# EVALUATION OF COPPER STATUS AND SOME RED CELL PARAMETERS IN PREGNANT WOMEN IN ENUGU STATE SOUTH EASTERN NIGERIA


## ABSTRACT

Copper is an essential trace mineral (micronutrient) that is naturally present in some foods and is available as a dietary supplement. Pregnancy, also known as gestation, is the time during which one or more offspring develops inside a woman.This study was desiged to assay the copper level of pregnant women in urban area and to evaluate the effect of the obtained valves on some blood parameters of the pregnant women**.** In this study, a total of 100 subjects and 50 controls was used. subjects were pregnant women while the controls were non-pregnant women. The copper level in subject was assayed with a serum copper test kit using automation with Bio E-lab fully automated chemistry analyzer and result of the complete blood count was gotten using Mindray Hematology analyzer. The mean for subjects (M=102.83±1.38) and control (M=102.68±0.94), p = 0.71. These results suggest that the difference between the copper level for subjects and controls is not really much.. The variables copper level and MCV were found to be slightly correlated, r(150) = ..018., p > .005. Additionally, copper levels in the subjects was also found to negatively correlated with MCH, r(150) = .907, p > .005. One-way analysis of variance showed that the correlation of copper levels was not significant on all of the red bloodcell parameters in the serum of the pregnant women.



***Keywords****: copper status, red cell parameters, pregnant women*


## INTROUDUCTION

Copper is an essential trace mineral (micronutrient) that is naturally present in some foods and is available as a dietary supplement. It is a cofactor for several enzymes (known as "cuproenzymes") involved in energy production, iron metabolism, neuropeptide activation, connective tissue synthesis, and neurotransmitter synthesis (Klevay,2010) . One abundant cuproenzyme is ceruloplasmin (CP), which plays a role in iron metabolism and carries more than 95% of the total copper in healthy human plasma ). In humans, copper is essential to the proper functioning of organs and metabolic processes. The human body has complex homeostatic mechanisms which attempt to ensure a constant supply of available copper, while eliminating excess copper whenever this occurs (Klevay,2011).

The availability of copper in suburban areas in usually high because of the use in production of many items like electrical wiring and plumbing materials such as household water pipes. These pipes and plumbing fixtures such as brass, faucet contain copper which can leach into the

drinking water when the copper level in the water exceeds the action level can cause problem to health ( Rosado ,2003).

They may be elevated level of copper in carbonated or acidic beverage that contact copper tubing .carbon dioxide can corrode the plumbing container which can add copper to softdrink. When these contaminated water and softdrinks are consumed together with the dietary copper , it can skyrocket the copper level in the blood of pregnant women which may lead to copper toxicity. unlike the rural areas that lack all of these advanced production that affect the copper level(Squitti *et al.,* 2014).

The average human diet provides approximately 1,400 mcg/day for men and 1,100 mcg/day for women that is primarily absorbed in the upper small intestine . Almost two-thirds of the body's copper is located in the skeleton and muscle (Squitti *et al.,* 2014). Only small amounts of copper are typically stored in the body, and the average adult has a total body content of 50–120 mg copper . Most copper is excreted in bile, and a small amount is excreted in urine. Copper levels in the body are homeostatically maintained by copper absorption from the intestine and copper release by the liver into bile to provide protection from copper deficiency and toxicity(Squitti *et al.,* 2014) .

Pregnancy, also known as gestation, is the time during which one or more offspring develops inside a woman . During pregnancy the plasma volume increases by 40-50% and the red blood cell volume increases only by 20–30%. These changes occur mostly in the second trimester and prior to 32 weeks gestation. Due to dilution, the net result is a decrease in haematocrit or hemoglobin, which is a measure of red blood cell concentration. Erythropoietin, which stimulates red blood cell production, increases throughout pregnancy and reaches approximately 150 percent of their pregnancy levels at term (Theobald, 2007).

