



## TO DETERMINE SERUM MAGNESIUM AND COPPER LEVEL IN BREAST CANCER DIAGNOSED PATIENTS

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### ABSTRACT

Breast cancer is the commonest malignancy of breast tissue that spreads and metastasise from the duct. The prognosis may be determined by parameters as Magnesium and Copper. In our study, 105 participants were enrolled and found out that 70.5% was BIRADS IV and 28.6% for BIRADS V and 67.6% of the total was low with a mean of  $1.58 \pm 0.4 \text{ mg/dL}$ . Magnesium was significantly low in BIRADS V and VI ( $p < 0.001$ ). Elevated Copper was found in 73% of patients, mean:  $198.59 \pm 71.0 \mu\text{g/dL}$  and the increase was found significant with higher BIRADS ( $p < 0.0001$ ). These changes may highlight the potential of these biochemical parameters in early detection, monitoring and evaluating breast cancer and including these parameters in routine tests may improve the screening and treatment of breast cancer.

**KEYWORDS :** Breast cancer, Magnesium, Copper, Screening

### INTRODUCTION

Breast cancer is the commonest malignancy in female population worldwide. (Atoe, 2014) Initially, the cancerous growth is confined to the duct but over time, cancers may progress and invade the surrounding breast tissue and metastasise. In 2020, 2.3 million women got diagnosed with breast cancer and 685,000 deaths globally. Female breast cancer occurs in every country at any age after puberty and rates increases in later age. (WHO, 2024) Major risk factor is being female and age above 50, family history of relatives with first degree, nulliparity and history of benign breast diseases. Menarche before the age of fifteen and menopause after the age of 55 years of age carry risk for breast cancer. Exposure to radiation, increased body weight and alcoholism are also risk factors. (Jain, 2001) Clinical presentation involves the presence of lump in breast, axillary nodal involvement or enlargement, weight loss, increasing non tender mass. (Turco, 1994)

There is little information about tumour growth influencing systemic availability of magnesium in a patient, nor is it clear whether treatment-associated changes of magnesium influenced tumour growth. (Wolf, 2009) Copper is essential in tumour progression, angiogenesis and metastasis. (Feng, 2020) Hence, we include Serum Copper and Magnesium as the parameters to see any changes.

### Aim

To explore serum magnesium and copper level in breast cancer patients and to find association between BIRADS classification and the parameters in breast cancer.

### MATERIALS AND METHODS

This study was done in Biochemistry department of a tertiary health care hospital during the year of 2023-2024. A total of 105 breast cancer Patients were included and BIRADS classifications was used to categorise them. Written informed consent was obtained from all subjects.

### Study Design

Cross-sectional study design

### Method

Study population consist of newly diagnosed female patients with breast carcinoma attending Breast-clinic OPD.

### Inclusion Criteria

- 1) Histo-patho-cyto-radiologically diagnosed female patients in the age group of 30-60 years.
- 2) Those who gave written consent.

### Exclusion Criteria

- 1) Patient who underwent any form of treatment for breast cancer.
- 2) Subject with co-morbid conditions or under test-parameter altering medications.
- 3) history of other malignancy and organ-transplant
- 4) Patient on Oral contraceptive pills
- 5) history of pregnancy or lactation
- 6) Alcoholic and chronic smokers
- 7) anaemia patients.

### Procedure:

**Data Measurements Techniques:** Principle of Photometry

### Study Tools

- 1) Study Performa
- 2) Auto-Analyser

### Data Collection Procedure

5ml of Venous blood was collected from patients and transported manually in clot Activator tubes, let to stand for 30minutes for clotting. The Clot activated sample were centrifuged at 3500RPM (15mins) and serum was separated using pipette in sterile condition, separated in Cups(2ml) and respective test parameters was run in the auto Analyser. The result was recorded, compared and analysed to look for any deranged values of selected parameters.

### Data Analysis

SPSS v24 (IBM Corp., Armonk, NY) was used for analysis of data and proper statistical tool was used as per variable.

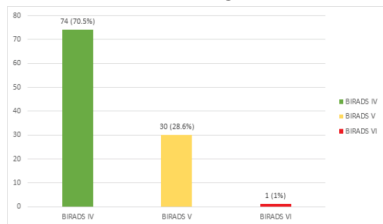
### Ethical Consideration

Ethical clearance obtained from the Institutional Ethics Committee of IGGMC bearing IEC number MUHS/ Medical/ MUHS-053212/2019. No personal identifiers were used in data

collection, OPD number assigned by MRD were used. Collected data were kept under lock and key in the Biochemistry department. Data collected were used only for study purpose.

**RESULT**

The mean age of study participants (n= 105) was 50.70 ± 10.9 years. Out of 105 participants, 74(70.5%) came under BIRADS-IV (Breast Imaging Reporting and Data System), 30(28.6%) were found to be in BIRADS-V, 1(1%) were found to be under the Classification of BIRADS-VI(Figure 1).



