E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/15.02.182

Research Article

An Assessment of Vitamin B12 Deficiency in Infants under Six Months with Severe Acute Malnutrition

Dr. Lipi Roat[1*], Dr. R.L. Suman[2], Dr. Mukesh Kumar Jat[3]
[1*]Senior Resident, Department of Pediatrics, RNT Medical College, Udaipur (Rajasthan), India.
[2]Senior Professor, Department of Pediatric, RNT Medical College, Udaipur [Rajasthan], India.
[3]Senior resident, Department of Pediatric, RNT Medical College, Udaipur (Rajasthan), India.
Corresponding Author: Dr. Lipi Roat
Received: 17.06.25, Revised: 15.06.25, Accepted: 20.07.25

ABSTRACT
Background - NFHS-5 shows improved nutrition indicators for children under 5, with lower rates of stunting, wasting, and underweight. However, interventions primarily target older children, neglecting the high prevalence of infant malnutrition. Vitamin B12 deficiency during infancy can cause anemia, poor growth, neurological damage, and developmental delays.
Methodology - This prospective observational study was conducted at Balchikitsalaya from June 2021 to December 2022. It includes 100 infants under 6 months with severe acute malnutrition, and data on demographics, clinical features, and vitamin B12 levels were collected. Descriptive statistics and statistical tests were used to analyze the data and assess the prevalence of vitamin B12 deficiency and its association with clinical features.
Result – Maximum number of infants with vitamin B12 deficiency were in age of 5-6 month. Loose stool and vomiting were the most common complaints. Low vitamin B12 level was found in 48% of infants. Clinical manifestations such as pallor, hyperpigmentation, and tremor were significantly associated with Vitamin B12 deficiency. There was significant association between vitamin B12 deficiency and anemia ($p<0.001$) and, thrombocytopenia ($p<0.001$). 29 infants had tremor, out of them 25 patients had vitamin B12 deficiency. This study shows significant association between tremor and low vitamin B12 deficiency ($P<0.001$). There was significant association between BMI and vitamin B12 level in mother ($P=0.012$).
Conclusion: Prevalence of vitamin B12 deficiency in less than six months infants with SAM was 48 % and tremors have significant association (p:001).

Keywords: Vitamin B12 Deficiency, Malnutrition, Infants, Tremor.

INTRODUCTION

According to the recent report of NFHS-5, there has been an improvement in nutrition indicators for children under 5 years compared to NFHS-4. The prevalence of stunting has reduced from 38.4% to 35.5%, wasting has reduced from 21.0% to 19.3%, and the prevalence of underweight has reduced from 35.8% to 32.1% [1].

However, the focus of nutritional interventions has primarily been on children aged 6 to 59 months, for which the World Health Organization (WHO) has provided clear recommendations for identification and treatment. It is important to note that globally, around 8.5 million infants under 6 months of age are malnourished, with an estimated prevalence of 14.8% in India [2].

Severe Acute Malnutrition (SAM) is often associated with deficiencies in iron, vitamin B12, and folate during infancy and early childhood [3]. 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 anemia, poor growth, increased susceptibility to infections, and irreversible neurological damage to the developing brain [4] . 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 [5]. 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 anemia, previous gastric bypass surgery, or short gut syndrome [6].

Aim of Study: To assess the prevalence of vitamin B12 deficiency and to analyze the clinical profile of infants who were admitted with severe acute malnutrition.

MATERIALS AND METHODS

Study Design: This prospective observational study was conducted at the Malnutrition Treatment Centre of Balchikitsalaya, MBGH, RNT MC Udaipur (Rajasthan) from June 2021 to December 2022.

Study Population: The study included a total of 100 infants aged less than 6 months who were diagnosed with severe acute malnutrition. Infants meeting the following criteria were considered eligible for inclusion in the study:

Inclusion Criteria

1. Weight for length (W/L) below -3 standard deviations (SD)
2. Visible severe wasting
3. Edema observed in both feet

Exclusion Criteria

1. Children with severe acute malnutrition due to non-nutritional causes, such as congenital heart disease or congenital malformation.
2. Infants aged over 6 months.
3. Participants who declined to provide informed consent.

Data Collection: Data collection was carried out following standardized protocols. Relevant demographic information and clinical data were recorded for each participant, including age, gender, anthropometric measurements, presence of edema, and other clinical features.

