



Serum Calcium and Phosphorus Levels during Different Stages of Pregnancy

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Abstract: The aim of this study was to compare serum calcium and phosphate levels between pregnant women in different stages of pregnancy and healthy non-pregnant women aged 32 ± 3 yrs. This study discerned a significant reduction (P values 0.03, 0.04) in the serum calcium level in first (7.7 ± 0.34 , 10.2 ± 0.43) second trimester (8.0 ± 0.39 , 10.2 ± 0.43) whilst insignificant levels were found in third trimester between pregnant women and control group at P value 0.06 (9.7 ± 0.27 , 10.2 ± 0.43). Phosphorus levels were insignificant between different stages of pregnancy and between study and control group (P value 0.33, 0.31, 0.31) with mean \pm SD for the first (3.16 ± 0.36 , 3.16 ± 0.36), second (3.17 ± 0.31 , 3.16 ± 0.36) and third (3.16 ± 0.31 , 3.16 ± 0.36) trimester. Correlation showed weak negative correlation between calcium level in first and second trimester and very weak correlation in third trimester of pregnancy ($R = -0.47$, -0.58 and -0.22) and no correlation detected between phosphorus level and all stages of pregnancy ($R = 0.00$, 0.00 , 0.00). This study concluded that pregnancy is associated with significant reduction in serum calcium level during the first and second trimester of pregnancy. Calcium level also correlates weakly negative with the duration of pregnancy. Phosphorus level does not affect either by circumstances of pregnancy nor its different stages. Human body resemble to demineralization bone calcium in order to attain normal calcium hemostasis.

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1. Introduction:

Calcium and inorganic phosphate are macronutrients and are very essential for bone formation in fetus (Mayne, 1996). In pregnancy, the very high concentration of circulating estrogen and progesterone alter the concentration of many substances in the maternal blood (Khastigir & Studd, 1994). A direct linear relationship has been established between daily dietary intake of calcium and serum calcium concentration. The menstrual cycle is associated with hormonal and physiological changes in the female body (Easthan, 1985).

Fetus skeleton is formed during pregnancy period and bone mineralization highly demands minerals, supplied maternally. Bone is greatest reservoir for calcium. Significant changes may occur in maternal skeletal system during the pregnancy that may result in osteoporosis and Osteomalacia (Prentic, 1994). Although major part of calcium is absorbed by the fetus in third trimester of pregnancy, however, calcium homeostasis begins from the earliest time of pregnancy.

Most studies of calcium metabolism in pregnancy have examined changes in serum markers of bone formation and urine markers of bone resorption, these studies fraught with a number of confounding variables, including lack of pregnancy baseline values, hemodilutional effect on serum markers, increase glomerular filtration rate and renal clearance changing in renal excretion. Many studies have reported that urinary markers of bone resorption (24h urine) are increased from early to mid-pregnancy conversely serum markers of bone formation are often decreased from early to mid-pregnancy and then rising to normal value. It's conceivable that the bone formation marker are artificially lowered by normal hemodilution and increased renal clearance during pregnancy (More, Bhattoa, Bettembuk, & Balogh, 2003). There are limited studies on the effects of pregnancy on bone turn-over marker in human; however the existing evidence suggests that the turn-over is low in the first half and increased towards the end of pregnancy (Kovacs & Kronenberg, 1997).

At the gestational age, diet may influence the bone metabolism during pregnancy and demonstrated controversial data. The most adaptive change in the third trimester is the protection of the maternal skeleton from bone density loss which is due to the shift in levels of 1, 25-dihydroxy vitamin D (Oliveri, Parisi, Zeni, & Mautalen, 2004). Plasma calcium and phosphorus are mainly regulated by parathyroid hormone and the active form of vitamin D and any interference with the action of vitamin D and Parathyroid hormone is reflected on the plasma concentration of calcium and phosphorus (Varley, 2000). In summary, the extra demand for calcium from the growing fetus, especially during the third trimester is physiologically compensated through changes in hormonal levels leading to increased intestinal absorption, decrease renal excretion and intestinal calcium absorption becoming the primary source of calcium (Kovacs, 2001).

To the best of our knowledge, there is lack of information regarding assessment of serum calcium and phosphorus during different stages of pregnancy, factors that might affect both health of mother and fetus. So this study aims to measure serum calcium and phosphorus levels in healthy Sudanese pregnant women and compared to non-pregnant women. In addition to correlate serum calcium and phosphorus levels with the duration of pregnancy.

2. Material and Methods:

This case-control study was performed in Khartoum state during period from June to September 2015. One hundred and fifty blood samples were collected from healthy Sudanese pregnant women and were divided equally into first, second and third trimester as test group and fifty samples were obtained from healthy non-pregnant women as control group for the comparison, both groups were age matched (32 ± 3) yrs. Women with cholestasis, bone disease, renal impairment, and those who were under nourished with calcium or pregnant nursing were excluded from this study.

