

ORIGINAL ARTICLE**Year :** 2015 | **Volume :** 52 | **Issue :** 1 | **Page :** 106--109**Trace elements; copper, zinc and selenium, in breast cancer afflicted female patients in LAUTECH Osogbo, Nigeria****ML Adeoti¹, AS Oguntola¹, EO Akanni², OS Agodirin³, GM Oyeyemi⁴,**¹ Department of Surgery, LAUTECH College of Health Sciences, PMB 4400, Osogbo, Osun State, Nigeria² Department of Hematology, LAUTECH College of Health Sciences, PMB 4400, Osogbo, Osun State, Nigeria³ Department of Surgery, Faculty of Clinical Sciences, University of Ilorin, Ilorin Kwara State, Nigeria⁴ Department of Statistics, University of Ilorin, Ilorin Kwara State, Nigeria**Correspondence Address:**

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Department of Surgery, LAUTECH College of Health Sciences, PMB 4400, Osogbo, Osun State
Nigeria**Abstract**

Background: There is an indication of the possibility of the direct or indirect influence of trace element in the development and prevention of malignant diseases, the contribution of the trace elements in the etiology of breast cancer has been under scrutiny. **Aims:** The aim of this study was to determine the serum concentration of trace element in serum of female patients with breast cancer in comparison with healthy controls. **Settings:** Breast Clinic of the Department of Surgery LAUTECH University teaching hospital Osogbo, in south-western Nigeria. **Materials And Methods:** A cross-sectional age matched controlled prospective study wherein the venous blood sample of 30 patients with breast cancer and 30 healthy volunteers as controls were analyzed using atomic absorption spectrophotometry. The collected data were analyzed using statistical package for the social sciences (SPSS Inc) 16. **Result:** The mean serum concentration of the copper, zinc and selenium were 95.3 ± 4.9 ug/dl and 65.2 ± 15 ug/dl, 62.7 ± 15.7 ug/dl and 93.5 ± 7.2 ug/dl, 45.0 ± 4.6 ug/l and 76.4 ± 8.9 ug/l in the two groups respectively. The concentrations of copper and copper-zinc ratio (C/Z) were significantly higher in the cancer bearing group compared to the controls (C/Z 1.6 ± 0.5 against 0.70 ± 0.14 the $P < 0.01$). The concentration of zinc and selenium in the venous blood of the breast cancer patients showed inverse relationship while that of the control showed a direct relationship (-0.03 against 0.09). In the breast cancer patients the correlation of copper and zinc, copper and selenium and zinc and selenium showed inverse relationships, none of the relationships was statistically significant. **Conclusion:** We found a significant association between the serum concentration of trace elements and breast cancer.

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Available from: <http://www.indiancancer.com/text.asp?2015/52/1/106/175573>**Full Text****Introduction**

Trace elements are micronutrients that are part of our daily diets, they are required in minute quantity, but are very important in many different biological processes,[1],[2] such as function of structural nutrients, normal healing, metabolism of genetic materials for growth and differentiation, programmed cell death and necrosis, protection against oxidative injuries and anti-inflammatory and anti-carcinogenesis effect.[3] On the other hand, some are

also involved in undesirable events in vivo,[1] such as participation in carcinogenesis and sustenance of cancerous cells in which lead, copper, chromium and zinc have been implicated. Some of the specific desirable anti-carcinogenetic activities of trace elements include the role of selenium in prevention of oxidative stress through its activity in glutathione and super oxide dismutase and activation of p53 a tumor suppressor gene and the role of zinc in the application of brakes in the cell cycle and induction of apoptosis.

The in vivo utilization of trace elements is complex and not completely understood.[2] They have redundancy of function because the same element may incite both positive and negative events depending upon its concentration and interaction with other trace elements.[1],[2],[4],[5]

The concentration of trace elements in body fluids and tissues are influenced by sex and age, the dietary intake, uptake in the gastrointestinal tract, storage, excretion and the presence or absence of disease state. These numerous influencing factors raise the question, of which is the appropriate tissue for estimating the bioactivity of these elements. However, for some of these elements, zinc, copper and selenium inclusive, the serum concentration has been found to be a reliable measure of their bioactivity in the body.[6],[7],[8]

