

## Original Article

## Medical Science

## Serum Calcium, Phosphorus and Alkaline Phosphatase levels in Preterm Babies

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## ABSTRACT [ENGLISH/ANGLAIS]

Preterm is defined as a baby with a gestation of less than 37 completed weeks. Premature infants are known to be at risk of developing metabolic bone disease. Preterm have low serum Calcium and Phosphorus level, with increased serum alkaline phosphates activity. In this study serum Calcium, Phosphorus and ALP activities were measured in preterm babies. The present study comprised of 75 preterm babies of which 25 were of 28-30 weeks, 25 were of 30-32 weeks and remaining 25 were of 34-36 weeks (controls) of gestational age. Serum Calcium and Phosphorus levels were found to be significantly low and serum ALP activity were found to be significantly high ( $p < 0.001$ ) at 28-30 weeks as compared to 34-36 weeks (controls) but serum Calcium and Phosphorous levels were found to be insignificantly low while serum ALP activities were found to be insignificantly high at 28-30 weeks as compared to 30-32 weeks of gestational age in preterm babies. The correlation between serum Calcium and Phosphorus were found to be positive at all gestational ages whereas serum ALP is negatively correlated with serum Calcium and Phosphorus at all gestational ages. It can be concluded that high serum ALP activity and low serum Calcium, and Phosphorus levels are associated with preterm babies.

**Keywords:** Pregnancy, preterm, calcium, phosphorus, alkaline phosphatase, perinatal

## RÉSUMÉ [FRANÇAIS/FRENCH]

Prématurité est définie comme un bébé avec une gestation de moins de 37 semaines terminées. Les bébés prématurés sont connus pour être à risque de développer une maladie métabolique des os. Prématurés ont un faible taux sérique de calcium et de phosphore niveau, avec augmentation de l'activité sérique des phosphates alcalins. Dans cette étude du sérum activités calcium, phosphore et ALP ont été mesurés chez les bébés prématurés. La présente étude composé de 75 bébés prématurés dont 25 ont été des semaines 28-30, 25 étaient de 30-32 semaines et 25 autres ont été des 34-36 semaines (contrôles) de l'âge gestationnel. Calcium sérique et de phosphore ont été trouvés à être très faible et l'activité sérique ALP ont été trouvés pour être significativement élevé ( $p < 0,001$ ) à la semaine 28-30 en rapport à 34-36 semaines (témoins), mais le calcium sérique et de phosphore ont été trouvés à être négligeable à faible tandis que les activités ALP sérique ont été trouvés pour être insignifiantement élevé à 28-30 en semaine par rapport à 30-32 semaines d'âge gestationnel chez les bébés prématurés. La corrélation entre le taux sérique de calcium et de phosphore ont été trouvés positifs à tous les âges gestationnels alors ALP sérique est corrélée négativement avec la calcémie et de phosphore à tous les âges gestationnels. Il peut être conclu que l'activité haute et basse ALP sérique de calcium sérique et de phosphore sont associés à des bébés prématurés.

**Mots-clés:** Grossesse, prématurité, calcium, phosphore, phosphatases alcalines, périnatale

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Accepted/Accepté:  
June, 2011

Full Citation:  
Chauhan SS,  
Sarkar PD. Serum  
Calcium,  
Phosphorus and  
Alkaline  
Phosphatase levels  
in Preterm Babies.  
World Journal of  
Life Sciences and  
Medical Research  
2011;9(3):56-9.

## INTRODUCTION

Preterm is defined as a baby with a gestation of less than 37 completed weeks (that is, up to 36 weeks or less than 259 days) [1]. A "premature" infant is one that has not yet reached the level of fetal development that generally allows life outside the womb. In the normal human fetus, several organ systems mature between 34 and 37 weeks, and the fetus reaches adequate maturity by the end of this period [2].

Preterm birth is a high risk factor for perinatal morbidity, mortality and later on neurodevelopmental disabilities

and adverse respiratory outcome [3]. Although, the rate of premature birth appears to vary by geographic region, the reported incidence varies between 6 and 10% [4]. Maternal medical conditions increase the risk of PB, and often labor has to be induced for medical reasons; such conditions include high blood pressure [5] pre-eclampsia [6] maternal diabetes [7] asthma, thyroid disease, and heart disease [8].

An increased risk of prematurity has been noticed among mothers who had a history of previous abortion and a history of previous twin pregnancy [9]. Worldwide,

prematurity accounts for 10% of neonatal mortality, or around 500,000 deaths per year [10]. The incidence of preterm deliveries in India is 14.5% [11].

Premature infants are known to be at risk of developing metabolic bone disease (MBD) [12]. Metabolic bone disease is characterized by a failure of complete mineralization of osteoid and encompasses disturbances ranging from mild under mineralization (osteopenia) to severe bone disease with fractures (rickets). MBD is common (50–60%) in infants 28 wk of gestation and in those with birth weights 1000 g or less. In these infants, the cause is usually inadequate Ca and phosphate intake. The risk of MBD is inversely proportional to gestational age and birth weight, and directly related to postnatal complications.

Biochemical measurements of serum Ca, inorganic phosphate (Pi), and alkaline phosphatase (ALP) activity are used routinely to identify infants with MBD [13].

## MATERIALS AND METHODS

For the present study 75 babies admitted to Department of Pediatrics and its neonatal unit was enrolled. The enrolled neonates were further divided into study group [50 neonates] and control group [25 neonates]. Fasting blood samples (12hr) were collected in EDTA vials & serum calcium, phosphorus and alkaline phosphatase were measured in three different groups of preterm babies at 28-30 weeks, 30-32 weeks and 34-36 weeks of GA.

