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Original Research Article

Assessment of Serum Calcium and Albumin Levels in Patients with Major Depressive Disorder in a Nigerian Tertiary Hospital

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Abstract: ***Background*:** Major Depressive Disorder (MDD) is a disabling psychiatric condition increasingly linked to metabolic and inflammatory disturbances. Alterations in serum calcium and albumin may contribute to neurobiological mechanisms underlying depression. ***Objective*:** To assess and compare serum total calcium and albumin levels between patients with Major Depressive Disorder and healthy controls. ***Materials and Methods*:** This cross-sectional case–control study was conducted at a tertiary psychiatric facility in Maiduguri, Nigeria, from January to June 2025. A total of 120 outpatients diagnosed with MDD using DSM-5 criteria and 120 age- and sex-matched healthy controls were enrolled. Serum total calcium was measured using the Arsenazo III method, while albumin was determined using the bromocresol green assay. Multivariate logistic regression analysis was applied. ***Results*:** Mean serum calcium (8.4 ± 0.6 vs. 9.2 ± 0.5 mg/dL) and albumin (3.6 ± 0.4 vs. 4.2 ± 0.3 g/dL) levels were significantly lower in MDD patients compared with controls ($p < 0.001$). Increasing serum calcium and albumin concentrations were independently associated with reduced odds of MDD. ***Conclusion*:** Lower serum calcium and albumin levels are significantly associated with Major Depressive Disorder, suggesting their relevance in depression pathophysiology.

Keywords: Major Depressive Disorder, Calcium, Albumin, Biomarkers, Inflammation, Nigeria.

INTRODUCTION

Major Depressive Disorder (MDD) is a chronic psychiatric illness characterized by persistent low mood, cognitive impairment, behavioral disturbances, and somatic symptoms that markedly impair daily functioning. Globally, MDD affects over 280 million people and remains a leading cause of disability and disease burden [1, 2].

Calcium is an essential mineral involved in neuronal signaling, neurotransmitter release, neuromuscular activity, intracellular signaling, and bone metabolism [3, 4]. Approximately 45–50% of circulating calcium is bound to albumin, while the remaining fraction exists as ionized calcium, the biologically active form. Although ionized calcium reflects physiological activity, total serum calcium is commonly measured in routine clinical practice because of accessibility and cost effectiveness [5].

Recent evidence suggests that disturbances in calcium homeostasis may contribute to psychiatric disorders, including depression [6, 7]. Hypocalcemia has been reported among individuals with depressive symptoms and suicidal behavior, possibly through impaired synaptic transmission and altered neuronal

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excitability [8-10]. Additionally, modulation of calcium channels has been shown to enhance antidepressant response, further implicating calcium signaling in mood regulation [11].

Albumin is a multifunctional protein that serves as a negative acute-phase reactant, antioxidant, and transport molecule. Reduced albumin levels reflect systemic inflammation and oxidative stress—processes increasingly recognized in the pathophysiology of MDD [6-13]. Population-based studies have demonstrated inverse relationships between serum albumin levels and depressive symptom severity, particularly after adjusting for inflammatory markers [14, 15].

Despite these observations, data on calcium and albumin alterations in African populations remain limited. This study aimed to assess serum total calcium and albumin levels among patients with Major Depressive Disorder attending a Nigerian tertiary hospital and compare them with healthy controls.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional case–control study was conducted at the psychiatric outpatient clinic of the Federal Neuropsychiatric Hospital, Maiduguri, Nigeria, between January and June 2025.

Study Population

A total of 120 adults aged 18–60 years diagnosed with MDD based on DSM-5 criteria were recruited. One hundred and twenty apparently healthy age- and sex-matched individuals served as controls.

Exclusion Criteria

Participants with renal, hepatic, endocrine disorders, active infections, anemia, pregnancy, or those receiving calcium or vitamin D supplementation were excluded.

Sample Collection and Laboratory Analysis

Five milliliters of venous blood were collected from each participant and centrifuged at 3000 rpm for 10 minutes. Serum total calcium was measured using the Arsenazo III method, and albumin was determined using the bromocresol green assay. C-reactive protein (CRP) was measured using immunoturbidimetric methods on a Roche Cobas analyzer.

Statistical Analysis

Data were analyzed using SPSS version 23. Continuous variables were compared using independent t-tests, while categorical variables were analyzed using chi-square tests. Multivariate logistic regression adjusted for body mass index (BMI) and CRP was performed. Statistical significance was set at $p < 0.05$.

RESULTS

There were no significant differences between the MDD and control groups in terms of age or sex distribution. Body mass index was slightly lower among MDD patients, while CRP levels were significantly higher ($p < 0.001$).

Table 1: Biochemical Parameters of Study Participants

Parameter	MDD (n = 120)	Control (n = 120)	p-value
Total Calcium (mg/dL)	8.4 ± 0.6	9.2 ± 0.5	<0.001
Albumin (g/dL)	3.6 ± 0.4	4.2 ± 0.3	<0.001
Corrected Calcium	9.0 ± 0.7	9.4 ± 0.5	0.02

Multivariate logistic regression analysis demonstrated significantly reduced odds of MDD with increasing serum calcium (OR = 0.57 per 0.5 mg/dL increase; 95% CI 0.46–0.70) and albumin levels (OR = 0.62 per 0.5 g/dL increase; 95% CI 0.52–0.74).

DISCUSSION

This study demonstrates significantly lower serum total calcium and albumin levels among patients with Major Depressive Disorder compared with healthy controls. These findings align with previous studies reporting hypocalcemia and hypoalbuminemia in individuals with depressive disorders and suicidal behavior [7-12].

Calcium plays a critical role in neuronal excitability, neurotransmitter release, and synaptic plasticity. Disruption of calcium signaling pathways may impair neuronal communication and contribute to mood dysregulation observed in depression [13]. Albumin, on the other hand, reflects systemic inflammation and antioxidant capacity, both of which are increasingly implicated in MDD pathophysiology [9, 10].

The strengths of this study include adequate sample size, well-matched control group, and adjustment for inflammatory markers. However, the cross-sectional design limits causal inference, and ionized calcium and vitamin D levels were not assessed.

CONCLUSION

Lower serum total calcium and albumin levels are significantly associated with Major Depressive Disorder, suggesting their involvement in depression pathophysiology. Longitudinal studies incorporating ionized calcium, vitamin D, and interventional approaches are recommended.

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