Since indication of the possibility of the direct or indirect influence of trace element in the development and prevention of malignant diseases the contribution of the trace elements has been under scrutiny.[9] Trace elements have been implicated in the pathogenesis of breast cancer.[10],[11] In various body tissues, varying concentrations and relationships have been documented world-wide.[11],[12] Inverse relationship has also been found between the concentration of zinc in the blood and presence of cancer of the breast while a direct relationship has been found between serum copper and copper-zinc ratio (C/Z) and cancer of the breast.[10],[13] Levels of selenium and iron have been found to be lower in breast cancer patients compared with healthy controls.[11] Among breast cancer patients in Nigeria, Alatisi et al.[14] at another center separate from ours, reported a direct relationship between concentration of lead in the serum, breast tissue and hair and breast cancer severity and an inverse relationship between tissue selenium and breast cancer. The selenium concentration was explained as reduced bioavailability due to its detoxifying effect on negatively implicated trace element in the body,[14] Due to the inconsistencies in the documentations on trace elements and cancer of the breast, we decided to determine the serum concentration of trace element in serum of our female patients afflicted with breast cancer in comparison with healthy controls in our center.

Materials and Methods

This is a cross-sectional age and sex matched controlled study wherein the venous blood sample of patients with breast cancer and healthy age matched volunteers (controls) were collected for analysis in our center between February 2009 and July 2010. The blood samples were taken at the surgery outpatient department and the derived serum was analyzed for zinc, selenium and copper. Hospital ethical clearance was obtained and patients' informed consent was sought before commencing the study. Venous blood sample was obtained from new patients with histologic or fine needle aspiration biopsy confirmed diagnosis of breast cancer that have not had any treatment for their disease. All were fasting samples obtained between the hours of 8 am and 10 am. The venous blood samples were collected in plain screw cap specimen bottles and then left for 30 min for retraction after, which centrifugation was carried out at 3000 g for 5 min and the supernatant serum was aspirated using pasteur pipette into another plain bottle. The collected supernatant was then pooled and stored at -20°C until the time of analysis. At the time of analysis 2 ml of thawed supernatant serum sample after thorough mixing was added to a clean 10 ml centrifuge tube and diluted to 10 ml with hydrochloric acid. The diluted serum sample was then centrifuged for 3 min as 3000 revolution per min to remove cellular debris before it was aspirated for analysis by atomic absorption spectrophotometry. Age and sex matched healthy volunteers were sought among patient relations and hospital staffs.

Male patients, patients on vitamin or mineral supplements, patients diagnosed of other co-morbidities including infective diseases were excluded. Patients who were pregnant or lactating, patients who have had any form of treatment for their disease and patients on hormone replacement therapy or oral contraceptives were also excluded.

Statistical analysis

The collected data were made on the spreadsheet and analyzed using the statistical package for the social sciences version 16.(SPSS Inc) The means of the ages in the separate groups were compared using two sample independent t-test. Because the distributions of the concentrations of the trace elements were not normally distributed and were dissimilar, non-pooled t-test was used for the comparison of their means. The minimum sample sizes required to achieve the similar results for a given power and level of significance for the three tests of hypotheses were calculated using SAS 9.0 package (SAS institutes). At a power value of 90% and 0.05 level of significance, the minimum sample sizes for copper, zinc and selenium were obtained to be 6, 6 and 5. Correlation analysis was carried out using spearman rho.

Results

A total of 30 breast cancer patients fit the inclusion criteria over the 18 months period. A total of 30 matched controls were selected. The frequency table for the age distribution is shown in [Table 1]. The age range in the cancer bearing group was 33-60 years with a mean of 47.3 ± 6.8 years, while the age range for the control group was 33-62 years with a mean of 46.5 ± 6.8 years. The mean ages for the two groups did not differ significantly $P = 0.678$. The mean serum concentration of the copper, zinc and selenium were 95.3 ± 4.9 ug/dl and 65.2 ± 15 ug/dl ($t = 13.90$, $DF = 35$, $p,$) 62.7 ± 15.7 ug/dl and 93.5 ± 7.2 ug/dl ($t = -9.788$, $DF = 24$) and 45.0 ± 4.6 ug/l and 76.4 ± 8.9 ug/l ($t = -9.253$, $DF = 45$) respectively [Table 2]. The concentrations of copper (C) and C/Z were significantly higher in the cancer bearing group compared with the controls [Table 3]. The concentration of zinc and selenium in the venous blood of the breast cancer patients showed an inverse relationship while that of the control showed a direct relationship [Table 4]. In the breast cancer patients, the correlation of copper and zinc, copper and selenium and zinc and selenium showed inverse relationships [Table 4], none of the relationships was statistically significant. {Table 1}{Table 2}{Table 3}{Table 4}

Discussion

The biologic and pathologic role of trace elements are numerous, complex and sometimes very inconsistent.[15] Their role apparently depends on the concentration and the balance of the positively and negatively implicated elements among other factors.[2] Because of the multiplicity of function and the varying role depending on balance and concentration, the role of trace elements in the management of patients is yet to be fully elucidated. Breast cancer is the most common malignant tumor in females and a leading cause of malignant death in females. Its etiology is multi-factorial.[11],[14],[16] Emphasis has been directed at trace elements as one of the modifiable risk factors.[14],[17] Similar to other studies, our study shows that the serum concentration of copper, zinc and selenium differ between breast cancer bearing patients and healthy individuals.