3. Ethical consideration:

Permission of this study was obtained from the manager of laboratory in Om Durman specialized maternal hospital. The objectives of the study were explained to all individual participating in the study. Health education about pregnancy was provided to all participants.

4. Sampling:

After informed consent and use of alcohol anti septic (70% ethanol) 3 ml of venous blood was collected using disposable syringe. The blood was collected in lithium heparin container and separated

by centrifuge for 3 minutes, 3000/rpm. Serum calcium and phosphate were estimated by A 25 analyzer it's fully automation.

5. Statistical analysis:

The data was analyzed using Statistical Package for Social Sciences (SPSS), Windows version 16, 1997 SPSS, Inc, Chicago, IL, and USA. Analysis of variance (ANOVA) and correlation were calculated.

6. Results:

This study discerned a significant reduction (P values 0.03, 0.04) in the serum calcium level in first (7.7 ± 0.34 , 10.2 ± 0.43) second trimester (8.0 ± 0.39 , 10.2 ± 0.43) whilst it was insignificant in third trimester between in pregnant women and control group at P value 0.06 (9.7 ± 0.27 , 10.2 ± 0.43).

Phosphorus level were insignificant between different stages of pregnancy and between case and control group of this study (P values 0.33, 0.31, 0.31) with mean \pm SD for the first (3.16 ± 0.36 , 3.16 ± 0.36), second (3.17 ± 0.31 , 3.16 ± 0.36) and third (3.16 ± 0.31 , 3.16 ± 0.36) trimester (Tables 1 and 2)

Further this study showed a weak negative correlation between calcium level in first and second trimester and very weak correlation in third trimester of pregnancy (R = -0.47, -0.58 and -0.22) and no correlation was detected between phosphorus level and all stages of pregnancy (R = 0.00, 0.00, 0.00) (Table 3).

Table 1: Calcium level and pregnancy stages.

Calcium level	First Trimester	Second trimester	Third trimester	Control
mean \pm SD (mg/dl)	7.7 ± 0.34	8.0 ± 0.39	9.7 ± 0.27	10.2 ± 0.43
P .value	0.03	0.04	0.06	-

Table 2: Phosphorus level during pregnancy stages.

Phosphorus level	First trimester	Second trimester	Third trimester	Control
mean \pm SD (mg/dl)	3.16 ± 0.36	3.17 ± 0.31	3.16 ± 0.31	3.16 ± 0.36
P value	0.33	0.31	0.31	-

Table 3: The correlation between calcium and phosphorus levels and pregnancy stages.

Parameter	First trimester	Second trimester	Third trimester
Calcium	- 0.47	- 0.58	- 0.22
Phosphorus	0.00	0.00	0.00

7. Discussion:

Serum calcium and phosphorus levels may vary depending on the physiological, biochemical and pathological variations (Mayne, 1996). In pregnancy, calcium and inorganic phosphate are important elements found in human body fluid in addition to sodium, potassium, magnesium and chloride. Serum calcium and phosphorus concentration might decrease during pregnancy due to insufficient dietary intake and that is directly proportional to the gestational age. In the present study, serum calcium was found to be significantly reduced in first and second trimester and insignificantly reduced in third trimester in pregnant women when compared to the control and there is a weak negative correlation with the duration of pregnancy. Serum phosphorus levels showed no significant difference in pregnant women when compared to the controls. That means the level of phosphorus concentration is not affected by pregnancy. Similar previous studies reported that there is no change in plasma phosphorus concentration during pregnancy.

Small significant increase observed in the serum calcium level in the third pregnancy, and phosphorus level is the same for all pregnancy stages (Power et al., 1999). Some decrease in the first and increase in third trimester in bone turnover and of pregnancy, also the turnover increase during lactation (Seely, Brown, DeMaggio, Weldon, & Graves, 1997).

The baby gets its vitamins and nutrients from its mother, especially during the third trimester. The significant decrease in serum calcium showed in this study could be attributed to demand of baby from his mother who feeds him minerals through maternal circulation.

If the pregnant mother does not take in enough calcium through the diet which she consumes, then she can get health problems and increase the risk of poor bone health. Thus, we recommend from this study measurement of serum calcium should be done regularly during pregnancy and pregnant women should take diet rich in calcium or calcium supplement if needed to compensate increase demand of fetus.

8. Conclusion and recommendations:

Serum calcium is significantly reduced during pregnancy but phosphorus level is not affected by pregnancy stages. Measurement of serum calcium should be done regularly during pregnancy and pregnant women should take diet rich in calcium or calcium supplement if needed to compensate increase demand of fetus.

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