ASSESSMENT OF SERUM TOTAL PROTEIN, ALBUMIN AND CALCIUM IN PREGNANT WOMEN ATTENDING ANTE-NATAL CLINIC, UNIVERSITY OF MAIDUGURI TEACHING HOSPITAL

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ABSTRACT

Background: Pregnancy is a normal physiological phenomenon with many biochemical changes including calcium metabolism. Calcium requirement increases during pregnancy, thereby increasing the chances of developing hypocalcaemia and hypoalbuminaemia.

Aim: The aim of the present study was to assess serum levels of total protein, albumin, and calcium among pregnant women in University of Maiduguri Teaching Hospital Maiduguri, Borno State.

Methodology: A total of two hundred (200) subjects were recruited for this study. One hundred and twenty (120) are confirmed pregnant women and 80 non pregnant women age matched were used as controls, out of the 120 pregnant women that participated in the study, 30 were in first trimester, 50 were in second trimester and 40 were in third trimester. Blood chemistry analysis was conducted spectrophotometrically using Biurets method (For Total protein), Bromocresol green method (for Albumin) and O-Cresolphthalein complexone (for calcium).

Results: The results show a significant lower value of calcium and albumin ($p<0.05$) among first trimester pregnant women when compared to the control subjects.The resultsshow a significant decrease in calcium and albumin ($p<0.05$) among second trimester pregnant women when compared to control subjects. The results show a significant lower value in calcium and albumin ($p<0.05$) among third trimester pregnant women when compared to control subjects. The results between 1st, 2nd and 3rd trimester pregnant women subjects show a significant difference in calcium and albumin ($p<0.05$), but there were no significant differences in total protein ($p>0.05$).The result shows no significant difference in total protein level ($p> 0.005$)among the first trimester pregnant women when compared to the control subjects. It also shows no any significant difference in total protein level ($p> 0.005$) among the third trimester pregnant women when compared to the control subjects.

Conclusion: There is reduction or decrease in calcium and albumin levels in pregnant women especially in the third trimester.

Key words: Pregnancy, Total Protein, Albumin, Calcium

INTRODUCTION

Pregnancy is a normal physiological phenomenon with many biochemical changes including calcium metabolism. Calcium requirement increases during pregnancy, thereby increasing the chances of developing hypocalcaemia and hypoalbuminaemia (Bassam, 2019).Total serum calcium normally falls throughout pregnancy, thus a healthy and balanced maternal diet is crucial since the diet needs to take care of the women's usual nutritional needs as well as the needs of the growing fetus, enabling the mother to maintain her stores of nutrients and those required for fetal health (Mridula, 2003).

The nutritional status of women before and during pregnancy is considered a determinant factor in maternal and neonatal health outcomes. Because pregnant women experience significant anatomical and physiological changes (Soma-Pillay, 2016).

They require an increased intake of protein as protein deposition in maternal organs and fetal tissues increases throughout pregnancy, mainly in the third trimester (Elango and ball, 2016).

The concentration of blood biomarkers inpregnant women is influenced by plasma volume expansion, and causes of hypoproteinemia in pregnancies can be very varied, including hemodilution, increased kidney clearance, and higher usage of proteins on behalf of the fetus and maternal organs (Soeters et al., 2019).

Calcium exists in three major forms in plasma, approximately 50% is in the free, or ionized form, which is the physiologically important fraction, 40% is bound to plasma protein and the remaining 10% is insoluble, complexes with anions; such as bicarbonate, phosphate and lactate (Endress and Rude, 2010). Physiologically, calcium is classified as either intracellular or extracellular. Extracellular calcium provides calcium ions for the maintenance of intracellular calcium levels, bone mineralization, blood coagulation and plasma membrane potential. Calcium stabilizes the plasma-membrane and influences the permeability and excitability. A decrease in serum free calcium concentration causes increase in neuromuscular excitability and tetany, an increased concentration reduces neuromuscular excitability (Endress and Rude, 2010). Calcium concentration, both total and free is characterized by a high physiological variation depending on age, sex, physiological stage (e.g pregnancy) and even season (Allen, 2015).

