

ORIGINAL PAPER

A study of serum zinc in depression

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ABSTRACT

Introduction: Depression, a mood disorder is a common mental health problem in all sections of people of the society, and it causes physical, psychological and social symptoms. So, keeping this in mind, the study is carried out to estimate serum zinc in cases of depression and compare the levels with that of age and sex matched healthy controls. **Aim:** To measure the serum zinc in clinically diagnosed patients with depression and study their levels in different age groups and gender. **Methods:** serum zinc estimation is done by colorimetric method. Serum albumin estimation is done by Bromocresol Green (BCG) method. **Results:** Serum zinc was significantly ($p < 0.01$) lower in the cases ($58.55 \pm 8.70 \mu\text{g/dl}$) than in the controls ($64.78 \pm 9.86 \mu\text{g/dl}$). **Conclusion:** It is suggestive that Serum zinc levels being lower in cases of depression; may have a role on the causation or be a result of depression. So, longer duration of study and with a larger sample size may reveal significant insights on the role of this micronutrient in depression.

Keywords: Psychiatry, Assam, micronutrient

INTRODUCTION

Depression, the common psychological disorder, affects about 121 million people worldwide. World Health Organization (WHO) states that depression is the leading cause of disability as measured by Years Lived with Disability (YLDs) and the fourth leading contributor to the global burden of disease. By the year 2020, depression is projected to reach second place in the ranking of Disability Adjusted Life Years (DALY) calculated for all ages. Today, depression already is the second cause of DALYs in the age category 15-44 years.¹

It is estimated that depression is the cause of 50-70% suicides.² There are some evidences that depression is accompanied by activation of the Inflammatory Response System (IRS). Increased numbers of leucocytes, monocytes, neutrophils, activated T-lymphocytes and secretion of neopterin and prostaglandins.³ An Acute Phase (AP) response is indicated by changes in serum acute phase proteins⁴ and increased secretion of

proinflammatory cytokines, such as interleukin-1b (IL-1b), IL-6 and interferon-g (IFN-g). Since these proinflammatory cytokines induce IRS activation, the above changes in depression may be caused by increased production of IL-1b, IL-6, and IFN-g.⁴ IRS activation is associated with decreasing in serum zinc. There is now evidence that depression is accompanied by lower serum zinc.⁴ IRS activation results in decreased serum albumin concentration and availability of less zinc (Zn) binding protein.⁵ However, it is not known whether the decrease in serum zinc in depression is attributable to lower serum albumin.

Zinc is an antagonist of the glutamate/N-methyl-D-aspartate (NMDA) receptor and exhibits antidepressant like activity in rodent tests/models of depression. This preliminary clinical study demonstrated the benefits of zinc supplementation in antidepressant therapy.⁶ All the above data indicate the important role of zinc homeostasis in the psychopathology and therapy of depression and potential clinical antidepressant activity of this ion.

The present study aims to measure the serum Zinc in clinically diagnosed patients with depression and study their levels in different age groups and gender.

METHODS

The present study comprised of 50 cases of depression and 50 age and sex matched healthy controls visiting the Department of Psychiatry, Assam Medical College, Dibrugarh, Assam. Inclusion Criteria: Patients of age group 16 to 50 years, newly diagnosed

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cases of depression as diagnosed by DSM IV and previously diagnosed cases of depression in which patient is drug free for atleast one month. Exclusion Criteria: Patients with other associated psychiatric disorders and dementia, Substance abuse, systemic illness like diabetes, hypertension, hypothyroidism, renal disease, liverdisease, obesity and cancer, pregnant ladies and lactatingmothers, patients on multivitamins and oral contraceptive pills(OCP) and patients with mental retardation and hearingimpairment. The Grading of the cases included in the present study into mild/moderate/severe was done using the 17 item Hamilton Depression Rating Scale.

METHODS

ESTIMATION OF SERUM ZINC (colorimetric method)^{7,8}

Zinc in an alkaline medium reacts with Nitro-PAPS to form a purple coloured complex. Intensity of the complex formed is directly proportional to the amount of zinc present in the sample.

