations of the Study

The study was conducted in a single hospital with small sample size. So, the results may not represent the whole community**.**

VI. Conclusion

According to the findings of this study, hypoglycemia is more frequent in the first 3-6 hours of life in both full-term and pre-term infants. Preterm low birth weight newborns are especially sensitive to hypoglycemia from the first hour of life. Hypoglycemia is more prevalent in septicemia, birth asphyxia, and diabetic mothers infant. Neonatal hyperglycemia is more frequent in babies with perinatal hypoxia and very low birth weight.

VII. Recommendation

Neonatal hypoglycemia is preventable and also treatable condition. So, early detection and effective treatment may decrease the morbidity and mortality of baby. So, in neonate and labor ward, routine blood glucose estimation should be done. Proper antenatal checkup and detection of risk factor associated with perinatal period – treatment of PET, birth asphyxia, and septicemia may reduce the development of abnormal glycemic status of newborn.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

References

[1]. Mclntosh N, Stenson B. The neonate. In: McIntosh N, Helms PJ, Smyth RL. Forfar & Arnil's Textbook of
[2]. Paediatrics. 6 th ed. Churchill Livingston 2003: 178.
[3]. Singh M, Deorari AK, Khajuria RC, Paul VK. Perinatal & neonatal mortality in a hospital. The Indian journal of medical research. 1991 Feb 1; 94:1-5.
[4]. Banu K, Rahman S. Disease pattern of neonatal period. Bangladesh J Child Health. 1982; 6:129-34.
[5]. Jane E, Mc Gowan. Neonatal hypoglycemia. Philadelphia Article. Endocrinology. July 1999: Neoreivews (2): 6-9.
[6]. Kalhan S, Saker F. Metabolic and endocrine disorders, Partone: Disorders of carbohydrate metabolism. In:
[7]. Fanaroff AA, Martin RJ, eds. Neonatal-perinatal medicine; Disease of the fetus and newborn. 6th ed. St.
[8]. Louis, MO; Mosby.Yean Book Inc: 1997.
[9]. Koh THH. Neuronal dysfunction during hypoglycemia. Arch. Dis. Child. 1988; 63: 1353-8.
[10]. Singh Z, Karu G, Goyal D L, Kaur M. Correlation of birth weight with other anthropometric measurements of newborns.Indian Journal of Basic and Applied Medical Research2013; 2: 870-79.
[11]. Mahmood AR, Haque GMS, Parvin T, Karim SR, Ferdousi Sk. Birth weight status of new born babies born at Dhaka medical college hospital.TAJ 2004; 17: 95-98.
[12]. Sajjaddian N, Shajar H, Rahimi F, Jahadi R, Barakat MG. Anthropometric measurement at birth as predictor of low birth weight. Health 2011; 3: 752-56.
[13]. Blanco CL, Baillargeon JG, Morrison RL, Gong AK. Hyperglycemia in extremely low birth weight infants in a predominantly Hispanic population and related morbidities. Journal of Perinatology. 2006 Dec; 26(12):737-41.
[14]. Milcic TL. Neonatal glucose homeostasis. Neonatal Network. 2008 May 1; 27(3):203-7.
[15]. Farrag HM, Cowett RM. Glucose homeostasis in the micropremie. Clinics in perinatology. 2000 Mar 1; 27(1):1-22.
[16]. Fanaroff AA, Korones SB, Wright LL, Verter J, Poland RL, Bauer CR, Tyson JE, PHILIPS III JB, Edwards W, Lucey JF, Catz CS. Incidence, presenting features, risk factors and significance of late onset septicemia in very low birth weight infants. The Pediatric infectious disease journal. 1998 Jul 1; 17(7):593-8.
[17]. Lilien LD, Rosenfield RL, Baccaro MM, Pildes RS. Hyperglycemia in stressed small premature neonates. The Journal of pediatrics. 1979 Mar 1; 94(3):454-9.
[18]. Pildes RS. Neonatal hyperglycemia. The Journal of pediatrics. 1986 Nov 1; 109(5):905-7.
[19]. Zarif M, Pildes RS, Vidyasagar D. Insulin and growth-hormone responses in neonatal hyperglycemia. Diabetes. 1976 May 1; 25(5):428-33.
[20]. Finberg L. Dangers to infants caused by changes in osmolal concentration. Pediatrics. 1967 Dec 1; 40(6):1031-4.
[21]. Misra PK, Tiwari DK, Sharma B, Kaul R. Free fatty acid and triglycerid in normoglycemic low birth weight newborns in early neonatal period. Ind. J. Pediatr 1984; 51: 637-641
[22]. Lubchenco LO, Baird H. Incidence of hypoglycemia in newborn infant as classified by birth weight and gestational age. Pediatrics 1971; 47: 831-37.
[23]. Tanzer Fatos, Yazar Nursel, Yazar Hidayet. Blood glucose level and hypoglycemia in full term neonate during the 48 hours of life. Journal of Topical Pediatrics. Vol-43, February 1997: 58-60.
[24]. Lucas A, Morely R, Cole TJ. Adverse neurodevelopment outcome of moderate neonatal hypoglycemia. Lancet 1984; 2: 311-3.
[25]. Pildes Rosita, Forbes Audrey F, Cornblath Marvin. The incidence of neonatal hypoglycemia – A complete survey. The Journals of Paediatrics, January 1967; 70: N. I. 76-80.

Dr. Nitish Kumar Kundu, et. al. "Determination of the Glycemic Status of Low birth weight (LBW) Babies." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 20(11), 2021, pp. 17-22.