

Original Research Article

Nutrient deficiencies in patients with psychiatric disorders – investigating how low levels of omega-3s, B vitamins and magnesium affect mental health conditions like depression, schizophrenia and bipolar disorder

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ABSTRACT

Background: Psychiatric disorders such as depression, schizophrenia and bipolar disorder are complex mental health conditions that significantly affect individuals' quality of life and functional ability. While their etiology is multifactorial, growing evidence suggests that nutritional factors play an important role in the onset and progression of these disorders. This study aims to explore the relationship between deficiencies in omega-3 fatty acids, B vitamins and magnesium and common psychiatric disorders, namely depression, schizophrenia and bipolar disorder.

Methods: This cross-sectional study was conducted from January 2022 to December 2022 at two tertiary care centers in Chattogram, Bangladesh: Chattogram Ma O Shishu Hospital Medical College and BGC Trust Medical College and Hospital. A total of 100 patients diagnosed with psychiatric disorders, including depression, schizophrenia and bipolar disorder, were enrolled from the outpatient and inpatient departments of psychiatry at both institutions. Data were analyzed using SPSS version 25.

Results: In this study, omega-3, B vitamin and magnesium deficiencies were observed in 61%, 58% and 47% of psychiatric patients, respectively. Deficiencies were most common among those with depression (72.9% omega-3, 66.7% B vitamins, 50% magnesium). Patients with longer illness duration (>5 years) showed higher deficiency rates, with 70.8% for omega-3, 79.2% for B vitamins and 62.5% for magnesium. Symptom severity was significantly higher in deficient patients, with mean scores of 26.5, 27.2 and 25.8 for omega-3, B vitamin and magnesium deficiencies, respectively ($p < 0.05$).

Conclusions: This study demonstrates a high prevalence of omega-3 fatty acid, B vitamin and magnesium deficiencies among patients with psychiatric disorders, particularly those with depression and longer illness duration. These deficiencies were significantly associated with greater symptom severity, underscoring the critical role of nutritional status in mental health.

Keywords: B vitamins, Bipolar disorder, Nutrient deficiencies, Omega-3s, Psychiatric disorders, Schizophrenia

INTRODUCTION

Psychiatric disorders such as depression, schizophrenia and bipolar disorder are major contributors to global

disability and socioeconomic burden, affecting millions of people worldwide.¹ While these disorders are multifactorial in origin, involving complex genetic, environmental and psychosocial influences, there is

growing recognition of the role of nutritional factors in the development and progression of mental health conditions.² In recent years, increasing research has focused on how deficiencies in specific nutrients, particularly omega-3 fatty acids, B vitamins and magnesium, may influence brain function and contribute to psychiatric morbidity.³ The brain is a nutritionally demanding organ, relying on a constant supply of essential nutrients to support neurotransmitter synthesis, maintain membrane integrity, modulate inflammatory pathways and facilitate neuroplasticity.⁴ Among these nutrients, omega-3 polyunsaturated fatty acids (PUFAs), especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), play a critical role in neuronal function and mental health. Several studies have demonstrated that individuals with depression and other psychiatric disorders often have lower levels of omega-3 PUFAs, with deficiencies linked to altered neuronal signalling, inflammation and impaired neurogenesis.^{5,6}

A meta-analysis by Grosso et al found that omega-3 supplementation, particularly EPA-predominant formulations, was effective in reducing depressive symptoms, especially in individuals with major depressive disorder (MDD).⁷ Similarly, reduced omega-3 levels have been observed in patients with schizophrenia and bipolar disorder, potentially contributing to disturbances in membrane phospholipids and neurotransmission.^{8,9} In addition to omega-3 fatty acids, deficiencies in B vitamins, including folate (vitamin B9), vitamin B12 and vitamin B6, have been implicated in psychiatric disorders. These vitamins are essential cofactors in one-carbon metabolism, which is involved in methylation processes and the synthesis of key neurotransmitters such as serotonin, dopamine and norepinephrine.¹⁰ Deficiencies in folate and vitamin B12 can result in elevated homocysteine levels, impaired methylation and disrupted neurotransmitter production, which have all been associated with depression, cognitive impairment and other psychiatric symptoms.¹¹

Almeida et al reported that supplementation with B vitamins may enhance treatment outcomes in depressed individuals, particularly older adults.¹² Furthermore, low B vitamin status has also been observed in patients with schizophrenia, with studies suggesting a potential link between folate metabolism abnormalities and cognitive deficits or negative symptoms.¹³ Another nutrient gaining attention in psychiatric research is magnesium, a mineral essential for over 300 biochemical reactions, including those regulating neurotransmission, synaptic plasticity and stress response systems such as the hypothalamic-pituitary-adrenal (HPA) axis.³ Magnesium deficiency is believed to contribute to the pathophysiology of depression by affecting glutamatergic transmission, promoting neuroinflammation and impairing stress resilience.^{3,6} Observational studies have consistently shown an association between low magnesium levels and increased prevalence of depressive symptoms and preliminary intervention studies suggest potential

antidepressant effects of magnesium supplementation.³ Despite accumulating evidence linking these nutrient deficiencies to mental health disorders, nutritional assessment and intervention remain underutilized in standard psychiatric practice.^{2,3} Individuals with psychiatric conditions are particularly vulnerable to poor dietary habits, malabsorption and medication side effects that can exacerbate nutritional deficiencies and, in turn, worsen psychiatric outcomes.^{2,4} This study aims to explore the relationship between deficiencies in omega-3 fatty acids, B vitamins and magnesium and common psychiatric disorders, namely depression, schizophrenia and bipolar disorder.

