



## Original Article

# Comparative study of Serum Creatinine and Serum Glucose Level between Term and Preterm Neonates in a Tertiary Care Hospital

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### Abstract

**Introduction:** A large number of babies are being delivered in our country prematurely. Renal function and glucose metabolism are not fully developed in these babies resulting in disturbance of their homeostasis.

**Objectives:** This study was conducted to measure serum creatinine and serum glucose in term and preterm infants and compare their values to find out any significant difference.

**Methodology:** This cross-sectional study included a total of hundred cases of neonates (term babies 50, preterm babies 50) who were admitted to the Paediatric inpatient department or delivered in the obstetrics department of Rajshahi Medical College Hospital during the period of July 2012 to December 2012. Data were collected from the parents who gave written informed consent. To test the results, whether they were statistically significant or not, 'z' test was applied.

**Result:** Among the total 100 neonates in the term group, the male-female ratio was 1:1.5, and in the preterm group, it was 1:1. In the preterm groups, 20 (20%) babies had a gestational age between 35-37 weeks, 15 (15%) babies had a gestational age between 32-34 weeks, and the rest 15 (15%) babies were in between 28-31 weeks. Here, mean serum creatinine value in term babies was  $0.89 \pm 0.16$  mg/dl, whereas that in the preterm babies was  $1.02 \pm 0.36$ . In the term babies, serum creatinine value  $> 0.9$  mg/dl was in 36%, and in the preterm babies, it was in 48%. Values of serum creatinine were found higher in the preterm neonates, which was statistically significant ( $Z = 2.338$ ,  $P < 0.05$ ). This study also showed mean serum glucose level in the term babies  $4.14 \pm 2$  mmol/l and in the preterm  $3.46 \pm 1.92$ . Hypoglycemia was found in 14% of term babies and 46% of preterm babies. Statistical analysis showed no significant difference between the means of the two groups (z test value 1.735 and p-value  $> 0.05$ ).

**Conclusion:** Raised serum creatinine is common in preterm babies. But, hypoglycemia may occur in both groups without any significant difference.

**Keywords:** Preterm babies, Term babies, Serum creatinine, Serum glucose.

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### Introduction

Being born prematurely is not an expected outcome for a fetus. For babies born near term,

this may have relatively few short- or long-term consequences. Still, for babies born particularly early, at 30 weeks of gestational age or less, there

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is a threat to survival and the subsequent quality of life. Preterm birth is a high-risk factor for perinatal morbidity, mortality, and later on neurodevelopmental disabilities.<sup>1</sup> Globally an estimated 9.6% (12.9 million) births are preterm birth, and in Bangladesh, the prevalence of preterm birth is 11.1%.<sup>2</sup> Thus, in Bangladesh, preterm delivery is a common condition demanding hospital admission.

As the rapid development of important functional cell structures in the lungs, pancreas, and kidneys takes place until the last few weeks of gestation, preterm birth may affect final development<sup>4,5</sup>. Thirty-four to thirty-six weeks of gestation seems to be a period of rapid maturation of various renal tubular transport mechanisms.<sup>5</sup> Though the full set of (1 million) glomeruli are achieved by 34 weeks of pregnancy, glomerular and tubular maturation goes on up to 2 months into postnatal life.<sup>6</sup> Therefore, a reduced nephron number after preterm birth persists throughout life and may affect long-term renal function and blood pressure.<sup>7,8</sup> So, early assessment of kidney function in the preterm baby is very much important.

Variation in blood glucose is an important metabolic problem in preterm babies. After birth, continuous transplacental transfer of glucose is interrupted. Neonates have to provide the brain and vital organs with sufficient glucose. In term newborn infants, this is accomplished through well-coordinated hormonal and metabolic adaptive changes. During the first week of life, preterm infants are at high risk of abnormal glucose homeostasis and development of hypoglycaemia<sup>10</sup> due to limited glycogen and fat stores.<sup>11</sup> Early detection and prompt management of blood glucose abnormality will ensure better management of these babies. Although hypoglycemia is very much common in these babies, the level may be even high. Hyperglycemia is common in extremely premature babies.

To the best of our knowledge, a few studies have been conducted on the assessment of serum creatinine and blood glucose in the context of prematurity in Bangladesh. But it seems to be

essential for immediate management, appropriate therapy, and thereby for improved outcome. So, this study was carried out to observe the difference in serum creatinine and serum glucose level between term and preterm infants and to ensure a better outcome for the preterm neonates.