Zinc

As documented by earlier researchers, the serum concentration of zinc in this study was significantly lower in cancer bearing patients compared with healthy controls. This is in support of the finding of hypozincemia associated with the burden of breast cancer.[14],[18] The role of zinc as antioxidant defense is suspected to be the reason for its deficiency, whether this deficiency state precedes the disease or occurs in defense against the cancerous process is still undecided, it is however, suggested that a deficiency of zinc predisposes to chromosomal damage.[19] Aside from the use of zinc as antioxidant, other factors that could be responsible for the hypozincemia in cancer patients are the increased loss in urine, the increased uptake of zinc by cancer cells [3] and the presence other normal homeostatic control mechanisms and pathologic processes not related to the presence of the malignancy.[11],[20]

Selenium

Selenium performs its anti-neoplastic function as an important component of antioxidant system; the enzyme glutathione peroxidase. Although equivocal, some researchers have also suggested that selenium inhibits the expression of oncogenes c-fos and c-myc and in the breast selenium has been documented as a free radical scavenger preventing oxidative damage to genetic material in the epithelial cells.[11] A strong inverse relationship has been found to exist between serum selenium concentration and risk of breast cancer.[20] In line with earlier documentations, the findings in this study also show lower concentration of serum selenium in cancer bearing patients. However, contrary to the documentation by Alatise et al.[14] in Nigeria, there was no significant correlation between selenium and zinc concentration in the blood of the cancer bearing patients or the controls.

Copper

Copper is a cofactor during redox reaction in cells. When in excess concentration however it binds to genetic material inducing oxidative damages. In support of previous studies,[14],[18] we found higher concentration of copper in blood of the breast carcinoma patients compared to healthy matched adults. We also found higher copper zinc ratio and copper selenium ratio in the cancer bearing patients. This relationship between copper and zinc and copper and selenium are in concordance with earlier documentation.[14] Even though, the exact mechanism responsible for the alterations in blood concentration of trace elements in cancer patients is yet to be fully understood, the findings in this study further lends credence to the presence of an inverse relationship between the negatively implicated element, copper and the positively implicated elements, zinc and selenium, in cancer bearing patients. Furthermore, in tune with previous documentations,[13],[21] the relationship is in favor of higher serum concentration of copper.

In this study, we are unable to comment on the trend of the relationship among the trace elements and between the trace elements and the breast cancer because this is cross-sectional samplings of the venous blood of the study while the relationship has been shown to be dynamic. However, the study by Alatise et al.[14] which sampled scalp hair and breast tissue to assess for chronic exposure in addition to the blood sample showed that the concentration of protective trace element (selenium and zinc) associated inversely with the burden of the disease (stage and volume of the disease) while the concentration of the negatively implicated trace element (lead and copper) had a

direct association with the burden of the disease even though their study had a limitation of small sample size. This same limitation also plagues our study because many patients who had been on some form of treatment, multivitamins or plant extracts and supplements were excluded. Notwithstanding the numerically small sample size we still analyzed and used tests of significance as we have done because we had a sample size of 30 in each group thus permitting us to use the statistical methods for large sample size. In addition, the calculated minimum sample size that will produce statistically significant differences in the obtained means of the serum concentrations of trace elements between the control and breast cancer afflicted patient for each of the trace elements was far exceeded.

