Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr ICV 2018= 82.06

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Assessment of serum zinc and copper levels in breast cancer patients: A case-control study

Pramila Gupta

Department of Pathology, Rajshree Medical Research Institute, Bareilly, Uttar Pradesh, India

ABSTRACT:

Background: Breast cancer is the most common cause of cancer in women. Zinc is a vital trace element in many homeostatic mechanisms of the body.Copper and zinc are necessary for optimal performance of superoxide dismutase. Hence; the present study was undertaken for assessing and comparing the serum zinc and copper levels in breast cancer patients and healthy controls. **Materials & methods:** A total of 25 breast cancer patients were enrolled in the present study after meeting the inclusion and exclusion criteria. Another set of 25 subjects were enrolled as healthy controls. Serum samples were obtained from all the patients and were sent to pathology department for serum element analysis. Auto-analyzer was used and serum levels of copper and zinc were assessed. All the results were recorded in Microsoft excel sheet and were analyzed by SPSS software. **Results:** Mean serum copper levels among breast cancer patients were180.11 µg/dL, while mean serum copper levels among normal controls were 112.70 µg/dL. Mean serum zinc levels among breast cancer patients were 33.19 µg/dL, while mean serum zinc levels among normal controls were 88.15 µg/dL. While comparing the mean copper and zinc levels among breast cancer patients and healthy controls, significant results were obtained. **Conclusion:** Zinc and copper play a definitive role in the pathogenesis of breast cancer.

Key words: Breast Cancer, Copper, Zinc

Received: 15 April, 2019 Revised: 25 July 2019 Accepted: 26 July 2019

Corresponding Author: Dr. Pramila Gupta, Department of Pathology, Rajshree Medical Research Institute, Bareilly, Uttar Pradesh, India

This article may be cited as: Gupta P. Assessment of serum zinc and copper levels in breast cancer patients: A case-control study. J Adv Med Dent Scie Res 2019;7(8): 122-124.

INTRODUCTION

Breast cancer is the most common cause of cancer in women and the second most common cause of cancer death in women in the U.S. Breast cancer refers to cancers originating from breast tissue, most commonly from the inner lining of milk ducts or the lobules that supply the ducts with milk.[1-3] Cancer cells are very similar to cells of the organism from which they originated and have similar (but not identical) DNA and RNA. This is the reason why they are not very often detected by the immune system, in particular, if it is weakened.[4] The trace elements and some metals have a significant and vital role in metabolism. Zinc is a vital trace element in many homeostatic mechanisms of the body.[5]

Copper and zinc are necessary for optimal performance of superoxide dismutase. The process of oxidative stress mostly occurs in an imbalance of the concentration of trace elements which is used in the structure of antioxidant enzymes.Metal ion chelating agents including transferrin, ferritin, ceruloplasmin, albumin and small molecules including vitamins, act as cell redox balance.[4-6] Hence; under the light of above mentioned data, the present study was undertaken for assessing and comparing the serum zinc and copper levels in breast cancer patients and healthy controls.

MATERIALS & METHODS

The present study was undertaken in the department of pathology and it included assessment and comparison of serum zinc and copper levels in breast cancer patients and healthy controls. Ethical approval was obtained from institutional ethical committee and written consent was obtained from all the patients after explaining in detail the entire research protocol.

Exclusion criteria for the present study included:

- Diabetic subjects,
- Hypertensive subjects,
- Subjects with presence of any form of metabolic disorder

A total of 25 breast cancer patients were enrolled in the present study after meeting the inclusion and exclusion criteria. Another set of 25 subjects were enrolled as healthy controls. Serum samples were obtained from all the patients and were sent to pathology department for serum element analysis. Auto-analyzer was used and serum levels of copper and zinc were assessed. All the results were recorded in Microsoft excel sheet and were analyzed by SPSS software. Chi- square test was used for assessment of level of significance. P- value of less than 0.05 was taken as significant.

RESULTS

In the present study, a total of 25 breast cancer patients and 25 healthy controls were analyzed. Mean age of the patients of the breast cancer group was 39.5 years, while mean age of the patients of the control group was 42.8 years. Mean serum copper levels among breast cancer patients were 180.11 µg/dL, while mean serum copper levels among normal controls were 112.70 µg/dL. Mean serum zinc levels among breast cancer patients were 33.19 µg/dL, while mean serum zinc levels among normal controls were 88.15 µg/dL. In the present study, while comparing the mean copper and zinc levels among breast cancer patients and healthy controls, significant results were obtained.