Serum calcium was estimated by OCPC method. Serum phosphorus was estimated by Modified Metol method. Serum alkaline phosphatase was estimated by Kinetic p-NPP method.

Student-t test will be applied to calculate the significance in differences of these parameter between the groups. Regression analysis will be done to study the interrelation between the said parameters. All calculation will be done by SPSS 9 software.

## RESULTS AND DISCUSSION

The present study was conducted in neonatal intensive care unit of Department of Pediatrics, Kamla Nehru Hospital in collaboration with Department of Biochemistry, Gandhi medical college, Bhopal, M. P. from January 2008 to January 2009.

Of the 75 preterm babies enrolled 45% were males & 30% females and there is 37 mothers of preterm babies were of

a poor dietary intake, whereas 20 mothers were of an average dietary intake & 18 mothers were of a normal dietary intake.

The main findings of the study were:

1. Serum calcium & phosphorus levels were significantly low at 28-30 weeks as compared to 34-36 weeks (Controls), but it was insignificantly low at 28-30 weeks as compared to 30-32 weeks & at 30-32 weeks as compared to 34-36 weeks (Controls) of gestational age in preterm babies.
2. Serum alkaline phosphatase level was significantly high at 28-30 weeks & 30-32 weeks as compared to 34-36 weeks of gestational age in preterm babies but it was insignificantly high at 28-30 weeks as compared to 30-32 weeks in preterm babies.
3. The correlation between serum calcium & phosphorus were found to be positive at all gestational ages. The each of them increases with the advancement of GA in preterm babies.
4. Serum alkaline phosphatase is negatively correlated with serum calcium & phosphorus at all gestational ages. As the gestational age increased, the activity of serum alkaline phosphatase was found to significantly decrease in preterm babies.
5. Serum calcium & phosphorus level in preterm babies whose mothers were fed calcium & phosphorus rich diet was found to be significantly higher than that found in preterm babies whose mothers were not fed calcium & phosphorus rich diet.

**TABLE 1**

Table 1 shows comparison of serum calcium, phosphorus and serum alkaline phosphatase levels at 28-30 weeks & 34-36 weeks (Controls) of gestational age in preterm babies.

Parameter	Cases	Controls	P-Value
	(n = 25)	(n = 25)	
	28-30 weeks	28-30 weeks	
Serum Calcium (mg/dl)	7.044 ± 1.753	9.284 ± 1.276	< 0.001
Serum Phosphorus (mg/dl)	3.012 ± 0.799	5.256 ± 1.308	< 0.001
Serum Alkaline Phosphatase (IU/L)	625.56 ± 176.28	322.08 ± 80.07	< 0.001

**TABLE 2**

Table 2 shows comparison of serum calcium, phosphorus and serum alkaline phosphatase levels at 30-32 weeks & 34-36 weeks (Controls) of gestational age in preterm babies.

Parameter	Cases (n = 25)	Controls (n = 25)	P- Value
	28-30 weeks	28-30 weeks	
Serum Calcium (mg/dl)	8.176 ± 1.771	9.284 ± 1.276	NS
Serum Phosphorus (mg/dl)	4.256 ± 1.126	5.256 ± 1.308	NS
Serum Alkaline Phosphatase (IU/L)	503.48 ± 164.37	322.08 ± 80.07	< 0.001

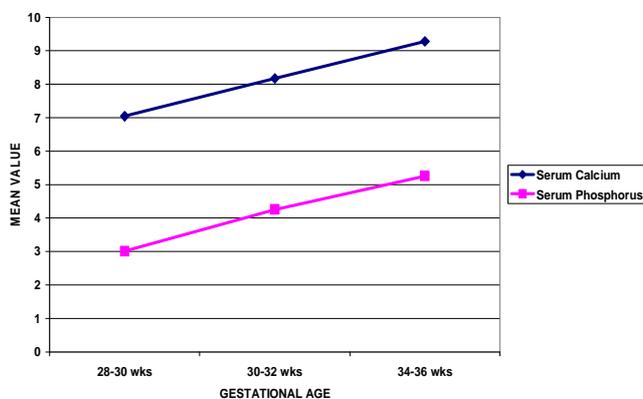
**TABLE 3**

Table 3 shows comparison of serum calcium levels in preterm babies whose mothers were fed & were not fed calcium rich diet (Milk, Beans, Egg, Leafy Vegetables, Cabbage etc).

Serum Calcium in preterm babies		
Whose mothers were not fed calcium rich diet	Whose mothers were fed calcium rich diet	P-Value
6.972 ± 1.506	8.684 ± 1.410	< 0.01

**FIGURE 1**

Figure 1 shows the trend of serum calcium and phosphorus in preterm babies



Decreased serum calcium & phosphorus levels in preterm babies signifies inadequate calcium & phosphate intake,

reduced opportunity for transplacental mineral delivery & excessive mineral loss after birth in preterm babies, decreased bone mineralization & increased bone resorption, increased calcitonin & increased urinary calcium & phosphorus excretion in preterm babies. Increased alkaline phosphatase level signifies increased bone cellular or osteoblastic activity in preterm babies.

**TABLE 4**

Table 4 shows comparison of serum phosphorus levels in preterm babies whose mothers were fed & were not fed phosphorus rich diet (Milk, Cereals, Meat, Egg, Leafy Vegetables etc).

Serum phosphorus in preterm babies		
Whose mothers were not fed calcium rich diet	Whose mothers were fed calcium rich diet	P-Value
2.9 ± 0.817	4.92 ± 1.208	< 0.05

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#### ACKNOWLEDGEMENT / SOURCE(S) OF SUPPORT

Nil

#### CONFLICT OF INTEREST

No conflict of interest was declared by authors.

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