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ZINC LEVEL IN APPARENTLY PREGNANT WOMEN IN URBAN AREA

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ABSTRACT

Pregnancy is the fertilization and development of one or more offspring, known as an embryo or foetus in a woman's uterus. It is a critical stage of development during which maternal nutrition can strongly influence obstetric and neonatal outcomes. This study investigated the level of serum zinc levels among pregnant women attending antenatal in urban areas in Enugu. A total number of 100 pregnant women (test) and 50 non-pregnant women of reproductive age were involved in the study and they served as control. Estimation of serum zinc was done using Bio E lab fully automated Chemistry Analyzer As.280 while estimation of RBC parameters was done using Mindray Autohaematology Analyzer BC.2800 model. Results obtained were analyzed using t-test and Pearson correlation and values were considered significant at $p<0.05$ and non-significant at $p>0.05$.The result shows a significant ($p<0.05$) decrease in the mean values of zinc (163.8 ± 58.21 mg/dl) in pregnant when compared with the mean values of zinc (226.2 ± 98.99 mg/dl) in non-pregnant women. Also results showed a positive correlation ($p<0.05$) between zinc and (Hb) (r = 0.414; P = 0.000), and (PCV) (r = 0.393; P = 0.000), and also a negative correlation with (MCHC) (r = -0.236; P = 0.018).The result of this study has shown that pregnancy could be associated with zinc deficiency which could be as a result of mothers increasing requirement for zinc or less intake of zinc.

INTRODUCTION

Pregnancy is a critical stage of development during which maternal nutrition can strongly influence obstetric and neonatal outcomes (Godfrey *et al.,* 2016). Optimal nutrition is necessary to maintain the health of the mother, to help ensure a normal, healthy delivery, and also to reduce the risk of birth defects, sub-optimal foetal development and chronic health problems in childhood (Kramer, 2013). Poor nutritional status and sub-optimal pre- and antenatal care are common in developing countries, often resulting in pregnancy complications and poor obstetric outcomes. (ADA, 2013). Pregnant women in sub-Saharan Africa face huge nutritional risk as a result of poverty, food insecurity, political and economic instabilities, frequent infections and pregnancies. The main nutritional issues impacting these women include maternal under- and over-nutrition and deficiencies of key pregnancy micronutrients, such as iron, folate, calcium, vitamin D and vitamin A. Zinc is Also an important micronutrient but much is yet not said in pregnancy. Consequently, poor obstetric outcomes, such as anaemia, neural tube defects (NTDs), rickets and low birth weight (LBW) and maternal and neonatal mortality, are common in sub-Saharan Africa (Hampshire *et al.*, 2014). Several studies have reported that pregnant women of

African origin are one of the immigrant groups at highest risk of pregnancy complications, such as hypertension and diabetes, and adverse birth outcomes, including preterm delivery, low birth weight infants, caesarean delivery and perinatal mortality (Urquia *et al.,* 2010). Although the exact causes of such outcomes have not yet been clearly identified, it is possible that poor pre-migration health and nutritional status, high parity, closely-spaced pregnancies, pre-existing diseases and lower socioeconomic status in the host countries are contributing factors (Carolan, 2010).

Pregnancy is a period of increased metabolic demands, with changes in the woman's physiology and the requirements of a growing foetus (King, 2012). During this time, inadequate stores or intake of vitamins or minerals, referred to collectively as micronutrients, can have adverse effects on the mother, such as anaemia, hypertension, complications of labour and even death (Ramakrishnan *et al.,* 2011). Furthermore, the foetus can be affected, resulting in stillbirth, pre-term delivery, intrauterine growth retardation, congenital malformations, reduced immunocompetence and abnormal organ development. Occurrence of multiple micronutrient deficiencies in pregnant women in developing countries has numerous confounding factors (Ramakrishnan *et al.,* 2011).

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Zinc is one of the trace elements important in human nutrition and metabolism, participating in all major biochemical pathways and playing multiple roles in the perpetuation of genetic materials (Ayman *et al.,* 2020). Zinc is widely recognized as an essential micronutrient with a catalytic role in over one hundred specific metabolic enzymes in human metabolism. Zinc supports the function of numerous proteins in the body, such as the metalloenzymes, which are involved in variety of metabolic processes, including the regulation of gene expression (Abah *et al.*, 2015). In addition, zinc stabilizes cell membranes, helping to strengthen their defence against free – radical attack (Maret, 2017). It assists in immune function, growth and development. Zinc is found in a variety of foods, but the bioavailability of zinc from foods of animal sources is higher than those from plant sources (Kurutas, 2016). The highest concentration occurs particularly in beef, pork, poultry and fish and in lesser amounts in eggs and dairy products. Legumes and whole grain product are good sources of zinc of consumed in large quantities. Dietary factors can influence zinc absorption for example; phytates binds zinc, thus limiting its bioavailability (Roohani *et al.,* 2015). Generally, the causes of zinc deficiency include inadequate intake, increased requirements malabsorption, increased losses and impaired utilization. Inadequate dietary absorption of zinc is the primary cause of zinc deficiency in most situations. This may result from a combination of low dietary intake, heavy reliance on foods with low zinc content and/or with zinc that is poorly absorbable. Several studies show that inadequate dietary intake is common in many parts of the world (Hotz, 2009). About 45% of the world population lives in countries with a high risk of zinc deficiency (Caulfield *et al.,* 2016). The prevalence of zinc deficiency in Sub-Saharan Africa including Nigeria is 50% (Caulfield *et al*., 2016). The national prevalence of zinc deficiency among under-five was reported to be 21% (Aaron *et al.,* 2018).