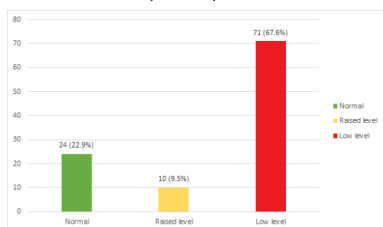
**Figure 1: Distribution of Breast Cancer Staging**

The mean level of the parameters of the Serum Magnesium and Copper is given in table 1

**Table 1: Serum Copper and Magnesium Levels of Participants (n=105)**

Parameter (Serum Level)	Normal Range	Minimum	Maximum	Mean	SD
Copper (µg/dL)	70–140µg/dL	117	524	198.59	71.0
Magnesium (mg/dL)	1.7–2.2mg/dL	0.6	2.7	1.58	0.4

The serum Magnesium level distribution is depicted in figure 2. Our study results showed that majority of the study participants had low level(67.6%).



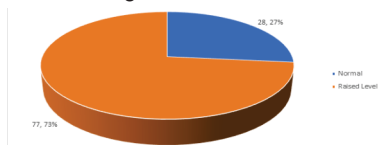
**Figure 2: Serum Magnesium Distribution of Study Participants (n= 105)**

Magnesium was found significantly lower at BIRADS-V and VI as shown in table 2. It was found to be statistically significant with p value <0.001

**Table 2: Comparison of BIRADS with Serum Magnesium and Copper in Breast Cancer.**

Parameters	BIRADS			P-value
	IV	V	VI	
Mg (Mean±SD)	1.70±0.3	1.31±0.3	0.80±0	0.001
Cu (Mean±SD)	180.87±46.3	232.5±88.2	490.00±0	0.0001

Figure 3 represents distribution of serum copper levels. It was found that the majority of the observations were elevated levels, with 73% showing raised level.



**Figure 3: Serum Copper level Distribution of the Study Participants (n= 105)**

**DISCUSSION**

Our study included a total 105 Patients of breast cancer, organised with the help of BIRADS classification as shown in Figure 1. The mean age of study population was 50.70±10.9 years. Malvia S et al had similar findings where breast malignancy were seen in 46-55 year olds. (Malvia, 2017) Ali JK et al found high prevalence of breast cancer in between 40-50 years. (Ali, 2018)

**Serum Magnesium:** In our study, decreased serum magnesium levels were seen, where the mean value was 1.5±0.4 mg/dL and the low level of magnesium constituted 67.6% of the study population as shown in Figure 2.

Atoe K et al found lower magnesium in breast cancer patient and contribute to cellular proliferation and tumour growth. (Atoe, 2014) Songara NS et al also found low serum magnesium level in study participants with breast cancer when compared to healthy individuals in their research. (Songara, 2022) Abdelgawad IA et al found serum magnesium went low to a minimum of 1.5mg/dL. (Abdelgawad, 2015) During rapid tumour growth, the cells have an increased demand for magnesium to support cellular proliferation and metabolic activity. Hence, the cancer cells may trap magnesium for their own growth, causing deficiency in the serum of the body. (Wolf, 2008)

As per Castiglioni S et al, magnesium is a cofactor for enzymes that protect against oxidative stress. In breast cancer, increased oxidative stress due to cancer metabolism can deplete magnesium reserves. (Castiglioni, 2011) Tao M et al found that higher diet of magnesium was inversely related to risk of death and intake of magnesium through food source can improve survival. (Tao, 2015)

**Serum Copper:** Our study showed elevated copper levels in the patients with a mean value of 198.59µg/dL (±71.0) as given in Table 1. 73% of the study participants were found to have raised copper as shown in Figure 3. This was found consistent with study of Hassan T et al and Zowczak M et al. (Hassan, 2017); (Zowczak, 2001)

The reason of its pathogenesis is unclear but it can presumably be due to the rise in the copper binding components like ceruloplasmin. (Arinola, 2008); (Capel, 1982) Linder MC et al stated that in the case of cancer and inflammation, plasma copper and ceruloplasmin rise and secretion of ceruloplasmin by the liver are heightened. (Linder, 1996) Tisato V et al stated that copper is important for tumour surveillance. The Pro-inflammatory cytokines like TNF-α and IL-6 stimulate hepatic copper release and contribute to elevation of serum copper. (Tisato, 2010) Tumour cells require Copper to protect against oxidative stress from their high metabolic rates as per Friske LM et al. (Friske, 2009)

Thus, our study findings correlate with the studies from past that breast cancer increases with the relative increase in age. It peaks at the age form 40-50 years and above. The stimuli that could possibly promote the late increase of breast tumorigenesis are the modified extracellular matrix and also the secreted products from senescent fibroblast. (Benz, 2008)

**CONCLUSION**

The statistically significant results obtained, helps evaluate the potential use of Serum copper and Magnesium. These consistent findings suggest that incorporating these biomarkers into routine clinical assessments may aid in early detection and tracking of breast cancer progression. The parameters could also be used to predict the survival rate and help in checking the nutritional deficiency.

**LIMITATIONS**

The study was conducted in a single clinical setting, thereby

affecting its generalizability. Due to cross-sectional nature, the parameters were measured at one point of time, which failed to consider the variations that could have occurred over time.

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