Copper is important during pregnancy, when blood supply doubles and energy level drops and also helps in creating the fetus heart blood vessels and cells as well as nervous , immune and skeletal systems. In pregancy ,excess copper levels can be associated with intrauterine growth restriction ,preclampsia and neurological disease because of oxidative damage caused by copper accumulation in the placenta and fetal tissue. Sometimes the changesin certain hormone levels and their effects on their target organs can lead to gestational diabetes and gestational hypertension. A pregnant woman will also become hypercoagulable, leading to increased risk for developing blood clots and embolisms, such as deep vein thrombosis and pulmonary embolism. Women are 4-5 times more likely to develop a clot during pregnancy and in the postpartum period than when they are not pregnant.

The study was done to estimate the copper level in pregnant women in an urban area.

## MATERIAL AND METHOD

### STUDY AREA

The research was carried out on apparently healthy pregnant women in a maternity hospital in Enugu town ,Enugu state ,Nigeria.It is located in the southeastern part of Nigeria.

**STUDY POPULATION**

A total number of 100 pregnant women mean age 20 ± years were recruited from the maternity hospital and their blood sample was collected .A total number of 50 non pregnant women mean age of 20 ± was used as control in the research. They all gave their consent to participate in this study.

**Ethical Approval**

Approval was gotten from the management of the maternity hospital and the consent of the subject and control was also obatined .

**Procurement of copper**

A commerically prepared serum copper test kit product of Centronic GmbH Am Kleinfield 11 Wartenberg Germany used to assay the copper serum level.

**SAMPLE COLLECTION TECHNIQUE**

A standard clean venepunture was used to collect the blood. 5ml of blood was collected from a prominent vein in the antecubital fossa of the arm of the subjects. 2ml of the blood sample was delivered in a plain container and the remaining 3ml of the blood sample was transfered in a commercially prepared Ethylene diamine tetra acetic acid ( EDTA) container . The blood sample in the plain container was spun with a centrifuge ,the serum extracted using an automatic micropippette and place in a labelled container.The sample was frozen until analyis and the analysis was carried out in Bioquest diagnostic laboratory in Parklane avenue in Enugu state.

**INCLUSION CRETRIA**

Healthy pregnancy women mean age of 20 ± and healthy non pregnant women mean age 20 ± in urban area were used in the research as test subject and control respectively.

**EXCLUSION CRETRIA**

Healthy pregnancy women mean age of 20 ± and healthy non pregnant women mean age 20 ± in the rural area were exclused in this study.

**METHOD**

**Estimation of copper level method**: automation

Bio E lab fully automated chemistry analyzer model AS – 280 product of Nanjing city, jiangsu province china.

The Bio E lab fully automated chemistry analyzer is an instrument that uses the pale yellow supernatant portion (serum) of centrifuged blood sample or a urine sample, and induces reactions using reagents to measure various components, such as sugar, cholesterol, protein, enzyme, etc.

**Estimation of Red cell parameter**

Method : Automation using MINDRAY AUTO HAEMATOLOGY ANALYZER MODEL BC-2800

**Statistical Analysis**

Data obtained were analyzed for mean and standard deviation. Statistical analysis was conducted using Intergrated Bussiness Machine Statistical Package for social sciences (IBM –SPSS) , version 2.0 and t- test level of significance was considered as <0.05 and >0.05.

## RESULT

The mean copper level of the subjects was 353.39 and S.D of 87.63. That of the control was 322.41 and S.D of 80.27.

**Table 1: Mean ± S.D of Copper Level among Subjects and Control**

| Parameter | Mean Value (Subjects) | Mean Value (Control) | t-value | p-value |
|---|---|---|---|---|
| **Copper Level**(ug/dL) | 353.39 ± 87.63 | 322.41 ± 80.27 | 2.098 | .038 |

**Mean Difference: 30.98**

A t-test was conducted to compare copper Level for subjects and controls. The mean for subjects (M=102.83, SD=1.38) and control (M=102.68, SD=0.94) conditions; t (150) =.484, p = 0.71. These results suggest that the difference between the copper level for subjects and controls is not really much. Specifically, our results suggest that when the difference is insignificant.

