

Original Article

Serum Calcium Level in Umbilical Cord Blood of Preterm and Term Babies

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Abstract

A cross sectional study was conducted in the Department of Biochemistry, Dhaka Medical College, Dhaka, from July 2017 to June 2018 to evaluate the serum calcium level in umbilical cord of preterm and term babies. In this study, hundred newborn babies were selected according to selection criteria from the Department of Obstetrics, Dhaka Medical College Hospital, Dhaka. Among them fifty were preterm (Group A) and fifty were term babies (Group B). Informed written consent from the mother or legal guardian of babies was taken after full explanation of procedure regarding this study. In Group A, mean±SD of serum calcium was 7.28±0.69 (mg/dl) where as in Group B, mean±SD of serum calcium was 9.42±0.70 (mg/dl). This value was significantly lower ($p<0.001$) in Group A than Group B. Serum calcium has significant ($p<0.001$) positive correlation with gestational age but no significant correlation with birth weight. Finding of this study might be helpful for early diagnosis of calcium deficiency in the preterm babies and also help to prevent the deficiency related neonatal morbidity and mortality.

Key words: Preterm, Term, Serum calcium, Gestational age and Birth weight.

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Introduction

Preterm birth is an emerging threat to newborn survival. Every year, 15 million babies are born preterm i.e. before 37 completed weeks of gestation, representing a rising. In southern Asia has the highest preterm birth rate of 11.1% and this number

is burden, 3.87 million among all region followed by Sub-Saharan Africa is 3.2million and South eastern Asia, Oceania are 1.9 cause of death, responsible for approximately 1 million deaths in every year. Among the top ten countries with the greatest number of preterm birth

Bangladesh is one of them. This is around 2.8% of the global preterm burden, although the proportional contribution of Bangladesh in global live births is only 2.3%. The rate of preterm in Bangladesh is around 14.1% of live births. Some risk factors and causes such as multiple pregnancies, fetal distress, placental dysfunction, placenta previa, abruptio placenta, teenage mother, pre-eclampsia, chronic medical illness, infection, diabetes mellitus, premature rupture of membrane, bicornuate uterus, incompetent cervix are associated with preterm birth.¹ Wide range of internal physiological changes occur during the time of pregnancy. It is a period of rapid growth and cell differentiation and alterations in dietary supply both for the mother and the fetus.²

The fetal skin is not yet keratinized in early stage of pregnancy, then through simple diffusion minerals are

transported from the amniotic fluid to the fetus. Later in pregnancy, transfer of minerals from mother to the fetus placenta and umbilical cord plays an important role. There are several factors such as food intake, supplementation, week of gestational age, health status and smoking status may influence the mineral status of pregnant women.³ There is increased demand of all the nutrient at the time of pregnancy and deficiency of any of this nutrient could affect pregnancy, delivery and outcome of pregnancy. During pregnancy alteration of calcium concentration occur in blood.⁴ Calcium is most abundant mineral in the body. Of the body's total calcium, bone store 99% of calcium and less than 1% in serum. Calcium has many biological functions- calcium messenger systems by which extracellular messengers regulate cell function, activation of several cellular enzyme cascades, smooth muscle and myocardial contraction, nerve impulse conduction, secretory activity of exocrine gland. Approximately, 30 gm calcium is required to mineralize its skeleton and to maintain normal physiologic processes.⁵ Inadequate nutritional intake, decreased responsiveness of parathyroid hormone to vitamin D as immature parathyroid gland, increased calcitonin level, increased urinary losses and hypoalbuminemia are the main causes to develop calcium deficiency in preterm babies. For calcium deficiency preterm baby may develop convulsion due to CNS irritability. Fetoscopy assess increase in cord blood serum calcium with increasing gestational age among the fetuses.⁶

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There is a significant link between mineral status in gestational age and fetal development, as well as with the subsequent health of the neonates. Mineral deficiencies are considered to be contributing factors in premature birth, miscarriage, intra-uterine growth restriction, birth defects and immune systems impairment. Various studies show mineral deficiency found in umbilical cord blood of preterm newborn babies. The aim of study is to assess the serum, calcium level in umbilical cord blood of preterm babies and compare them with term babies. The outcome of the study will help early diagnosis of mineral deficiency and also help to prevent deficiency related neonatal morbidity and mortality and any complication of them. We need to develop preventive strategies like regular antenatal check-up for estimation of serum calcium level of pregnant women and provide mineral supplementation to them, as the maternal serum calcium concentration influence the gestational age and birth weight of neonates as outcome of pregnancy and however, there is need for proper, adequate and balanced nutrient during pregnancy to affect neonates as healthy outcome.

