

Concentration of sodium, potassium, chloride and calcium across trimester of pregnancy

Abstract

Pregnancy is a period of altered body systems. This study is aimed at assessing electrolytes level in the three trimesters of pregnancy. Blood samples of one hundred pregnant women in their various trimesters were collected by aseptic techniques into a lithium heparin bottle for electrolytes analysis. Using standard laboratory methods, the serum electrolytes level were analyzed using an automated blood gas and electrolytes analyzer (OPTI CCA – TS2). Based on Reference values of electrolytes during pregnancy, 94% had normal serum sodium concentration, potassium serum concentration 48% and Chloride serum while calcium serum concentration was low 12% across the trimesters. Descriptive statistics were used (frequency and percentage distribution) for socio-demographic characteristics; chi-square was used to test the hypothesis at 0.05 level of significance. Statistical Package for Social Sciences Version 20.0 was used to support the data analysis. The study revealed no significant relationship between electrolytes level and trimesters of pregnant women receiving antenatal care in the selected obstetric and gynaecological hospitals in a low income country. This may suggest poor kidney adaptation in maintaining electrolyte balance in pregnancy among the women, Therefore there may be need to assess electrolytes levels during antenatal care as part of routine investigations.

Keywords: Pregnancy, calcium, potassium, chloride, sodium

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Introduction

Pregnancy is the means through which human race populates, sometimes burdened with minor complications to the woman that embrace it. Virtually every system of the body is affected by the physiological changes that follow pregnancy including the fluids and electrolytes balance. Pregnancy is marked by unusual feeling of discomfort throughout the trimesters as every system of the body tries to adapt to the physiological changes. Among other adaptations, the renal, urinary, gastrointestinal and cardiovascular changes that follow each trimester help to maintain foeto-maternal well-being.¹ The effect of pregnancy on the biochemical components of the body system has been a background cause of cascades of events that has led to poor pregnancy outcome and the general health of the woman and her baby. Fluctuation in maternal serum ions is postulated to be the triggering cause of elevated blood pressures in pre-eclampsia.^{2,3} Pregnancy induced hypertension has contributed to increased rate of foeto-maternal morbidity and mortality and serum electrolytes are implicated to play major role in the aetio-pathogenesis of hypertension.⁴ The solute concentration of the internal environment is dependent on electrolytes and their disparity can be a health risk. For example pre-eclampsia is associated with foeto-maternal complications like elevated liver enzymes, pulmonary oedema, preterm birth, foetal growth retardation, intra-uterine foetal death, blurred vision, oliguria, abruptio placenta and cardiovascular diseases. Deficiency of potassium, sodium, calcium and chloride are associated with different health conditions in pregnancy ranging from smooth muscle contractility, muscle spasm, body aches to palpitation of the heart, breathing difficulty, cardiac dysrhythmia which may lead to cardiac arrest or lung paralysis, renal failure and increased blood pressure. Hence, the evaluation of serum electrolytes in the various trimester of pregnancy will provide a useful suggestion for the study of physiological and pathological changes during pregnancy. This study is designed to assess the electrolytes level in the three trimesters of pregnancy.

Materials and methods

The study was carried out in four selected private obstetric and gynaecological hospitals in a low income country between March to April, 2020. Pregnant women with no known history of hypertension, diabetes, renal complications, chronic alcohol consumption etc but with normal baseline booking laboratory parameters were the inclusions. A total blood sample of 100 pregnant women who were attending antenatal care in the selected private hospitals were used. The blood samples were grouped into the three trimesters.

Collection of blood sample

Three (3mls) of venous blood was collected under aseptic method from the antecubital fossa without the application of a tourniquet to prevent disrupting the hemorheological properties of the blood into lithium heparin sample bottle. The blood was allowed to clot and separate. About 1ml (125µm or 10 drops) of serum was aspirated into the automated blood gas and electrolytes analyzer (OPTI CCA – TS2 model OP6 – 002052 OPTI Medical System, USA) and analyzed for sodium, potassium, chloride and calcium levels by ion selective electrode method. The values were compared with a laboratory reference values of serum- electrolytes across trimester by Abbassi-Ghanavati et al, (2009). Ethical approval was obtained from the hospitals used and individual client for the study.

Statistical analysis

Data were presented using the Microsoft Access data base 2010. Chi-square was used to test the hypothesis at 0.05 significance. Statistical Package for Social Sciences (SPSS) version 20.0 was used to support the analysis and a p value <0.05 was considered statistically significant.

Results

One hundred (100) blood samples of participants were analyzed under the three trimesters of pregnancy. The women were aged

between 20 – 42 years. Result revealed that 94% have normal sodium level, 48% had normal potassium concentration level, 86% had normal chloride concentration while 12% had normal calcium level. Also, there was 6% low sodium level across the trimesters, 52% low potassium concentration 6% low and 8% high concentration level of chloride and low concentration level of calcium is very high 88%. Table 2 shows that there is no significant relationship between electrolyte concentration and trimester of participants.

