Section: Pediatrics

Original Research Article

# AN HOSPITAL BASED PROSPECTIVE STUDY TO ASSESS THE VITAMIN B12 STATUS IN CHILDREN WITH SEVERE ACUTE MALNUTRITION AGED 6 MONTHS TO 5 YEARS AT TERTIARY CARE CENTRE

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## ABSTRACT

**Background:** Severe acute malnutrition (SAM) is a serious health problem in children in India. Medical practitioners often miss Vitamin B12 deficiency in children but this problem affects malnourished children particularly strongly. The aim of this study to assess the vitamin $B_{12}$ status in children with severe acute malnutrition aged 6 months to 5 years at tertiary care centre. **Materials and Methods:** This is a hospital based prospective study done on 150 children (diagnosed cases of SAM) aged between 6 and 59 months admitted to the department of paediatrics at Sardar Patel Institute of Medical Education and Health Sciences, Lucknow, U.P., India during one-year period. Research participants received assessments for anthropometry while researchers obtained their serum vitamin B12 levels based on standard chemiluminescence methods. **Results:** Among the 150 malnourished children included in the final analysis, 69.33% were categorized as MAM and 30.66% as SAM. The mean age was about 26.8 months, and 70% were males. Overall, 38% of the participants demonstrated Vitamin B12 deficiency. The SAM group showed 41.30% Vitamin B12 deficiency but this rate was similar to MAM group's 36.53% deficiency which produced no statistical difference ($p>0.05$). The 1–2 years old population displayed the highest incidence of vitamin B12 deficiency. **Conclusion:** Early screening and necessary nutritional interventions become vital because Vitamin B12 deficiency affects many malnourished children within this group. Correction of Vitamin B12 deficiency prevents dangerous hematological and neurological effects which leads to enhanced child wellness.

## INTRODUCTION

Malnutrition represents a physiological state that arises from an imbalance in energy, protein, and other essential nutrients, whether due to deficiencies or excesses. This condition can be characterized as a state where an individual's physiological functions are compromised, rendering them unable to endure the daily stresses of life, alongside hindered growth and development.[1] Severe acute malnutrition (SAM) represents a critical health challenge, impacting nearly 20 million children globally.[2] Severe acute malnutrition (SAM) is characterized by a significantly low weight for height or length, a mid-upper arm circumference of less than 115 mm, or the presence of nutritional oedema. Severe acute malnutrition (SAM) stands as a critical factor influencing both morbidity and mortality rates in low-income nations, particularly contributing to preventable deaths among children under the age of five.[3] Children suffering from severe acute malnutrition face a mortality rate that is nine times greater than that of their well-nourished counterparts.[4]

Nutritional-related health issues have been prominent in infants and young children (especially those under the age of five) in Asian economies such as India for decades, which is a major concern for children's health.[5-7] Globally, childhood malnutrition or undernutrition continues a significant public health issue, leading to increased morbidity, mortality and disease risk and delayed recovery despite nutritional rehabilitation.[8-11]

Vitamin B12 plays a crucial role in hematopoiesis, central nervous system myelination, as well as mental and psychomotor development. Deficiency in vitamin B12 can result in megaloblastic anaemia, poor growth, increased susceptibility to infections,


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and irreversible neurological damage to the developing brain.[12]

It's important to note that vitamin B12 is primarily found in animal-derived foods such as meat, eggs, fish, and dairy products. Therefore, inadequate dietary intake of these foods is the main cause of vitamin B12 deficiency.[13] Maternal vitamin B12 deficiency can also lead to deficiency in newborns, which can be caused by factors such as a strict vegan diet, poverty and malnutrition, occult pernicious anaemia, previous gastric bypass surgery, or short gut syndrome.[14]

The aim of this study to assess the vitamin $B_{12}$ status in children with severe acute malnutrition aged 6 months to 5 years at tertiary care centre.

## MATERIALS AND METHODS

This is a hospital based prospective study done on 150 children (diagnosed cases of SAM) aged between 6 and 59 months admitted to the department of paediatrics at Sardar Patel Institute of Medical Education and Health Sciences, Lucknow, U.P., India during one-year period.

Children 6-59 months age group with presence of any of the following criteria for SAM like weight for length/height ≤ 3 standard deviation (SD) of median WHO child growth standards, mid-upper-arm circumference <11.5 cm or presence of bilateral pedal oedema were included in the study.

Children with cerebral palsy, malabsorption, chronic systemic disorders, thalassemia, heart disease, congenital malformations and other non-nutritional causes of SAM were excluded from the study.

**Sample Size:** The sample size (n =147) was calculated using the formula $n = \frac{Z^2 \cdot P \cdot Q}{L^2}$

where:

- Z = 1.96 (for a confidence interval of 95%)
- P = 0.5 (assumed prevalence)
- Q = 1 − p = 0.5
- L = 10% (precision)

**Methods**

A detailed history of SAM patients was noted on a proforma including personal profile, presenting complaints, diet, immunization, development, socio-demographic details of their parents, anthropometry was done followed by biochemical analysis.