Materials and Methods

This cross sectional study was carried out in the Department of Biochemistry, Dhaka Medical College, Dhaka, during the period of July 2017 to June 2018. The study subjects were 50 preterm (Group A) and 50 term babies (Group B), selected from Department of Obstetrics, Dhaka Medical College Hospital by purposive sampling. Diagnosed case of preterm labour and term labour were included in this study. Babies, whose mother have history of DM, chronic illness, malignancy, COPD, CKD, Liver diseases were excluded from this study. Data was collected in predesigned data collection sheet. Prior to the collection of blood sample, the objectives, nature, purpose and potential risk of all procedures used for the study explained in details and informed written consent was taken from the mother or legal guardian of babies. With all aseptic precaution 5ml blood sample was collected from maternal end of umbilical cord immediately following delivery from each study subject in a dry, clean, deionized test tube without any anticoagulant, test tubes were labeled and coded for identification and kept in slanting position up to 30 minutes, then centrifuged at 3000rpm for 10 minutes and the separated serum was kept in Eppendorf tube after proper labeling. From each Eppendorf about 20µl serum was used for serum calcium. Serum calcium was measured by colorimetric method. All the biochemical tests were carried out as early as possible. Whenever there was a delay, the sample was stored in ultra-freezer at - ,to avoid loss of bioactivity and contamination. All the biochemical tests were performed in the Department of Biochemistry, Dhaka Medical College, Dhaka. Continuous data were expressed as

mean ±SD and compared between two groups of babies by unpaired Student's t-test. Correlation was done by Pearson's correlation coefficient. All p values were two-tailed with significance defined as p<0.05 at the level of 95% confidence interval (CI). All analysis was done using the SPSS 22 (Statistical Package for Social Science) package for windows.

Results

Table 1: Demographic profile of the preterm and term babies (N=100)

Variables	Groups		t value	p value
	Group A (n=50) mean±SD	Group B (n=50) mean±SD		
Birth weight (kg)	2.10±0.51	2.93±0.40	8.97	<0.001
Gestational age (weeks)	33.96±1.93	38.68±1.17	14.81	<0.001

*Unpaired Student's 't' test was done to measure the level of significance

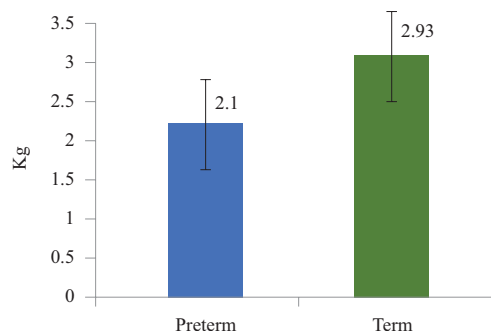


Figure 1: Bar diagram showing birth weight in preterm and term babies

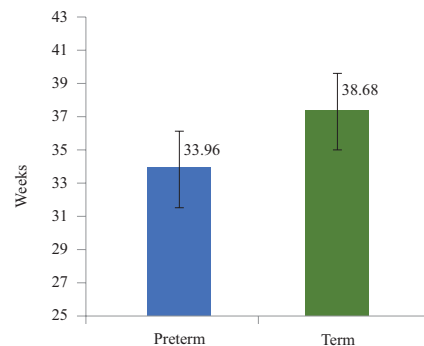


Figure 2: Bar diagram showing gestational age in preterm and term babies

Table 2 shows the laboratory findings of the preterm and term babies. The study revealed that mean±SD of serum calcium level was in Group A 7.28±0.69mg/dl. In Group B, mean±SD of serum calcium level was 9.42±0.70 mg/dl. Serum calcium level was (p value <0.001) lower in

Group A than Group B

Table 2: Laboratory findings of the preterm and term babies (N=100)

Parameters	Groups		t value	p value
	Group A (n=50) mean±SD	Group B (n=50) mean±SD		
Serum Calcium (mg/dl)	7.28±0.69	9.42±0.70	15.36	<0.001

*Unpaired Student's 't' test was done to measure the level of significance

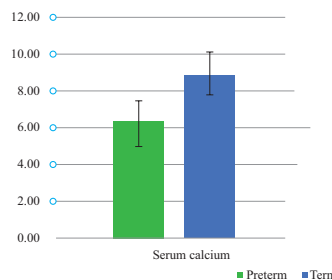


Figure 3: Bar diagram showing Serum Calcium in preterm and term babies

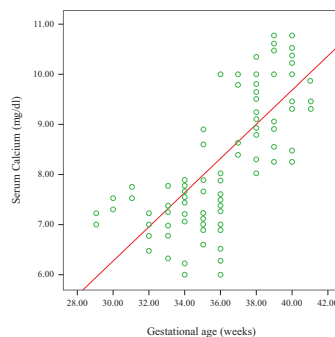


Figure 4: Scattered diagram showing correlation between gestational age and serum calcium (r = 0.731; p= <0.001). Significant positive correlation between gestational age and serum calcium.