Laboratory Investigations: 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: Descriptive statistics such as mean, standard deviation, and percentages were used to summarize the demographic and clinical characteristics of the study population. 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.

RESULT

Hundred children were admitted at MTC with severe acute malnutrition aged 1-6 months, were enrolled, among them 56% males and 44% females. The mean age of infants was 3.99 ±1.62 months. We divided these 100 infants according to their age group, majority of infants 41 (41%) were in the age group of 5 to 6 month of age as shown [Table no.1]

As per Kuppuswamy 's scale, majority of children 88% were belonged to lower socioeconomic status while rest of children 12% were in middle socioeconomic status.

According to SAM criteria, in our study all infants fulfilled weight for length z score <3SD along with 7 patients also had bilateral pedal edema. In our study we found that majority 86% of patients were on exclusive breastfed, while remaining were 14% had faulty feeding practices like partially breast feeding and none of the child was devoid of breast feeding. Majority of 57.2% mothers underweight, 40 % had normal BMI.

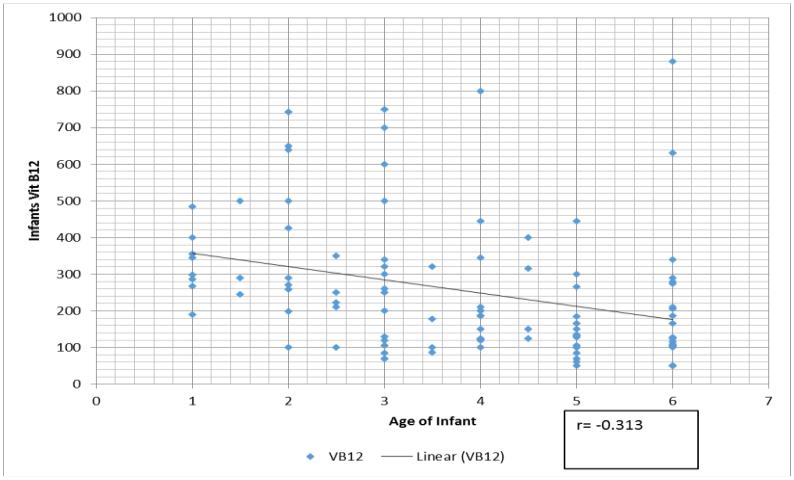
We distributed infants on the basis of their chief complain. Maximum number of patients presented with loose stool and vomiting (40%), apathy (37%), fever (35%), cough and cold (25%), refusal to feed (22%), involuntary movements (10%), not gaining weight (10%), swelling (7%), abdominal distension (4%) and convulsion (3%).

On the basis of clinical examination 71% infants having pallor, 64% having hyperpigmentation of skin, 34% having sparse and hypopigmented hair, 30 % having hypotonia 29% having tremor. [Table no.4]

On the basis of vitamin B12 level, 48 % found low level (<200pg/dl) as depicted in [Table no.2] As per various age group vitamin B12 level as in Table No.1, mean vitamin B12 level was 247.92±172.19. As age of infants increase vitamin B12 levels were decrease and we found to be significant association between age of infants and vitamin B12.

Table 1. Association of Vitamin B12 Deficiency with Age of Infants

AGE IN MONTH	NO. OF INFANTS	MEAN VIT B12	STD. DEVIATION	P VALUE
1-<2 Month	11	332.82	96.92	<0.001
2-<3Month	13	385.15	188.82	
3-<4Month	15	350.27	232.02	
4-<5Month	20	199.20	111.47	
5- 6Month	41	167.95	125.78	
Total	100	247.92	172.19	



There is a negative correlation between age of infants and vitamin B12 deficiency

Table 2. Distribution of Infants as Per Deficiency Level of Vitaminb12

VITAMIN B12(PG/ML)	NO. OF INFANTS	%
<200 (pg/ml)	48	48%
200-<300 (pg/ml)	25	25%
>300 (pg/ml)	27	27%
Total	100	100

According to level of vitamin B12, in our study 48% infants found low (<200pg/ml) vitamin B12 deficiency, 25% infants came into borderline (200-<300 pg/ml) vitamin B12, and 27% had >300 pg/ml means had normal serum vitamin B12.

