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Study of Serum Levels of Trace Elements (Selenium, Copper, Zinc, and Iron) in Breast Cancer Patients

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Abstract: *Purpose:* Malignancy of the breast is one of the commonest causes of death in women aged between 40-45 years. The aim of this study was to carry out a comparative study to investigate the effect of minerals on the risk of a woman developing breast cancer. *Materials and methods:* Three hundred blood samples were used to analyze the status of concentration of Selenium (Se), Copper (Cu), Zinc (Zn) and Iron (Fe) in breast cancer (BC) patients and healthy individuals by using atomic absorption spectrophotometer. *Results*: There was a significant ($p<0.05$) decline in the concentration of Se in serum samples of BC patients as on comparison with the healthy individuals. Concentration of Cu of BC patients was increased significantly ($p<0.05$) on comparison with the healthy individuals. There was a significant ($p<0.05$) decline in the concentration of Zn in BC patients on comparison with the healthy individuals. Level of difference of Fe remain insignificant ($p>0.05$) in serum of BC patients. There was a significant decline in the concentration of Se and Zn while high level of serum copper in breast cancer patients, as compared with normal healthy controls. *Conclusion*: We found a significant association between trace elements (serum selenium, zinc and copper) with breast cancer.

Keywords: Breast Cancer (BC), Serum Minerals, Selenium (Se), Copper (Cu), Zinc (Zn) and Iron (Fe)

1. Introduction

The breasts are external symbol of beauty and womanhood in women; however cancer of the breast is responsible for the death of millions of women worldwide every year. Malignancy of the breast is one of the commonest causes of death in women aged between 40-45 years [1]. The incidence of this disease is rising in many countries such as Japan and other developing nations and has become a genuine public health problem, with one woman in ten, developing it in her lifetime throughout the world. The incidence of breast cancer increases with age, being uncommon below the age of 32 years; however its behaviour varies from slow to rapid progressive disease despite available treatment. There is a high mortality and poor survival in breast cancer because of partial to low utilization of breast cancer screening measures to detect tumours at a more treatable stage [2]. BC has remained a main clinical challenge due to its poor prognosis, limited treatment options, relatively resistance to chemotherapy / radiotherapy and late diagnosis of the disease. Several possible mechanisms have been proposed for the probable role of Selenium (Se), copper (Cu), zinc (Zn), and iron (Fe) in BC etiology [3-6]. Since the beginning of the 1970s the minerals has received a lot of attention as per the variations of mineral concentration in serum has been related to increased risk for various types of cancer in humans [7-10]. Se plays a vital role in cancer prevention and appears to have important structural and enzymatic roles such as antioxidant activity. It is well established that oxidative

stress plays an important role in the carcinogenic process, as reactive oxygen species (ROS) which induce oxidative damage, DNA damage and protein damage. However, in the literature there are many controversial studies regarding the protective/therapeutic role of Se in human cancer [11-13]. Fe and Cu can produce the reactive oxygen species which can attack DNA and cause DNA mutation, and can act as an element in the pathological process of cancer, as Fe may be a limiting nutrient to the growth and replication of cancer cells in the humans [14]. Cu can be concerned in the activation of several organic peroxide and making them more carcinogenic [15]. Zn plays an anti carcinogenic role by stabilizing the structure of DNA, RNA and ribosome [16] also Zn is necessary to the functions of several transcriptional factors, proteins that recognize certain DNA sequences and control gene transcription [17]. Zn protects against free radical damage and may influence immune response [18, 19]. The aim of the present study was to determine the real status of Se, Zn, Cu and Fein serum of BC patients against the serum of healthy individuals in Kashmir Valley India.

2. Material Methods

100 hundred patients diagnosed with breast were considered for the study. Venous blood samples were collected into plain vials from patients (100) and control group (100) and were transported to the laboratory on ice and centrifuged at 3000 rpm for 15 minutes and serum was stored at -4°C until the day of mineral estimation, by using Atomic Absorption Spectroscopy AAS - ECIL. For statistical analysis, SPSS software was used and p-values less than 0.05 were regarded as statistically significant.

Preparation of serum for mineral estimation

a. 4 ml of Diacid (3ml nitric acid**:** 1 ml picric acid) were added to 1ml of serum in volumetric flask of 100ml volume.
b. The flask was then kept at room temperature for overnight.
c. Then on next day flask was put on a hot plat at simmering heat till the volume in the flask was reduced up to 0.5ml.
d. Then final volume of flask was made up to 10ml by diluting by distilled water.
e. These 10ml were used for the examination of mineral estimation by using the Atomic absorption spectrophotometer.