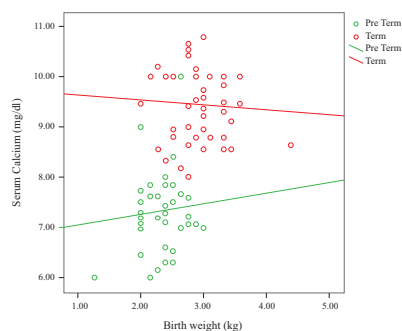


Figure 5: Scattered diagram showing correlation between birth weight and serum calcium in preterm and term (r = +0.141; p= 0.328 and r = -0.040; p=0.784)

Discussion

Preterm birth refers to the birth of a baby before 37 completed weeks of gestation. A term baby was defined as birth of baby anytime from 37 weeks to 42 weeks of gestation. Preterm birth is increasingly common complex condition with multiple risk factor and has substantial medical, psychological, economic and social impacts. Lungs are the most common organ that is affected by preterm delivery, because these are one of the last organ to develop in utero.⁷

In perinatal health care preterm delivery is a major challenge. The incidence of preterm delivery in most developed countries has been about 7–10% of live births over the past 30 years. Contribution of several factors are responsible for overall rise in the incidence of preterm delivery. These factors are- increased use of assisted reproduction techniques, increasing rates of multiple births, and more obstetric intervention. The key hormone of pregnancy is progesterone. The progesterone induced blocking factor (PIBF)⁷ release from lymphocytes of pregnant women which mediates the immunomodulatory and antiabortive effects of progesterone due to presence of progesterone. Upregulation of progesterone receptors on activated lymphocytes among placental cells and CD8+ cells by immunologic recognition of pregnancy and subsequent activation of maternal immune system. Increased pro inflammatory cytokines, low PIBF, and reduced IL-10 expressions on lymphocytes present in patients at risk of preterm delivery.⁸

Now a day's progressive steps has taken to improve the survival of premature neonates, mostly by timely interventions, antenatal administration of corticosteroids, better NICU care and exogenous surfactant therapy but still leading cause of neonatal morbidity and mortality is the prematurity.¹¹ The most frequent neonatal morbidities include respiratory abnormalities, patent ductus arteriosus, intra cranial hemorrhage, jaundice, necrotizing enterocolitis, infections, chronic lung disease and retinopathy of prematurity.⁹

Serum calcium is critical for development of fetus. Deficiency of calcium can lead to the adverse maternal and fetal outcome. This study was done to see the serum calcium level in cord blood of preterm and term babies.

In the present study, mean±SD of serum calcium in preterm and term babies was 7.28±0.69 mg/dl and 9.42±0.70 mg/dl respectively. Mean serum calcium was significantly lower (p<0.001) in preterm babies than that of term babies which was similar with an observational study conducted by Elizabeth et al.¹⁰ in India over 500 newborn babies. He found significant lower serum calcium level in preterm than term babies. Another prospective study was carried out by Deshpande

et al.¹¹ over 72 preterm and 428 term babies and found mean values of serum ionic calcium in cord blood of preterm babies were 1.11mmol/l and term babies were 1.10mmol/l. So, there was no significant difference of serum ionic calcium in cord blood of preterm and term babies. This result was far away from this study. This is may be due to different selection criteria and unequal distribution of preterm and term babies.

In the present study, serum calcium level has significant positive correlation with gestational age. This finding was similar to the findings of study conducted by Fenton et al.⁶ and Bayomy et al.¹² In the current study, serum calcium level was positively correlated with birth weight but not significant in preterm babies and serum calcium is negatively correlated with birth weight but not significant in term babies. During search, no study found about correlation of serum calcium with birth weight.

Conclusion

It is concluded from this study that, serum calcium level in cord blood of preterm babies are lower than the term babies. There is significant positive correlation of serum calcium level with gestational age but no significant correlation with birth weight. So, routine checkup of mother for serum calcium level is needed to prevent hypocalcemia of babies and to prevent this element deficiency related neonatal morbidity and mortality.

The limitations of this study were- sample was taken purposively, so there may be chance of bias which can influence the result, correlation of serum calcium level between mother and baby was not done.

Large scale prospective study may be carried out nationwide to confirm the alteration of serum calcium level in the umbilical cord blood between preterm and term babies. Correlation of serum calcium level between mother and baby would be done. Routine estimation of serum calcium level of pregnant women during antenatal check-up would be done.

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