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Research Article

Mineral status of female breast cancer patients in Tamil Nadu

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ABSTRACT

Cancer is rated as one of the most dreadful diseases next to AIDS. Breast cancer has emerged as the leading site of cancer among women and has overtaken cancer of the uterine cervix. The aim of the study was to find out mineral status in plasma and tissue of the breast cancer patients compared to healthy subject and minerals selected for the study were calcium, phosphorous, iron, copper and chlorine. In breast cancer condition, calcium, phosphorous and iron levels were significantly increased and decreased copper and chlorine levels in both tissue and plasma were observed. Present study results showed that the minerals could be used as diagnostic tool for breast cancer patients. It was concluded that copper and chlorine supplementation might lower risk of breast cancer patients.

Keywords: Breast cancer; Minerals; Plasma; Tissue

INTRODUCTION

Breast cancer is a “malignant neoplasm of the breast”. A cancer cell has a characteristic that differentiates it from normal tissue cells with respect to the cell outline, shape, structure of nucleus and most importantly, its ability to metastasize and infiltrate. When this happens in the breast, it is commonly termed as ‘Breast Cancer’. Cancer is confirmed after a biopsy (surgically extracting a tissue sample) and histopathological evaluation. Breast cancer is the commonest cause of deaths (after skin cancer) due to cancer in women. It is also the third lead cause of death due to all causes. It is estimated that breast cancer caused nearly 40,000 deaths in 2007, in USA alone. Breast cancer arises most commonly from the epithelial cells of milk producing lobules and ductules. Other cells may also produce cancer but are very uncommon and hence not discussed (Oldnall, 2012).

There are several types of breast cancer, but some of them are quite rare. In some cases a single breast tumor can be a combination of these types or be a mixture of invasive and *in situ* cancer. The different types are, Invasive (or infiltrating) ductal carcinoma, Invasive (or infiltrating) lobular carcinoma, Inflammatory breast cancer, and Triple-negative breast cancer. Special types of invasive breast carcinoma include Adenoid cystic (or adenocystic) carcinoma, Low grade adenosquamous carcinoma, Medullary carcinoma, Mucinous (or colloid) carcinoma, Papillary carcinoma, and

Tubular carcinoma. Some sub-types have the same or maybe worse prognosis than standard infiltrating ductal carcinoma. These include Metaplastic carcinoma, Micropapillary carcinoma, Mixed carcinoma (has features of both invasive ductal and lobular) (American Cancer Society, 2012). In general, all of these sub-types are still treated like standard infiltrating ductal carcinoma (David *et al.*, 2000).

The most common clinical sign of breast cancer is a painless, hard and fixed lump in the breast. This is one of the reasons that make clinical detection of breast cancer very difficult, as painlessness gives the woman a false sense of security. If the lump is movable, it is less likely to be cancer, and more likely to be benign cysts. Approximately, one-tenth of the patients have breast pain with no detectable lump. Other symptoms are categorized under breast distortion. Dimpling of the skin surface, swelling, skin irritation, skin edema with *peau d'orange* appearance, nipple inversion, tenderness and nipple discharge. At times, a rapidly growing tumor may cause dilated superficial veins forming prominent vascular patterns, visual on the breast surface (American Cancer Society, 2012).

There are many ways in which one can diagnose breast cancer at its early stage. They are Breast Self Exam, Clinical Exam, Mammography Findings, Magnetic Resonance Imaging, Breast Ultrasound and Ductogram (Gotzsche and Nielsen, 2011).

Treatment of breast cancer is determined by the patient's age and preference, patient's medical history, staging at the time of diagnosis, and type of cancer. Surgery is the most preferred method of removal of cancer infested sites. In most of the surgical procedures, ideally, at least a few lymph nodes are removed to determine if the cancer is localized or spread. Based on this information, the oncologists work out follow-up

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Table 1: Minerals Analysis in tissue homogenate

Parameters Study Group	Minerals Analysis				
	Calcium** (mg/g)	Phosphorous** (mg/g)	Iron** (µg/g)	Copper** (mg/g)	Chlorine** (mg/g)
Group I	0.38 ± 0.02	60.0 ± 6.12	6.60 ± 0.54	0.32 ± 0.04	48.6 ± 4.92
Group II	0.14 ± 0.009	28.0 ± 2.73	3.70 ± 0.27	1.14 ± 0.07	88.40 ± 7.89

Group I – Breast Cancer and Group II – Normal Persons; Data were expressed as Mean ± SD; **P < 0.001 statistically significant level.

