

Original Article

Serum calcium and phosphate level in normal pregnant women

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Abstract:

Background and Objectives: Pregnancy is the physiological process in which progressive anatomical, physiological and biochemical changes occur. Secretion of different hormones during pregnancy is responsible for maternal adaptation to the increasing demand of the growing fetus. The present study was aimed to evaluate serum calcium and phosphate status in normal pregnant women in different trimesters. **Materials and Methods:** A total number of 140 subjects, age range 20-40 (yrs) were recruited in the study which includes 100 normal pregnant women termed as study group (Group B) and 40 healthy women without pregnant (Group A), served as Control. Group B subjects were subdivided into Group B1 (n=12), Group B2 (n=30) and Group B3 (n=58) on the basis of duration of pregnancy- 1st, 2nd and 3rd trimesters respectively. Calcium was measured by CPC (photometric method for Ca) and serum phosphate by colorimetric method. Statistical analysis was done using SPSS for Windows, Version 10. Unpaired Student's 't' test performed to calculate statistical differences between groups. **Results:** Age (yrs) (mean±SD) and BMI of the pregnant women in different groups did not show statistical difference. Serum calcium (mean±SD) levels in the 1st (p=0.0001) and 2nd (p=0.02) trimester was significantly higher compared to the Controls. In 3rd the value was significantly lower (p=0.015) compared to the Controls and of 1st and 2nd trimesters (p=0.001). Serum phosphate (mean±SD) levels in three trimesters did not show statistical significant difference compared to the Controls and among the pregnancy groups. **Conclusion:** The data concluded that serum calcium level was lower during third trimester of the study subjects which may be explained by the fact of increased demand of the growing fetus and exposing the mother at risk of complications related to low serum calcium.

Key words: calcium, phosphate, pregnancy.

Introduction:

Maternal physiological change during pregnancy is concerned with the nutrition of growing fetus and her own adaptation needed for this purpose¹. It is known that maternal nutrition during pregnancy exerts profound effect on fetal growth and development²⁻⁴. In the face of reduced nutrient intake or increased nutrient requirements competition between the mother and the fetus may limit the availability of the nutrients required for optimal fetal growth^{5,6}. Usually fetal growth involves an increase in cell number during embryonic and fetal development which is followed by an increase in cell size and this growth becomes dominant in the third trimester⁷. The normal fetal skeleton has accreted about 30g calcium by the end of gestation, but about

80% of the accretion occurs rapidly during the third trimester which is attributed to the axial growth⁸. In achieving the growth maternal dietary composition found to have important effect⁹. During pregnancy, the very high circulatory concentrations of estrogen and progesterone alter the concentration of many substances in the maternal blood¹⁰. Maternal blood calcium and phosphate level found to vary in different trimesters¹¹⁻¹³. Lower maternal serum calcium level was found to be associated with pregnancy induced hypertension and pre-eclampsia, and calcium supplementation was suggested to circumvent the plausible conditions¹⁴⁻¹⁵. Lower bone calcium and phosphate is associated with increase risk of maternal bones fracture⁸. Data are lacking regarding the serum calcium status of pregnant women in different

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Serum calcium and phosphate level in normal pregnant women

trimesters. However, Akhter et al (2003) have measured serum calcium level in third trimester¹⁶. They have demonstrated lower serum calcium level during pregnancy. In the present study attempt was made to evaluate serum calcium and phosphate status in different trimester. Result of the study may help in understanding the dynamics of serum calcium and phosphate in different trimesters and provide a lead in future study of pregnancy related complications.

Table I: Age and BMI in different study groups

Group	Age (yrs)	BMI (Kg/m ²)
Group A (n=40)	26.18±5.2	25.1±5.2
Group B ₁ (n=12)	26.75±4.3	24.2±3.5
Group B ₂ (n=30)	25.67±4.0	25.4±5.3
Group B ₃ (n=58)	25.28±3.8	23.3±3.4

Results were expressed as mean±SD. n=number of subjects. Unpaired t-test was performed to calculate statistical difference between groups. P value <0.05 was taken as level of significance.