## Materials and Methods

The present study was conducted in the Department of Pediatrics, Rajshahi Medical College Hospital, Rajshahi, over a period of six months from July 2012 to December 2012. It was a hospital-based cross-sectional study. Preterm neonates admitted in the Department of Pediatrics and term neonates delivered in the Department of Gynaecology and Obstetrics, Rajshahi Medical College Hospital, fulfilling the inclusion criteria were studied. Purposive sampling was done to select the study population. Total 100 Neonates (50 preterm and 50 term neonate), both male and female, age < 72 hours, whose parents gave written informed consent were included in the study. In the case of term babies, gestational age 37 completed weeks to <42 weeks with a birth weight of 2.5 kg to 4kg were included, and in case of preterm baby, 32 weeks to <37 completed weeks with birth weight 1kg to 2.5 kg were enrolled in the study. Neonates with Perinatal asphyxia, neonatal sepsis, meconium aspiration were excluded from the study. Neonates with palpable kidney, receiving frusemide, having a history of exchange transfusion, maternal diabetes, or hypertension were also excluded from the study. Serum creatinine 0.8-1.0 mg/dL was considered normal and levels above 1.5 mg /dl were considered as renal impairment.**11.12** Hypoglycemia was considered at plasma glucose 40 mg/dL (2.2 mmol/l)<sup>13</sup> and Hyperglycemia at plasma glucose > 125 mg/dL (7.0 mmol/l).<sup>13</sup>

**Study procedure:** Gestational age of the enrolled infants was assessed by counting from the first day of the last menstrual period and confirmed by the new Ballard scoring system. A detailed history was taken, and a clinical examination was done in each case. All the information was recorded in a structured questionnaire. Written informed consent was taken from the parents of each study infant;

No patient was to come in contact with any harmful device. The confidentiality of the patients was maintained strictly. Only if the parents give written consent, then the child is included in the study. With strict aseptic precaution, venous blood samples were collected and sent to the Pathology Department of Rajshahi Medical College Hospital for assessment of serum creatinine and serum

glucose level. After getting laboratory results, all data were recorded. After collecting data, these were analyzed and interpreted using Statistical Package for Social Science (SPSS) software version 20. We compare the means of variables of two groups using a two-sample Z test. Results were presented by appropriate charts and tables.

## Results

A total of 100 infants were included in the study. The number of terms and preterm babies was 50 each. In the term group, the male-female ratio was 1:1.5, and in the preterm group, it was 1:1. The distribution of the study population by gestational age is shown in table 1. The distribution of the study population by sex is shown in figure 1. Neonates with birth weight >2500 gm were 35 (35%), birth weight 1500-2500 gm were 15 (15%), birth weight 1000-1500 gm were 25 (25%), birth weight 1500-2500 gm were 10 (10%).

In the term babies, serum creatinine value > 0.9 mg/dl was in 18 (36%), and in the preterm babies, it was in 24 (48%). The mean serum creatinine value in term babies was  $0.89 \pm 0.16$  mg/dl, whereas that in the preterm babies was  $1.02 \pm 0.36$ . There was a significant difference between the mean of the two groups (p-value <0.05), where z test value was 2.338.

Mean serum glucose level in the term  $4.14 \pm 2$  mmol/l and in the preterm  $3.46 \pm 1.92$ . Hypoglycemia was found in 7 (14%) in the term babies and 23 (46%) in preterm babies. We compare the mean of the two groups. Here z test values were 1.735 and p-value >0.05. The serum glucose level of preterm neonates was not significantly higher than that of term neonates.

**Table 1:** Distribution of the study population by gestational age

Gestational age	Frequency	Percentage
38- 42 weeks	50	50%
35-37 weeks	20	20 %
32-34 weeks	15	15 %
28-31 weeks	15	15 %

Table 1 shows the distribution of the neonates by gestational age. Term neonates with gestational age 38-42 weeks were 50 (50%), gestational age 35-37 weeks were 20 (20%), gestational age 32-34 weeks were 15 (15%), and gestational age 28-31 weeks were 15 (15%).