MATERIALS AND METHODS

Study area

The study was carried out on pregnant women in maternity hospital in Enugu State, Nigeria. It is also located in south Eastern part of Nigeria.

Subject Selection

A total number of 100 pregnant women (test) and 50 non-pregnant women of reproductive age served as control.

Inclusion Criteria

Subjects that were considered eligible to participate in the study were pregnant women and between 22 and 45 yrs were consecutively recruited into the study.

Exclusion Criteria

Subjects less than 22 years and more than 45 years were excluded from the study. Also lactating mothers were also excluded.

Sample Collection:

About 5 ml of blood samples were withdrawn from the ante-cubital vein by means of sterile hypodermic syringes into plain container, which was left for 1hr for complete clothing to take place. After which the serum was separated from the cell by centrifuging at 1500 rpm for 5minutes. The samples were used for the analysis of serum zinc.

Estimation of zinc level using automation

Machine: Bio E lab fully automated Chemistry Analyzer As.280

Principle: It is machine that uses the serum of centrifuged blood sample or a urine sample and induces reactions using reagents to measure various components colorimetrically, such as sugar, cholesterol, protein, enzyme, etc.

Procedure

A certain precise volume of sample (normally 30 micro liters) is collected by using a dilution pipette, and diluted by 5 times using a dilution disc. The measurable sample is 150 micro liters (µl). From this dilution sample, a precisely-measured amount of 2 to 25 microliters per test item is transferred to a reaction cell (1 eye drop in the rotating reactor is about 40 microliters). The reaction cell already contains reagent transferred from the reagent bottle in reagent turntable 1.

Reactions are induced in the samples in the reaction cells at a temperature of 37µ. If a color reaction does not occur with one kind of reagent, it is possible to add a second or third kind of reagent (reagent turn table 2). After allowing the reaction to proceed for a certain time (normally 10 minutes), the colour density is measured by using a colorimeter (in the figure, "multi-wavelength photometer"). The mechanism of the colorimeter is to shine a light through the sample being measured, and then electrically detect the amount of transmission. The measured data is indicated numerically using A/D converters (analogue→digital converter), calculated by CPU, and the results are output.

Estimation of RBC parameters, Mindray Autohaematology Analyzer BC.2800 model was used for the analysis.

Statistical Analysis

Data analysis was conducted using Statistical Package for Social Sciences (SPSS) version 20 for windows 10. The results were expressed as mean ± S.D. Data obtained from this study were analyzed using independent t-test which was used to compare mean differences. Also, extent of relationship was done using Pearson correlation and values were considered significant at $p<0.05$ and non-significant at $p>0.05$.

RESULTS

Table 1 shows the level of zinc in pregnant and non-pregnant women. The result shows a significant ($p<0.05$) decrease in the mean values of zinc (163.8 ± 58.21 mg/dl) in pregnant when compared with the mean values of zinc (226.2 ± 98.99 mg/dl) in non-pregnant women.

Table 2 shows the relationship between zinc and other red blood cell parameters in pregnant women. The result shows a significant positive correlation ($p<0.05$) between zinc and haemoglobin level (Hb) (r = 0.414; P = 0.000), and packed cell volume (PCV) (r = 0.393; P = 0.000), and also a negative correlation with mean corpuscular haemoglobin concentration (MCHC) (r = -0.236; P = 0.018).