Table 1 Laboratory reference values of electrolytes during pregnancy

| Unit | 1 st trimester | 2 nd trimester | 3 rd trimester |
|-----------------|---------------------------|---------------------------|---------------------------|
| Sodium: MEq/L | 133-148 | 129-148 | 130 -148 |
| Potassium MEq/L | 3.6 – 5 | 3.3 -5 | 3.3 – 5.1 |
| Calcium MEq/L | 8.8 -10.6 | 8.2 -9 | 8.2 -9.7 |

Table 2 Distribution of participants' age and parity (N = 100)

| Category | Frequency | Percentage |
|----------|--------------------|------------|
| Age | 20- 30 | n= 46 46% |
| | 31- 40 | n= 53 53% |
| | 41 and above | n=6 6% |
| Parity | 1 Birth | n= 41 41% |
| | 1-2 Births | n =53 53% |
| | 4 and above Births | n=6 6% |

Table 3 Cumulative representation of electrolytes concentration across three trimesters

| Electrolyte | Normal | Trimster | Low | Trimster | High | Trimster |
|-------------|---------|----------------------|---------|----------------------|-------|----------|
| Sodium | 94(94%) | 1 st - 25 | 6(6%) | 1 st - 1 | 0(0%) | - |
| | | 2 nd - 51 | | 2 nd - 4 | | |
| | | 3 rd - 18 | | 3 rd - 1 | | |
| Postassium | 48(48%) | 1 st - 11 | 52(52%) | 1 st - 15 | 0(0%) | - |
| | | 2 nd - 26 | | 2 nd - 29 | | |
| | | 3 rd - 11 | | 3 rd - 8 | | |
| Chloride | 86(86%) | 1 st - 24 | 6(6%) | 1 st - 1 | 8(8%) | 1st - 1 |
| | | 2 nd - 47 | | 2 nd - 4 | | 2nd - 4 |
| | | 3 rd - 15 | | 3 rd - 1 | | 3rd - 3 |
| Calcium | 12(12%) | 1 st - 3 | 88(88%) | 1 st - 23 | 0(0%) | - |
| | | 2 nd - 5 | | 2 nd - 50 | | |
| | | 3 rd - 4 | | 3 rd - 15 | | |

Table 4 Chi-square of hypothesis

| X ² cal | Df | P -Value | Inference | Decision at P> 0.05 |
|--------------------|----|----------|-----------|---------------------|
| 1.92 | 2 | 0.383 | p>0.05 | HO accepted |

Hundred (100) blood samples of pregnant women were assessed. Forty six (46%) were within 20-30 years, 53 (53%) within 41-40 and

6(6%) within 41 and above years. Forty one (41%) were first time mothers, 53(53%) had 1-2 birth and 6(6%) with 4 and above child births.

Discussion

Pregnancy is a unique state characterized by adaptive alterations in using systems of the body.⁵ It is a period of fluid overload resulting from active sodium and water retention primarily induced by the activation of renin angiotensin system.⁵ Deficiency of potassium, sodium, calcium and chloride are associated with different health conditions in pregnancy that has resulted to increased rate of foeto-maternal morbidity and mortality. Hyponatremia and hypokalemia observed in pre-eclamptic patients bring about imbalance of electrolytes in serum and therefore may act as causative factors in pathogenesis of pre-eclampsia.⁶ This study revealed non-significant relationship between electrolytes concentration and trimester however noted a mild variations in electrolytes concentration across the trimesters as opposed to the findings by Omorogiuwa et al.,⁵, whose study opined that sodium, potassium, chloride and bicarbonate remained unchanged in the three trimesters of pregnancy. However, Akinloye et al, 2013 observed no changes in sodium but significant increase in chloride concentration in first and 2nd trimester which agrees with this study which revealed a 94% normal level of sodium and a significant increase in chloride in the second and third trimester. The study also shows a high number of low potassium and calcium. This agrees with the findings of Obembe et al.,⁷ who reported that potassium wastage is expected in pregnancy because pregnant women eat and excrete normal quantities of sodium yet have a high aldosterone and mineralocorticoids.

Indumatic et al.,⁸ opined that calcium metabolism during pregnancy is under strain, about 25gms of foetal calcium is derived from maternal circulation and about eighty percent of the total foetal calcium is deposited during the third trimester resulting to low circulation of calcium level in the maternal blood. However, despite the low level of calcium in circulation, there is high level of calcium ions intracellularly and this can lead to hypertension. Pregnancy induced hypertension may be an early indication of abnormality in sodium and potassium transportation across the vascular smooth muscle cell membrane which is responsible for blood pressure maintenance.⁸

Conclusion

Electrolytes are vital mineral ions that regulate the osmolality of the internal body systems and their derangement can be fatal. This study shows a significant variation in serum electrolytes concentration across the three trimesters especially the potassium and calcium therefore suggesting the importance of including electrolytes assessment during pregnancy as one of the routine and universal investigations to be done during pregnancy in order to curb the foeto-maternal morbidity and mortality associated with electrolytes imbalance menace caused by electrolytes imbalance during pregnancy.

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None.

Conflicts of interest

The author declares that there is no conflict of interest to disclose.

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