METHODS

This cross-sectional study was conducted from January 2022 to December 2022 at two tertiary care centers in Chattogram, Bangladesh: Chattogram Ma O Shishu Hospital Medical College and BGC Trust Medical College and Hospital. A total of 100 patients diagnosed with psychiatric disorders, including depression, schizophrenia and bipolar disorder, were enrolled from the outpatient and inpatient departments of psychiatry at both institutions using purposive sampling. After obtaining informed consent, detailed socio-demographic and clinical information was collected using a structured questionnaire. Blood samples were taken to assess serum levels of omega-3 fatty acids, B vitamins (folate, vitamin B12) and magnesium using standard laboratory methods. Symptom severity was evaluated using appropriate psychiatric rating scales relevant to the diagnosis.

Data were analyzed using SPSS version 25. Descriptive statistics were applied to summarize socio-demographic and clinical variables, while chi-square tests and independent t-tests were used to assess associations between nutrient deficiencies and clinical outcomes, with a p value < 0.05 considered statistically significant. Informed written consent was taken from the study subjects. Ethical clearance was taken from the Institution Review Board.

RESULTS

The majority of participants (42%) were aged between 18 and 30 years. Males accounted for 56% of the sample, while females comprised 44%. In terms of psychiatric diagnoses, depression was most prevalent (48%), followed by schizophrenia (32%) and bipolar disorder (20%). A high prevalence of nutrient deficiencies was observed, with 61% of participants showing omega-3 deficiency and 58% with B vitamin deficiencies. Magnesium deficiency was present in 47% of individuals. Overall, 82% of patients exhibited at least one deficiency, highlighting the nutritional vulnerability in this population. The prevalence of all three nutrient deficiencies was highest among patients with depression, with omega-3 and B vitamin deficiencies observed in 72.9% and 66.7%, respectively. Schizophrenia patients also showed considerable

deficiency rates, particularly for B vitamins (59.4%) and magnesium (50%). Patients with bipolar disorder had relatively lower deficiency rates across all nutrients. Deficiencies in omega-3, B vitamins and magnesium were significantly associated with higher symptom severity scores ($p<0.05$). Patients with B vitamin deficiency had the highest mean severity score (27.2 ± 5.1), followed by those with omega-3 and magnesium deficiencies. These findings

suggest that nutrient deficiencies are linked to worsened clinical presentation. There was a clear trend of increasing nutrient deficiency prevalence with longer illness duration. Patients with illness exceeding 5 years had the highest rates of omega-3 (70.8%), B vitamin (79.2%) and magnesium (62.5%) deficiencies, indicating a potential cumulative effect of chronic psychiatric illness on nutritional status.

Table 1: Socio-demographic characteristics of the study participants (n=100).

Variable	Frequency (N)	(%)
Age group (in years)		
18–30	42	42
31–40	35	35
>40	23	23
Gender		
Male	56	56
Female	44	44
Diagnosis		
Depression	48	48
Schizophrenia	32	32
Bipolar disorder	20	20

Table 2: Prevalence of nutrient deficiencies among participants (n=100).

Nutrient deficiency	Frequency (N)	(%)
Omega-3 deficiency	61	61
B vitamin deficiency	58	58
Magnesium deficiency	47	47
At least one deficiency	82	82
No deficiency	18	18

Table 3: Distribution of Nutrient Deficiencies According to Psychiatric Diagnosis (n=100).

Diagnosis	Omega-3 deficiency (%)	B vitamin deficiency (%)	Magnesium deficiency (%)
Depression (n=48)	35 (72.9)	32 (66.7)	24 (50.0)
Schizophrenia (n=32)	18 (56.3)	19 (59.4)	16 (50.0)
Bipolar disorder (n=20)	8 (40.0)	7 (35.0)	7 (35.0)

Table 4: Association between Nutrient Deficiencies and Symptom Severity (n=100).

Deficiency type	Mean symptom severity score $\pm$ SD	P value*
Omega-3 deficiency	26.5 $\pm$ 4.8	0.002**
No omega-3 deficiency	22.1 $\pm$ 5.2	
B vitamin deficiency	27.2 $\pm$ 5.1	0.001**
No B vitamin deficiency	21.9 $\pm$ 4.7	
Magnesium deficiency	25.8 $\pm$ 4.3	0.010**
No magnesium deficiency	22.6 $\pm$ 5.0	

*Independent t-test applied, **Statistically significant.