Table 1: Concentration of zinc in pregnant and non-pregnant subjects

Parameter	**Pregnant women**	**Non-pregnant**	**t-value**	**p-value**
Zinc (mg/dl)	163.8 ± 58.21	226.2 ± 98.99	4.120	0.000

P<0.05 …. Signifcant

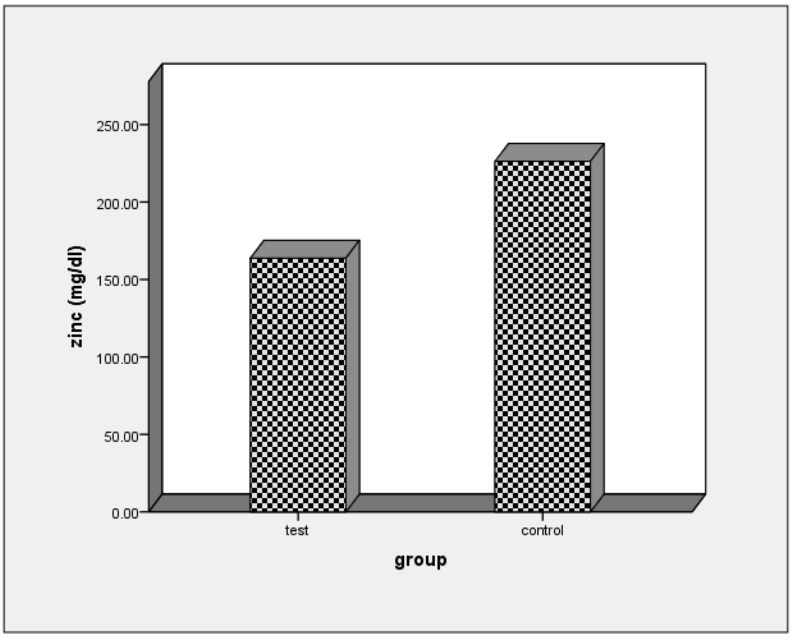

Figure 1: Concentration of zinc in pregnant and non-pregnant subjects

Table 2: Correlation of serum zinc with red blood cell parameters in pregnant group

Parameter	Correlation coefficient	p-value
Hb	0.414	0.000
PCV	0.393	0.000
MCHC	- 0.236	0.018
MCH	-0.118	0.243
MCV	-0.011	0.912

P<0.05 ……. Significant

p>0.05 …….. Not significant

DISCUSSION

Zinc is an essential element for optimal development of human body and it plays a role in cellular cohesion, natural growth and development, proper performance of immune system and increase of appetite, and is a necessary element for many vital functions of body (Dickinson *et al.,* 2011). During pregnancy, level of zinc in mother plays an important role in foetal-neonatal outcomes like growth, birth weight, neurobehavioral development, performance of immune system and rate of mortality and adequate amount of zinc in pregnant women is essential for the optimum embryo and neonatal (Moran *et al.,* 2012).

The result of the study showed a significant decreased level of zinc among the pregnant women when compared with non-pregnant women which could be due to foetal increasing requirement for zinc or less intake of zinc. The result of this study is similar to that reported by other scholars (Yasodhara *et al.,* 2016). A previous report in Abakaliki, South Eastern, Nigeria, also demonstrated that among 349 pregnant women studied, 65% were deficient in zinc (Ugwuja, *et al.,* 2011).

A recent study conducted in Bangladesh reported a lower serum zinc level amongst pregnant women as compared to non-pregnant / lactating women (Iqbal *et al.,* 2018).

Studies conducted in other developing countries have also documented zinc deficiency in pregnant women due to less intake of dietary zinc (Goel and Misra, 2014). These studies were undertaken in a community, which consumed a diet where the main source of energy was cereals. The presence of higher amount of phytates and dietary fiber in such diet, known to cause poor zinc absorption could be a major contributing factor for high prevalence of zinc deficiency in this previous studied population (Lonnerdal, 2015). Hemodilution during last trimester of pregnancy could be another factor for lower zinc levels amongst the pregnant women. Poor pre-pregnancy nutritional status and low serum zinc levels could be other contributing factors leading to low serum zinc levels during pregnancy (Brown *et al.*, 2016).

Also, the result of this study showed relationships between serum zinc and some red blood cell parameters. The result showed a positive correlation between zinc with haemoglobin (Hb) and packed cell volume (PCV); however, a negative correlation was found between zinc with mean corpuscular haemoglobin concentration (MCHC). This finding is in consistence to the finding of Arijanty *et al.*, 2016 indicating that low zinc levels could be associated with aneamia. Another study conducted by Kelkitli *et al*. 2016 also recorded lower serum zinc levels in anemic patients than in the control groups. The mechanisms responsible for a decline in serum zinc concentrations during pregnancy have not been well documented. It is thought to occur as a result of normal physiologic adjustment in pregnancy, response to hormonal changes, haemodilution or a combination of these factors and is not necessarily indicative of inadequate zinc nurture (King, 2013).

Conclusion

The result of this study has shown that pregnancy could be associated with zinc deficiency. Therefore, a balanced, nutritious diet is an important aspect of a healthy pregnancy. Also, it is recommended that the Nigerian government implement a policy on food diversification, biofortification, copper and zinc supplementation as ways of improving child and maternal health in this population. And there is need for

public enlightenment program to educate pregnant women on the need to maintain a balanced diet containing sufficient amounts of micronutrients and vitamins. It is recommended that facilities for the routine monitoring of micronutrients among pregnant women in the area be provided.

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