Alkaline medium

Zinc + Nitro-PAPS → Purple coloured complex.

ESTIMATION OF SERUM ALBUMIN {BROMOCRESOL GREEN (BCG) METHOD}⁹

Principle: Albumin binds with the dye Bromocresol Green in a buffered medium to form a green coloured complex. The intensity of the colour formed is directly proportional to the amount of albumin present in the sample.

Albumin + Bromocresol Green → Green Albumin BCG Complex

Apart from unpaired student’s test, ANOVA, Regression Analysis was the statistical tools applied.

Highest number of depression cases included in the study were in the 26-30 years age group (26%), followed by 21-25 years age group (24%).16-20 years age group with only 3 cases showed the lowest number of cases i.e., 6%.

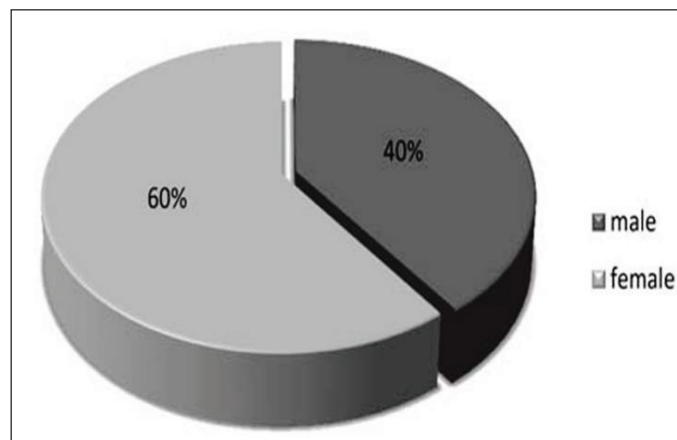


Figure 2 Gender distributions of cases

The diagram shows that majority of the cases in the present study were females. 40% of cases were males and 60% of the cases were females with a male female ratio of 0.67:1.

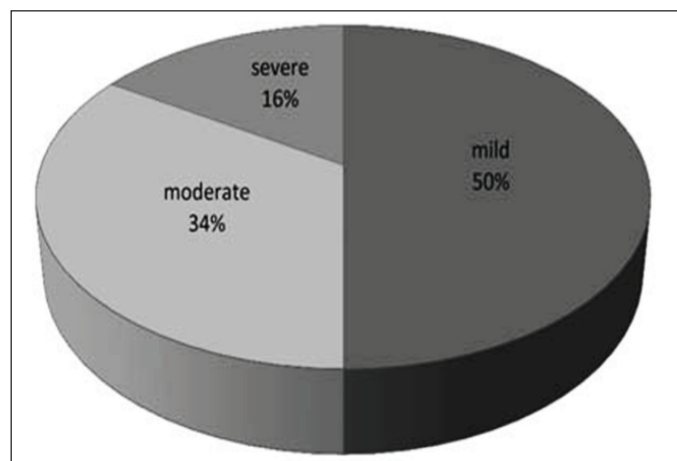


Figure 3 Different grades of depression

In the diagram, it is seen that mild depression constitutes the majority of the cases under study. 25 cases (50%) of total cases were mild depression, 17 cases (34%) were moderate depression and 8 cases (16%) were severe depression.

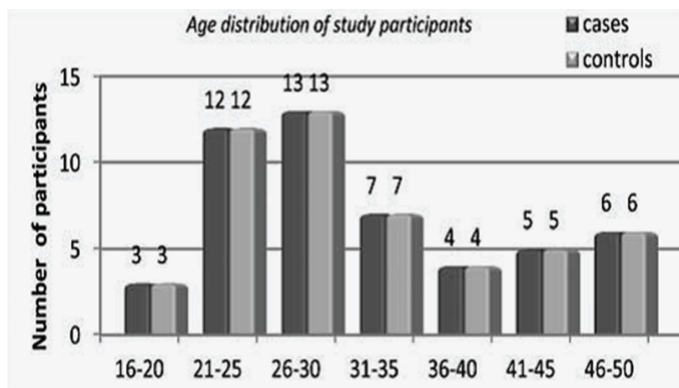


Figure 1 Age distribution of cases

Table1 Comparison in cases and controls

Parameters	Cases		Controls		P-Value
	Mean	SD	Mean	SD	
Serum Zinc(µg/dl)	58.55	8.70	64.78	9.86	<0.01*
Serum Albumin(g/dl)	3.70	0.41	3.85	0.46	>0.05