**Table 2: Correlation of Copper Level in the Serum and the various Red blood cell Parameters**

| Parameters | Copper Levels | | | $X^2$ | Sig. | R | sig |
|---|---|---|---|---|---|---|---|
| | Hypocupraemia | Normal Level | Hypercupraemia | | | | |
| **Hb** | | | | 16.04 | .000 | -.401 | .000 |
| **Severe (<7g/dl)** | 1(1.0) | 83(83.0) | 0(0.0) | | | | |
| **Mild (9-11g/dl)** | 4(4.0) | 12(12.0) | 0(0.0) | | | | |
| **PCV** | | | | .107 | .743 | -.033 | .746 |
| **Moderate** | 0(0.0) | 2(2.0) | 0(0.0) | | | | |
| **Slight** | 5(5.0) | 93(93.0) | 0(0.0) | | | | |
| **MCHC** | | | | .336 | .562 | -.058 | .567 |
| **Low (200-** | 0(0.0) | 6(6.0) | 0(0.0) | | | | |
| **300g/L)** | 5(5.0) | 89(89.0) | 0(0.0) | | | | |
| **Normal (315-** | 0(0.0) | | | | | | |
| **360g/L)** | | | | | | | |
| **High (>350g/L)** | | | | | | | |
| **MCV** | | | | .034 | .855 | .018 | .856 |
| **Microcytic** | 1(1.0) | 4(4.0) | 0(0.0) | | | | |
| **Anaemia (20-** | | | | | | | |
| **70µg/cell)** | 16(16.0) | 79(79.0) | 0(0.0) | | | | |
| **Normal** | 0(0.0) | 0(0.0) | 0(0.0) | | | | |
| **Macrocytic** | | | | | | | |
| **Anaemia (>100)** | | | | | | | |
| **MCH** | | | | .014 | .905 | .907- | .012 |
| **Hypochromia** | 1(1.0) | 4(4.4) | 0(0.0) | | | | |
| **Normal** | 17(17.0) | 78(78.0) | 0(0.0) | | | | |
| **Others** | 0(0.0) | | 0(0.0) | | | | |

The variables copper level and MCV were found to be slightly correlated, r(150) = ..018., p > .005. Additionally, copper levels in the subjects was also found to negatively correlated with MCH, r(150) = .907, p > .005.A positive correlation means the relationship between the Red blood cell parameters and copper level gearing towards the same direction.



## DISCUSSION

Trace Element (trace metals) are minerals present in living tissues in small amount. Copper is one of the many trace metals and it's widely distruted in food and water. This study compares the copper level in pregnant women and non pregnant as test subject and control respectively while checking the effect the copper level will have on Red blood cell parameters in the pregnant women.

In the study the mean differences in the copper level of the pregnant and non pregnant women was low (0.71). The p-value is greater 005,this indicates that the differences was not significant.In the relationship between copper level and the Red blood cell parameters the variables were found to be slightlycorrelated, r(150) = ..018., p > .005. there is no significant difference between copper level and Red blood cell parameters. Copper deficiency has not been documented in humans during pregnancy. It is quite possible that the demonstrated teratogenic effects of the drug penicillamine, which is a copper chelator, may be mediated through copper deficiency, but copper status has not been investigated in the reported cases . Copper level can be analyzed in both blood and water (drinkable water ,sea water) using copper kit and this is done to maintain a normal copper level in diet and water to avoid hypocupremia (low blood copper level) and copper toxicity Obeagu, 2018; Obeagu *et al.,* 2014; Obeagu *et al.,* 2021; Eze *et al.,* 2021).

## CONCLUSION

This study proves from the results obtained from that the difference between the copper level for subjects and controls is not really much, and there is no significant difference , analysis of variance showed that the effect of copper levels was not significant on all of the Red blood cell parameters in the serum of the pregnant women.

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