Proteins are synthesized predominantly in the liver; immunoglobulins are synthesized by mononuclear cells of lymph nodes, spleen and bone marrow. The two general causes of alteration of serum total protein are a change in the volume of plasma water and a change in the concentration of one or more of the specific proteins in the plasma, about 93% of blood consist mostly of protein (Tietz, 2005). About 80% of protein-bound is associated with albumins, with the remaining 20% being associated with globulins (Endress and Rude, 2010).

Albumin is one of the most abundant proteins in the blood fluid which is produced in the liver. It also acts as the carrier molecule for lipid, steroid hormone and calcium (Anne *et al*., 2001).Albumin is a globular water- soluble unglycosylated serum protein with approximate molecular weight of 65,000 Daltons (Anne *et al*., 2001). It makes up approximately 60% of the total plasma protein, about 40% of albumin is present in the plasma and other 60% is present in the extracellular space. The liver produces about 12g of albumin per day (Tietz, 2005). The objective of the study is to estimate serum total protein, Albumin and calcium in pregnant women and controls, and to compare the results of serum total protein, albumin and calcium obtained from pregnant women with those of controls.

MATERIALS AND METHODS

A total of two hundred (200) subjects were recruited for this study. One hundred and twenty (120) are confirmed pregnant women and 80 non pregnant women age matched were used as controls.

The study was approved by the joint research and ethical clearance committee of the University of Maiduguri Teaching Hospital. Blood specimen was taken in a plain container, separated using centrifuge at 400 to acquire serum and were estimated using Biurets method (For Total protein) (Sanchez and Cano, 2005). Bromocresol green method (for Albumin) and O-Cresolphthalein complexone (for calcium) using spectrophotometer at different wave lengths (Teitz,2005). Summary of descriptive statistics were determined using one way anova and student t-test at 95% confidence limit.

Inclusion and exclusion criteria

The study included only confirmed pregnant and non-pregnant women as control, who are willing to participate in the study. The research excluded subjects with hypertension, diabetes mellitus, those on calcium supplementation and those who did not consent to this study.

Ethical clearance

Ethical clearance was obtained from the research and ethical committee of University of Maiduguri Teaching Hospital, Maiduguri, Borno state.

Statistical analysis

The data obtained were analyzed for descriptive statistics, ANOVA and student t-test using statistical package for social sciences version 22.0 and level of confidence was set at 95% confidence limit.

RESULTS

Table 1 results shows a significant lower values of calcium and albumin ($p<0.05$) among first trimester pregnant women when compared to the control subjects. Whereas there is no significant difference in their total protein level ($p> 0.005$).

Table 2 shows a significant difference in all the parameters (calcium albumin and total protein) between the second trimester pregnant women and control subjects ($p<0.05$).

Table 3 shows a significant difference in calcium and albumin level in third trimester pregnant women when compared to control subjects ($p<0.05$). Whereas there was no any significant difference in their total protein level ($p> 0.005$).

Table 4 the comparison between 1st, 2nd and 3rd trimester subjects show a significant difference in calcium and albumin ($p<0.05$), but there were no significant differences in total protein ($p>0.05$).

Table 1: Comparison of Calcium, Albumin and Total protein levels between first trimester and control subjects

Parameters	1st trimester (n=30)	control (n=80)	p value	Remarks
Calcium (mmol/l)	2.31±0.32	2.36±0.18	0.000	S
Albumin (g/l)	40.5±7.20	41.4±4.84	0.002	S
Total protein (g/l)	67.0±8.32	69.3±7.28	0.225	NS

Values expressed as Mean ± SD

p<0.05= Significant (S), p>0.05= Not significant (NS)

Table 2: Comparison of Calcium, Albumin and Total protein level between second trimester and control subjects

Parameters	2nd trimester (n=50	control (n=80)	p value	Remarks
Calcium (mmol/l)	2.34±0.24	2.36±0.18	0.000	S
Albumin (g/l)	40.94±7.27	41.4±4.84	0.004	S
Total protein (g/l)	67.38±9.22	69.31±7.28	0.032	S

Values expressed as Mean ± SD

p<0.05= Significant (S), p>0.05= Not significant (NS)