3. Results and Discussion

All values of Se, Zn, Cu and Fe are expressed as means ± SE at each time interval. The level of significance was set at $p<0.05$ and data was analyzed by SPSS. Figure 1 represent the serum concentration of Se, Zn, Fe, and Cu among BC patients and controls.

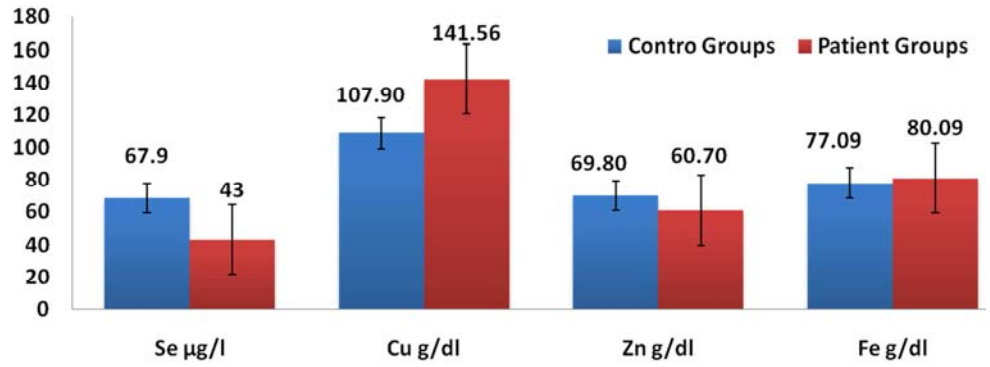

Figure 1. *Showing Se, Zn, Fe, and Cu among Breast Cancer and healthy individuals.*

The mean serum Se levels were significantly $p<0.05$ different in BC patients and in the control group of healthy individuals. The mean serum Cu levels ($p<0.05$) different in BC patients and in the control group of healthy individuals. The mean serum Zn levels $p<0.05$ different in BC patients and in the control group of healthy individuals. The mean serum Fe levels were insignificantly ($p>0.05$) different in BC patients and in the control group of healthy individuals.

Breast cancer is an important contributor to morbidity and mortality in humans. Trace elements have been regarded as a breast cancer preventive factor. In many past studies on minerals it was showed that there was an inhibitory effect of some minerals on the cell growth, DNA, RNA and protein synthesis in transformed cells, [12] in view of the above data we analyze the status of Se, Zn, Fe, and Cu in serum of BC and healthy individuals. Our results showed that there was a significant decline in the concentration of Se in serum samples of breast cancer samples as compared to control group samples which was in agreement with the findings of many coworkers [7, 20, 21]. The decline of Se in serum may be due to over uptake of Se by malignant cells due to which there was an increase level of Se in tumor cells. The concentration of Cu in breast cancer serum samples in our study was increased significantly on comparison with the healthy individuals which was in agreement with the findings of many coworkers in different cancers, breast cancer [23], bladder cancer [22], colorectal cancer [24], Gastric cancer [25]. This study also supports the previous studies were it

was shown that Cu can be concerned in the activation of several organic peroxides [26, 27] and can produce the hydroxyl radicals which cause mutation in DNA which may be one of the causes of cancer development.

As documented by earlier researchers that the Zn concentration in cancer patients was decreased as compared to healthy individuals which was in accordance with the results of our study were serum concentration of zinc was significantly lower in serum samples of breast cancer patients as compared to serum samples of healthy controls [28-30]. Zn plays an important role in stabilizing the structure of DNA, RNA and ribosome, it is also necessary for functioning of several transcription factors, proteins that recognize certain DNA sequences and control gene transcription and protects against free radical damage [31-33]. So may be due to decline in the concentration of Zn in breast cancer patients any of the above process get disturbed and may be acting as a causative agent for cancer. In this study there was found no significant difference in the levels of Fe in serum of breast cancer patients as compared with the healthy individuals and are in contradict with the findings of Weinberg (1996) [34].

4. Conclusion

Our study shows an association of trace elements (serum selenium, zinc and copper) with breast cancer, as minerals appear to have important structural and enzymatic roles in body, as there are some minerals having role in antioxidant activities like Se or some having role in stabilization of DNA, RNA, ribosome and protein structures like Fe and Cu or some producing oxygen reactive species like Zn. The increase or decrease of mineral concentration in serum of breast cancer patients may be one of the factors which can lead to other biological processes to cause breast cancer.

Conflict of Interest

Authors declare that they have no conflict of interests.

Author's Contribution

All authors read and approved the final manuscript.

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