Table 2: Minerals Analysis in plasma

Parameters Study Group	Minerals Analysis				
	Calcium** (mg/dl)	Phosphorous** (mg/dl)	Iron** (µg/dl)	Copper** (mg/dl)	Chlorine** (mg/dl)
Group I	73.35 ± 3.72	27.60 ± 2.50	691.79 ± 18.33	.034 ± 0.006	177.40 ± 15.05
Group II	9.78 ± 0.43	3.30 ± 0.27	161.60 ± 35.05	0.089 ± 0.008	243.20 ± 21.48

Group I – Breast Cancer and Group II – Normal Persons; Data were expressed as Mean ± SD; **P < 0.001 statistically significant level.

therapeutic procedure. Chemotherapy is the use of drugs or chemicals to treat and/or prevent the spread of cancer. The cytotoxic chemicals used for this therapy interferes with the process of cell division thus containing the cancer cells and in due course, killing the cancer cells. Radiation therapy treatment involves the use of radiation to kill the cancer cells, primarily for preventive treatment, after surgery. Endocrine treatment involves interference with patient's hormones. Breast cancer patients test positive for estrogen or progesterone levels and may be given endocrine therapy to interfere with the estrogen's aid in the growth of malignant cancer cells (American Cancer Society, 2012 and Saini *et al.*, 2012).

Considering the high mortality and effective treatment for breast cancer if detected early, many preventive programs have been initiated. Most involve regular Breast Self Exam and yearly Mammography. As well as oophorectomy and bilateral prophylactic mastectomy has been found to reduce risk in a non-randomised trial for women with BRCA1/2 mutations. As knowledge of non-endocrine risk factors increases so new interventions will emerge to reduce the incidence of ER +ve and ER -ve breast cancer (Pegg, 2011).

MATERIALS AND METHODS

Blood was collected with ethylene diamine tetra acetic acid (EDTA) for the separation of plasma to determine blood parameters. The breast tissues were homogenized with motor driven teflon coated homogenizer in ice-cold 0.1M Tris-HCl buffer pH 7.4 to get 10% homogenate. Calcium was estimated by Clark's method (Clark, 1921). The phosphorus level was determined by Fiske and Subbarow's method (Fiske and Subbarow, 1925). Iron was estimated by Ramsay's method (Ramsay, 1953). The level of copper was determined by Shaffer and Hartmann's method (Shaffer and Hartmann, 1921). A chloride level was identified by Schales and Schales's method (Schales and Schales, 1941).

STATISTICAL ANALYSIS

Statistical analyses were carried out on a personal computer with the use of the SPSS software evaluation version 15.0 (SPSS Inc. Chicago, IL, USA). The results were expressed as mean ± standard deviation (SD). Data were analyzed using independent "t" test by applying mean comparison method. Significant difference were defined as two tailed p<0.001. Graphs were produced using Microsoft office Excel-2003 with the help of chart options.

RESULTS AND DISCUSSION

Cancer is a multifactorial disease that results from the interaction of multiple genetic and environmental factors (Pharoah *et al.*, 2004). Cancer cells may invade nearby tissue. And they may spread through the blood stream and lymphatic system to others parts of the body. The estimation of minerals like Calcium, Phosphorous, Iron, Copper, and Chlorine were carried out using spectrophotometer and titration methods. The Table 1 and Table 2 showed that the tissue and plasma levels of minerals in breast cancer patients compared with normal persons respectively.

The Figure 1 and Figure 2 depict the tissue and plasma levels of minerals in breast cancer patients compared with normal persons respectively. In the present study, plasma and tissue levels of calcium showed a significant increase in breast cancer patients when compared to disease free individuals. This has also been reported in other malignancies (Rizk *et al.*, 1984). The results of the present study, hypercalcemia in breast cancer has been attributed in part to osteolytic bone metastases and this account for 20-30% of the hypercalcemia cases in oncology patients (Usoro *et al.*, 2010).