DISCUSSION

Breast cancer is the world's most common cancer among women, and it is the most likely reason that a woman will die from cancer. Breast cancer is becoming an increasingly urgent problem in low- and middle-income countries (LMICs), where incidence rates, historically low, have been rising by as much as 5 percent per year.[6] High-income countries (HICs) report the highest breast cancer incidence rates, but these countries have also made the most progress in improving outcomes. In 2010, the majority of the 425,000 global breast cancer deaths occurred in LMICs, and that percentage is expected to grow.[7- 9]

Breast tumors usually start from the ductal hyperproliferation, and then develop into benign tumors or even metastatic carcinomas after constantly stimulation by various carcinogenic factors. Tumor microenvironments such as the stromal influences or macrophages play vital roles in breast cancer initiation and progression. The mammary gland of rats could be induced to neoplasms when only the stroma was exposed to carcinogens, not the extracellular matrix or the epithelium.

Table 1: Age-wise distribution

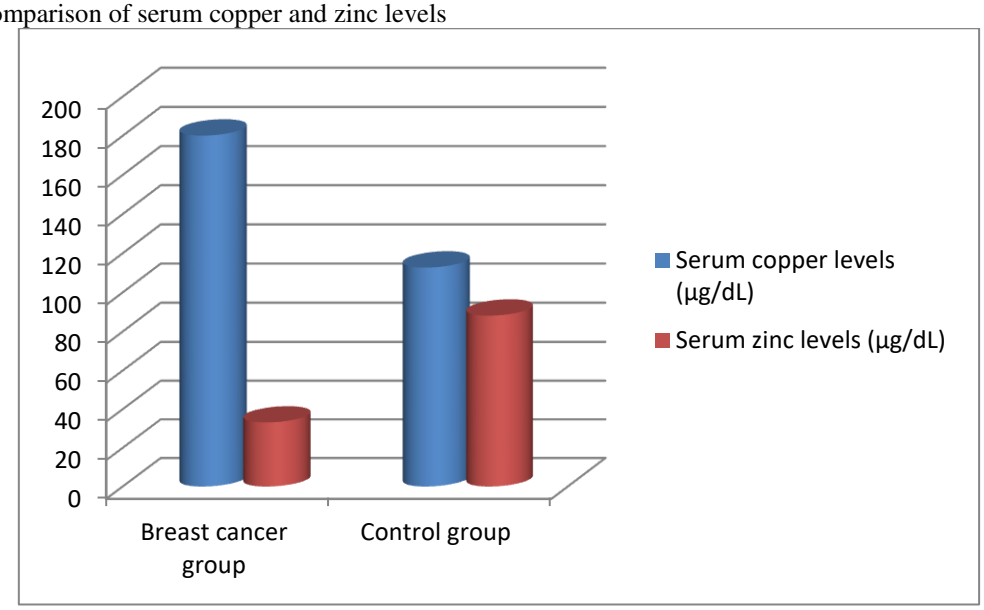
Parameter		Breast cancer group	Control group
Age group (years)	Less than 30	3	5
	30 to 40	12	9
	More than 40	10	11
	Total	25	25

Table 2: Comparison of serum copper and zinc levels

Parameter	Breast cancer group	Control group	p- value
Serum copper levels (µg/dL)	180.11	112.70	0.00*
Serum zinc levels (µg/dL)	33.19	88.15	0.02*

*: Significant

Graph 2: Comparison of serum copper and zinc levels



Macrophages can generate a mutagenic inflammatory microenvironment, which can promote angiogenesis and enable cancer cells to escape immune rejection. Different DNA methylation patterns have been observed between the normal and tumor-associated microenvironments, indicating that epigenetic modifications in the tumor microenvironment can promote the carcinogenesis.[10-12]Hence; under the light of above mentioned data, the present study was undertaken for assessing and comparing the serum zinc and copper levels in breast cancer patients and healthy controls.

In the present study, a total of 25 breast cancer patients and 25 healthy controls were analyzed. Mean age of the patients of the breast cancer group was 39.5 years, while mean age of the patients of the control group was 42.8 years. Mean serum copper levels among breast cancer patients were 180.11 µg/dL, while mean serum copper levels among normal controls were 112.70 µg/dL. Mean serum zinc levels among breast cancer patients were 33.19 µg/dL, while mean serum zinc levels among normal controls were 88.15 µg/dL. Ahmadi N et al examined the trace element serum levels in women with breast cancer before and after chemotherapy .Sixty patients were studied undergoing specialist. First sampling was taken before chemotherapy (after 4 weeks of surgery) and second sampling was taken after the completion of 3 courses of chemotherapy, approximately 9 weeks after the first chemotherapy. The patients took Adriamycin 60mg/m2 Cytoxan 600mg/m2. Serum zinc and iron levels were measured using standard spectrophotometric method. Measurement of serum copper was done by atomic absorption spectroscopy. Serum zinc and iron levels in women after chemotherapy significantly decreased ($p<0.001$), however, the serum level of copper increased but was not significant ($P=0.676$). Their findings demonstrated significant decrease in zinc and iron levels in breast cancer patients after 3 courses of Adriamycin and Cytoxan chemotherapy.[13]