Fig 1: Distribution of study population by sex

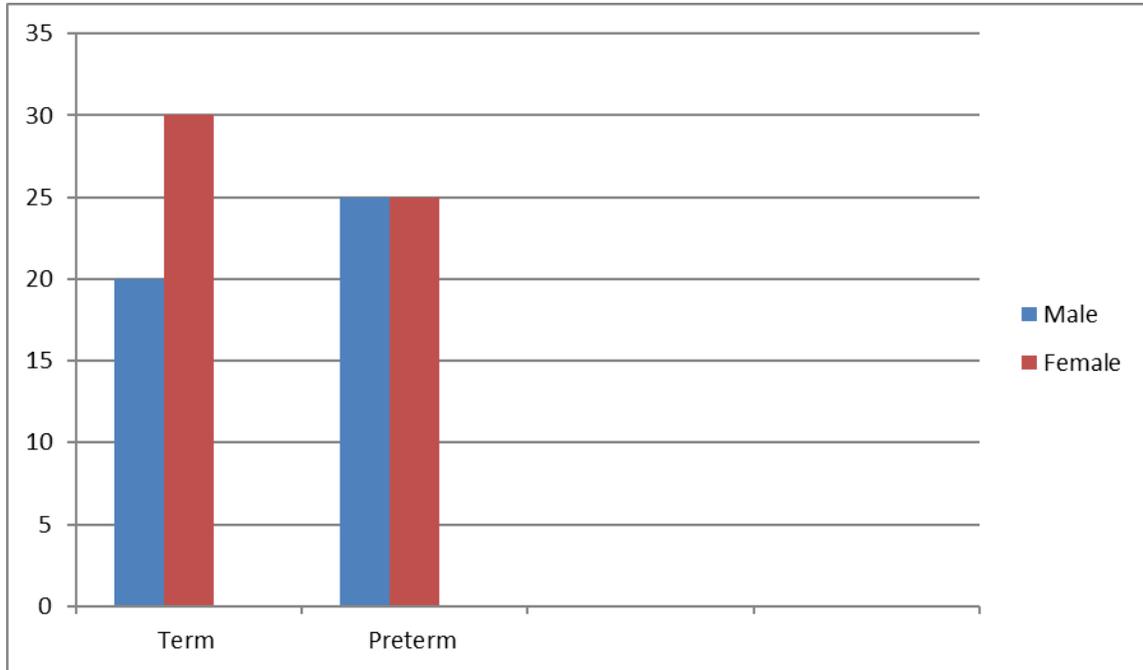


Figure 1 shows the sex distribution of the term and preterm neonates. There were 20 (40%) males and 30(60%) females in the term group and 25 (50%) males and 25 (50%) females in the preterm group.

**Table 2:** Serum creatinine level in the neonates with gestational age

Gestational Age	Serum creatinine		Mean $\pm$ SD
	$\leq 0.9$ mg/dl	$> 0.9$ mg/dl	
38-42 weeks	32 (64%)	18 (36%)	0.89 $\pm$ 0.16
35-37 weeks	11(55%)	9(45%)	0.95 $\pm$ 0.28
32-34 weeks	9(60%)	6(40%)	1.00 $\pm$ 0.40
28-31 weeks	6(40%)	9(60%)	1.15 $\pm$ 0.41

Table 2 shows serum creatinine levels in neonates of different gestational ages. Mean serum creatinine value in term (38-42 weeks) was 0.89 $\pm$ 0.16 mg/dl, but in the 35–37-week infant was 0.95 $\pm$ 0.28 mg/dl. Serum creatinine value  $> 0.9$  mg/dl were in 36% of the 38-42 week infant, in 45% of the 35-37week infant, in 40% of the 32-34 week infant and in 60% of the 28-31 week infant.

**Table 3:** Comparison between Serum creatinine level in the term and preterm babies

Gestational Age	Serum creatinine		Mean ( $\pm$ SD)	P-value
	$\leq 0.9$ mg/dl	$> 0.9$ mg/dl		
Term (n=50)	32 (64%)	18 (36%)	0.89 $\pm$ 0.16	<0.05
Preterm (n=50)	26(52%)	24(48%)	1.02 $\pm$ 0.36	

Table 3 shows serum creatinine in the neonates where Z test value 2.338; P-value < 0.05

**Table 4:** Serum glucose level in the neonates with gestational age

Gestational Age	Serum glucose (mmol/L)			Total
	< 2.2	2.2-7.0	>7.0	
38-42 weeks	7(14%)	36(72%)	7(14%)	50
35-37 weeks	10(50%)	9(45%)	1(10%)	20
32-34 weeks	8(53.33%)	7(46.66%)	0(0%)	15
29-31 weeks	7(46.66%)	8(53.33%)	0(0%)	15

Table 4 shows serum glucose levels in the neonates in relation to gestational age. Glucose levels <2.2 mmol/L (Hypoglycemia) were found in 14% neonates with gestational age 38-42 weeks, in 50% neonates with gestational age 35-37 weeks, in 53.3% neonates with gestational age 32-34 weeks, and in 46% neonates with gestational age 28-31 weeks.

