

SERUM MAGNESIUM LEVELS IN WOMEN WITH BREAST CANCER IN BENIN CITY, NIGERIA

ATOE K¹, IDEMUDIA J.O¹, EBOREIME O².

**1. DEPARTMENT OF CHEMICAL PATHOLOGY, UNIVERSITY OF
BENIN TEACHING HOSPITAL BENIN CITY.**

2. DEPARTMENT OF SURGERY, CENTRAL HOSPITAL, BENIN CITY.

ALL CORRESPONDENCE TO:

DR. IDEMUDIA JOSEPH OSAGIE

**DEPARTMENT OF CHEMICAL PATHOLOGY, UNIVERSITY OF
BENIN TEACHING HOSPITAL BENIN CITY.**

PHONE NUMBER: 08023349492

E-mail: osagiep2001@yahoo.com

ABSTRACT

Aim: The aim of this study was to compare the serum magnesium levels of patients with breast cancer and those without the disease.

Study Design: This is a cross-sectional prospective study.

Place and Duration of Study: The study was carried out at the Department of Surgery, Central Hospital, Benin City and Department of Chemical Pathology, University of Benin Teaching Hospital Benin city, Nigeria, between July, 2011 and October 2012.

Methodology: A total of 60 female participants from Central Hospital, Benin City, Nigeria were recruited for this study. 30 of these women (50%) had breast cancer and 30 women (50%) without the disease served as control. Venous blood was obtained from participants and serum magnesium level was determined using standardized laboratory methods.

Results: The results showed a statistically significant reduction in serum magnesium level of patients with breast cancer compared with those without the disease.

Conclusion: We demonstrated from this present study that the participants with breast cancer have reduced serum magnesium level compared to those without the disease (control) and it is advisable to add magnesium as an adjuvant therapy in the management of breast cancer.

Key words: serum magnesium, breast cancer.

Introduction

Breast cancer is the commonest malignancy among females worldwide¹. The exact cause of breast cancer is unknown, however some risk factors include age, family history, life style (alcohol consumption, hormone use), obesity, post menopausal women with hypercholesterolemia. Researchers at the University of North Dakota in the United States suggested that analysis may be ignoring the role of magnesium as an important risk factor in breast cancer.

Aleksandrowicz et al also reported in Poland that inadequacy of magnesium and antioxidants are important risk factor in predisposing to leukamia².

Studies have shown that 46% of patients admitted to an ICU (intensive care unit) in a tertiary cancer center presented with hypomagnesemia and they concluded that the incidence of hypomagnesemia in critically ill cancer patients is high³. The incidence rises to 60 to 65% in all patients admitted into the intensive care units in which nutrition, diuretics, hypoalbuminemia, and aminoglycosides may play important roles^{4,5,6}.

Over 300 enzymes systems that influence the metabolism of carbohydrate, amino acids, nucleic acid, protein and ion transport, require magnesium^{7,8}. The role of magnesium in fatty acid and phospholipid metabolism, that affect permeability and stability of membrane, were elucidated^{9,10}.

It has been proposed that magnesium is central in the cell cycle, and that its deficiency is an important condition in pre cancerous cell transformation^{11,12,13}. Magnesium deficiency would therefore lead to physiological decline in cells setting the stage for cancer.

It is known that carcinogenesis induces magnesium distribution disturbance, which causes magnesium mobilization through blood cells and magnesium depletion in non-neoplastic tissue. Magnesium deficiency seems to be carcinogenic and in case of solid tumours a high level of supplemented magnesium inhibits carcinogenesis¹⁴.

Studies carried out at the University of Ibadan Nigeria showed an increased serum magnesium level in breast cancer patients compared with controls and it was suggested that this increase may be an indication of its protective effect against cancer.¹⁵

The objective of this study is to evaluate and compare serum magnesium levels of patients with breast cancer with those without the disease.

Patients and methods

A total of 60 female participants from Central Hospital Benin City, Nigeria were recruited for this study between 1st July 2011 through 31st October 2012 (15 months). 30 of these women (50%) had breast cancer and 30 women (50%) without the disease served as control.

The study was approved by the management of the hospitals and participation was voluntary.

Biochemical analysis was done at the Department of Chemical Pathology, University of Benin Teaching Hospital.