Table 3: Comparison of Calcium, Albumin and Total protein level between third trimester and control subjects

Parameters	3rd trimester (n=40)	control (n=80)	p value	Remarks
Calcium (mmol/l)	2.19±0.31	2.36±0.18	0.000	S
Albumin (g/l)	38.75±7.27	41.4±4.84	0.027	S
Total protein (g/l)	71.0±8.85	69.31±7.28	0.980	NS

Values expressed as Mean ± SD

p<0.05= Significant (S), p>0.05= Not significant (NS)

Table 4: Comparison of Calcium, Albumin and Total protein in 1st, 2nd and 3rd trimesters

Trimesters Parameters	1st (n=30)	2nd (n=50)	3rd (n=40)	p value	Remarks
Calcium (mmol/l)	2.31±0.32	2.34±0.246	2.19±0.31	0.004	S
Albumin (g/l)	40.53±7.27	40.94±7.27	38.75±6.27	0.027	S
Total protein (g/l)	67.00±8.32	67.38±9.22	71.02±8.85	0.098	NS

Values expressed as Mean ±SD
p<0.05= Significant (S), p>0.05= Not significant (NS)

DISCUSSION

This study was aimed at determining the serum levels of calcium, albumin and total protein in pregnant women attending ante-natal clinic of University of Maiduguri Teaching Hospital. In this study, levels of serum calcium were lower in pregnant women in comparison to non-pregnant women, this indicates a negative effect of pregnancy on serum calcium. This study is in line with the findings of Tagreed*et al.,*(2018) who revealed that pregnancy was clearly associated with low serum calcium levels. He attributed that the low level of calcium found in pregnant women especially in the third trimester is due to the demand by the fetal for proper bone growth and development. In addition to this, some pregnant women eating habit change with pregnancy, this may lead to inadequate calcium for the mother and the baby Tagreed *et al.,*(2008). Moreover, several clinical studies have shown that intestinal absorption of calcium is doubled during pregnancy from 12 weeks of gestation; this seems to be a major maternal adaptation to meet the fetal need for calcium (Kovacs, 2001). This is also observed in this study where the calcium level is higher in both first and second trimester than in third trimester, which is in line with the study of Bassam(2019) which shows a significantly and continuously reduced calcium level during the third trimester. Concentrations of calcium are also affected by reduced albumin concentration because some percentages of calcium are mostly bound to albumin (Teitz ,2005).

In this study, levels of serum albumin were lower in pregnant women compared to non-pregnant women. This finding was similar to the study conducted by Sufrin*et al*., (2015)who found that the concentration of albumin decreases in pregnancy, the total amount of protein is apparently unchanged; decreases in concentration are thought to be the result of an increase in plasma volume (Sufrin *et al*., 2015.)

However, in this study levels of serum total protein in pregnant and non-pregnant women remain unaltered in 1st and 3rd trimester but slightly decreased in 2nd trimester, this agrees with the findings of Sufrin (2015), who stated that the concentration of total proteins during pregnancy did not alter significantly, the fall in protein concentration seen during pregnancy most likely as a result of the dilution of the plasma, since total protein concentration is inversely related to plasma water concentration. The abrupt increase in protein concentration seen before laborcorresponds to a decrease in plasma water, while the rapid fall in concentration seen within 12 to 24 hours after deliveryis the result of the mobilization of the excess extracellular fluid of pregnancy (Sufrin*et al*., 2015).

This study has also showed that there is a significant difference in calcium and albumin when compared according to the three trimesters.

This agrees with the studies of Bassam (2019) that serum calcium levels fall gradually during pregnancy and towards the end of gestation. This also agrees with our findings where in first and second trimester the calcium levels are higher than the third trimester However, Bassam *(*2019) reported that calcium deficiency in pregnancy is due to severe dietary inadequacy in individuals who are unable to eat diet rich in dairy products.

CONCLUSION

Pregnant women are at risk when they already have hypocalcaemia/hypoalbuminemia and must undergo a strain on their bodies to meet the normal needs with the additional needs of calcium during pregnancy. Based on this research work, there is reduction or decrease in calcium and albumin levels in pregnant women especially in the third trimester.

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