Table 5: Prevalence of nutrient deficiencies based on duration of illness (n=100).

Duration of illness	Omega-3 deficiency (%)	B vitamin deficiency (%)	Magnesium deficiency (%)
<1 year (n=34)	16 (47.1)	14 (41.2)	12 (35.3)
1–5 years (n=42)	28 (66.7)	25 (59.5)	20 (47.6)
>5 years (n=24)	17 (70.8)	19 (79.2)	15 (62.5)

DISCUSSION

The present study demonstrates a high prevalence of nutrient deficiencies specifically omega-3 fatty acids, B vitamins and magnesium among patients with psychiatric disorders, including depression, schizophrenia and bipolar disorder. These findings support and extend the existing literature suggesting that nutritional status plays a critical role in the pathophysiology and clinical severity of mental health conditions. In this study, 61% of patients exhibited omega-3 fatty acid deficiency, with the highest prevalence observed among those with depression (72.9%). These findings are consistent with the work of Martins, who reviewed numerous studies and concluded that individuals with depression and bipolar disorder often display significantly reduced omega-3 levels, with deficiency rates reaching as high as 70–75% in depressive populations.¹⁴ Similarly, Amminger et al reported that omega-3 supplementation could reduce the risk of progression to psychosis in high-risk individuals, further underscoring the relevance of omega-3 status in psychiatric populations.¹⁵ Our observed deficiency rate among schizophrenia patients (56.3%) is comparable to data from Peet et al who reported substantial omega-3 depletion and membrane lipid abnormalities in individuals with schizophrenia.¹⁶ The prevalence of B vitamin deficiencies in this study was 58%, with notably higher rates in the depression (66.7%) and schizophrenia (59.4%) groups.

Similar trends were reported by Bottiglieri et al, where approximately 60–70% of patients with depression were found to have folate or vitamin B12 deficiencies, which were associated with greater symptom severity and poor treatment response.¹⁷ Moreover, Miller emphasized the role of impaired one-carbon metabolism, often resulting from B vitamin deficiencies, in the pathogenesis of depression, cognitive dysfunction and schizophrenia.¹⁸ Our findings align with these reports, suggesting a significant association between B vitamin status and psychiatric symptom burden. Magnesium deficiency was observed in 47% of participants, with a slightly higher prevalence among those with depression and schizophrenia (50% each). Eby et al similarly documented that individuals with depressive symptoms frequently present with magnesium deficiency, reporting rates between 40% and 50%, which may exacerbate mood disturbances and treatment resistance.¹⁹

Furthermore, a recent review by Serefko et al highlighted magnesium's crucial role in mood regulation and neuroprotection, noting that magnesium supplementation may alleviate depressive symptoms, particularly in those with documented deficiency.²⁰ A significant association between nutrient deficiencies and symptom severity was also evident in this study. Patients with omega-3, B vitamin or magnesium deficiencies demonstrated higher mean symptom severity scores, with B vitamin-deficient individuals showing the greatest burden. These findings are supported by the meta-analysis conducted by Cheung et al, which concluded that nutritional interventions,

particularly targeting deficiencies in omega-3 and B vitamins, are associated with reduced depressive symptom severity and improved clinical outcomes.²¹ Similarly, Sarris et al, emphasized the potential of targeted nutritional support in reducing psychiatric symptom severity, particularly in populations with established deficiencies.²

Notably, nutrient deficiency prevalence increased with illness duration, with individuals suffering from psychiatric illness for over 5 years showing omega-3, B vitamin and magnesium deficiency rates of 70.8%, 79.2% and 62.5%, respectively. This trend mirrors findings by Kaplan et al who reported that long-term psychiatric illness is associated with cumulative nutritional depletion, often exacerbated by poor dietary habits, socioeconomic factors and medication side effects.²² The study also revealed that patients with depression exhibited the highest rates of all three nutrient deficiencies compared to the schizophrenia and bipolar disorder groups. This observation is consistent with previous findings by Jacka et al, who demonstrated that individuals with depression often have poorer overall nutritional status and greater susceptibility to dietary inadequacies.²³

This study was cross-sectional in design, limiting the ability to establish causal relationships between nutrient deficiencies and psychiatric disorders. The absence of a healthy control group restricts comparison with the general population. Nutrient levels were assessed at a single time point, which may not reflect long-term nutritional status. Additionally, dietary intake, socioeconomic status and medication use, which could influence nutrient levels, were not thoroughly evaluated. The relatively small sample size from two institutions may also limit the generalizability of the findings.

CONCLUSION

This study demonstrates a high prevalence of omega-3 fatty acid, B vitamin and magnesium deficiencies among patients with psychiatric disorders, particularly those with depression and longer illness duration. These deficiencies were significantly associated with greater symptom severity, underscoring the critical role of nutritional status in mental health. The findings highlight the need for routine nutritional screening and consideration of targeted dietary or supplement-based interventions as adjuncts to conventional psychiatric treatment to potentially improve clinical outcomes.

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