*-Statistically significant

Serum Zinc in cases (58.5 ± 8.70 ig/dl) was significantly lower (p<0.01) than in the controls (64.78± 9.86 ig/dl). Serum albumin

was also lower in the cases (3.70± 0.41g/dl) than in the controls (3.85± 0.46 g/dl) but not statistically significant.

Serum Zinc in cases (58.5 ± 8.70 $\mu\text{g/dl}$) was significantly lower ($p < 0.01$) than in the controls (64.78 ± 9.86 $\mu\text{g/dl}$). Serum albumin was also lower in the cases (3.70 ± 0.41 g/dl) than in the controls (3.85 ± 0.46 g/dl) but not statistically significant.

Table 2 Comparison in male and female cases

PARAMETERS	Cases			Controls		
		MEAN	S.D	MEAN	S.D	P VALUE
SERUM ZINC($\mu\text{g/dl}$)	MALE	56.0	6.99	66.65	9.05	<0.01*
	FEMALE	60.25	9.40	63.54	10.32	NS

*= Statistically significant; NS= Not Significant($p > 0.05$)

From the above table, it is observed that serum zinc in male and female cases were respectively lower than in the male and female controls. However, serum zinc (56.0 ± 6.99 $\mu\text{g/dl}$ vs. 66.65 ± 9.05 $\mu\text{g/dl}$) in the males was statistically significant ($p < 0.01$).

Table 3 Comparison on basis of different grades of depression in cases and controls

		Mild	Moderate	Severe
		MEAN \pm S.D	MEAN \pm S.D	MEAN \pm S.D
Serum zinc($\mu\text{g/dl}$)	CASES	57.94 \pm 8.95	58.94 \pm 6.78	59.61 \pm 12.10
	CONTROL	63.05 \pm 10.0	65.77 \pm 10.62	68.12 \pm 9.08
	P value	NS	<0.05*	NS

*= Statistically significant; NS= Not Significant($p > 0.05$)

In the above table, it is observed that serum zinc is lower in cases compared to the controls in all categories of depression cases and it is significantly lower in the moderate depression cases.

Table 4 Correlation of serum zinc and albumin with Hamilton Score in the cases

PARAMETER	r- value	p-value
Serum zinc	0.097	NS
Serum Albumin	0.154	NS

NS –not significant

From the above table, it is observed that both serum albumin and serum zinc shows a positive correlation with the severity of depression.

Table 5 Correlation of serum zinc with serum albumin in the cases

Zinc	Albumin	
	r value	p value
	0.210	NS

NS-not significant

In the table, it is observed that serum zinc and serum albumin shows a positive correlation, but it was not significant statistically.

DISCUSSION

The analysis of serum zinc in the study participants, showed that serum zinc was found to be significantly lower ($p < 0.001$) in the depressed study participants (58.55 ± 8.70 $\mu\text{g/dl}$) than in the healthy controls (64.78 ± 9.86 $\mu\text{g/dl}$). Siwek M et al also found significantly lower (by 22%) serum zinc level in depressed patients than in healthy volunteers.¹⁰ Salimi et al in an Iranian population of 144 depressed patients and 161 age and sex matched healthy controls found significantly lower levels of zinc depressed patients.¹¹ Mousavi et al, in a study

in 46 depressed patients, found the serum concentration of zinc was about half of normal value and the difference was statistically significant ($p = 0.02$) between depressed patients and controls.¹²