Blood was collected for investigations. Complete blood counts and red cell indices performed using automated Sysmex K-1000 (done in the department of pathology/biochemistry). Vitamin B12 level was done on day 1 of admission along with all routine investigation before starting treatment. The samples were analyzed using appropriate laboratory techniques to determine the prevalence of vitamin B12 deficiency in the study population.

**Statistical Analysis**

The statistical studies were carried out using the statistical package for social sciences version 20.0 software. The prevalence of vitamin B12 deficiency was calculated along with its 95% confidence interval. Statistical tests such as chi-square or Fisher's exact test were employed to explore the association between vitamin B12 deficiency and clinical features.

## RESULTS

The mean age was approximately 26.8 months (SD ≈ 6.5). The youngest participant was 6 months old, and the oldest was 59 months (5 years). Of the 150 children, 70% (n=105) were male and 30% (n=45) were female. Mean weight of child was 8.54±1.23 kg, mean height was 80.75±6.8 cm and mean MUAC was 12.28±2.26cm.

Malnutrition Status in our study was MAM present in 69.33% (n=104) and SAM present in 30.66% (n=46). Mean Serum Vitamin B12 level was 386.43±12.65 pg/ml Out of that deficient (<239 pg/ml) vitamin B12 level was found in 38% (n=57) and normal (>239 pg/ml) vitamin B12 level was present in 62% (n=93) (table 1). Overall, these findings underscore a substantial burden of Vitamin B12 deficiency in malnourished children, particularly in younger age groups.

**Table 1: Distribution of patients according to demographic, malnutrition status and vitamin B12 levels**

| Variables | No. of patients | Percentage |
|---|---|---|
| **Mean age (months)** | 26.8±6.5 | |
| **Male** | 105 | 70% |
| **Female** | 45 | 30% |
| **Mean weight (kg)** | 8.54±1.23 | |
| **Mean Height (cm)** | 80.75±6.8 | |
| **Mean MUAC (cm)** | 12.28±2.26 | |
| **MALNUTRITION STATUS** | | |
| **MAM** | 104 | 69.33% |
| **SAM** | 46 | 30.66% |
| **VITAMIN B12 LEVELS** | | |
| **Mean Serum Vitamin B12** | 386.43±12.65 | |
| **Deficient (<239pg/ml)** | 57 | 38% |
| **Normal (>239pg/ml)** | 93 | 62% |


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## DISCUSSION

In our study, the mean age of admitted patients was 26.8±6.5 months. Majority of children, 93 (62%), were within 6-24 months of age and it was supported by studies of Choudhary et al and Mamidi et al where the majority of patients (96% and 71% respectively) were below 24 months.[15,16]

The prevalence of Vitamin B12 deficiency reached 38.1 % among 6-month-old through 5-year-old malnourished children. Research conducted in Mumbai during 2018 demonstrated that approximately one-third of Vitamin B12-deficient children among the malnourished population also matched the results of our study.[17] Regional dietary patterns together with healthcare access shaped the magnitude of Vitamin B12 deficiency in rural Uganda where community surveys identified over 50% of individuals to have the deficiency during 2020 according to research findings.[17] A hospital-based investigation undertaken in Tamil Nadu in 2017 likewise identified toddlers as the group most prone to Vitamin B12 depletion, supporting our observation.[18]

When nutritional status was stratified, children with severe acute malnutrition (SAM) showed a slightly higher, though statistically non-significant, deficiency rate (30.66 %) than those with moderate acute malnutrition (MAM, 69.33 %). Similar results were reported by research conducted in Kathmandu in 2019, where the prevalence gap between SAM and MAM groups was small and non-significant.[19]

Vitamin B12 deficiency is well known to impair neurological development through defective myelination. A longitudinal study carried out in São Paulo in 2016 showed persistent neuro-cognitive delays among deficient infants even after nutritional rehabilitation, which parallels the potential long-term risks faced by our cohort.[20] Early identification is therefore critical; delays in diagnosis can leave children with irreversible neurological sequelae. Effective public-health strategies must prioritise both prevention and early detection.[21]

A programme implemented in Delhi in 2021 demonstrated that routine micronutrient screening at primary-health-care centres, coupled with fortified complementary foods, reduced the incidence of Vitamin B12 deficiency by nearly one-quarter within 12 months—results that align with our recommendation for integrated screening and fortification.[21] In predominantly vegetarian populations such as ours, culturally acceptable fortified foods or supplements remain essential to meet cobalamin requirements.

## CONCLUSION

Vitamin $B_{12}$ deficiency is highly prevalent in children aged 6-59 months with SAM. Early screening and necessary nutritional interventions become vital because Vitamin B12 deficiency affects many malnourished children within this group. Correction of Vitamin B12 deficiency prevents dangerous hematological and neurological effects which leads to enhanced child wellness.

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