The phosphorous level in plasma and tissue were found to be significantly increased in breast cancer patients when compared to healthy subjects. The elevations of phosphorous levels are probably due to the increased cellular activity in malignant tissue and active

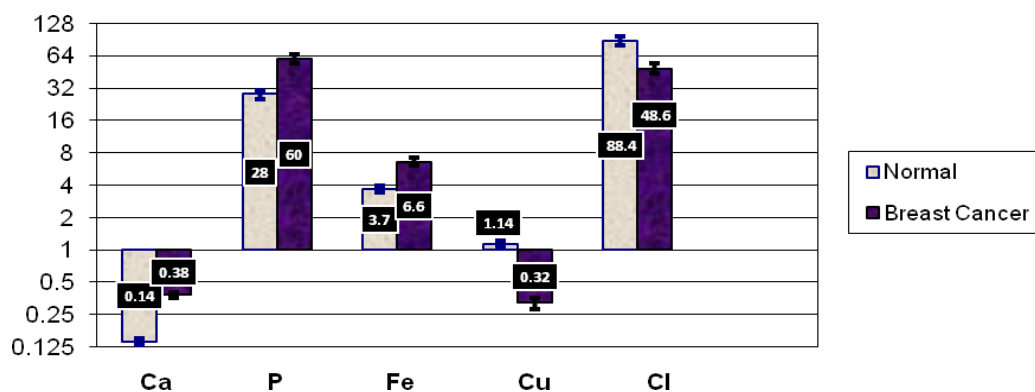


Figure 1: The tissue homogenate levels of minerals

Where Ca-Calcium, P-Phosphorous, Fe-Iron, Cu-Copper and Cl-Chlorine

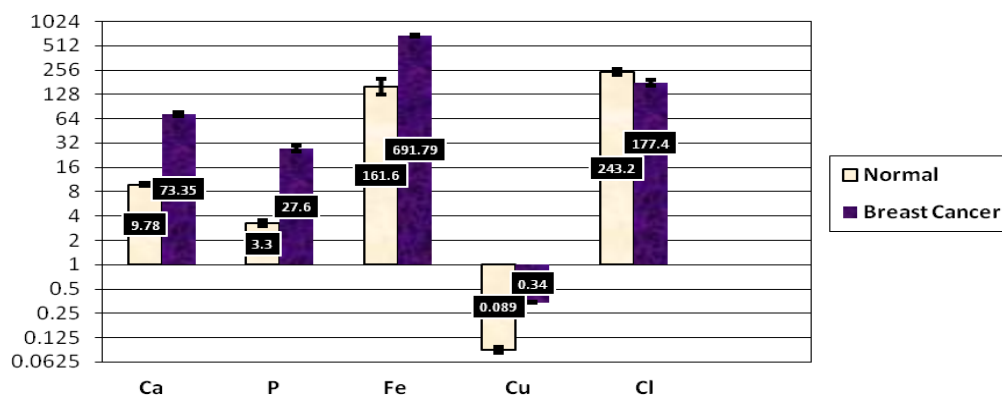


Figure 2: The plasma levels of minerals

Where Ca-Calcium, P-Phosphorous, Fe-Iron, Cu-Copper and Cl-Chlorine

enzymatic systems leading to increased amounts of trace elements (Ng *et al.*, 1997).

The plasma and tissue levels of iron were slightly higher in the cancer patients when compared to normal healthy subjects. Similar studies also reported the slightly elevated levels of iron in breast cancer patients compared with normal persons (Cui *et al.*, 2007). The potential role of iron in cancer etiology is supported by several plausible mechanisms as transition metals, iron, can generate reactive oxygen species including hydroxyl radicals. These reactive oxygen species can attack DNA and cause DNA mutations thus contributing to the pathological process of cancer (El Fotouh *et al.*, 2012).

In the present study plasma and tissue levels of copper showed a significant reduction in the cancer group when compared to normal healthy subjects. Thus, present study supports the possibility of the uptake of copper from the blood and tissue by cancer cells. This may be an indication that copper is associated with the pathogenesis of breast cancer (Arinola and Charless, 2008). The present study results clearly showed reduction in the copper level so that dietary supplementation might be recommended to breast cancer patients in addition to normal diet.

In the current study, plasma and tissue levels of chlorine showed a significant decrease in breast cancer

patients when compared to normal persons. Similar studies also reported the decreased levels of chlorine in breast cancer patients compared with normal persons (Vatankhah *et al.*, 2003). So that dietary supplementation might be recommended to breast cancer patients in addition to normal diet.

CONCLUSION

Breast cancer is the most common malignancy in women, affecting approximately one in eight women over their life time. Women with breast cancer have higher calcium, phosphorous, and iron than healthy women. Copper and chlorine levels decreased in breast cancer. Present study results clearly demonstrated the reduction in the amount of certain minerals (copper and chlorine), so that dietary supplementation with natural minerals might be recommended to breast cancer patients in addition to normal diet. It was also proposed that minerals could be used as diagnostic tool for breast cancer. From the present study, it was also concluded that copper and chlorine food supplement might lower risk of breast cancer.

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