Group A; Healthy non pregnant control group, Group B₁, 1st trimester pregnant cases; Group B₂, 2nd trimester pregnant cases; Group B₃, 3rd trimester pregnant cases

Materials and methods:

This cross sectional study was carried out in the Department of Physiology, Dhaka Medical College, Dhaka, from July-2009 to June-2010. A total number of 100 normal pregnant women, consecutively attending Out-patient Department, Dhaka Medical College were recruited in the study and termed as study subjects (Group B). On the basis of duration of pregnancy Group B subjects were subdivided into Group B₁ (n=12), Group B₂ (n=30) and Group B₃ (n=58) representing 1st, 2nd and 3rd trimester respectively. Forty age-matched healthy non pregnant women served as controls (Group A, n=40) and were recruited from personal contact. Pregnant and non-pregnant women suffering with chronic disease of renal disease, liver, thyroid, parathyroid origin and diabetes mellitus disease were excluded from the study. Women under calcium and vit-D supplementation were also excluded. The selected subjects were clearly briefed about the purpose and nature of the study and written consent was obtained on agreement. Ethical approval for the study was taken from the Ethical Review Committee of Dhaka Medical College. Five (ml) of blood was collected following as aseptic

preparation, serum separated and preserved at -20°C for further biochemical analyses. Serum total calcium level was measured by O-cresolphalein-complexone without deproteinization and serum phosphate level was measured by colorimetric method. Data were expressed as mean±SD. Statistical analyses was done by using SPSS, Version 10. Unpaired Student's-'t' test was used to perform comparison between two groups.

Table II: Serum calcium and phosphate level in different trimesters of the study subjects

Groups	Serum Calcium (mg/dl)	Serum Phosphate (mg/dl)
Group A (n=40)	8.77±0.56 ^a	3.51±0.92
Group B ₁ (n=12)	9.68±0.99 ^b	3.38±0.78
Group B ₂ (n=30)	9.21±1.00 ^{b,c}	3.41±0.80
Group B ₃ (n=58)	8.14±1.53 ^d	3.38±0.84

Results were expressed as mean±SD. n=number of subjects. Unpaired t-test was performed to calculate statistical difference between groups. Different superscript in the column indicates significant difference at p<0.05.

Group A; Healthy non pregnant control group, Group B₁, 1st trimester pregnant cases; Group B₂, 2nd trimester pregnant cases; Group B₃, 3rd trimester pregnant cases

Results:

Age (mean±SD, yrs) and BMI (Kg/m²) were shown in Table I. The two variables in the study groups did not show statistical difference.

Serum Calcium:

Serum calcium (mean±SD, mg/dl) levels in Group B₁ and B₂ were significantly higher (p=0.0001 and p=0.020 respectively) compared to the Controls. Between the Groups B₁ and Group B₂ no significant difference was observed (p=0.175). Mean (±SD) serum calcium in the Group B₃ was significantly lower compared to the Controls 'Group A' (p=0.015) as well as Group B₁ and Group B₂ (p=0.001 for both).

Serum phosphate:

Serum phosphate (mean±SD, mg/dl) levels of the study subjects were shown in table II. Mean (±SD) serum phosphate levels in the study Groups B₁, B₂ and B₃ were almost similar and did not show significant difference compared to the Controls (p=ns).

Discussion:

Maternal blood calcium and phosphate level found to vary in different trimesters¹¹⁻¹³. One of the earlier studies has shown very minimum change in serum calcium and phosphate during different stages of pregnancy¹¹. In the present study we have observed higher level of serum calcium in first and second trimesters of the of the study subjects. At third trimester it significantly ($p=0.001$) compared to both first and second trimester groups and also of the controls ($p=0.015$). Serum inorganic phosphate level found to be almost similar during pregnancy in different trimester. The lower level of serum calcium at third trimester is in agreement with others¹⁷⁻²¹. It is argued that increased need to the growing fetus and at the same time dilution of the molecule owing to increased extracellular fluid may explain the lower level of calcium level in third trimester. However, dietary deficiency in the face of no calcium supplement might have contributed to the lowering of serum calcium in the Group B₃. It is known that 50% of calcium is free in the plasma protein^{22,23}. Moreover, pregnancy is associated with increase in urinary calcium loss which is attributed to the increased glomerular filtration rate²⁴. The scenario is further compounded by the fact of fall of serum albumin level during pregnancy (8,25) results in lowering serum calcium level. The findings of the present study reconfirmed the fact of increased need

of calcium at this state and exposing the mother at risk of developing complications if not addressed the issue with greater attention.

It was interesting to note that serum phosphate was almost similar in three trimesters of the study subjects and also did not show statistical difference with controls. This is contrast to other investigators, who demonstrated lower phosphorus during pregnancy (17). It was hypothesized that serum phosphate level falls during pregnancy due to low intake, hypoalbuminemia and increase demand for fetal growth (17). Lack of consistency in this regard needs to be addressed. It may be mentioned that serum parathyroid hormone and plasma albumin were determined in the study which might have explained the possible mechanism in this regard. One of the major weaknesses of the present study is failure to look into the birth weight of the baby and explore any relationship, if any, with blood calcium and phosphate levels which needs to be addressed in future studies.

It may be concluded that serum calcium level was lower during third trimester of the study subjects which may be explained by the fact of increased demand of the growing fetus and exposing the mother at risk of complications related to low serum calcium.

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Serum calcium and phosphate level in normal pregnant women

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