Sample collection and preparation

Venous blood was obtained from participants with breast cancer immediately diagnosis was made prior to the commencement of chemotherapy, venous blood was also obtained from age matched female control subjects. The samples were allowed to clot and retract and then centrifuged at 3000 RPM for 15mins. The sera were harvested and stored frozen at -20⁰C until analysis was carried out.

Data analysis

Data analysis was conducted using the general linear model of SAS, 2004 model. The result of the study was expressed as mean ± standard error of mean. Analysis of variance was used to test for difference in the group. Duncan's multiple range tests was employed to express the mean that show significant differences.

Assay method

Serum magnesium levels was assayed using direct spectrophotometric method. In the reaction, magnesium forms a coloured complex with calmagite in alkaline medium to produce a red complex which was measured spectrophotometrically at 539 nm. EGTA (ethylene glycol tetra acetic acid) was added to prevent calcium interference, and a surfactant which eliminated the effect of protein. The colour produced was proportional to the magnesium concentration¹⁶.

The concentration of magnesium is obtained from the equation

$$\frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times \frac{\text{concentration of standard}}{\text{concentration of sample}}$$

Result

Participants were both pre menopausal and post menopausal women. The mean age of participants with breast cancer was 55 ± 1.6 (range 45 to 65) years while that of the control was 51 ± 1.4 (range 42 to 66) as shown in table 1.

Table1 also shows statistically significant difference between the mean serum magnesium levels of the participants with breast cancer and control; 1.095 ± 0.007 Vs 2.520 ± 0.053 with P-value 0.03.

The difference in the mean serum magnesium levels between the participants with breast cancer and control is also shown in the histogram in figure 1.

Table1: The mean age and magnesium level of participants without the disease (control) and those with breast cancer.

CONTROL		
	AGE (YEARS)	MAGNESIUM (mmol/L)
Mean	51	2.520
Sample size	30	30
SEM	1.422	0.053
Minimum	42	2.040
Maximum	66	2.920
BREAST CANCER PATIENTS		
Mean	55	1.095
Sample size	30	30
SEM	1.602	0.007
Minimum	45	0.815
Maximum	65	1.440

Figure1



This is a histogram showing serum magnesium level of breast cancer patient Vs control

Key



Control



Breast Cancer Patient

Discussion

The findings from this study showed reduced serum magnesium level in breast cancer patient compared to the control, this is in agreement with earlier studies by Aleksandrowicz in Poland who reported hypomagnesaemia in leukemic patients² and this contradicts the findings by Arinola et al in Ibadan, Nigeria who reported hypermagnesaemia in breast cancer patients.¹⁵

Studies have shown that 4% of breast cancer women in the United Kingdom are due to alcoholic consumption¹⁷. It was shown that women who had one or two drinks a day had increased risk of developing breast cancer by 10%, while those that had more than three drinks a day raised their risk by 30%. This probably may be due to the fact that alcohol causes a reduction in magnesium level. Studies have shown that low magnesium level is associated with dramatic increase in free radical generation as well as glutathione depletion and this is implicated in infection and cancer¹⁸.

Studies have shown an increased cancer rate in regions with low magnesium level in soil and drinking water¹⁹. School of public health at the Kaohsiuny Medical College in Taiwan, found that magnesium also exerts a protective effect against gastric cancer²⁰. Pretreatment hypomagnesaemia has been reported in young leukaemic children, 78% of whom have history of anorexia, and have excessive gut and urinary loss of magnesium.

Study from Sweden reported that women with the highest magnesium intake had a 40% lower risk of developing cancer than those with the lowest intake of mineral²¹. Studies from the school of public health at the University of Minnesota in 2006 reported that diet rich in magnesium reduced the occurrence of colon cancer²².

It has also been reported that cancer patient receiving chemotherapy may be at high risk for developing hypomagnesaemia due to side effects such as diarrhea that can deplete magnesium stores²³.

Conclusion

We have demonstrated from this present study that the participant with breast cancer have reduced serum magnesium level compared to the control and it is advisable to add magnesium as an adjuvant therapy in their management. Magnesium should also be routinely assayed for in patients with breast cancer as a baseline investigation and during the course of chemotherapy.

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Competing Interest: there was no competing interest.

Author's Contribution: There was equal contribution of all the authors to this study. All the authors read and approved the final manuscripts.

Consent: All the participants were properly briefed about the study and an informed consent was obtained from them before venous blood was collected.

Ethical Approval: The study was approved by the Management of Central Hospital, Benin city, Nigeria

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