In the present study, while comparing the mean copper and zinc levels among breast cancer patients and healthy controls, significant results were obtained. In another study conducted by Pavithra V, authors estimated the serum levels of calcium, copper, magnesium, iron, phosphorus and zinc and determine their role in causing breast cancer in female patients. Newly diagnosed female patients with breast cancer in the age group of 30-60 y attending Oncology clinic were included in the study. Serum was separated and tests were performed according to standard procedure for each metal ion on the same day. The estimation of metal ions was done by UV-Visible Spectrophotometer-CHEM 7. The study was conducted on 54 female patients with breast cancer and 54 female controls with mean age of 47.2±8.14 y and 46.8±8.4 y respectively. There was statistically significant increase in serum levels of calcium, copper, iron and phosphorus in patients with breast cancer when compared to controls. The increase in serum levels of magnesium was insignificant. A statistically significant decrease in serum zinc levels was observed in patient with breast cancer when compared to controls. The study highlighted the role of calcium, copper, iron, phosphorus, magnesium and zinc in the pathogenesis of breast cancer.[14]

CONCLUSION

Under the light of above obtained results, the authors conclude that zinc and copper play a definitive role in the pathogenesis of breast cancer. However; further studies are recommended.

REFERENCES

1. Cancer-Its various types along with causes, symptoms, treatments and stages, in: cancer info guide. 2009. [15 Mar. 2010]. http://www.cancer-info-guide.com/
2. Hartmann LC, Sellers TA, Frost MH, Frost MH, Lingle WL, Degnim AC et al. M. Benign breast disease and the risk of breast cancer. N Engl J Med. 2005;353:229–237.
3. Eberl M. M., Sunga A. Y., Farrell C. D., Mahoney M. C. Patients with a Family History of Cancer: Identification and Management. JABFM. 2005;18:211–217.
4. Mieszkowski M. R. Cancer – A biophysicist's point of view. In: Digital Recordings. 2006. Sep 04, [15 Mar 2010]. http://www.digital-recordings.com/publ/cancer.html.
5. Baumann M, Krause M, Hill R. Exploring the role of cancer stem cells in radioresistance. Nat Rev Cancer. 2008;8:545–554.
6. Smalley M, Piggott L, Clarkson R. Breast cancer stem cells: obstacles to therapy. Cancer Lett. 2013;338:57–62.
7. Zhang M, Lee AV, Rosen JM. The Cellular Origin and Evolution of Breast Cancer. Cold Spring Harbor perspectives in medicine. 2017;7:a027128.
8. Anderson B O, Braun S, Carlson R W, Gralow J R, Lagios M D. 2003. “Overview of Breast Health Care Guidelines for Countries with Limited Resources.” The Breast Journal 9 (Suppl. 2): S42–50.
9. Anderson B O, Cazap E, Saghir N S El, Yip C H, Khaled H M. and others. 2011. “Optimisation of Breast Cancer Management in Low-Resource and Middle-Resource Countries: Executive Summary of the Breast Health Global Initiative Consensus, 2010.” The Lancet Oncology 12 (4): 387–98.
10. Massihnia D, Galvano A, Fanale D. et al. Triple negative breast cancer: shedding light onto the role of pi3k/akt/mtor pathway. Oncotarget. 2016;7:60712–60722.
11. Baselga J, Gomez P, Greil R. et al. Randomized phase II study of the anti-epidermal growth factor receptor monoclonal antibody cetuximab with cisplatin versus cisplatin alone in patients with metastatic triple-negative breast cancer. J ClinOncol. 2013;31:2586–2592.
12. Anestis A, Karamouzis MV, Dalagiorgou G. et al. Is androgen receptor targeting an emerging treatment strategy for triple negative breast cancer? Cancer Treatment Reviews. 2015;41:547–553.
13. Ahmadi N, Mahjoub S, Hosseini RH, Khani MT, Moslemi D. Alterations in serum levels of trace element in patients with breast cancer before and after chemotherapy. Caspian J Intern Med. 2018 Spring; 9(2): 134–139.
14. Pavithra V, Sathisha TG2, Kasturi K3, Mallika DS4, Amos SJ4, Ragunatha S5. Serum levels of metal ions in female patients with breast cancer. J ClinDiagn Res. 2015 Jan;9(1):BC25-c27.