Exposure to trace metals and tissue concentration of trace element is a modifiable risk factor. Hence, discovery of a credible and strong causal association between trace elements and cancer of the breast cancer may create a new frontier for the attempt at prevention and for the overall management of an established disease. Lin et al. have already suggested a diet deficient in copper for cancer bearing patients.[22] while others have recommended a diet rich in selenium for prevention of malignancies.[6]

References

- 1 He K. Trace elements in nails as biomarkers in clinical research. *Eur J Clin Invest* 2011;41:98-102.
- 2 Arinola O, Akiibinu M. The levels of antioxidants and some trace metals in Nigerians that are occupationally exposed to chemicals. *Indian J Occup Environ Med* 2006;10:65-8.
- 3 John E, Laskow TC, Buchser WJ, Pitt BR, Basse PH, Butterfield LH, *et al.* Zinc in innate and adaptive tumor immunity. *J Transl Med* 2010;8:118.
- 4 Schwartz MK. Role of trace elements in cancer. *Cancer Res* 1975;35:3481-7.
- 5 Zhang Y, Gladyshev VN. General trends in trace element utilization revealed by comparative genomic analyses of Co, Cu, Mo, Ni, and Se. *J Biol Chem* 2010;285:3393-405.
- 6 Harvey LJ, Ashton K, Hooper L, Casgrain A, Fairweather-Tait SJ. Methods of assessment of copper status in humans: A systematic review. *Am J Clin Nutr* 2009;89:2009S-24.
- 7 Hambidge M. Biomarkers of trace mineral intake and status. *J Nutr* 2003;133 Suppl 3:948S-55.
- 8 Strand TA, Adhikari RK, Chandyo RK, Sharma PR, Sommerfelt H. Predictors of plasma zinc concentrations in children with acute diarrhea. *Am J Clin Nutr* 2004;79:451-6.
- 9 Adaramoye OA, Akinloye O, Olatunji IK. Trace elements and vitamin E status in Nigerian patients with prostate cancer. *Afr Health Sci* 2010;10:2-8.
- 10 Rizk SL, Sky-Peck HH. Comparison between concentrations of trace elements in normal and neoplastic human breast tissue. *Cancer Res* 1984;44:5390-4.
- 11 Suzana S, Cham BG, Ahmad Rohi G, Mohd Rizal R, Fairulnizal MN, Normah H, *et al.* Relationship between selenium and breast cancer: A case-control study in the Klang Valley. *Singapore Med J* 2009;50:265-9.
- 12 Tinoco-Veras CM, Bezerra Sousa MS, da Silva BB, Franciscato Cozzolino SM, Viana Pires L, Coelho Pimentel JA, *et al.* Analysis of plasma and erythrocyte zinc levels in premenopausal women with breast cancer. *Nutr Hosp* 2011;26:293-7.
- 13 Gupta SK, Shukla VK, Vaidya MP, Roy SK, Gupta S. Serum trace elements and Cu/Zn ratio in breast cancer patients. *J Surg Oncol* 1991;46:178-81.
- 14 Alatisie OI, Schrauzer GN. Lead exposure: A contributing cause of the current breast cancer epidemic in Nigerian women. *Biol Trace Elem Res* 2010;136:127-39.
- 15 Franklin RB, Costello LC. The important role of the apoptotic effects of zinc in the development of cancers. *J Cell Biochem* 2009;106:750-7.
- 16 Usoro NI, Omabbe MC, Usoro CA, Nsonwu A. Calcium, inorganic phosphates, alkaline and acid phosphatase activities in breast cancer patients in Calabar, Nigeria. *Afr Health Sci* 2010;10:9-13.
- 17 Garland M, Morris JS, Colditz GA, Stampfer MJ, Spate VL, Baskett CK, *et al.* Toenail trace element levels and breast cancer: A prospective study. *Am J Epidemiol* 1996;144:653-60.
- 18 Ajayi GO. Copper and zinc concentrations in Nigerian women with breast cancer. *Eur J Gynaecol Oncol* 2011;32:307-8.
- 19 Khorasani G, Shokrzade M, Salehifar E, Asadi M, Shabankhoni B. Comparison of lead and zinc plasma levels in gastric cancer patients and healthy volunteers. *Res J Biol Sci* 2008;3:631-4.
- 20 Charalabopoulos K, Kotsalos A, Batistatou A, Charalabopoulos A, Vezyraki P, Peschos D, *et al.* Selenium in serum and neoplastic tissue in breast cancer: Correlation with CEA. *Br J Cancer* 2006;95:674-6.
- 21 Sharma K, Mittal DK, Kesarwani RC, Kamboj VP, Chowdhery. Diagnostic and prognostic significance of serum and tissue trace elements in breast malignancy. *Indian J Med Sci* 1994;48:227-32.
- 22 Lin CC, Huang JF, Tsai LY, Huang YL. Selenium, iron, copper, and zinc levels and copper-to-zinc ratios in serum of patients at different stages of viral hepatic diseases. *Biol Trace Elem Res* 2006;109:15-24.

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