**Table 5:** Comparison between Serum glucose level in the term and preterm babies

Gestational Age	Serum glucose (mmol/L)			Mean $\pm$ SD
	< 2.2	2.2-7.0	>7.0	
Term	7(14%)	36(72%)	7(14%)	4.14 $\pm$ 2
Preterm	23(46%)	26(52%)	1(2%)	3.46 $\pm$ 1.92

Table 5 shows serum glucose levels in term and preterm babies. Here, Z test value were 1.735; P-value > 0.05.

## Discussion

A total of 100 neonates were included in the study. All babies were assessed by history, physical examination. In the preterm groups, 20 (20%) babies had a gestational age between 35-37 weeks,

15 (15%) babies had a gestational age between 32-34 weeks, and the rest 15 (15%) babies were in between 28-31 weeks.

In this study, serum creatinine was measured as a marker of renal function, with levels 0.8-1 mg / dL considered normal value in newborns. Here, the

mean serum creatinine value in term babies was  $0.89 \pm 0.16$  mg/dl, and that in the preterm babies was  $1.02 \pm 0.36$ . In the present study, mean serum creatinine value in term (38-42 weeks) were  $0.89 \pm 0.16$  mg/dl, that in the 35-37 week infants were  $0.95 \pm 0.28$  mg/dl, in 32-34 week infants were  $1.00 \pm 0.40$  and in 28-31 week infant, serum creatinine was  $1.15 \pm 0.41$ . This shows a gradual increase in serum creatinine with increasing prematurity. This finding was consistent with Singh S<sup>14</sup> and S Lacobelli<sup>15</sup>. Singh S et al. observed that creatinine levels in 28-30 weeks of gestational age were  $67.64 \pm 7.4$ , that in the 30-32 weeks were  $58.52 \pm 3.8$  and in 34-36 weeks it was  $46.31 \pm 7.7$ ; all of which suggests that serum creatinine level was significantly increased at 28-30 weeks and 30-32 weeks as compared to 34-36 weeks of gestational age in preterm neonates<sup>14</sup>. However, raised serum creatinine levels were transient in all of these cases. No infant died in this study due to renal failure. Serum creatinine came down to normal by 3-7 postnatal days on follow-up investigation. This finding was consistent with Mannan MA, Shahidulla M, Salam F et al<sup>16</sup>. Transient high serum creatinine might be due to the backflow of creatinine across leaky immature tubular and vascular structures. Renal failure should be suspected if the serum creatinine value rises or fails to show normal postnatal fall.

In the present study, mean serum sugar levels in the term babies were  $4.14 \pm 2$  mmol/l and in the preterm,  $3.46 \pm 1.92$ . Hypoglycemia was found in 7 (14%) patients in the term babies and 23(46%) patients in preterm babies, but this was not statistically significant. In contrast to our study, lower serum glucose levels in preterm infants have been reported by norval<sup>17</sup> and lubchenco<sup>18</sup>.

Preterm neonates are highly prone to develop raised serum creatinine and hypoglycemia in the first few days of their life. Although renal function impairment is rare, careful monitoring for renal function and early diagnosis of renal failure and hypoglycemia are necessary for treatment & better outcomes for these babies. The study was based on a small sample size of one hundred infants. So the study does not accurately represent the whole neonates of the population. If the study was

conducted on larger sample size, the result would be more satisfactory.

## Conclusion

Preterm birth is still a major concern in our country. The transition from fetal to neonatal life requires a number of adaptations that are more difficult to accomplish by preterm than term newborns. Most of these babies suffer from a variety of complications; inadequate kidney function and fluctuating blood glucose are important of them. Knowledge about the reference range of serum creatinine can exactly diagnose the disease, eliminate the hazards of anxiety and unnecessary investigations in otherwise normal cases, and also be essential for proper management of fluid and electrolytes in them. Early detection and prompt management of blood glucose abnormality will ensure better management of these babies.

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