Amani R et al found a linear significant correlation between dietary zinc intakes and its serum levels in samples ($r = 0.62$; $p < 0.001$) and Major depressive disorder (MDD) students ($r = 0.55$; $p < 0.001$).¹³ Maes et al found that Serum Zinc (Zn) and Albumin were significantly lower in major depressed patients than in normal volunteers. In healthy volunteers and major depressed patients, there were significant and positive correlations between serum Zinc and Albumin.¹⁴

Roosbeh Jamshid et al,¹⁵ Maes et al,⁴ Mc Loughlin et al¹⁶ also found lower values of serum zinc in depression. Thus, the findings of serum zinc in the present study are consistent with the findings of all the above researchers.

On gender wise analysis, serum zinc was found to be lower in the depressed study participants than in the healthy controls in both the genders, and it was statistically significant in the males ($p < 0.001$). When compared with healthy controls, serum Zinc was found to be significant ($P < 0.05$) in the moderately depressed cases (58.94 ± 6.78 $\mu\text{g/dl}$ vs. 65.77 ± 10.62 $\mu\text{g/dl}$), whereas it was not significant ($p > 0.05$) in the mild (57.94 ± 8.95 $\mu\text{g/dl}$ vs. 63.05 ± 10 $\mu\text{g/dl}$) and in the severe depression cases (59.61 ± 12.1 $\mu\text{g/dl}$ vs. 68.12 ± 9.08 $\mu\text{g/dl}$).

Serum zinc did not show any statistically significant difference ($p > 0.05$) when analysed in the different grades of depression. Zinc showed the lowest values in the mild cases (57.94 ± 8.95 $\mu\text{g/dl}$), followed by moderate (58.94 ± 6.78 $\mu\text{g/dl}$) and severe cases (59.61 ± 12.1 $\mu\text{g/dl}$) respectively.

The lower zinc level observed in depression could be caused by three different reasons. First, by nutritional deficiencies: primary, inducing the development of depressive symptoms or secondary to depression, resulting from the reduced

appetite, the typical picture of the disease. Patients suffering from depression tend to have lower levels of zinc in the blood than healthy subjects.¹⁰ In a study by Griever et al an association was found between serum zinc and higher degrees of depression and also a poor nutritional status measured with the Mini Nutritional Assessment in geriatric long term care residents.¹⁷

Second, an explanation for the reduction in the level of zinc in the blood of depressed patients could be hyper stimulation of the hypothalamic- pituitary-adrenal (HPA) axis, and the associated hypercortisolism. A third and more convincing concept is that, a lower zinc level is the result of inflammation and acute phase response and is associated with oxidative stress.¹⁰

The low serum zinc as found in the present study can be attributed to low levels of the binding protein, albumin. Maes et al¹⁴ suggested that major depression is accompanied by activation of the inflammatory response system (IRS). Other signs of IRS activation, which have been reported in major depression, are lowered serum zinc and serum albumin concentrations. In serum, zinc is closely bound to albumin. The results of that study suggest that lower serum zinc in depression is in part explained by lowered serum albumin and by another depression-related mechanism. It is suggested that lower serum Zinc in depression may be secondary to sequestration of metallothionein in the liver, which may be related to increased production of interleukin-6.¹⁴ Decreased food intake may also be a contributing fact to low albumin and zinc in depression.

CONCLUSION

From the present study, it was observed that serum zinc was significantly lower in patients with depression as compared to age and sex matched healthy controls. The decrease in serum zinc showed no significant correlation with the severity of depression. In the study, serum zinc was found to have a positive correlation with serum albumin. Zinc appears to have a significant role in depression. If zinc supplementation could lower the effective doses of antidepressants, then some unwanted side effects of such drugs could be decreased. However, there is need for more studies on this subject with larger sample sizes, taking care of all variables and in completely newly diagnosed patient group to peer deep into the problem so as to enable to explore unforeseen areas encompassing this disease syndrome.

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Ethical clearance: Taken

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Contribution of authors: I (We) declare that this work was done by the author(s) named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors.

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