Table 3. Association between Haemoglobin and Vitamin B12 Deficiency

Haemoglobin (gm/dl)						
Vitamin B12	Severe	Moderate	Mild	Normal	Total	P Value
Low (<200pg/ml)	34(79.1%)	9(34.6%)	5(28.8%)	0(0%)	48(48%)	<0.001
Border line (200-300pg/ml)	5(11.6%)	11(42.3%)	8(33.3%)	1(14.3%)	25(25%)	
Normal (>300pg/ml)	4(9.3%)	6(23.1%)	11(45.9%)	6(85.7%)	27(27%)	
Total	43(100)	26(100)	24(100)	7(100)	100(100)	

Table 3 shows the association between Vitamin B12 deficiency and hemoglobin levels was examined in this study. Among infants with severe Vitamin B12 deficiency (<200 pg/ml), 79.1% had low hemoglobin levels. The association between Vitamin B12 deficiency and hemoglobin levels was statistically significant ($p<0.001$).

The association between platelet count and Vitamin B12 deficiency levels among the studied population. The platelet count was classified as low (<150 x 10^3/µl), normal (150-450 x 10^3/µl), and high (>450 x 10^3/µl). The major findings of the study reveal that infants with low Vitamin B12 levels had a significantly low platelet count (72.9%) compared to those with borderline or normal Vitamin B12 levels. The statistical analysis confirmed a significant association between platelet count and Vitamin B12 deficiency ($p<0.001$).

Table 4. Association between Mcv with Vitamin B12 Deficiency

MCV					
Vitamin B12	<70fl	70-90fl	>90fl	Total	P Value

Low	4(28.6)	17 (39.5)	27(62.8)	48(48)	0.056
border line	5(35.7)	10(23.3)	10(23.3)	25(25)	
Normal	5(35.7)	16(37.2)	6(14.0)	27(27)	
Total	14 (100)	43(100)	43(100)	100	

The major findings indicate that infants with low Vitamin B12 levels exhibited a higher prevalence of pallor (59.2%) and hyperpigmentation (72.6%) compared to the borderline and normal deficiency groups. Additionally, tremor was predominantly observed in infants with low Vitamin B12 levels (86.2%). The association between clinical manifestations and Vitamin B12 deficiency was statistically significant for pallor ($p<0.001$), hyperpigmentation ($p=0.001$), and tremor ($p<0.001$).

DISCUSSION

The SAM infants were divided into different age groups, with the majority (41%) falling into the 5 to 6-month age group. It was noted that the frequency of SAM increased as the infants grew older, potentially due to an increased demand for nutrition without sufficient intake. Of the infants, 56% were males and 44% were females. This male-to-female ratio of 1.2:1 was similar to findings from another study by Adhualia A et al. [7], which enrolled 103 children with SAM aged 0-59 months. Goyal et al. [8] also reported a higher percentage of males (57.5%) compared to females (42.5%) in their study.

The infants were categorized based on their chief complaints at the time of enrollment. The most common complaints were loose stool and vomiting (40%), apathy (37%), fever (35%), cough and cold (25%), refusal to feed (22%), involuntary movements (10%), not gaining weight (10%), swelling (7%), abdominal distension (4%), and convulsions (3%). Over 90% of the patients had non-specific complaints upon admission, suggesting a lack of awareness among parents regarding their children's growth. Similar chief complaints were reported in a study by Ali, S.M. et al. [9], where the most frequent comorbidities encountered were anemia (80%), diarrhea (59%), and pneumonia (29%). Adhualia A et al. [7] found that the most common complications among SAM children were sepsis (39.8%), pneumonia (13.6%), chronic diarrhea (6.8%), persistent diarrhea (1%), anemia (7.8%), and infantile tremor syndrome (4.9%). WHO and all other literature recommended exclusive breast feed (EBF) till six months, in our study 86% infants on EBF, only 14% on faulty feeding practices and none of the child on top feed even then 48% infant had Vitamin B12 deficiency. These may be because of maternal malnutrition and their nutritional deficiencies. The study revealed that 57.3% mothers are underweight as per their BMI out of 70 mothers. El C, Celikkaya ME [13] found similar findings in their study.

Clinical examinations revealed that 71% of infants had pallor, 64% had hyperpigmentation of the skin, 34% had sparse and hypopigmented hair, 30% had hypotonia, and 29% had tremors.

Regarding vitamin B12 levels, we found that 48% of infants had low levels (<200 pg/ml), 25% were in the borderline range (200-<300 pg/ml), and 27% had normal serum vitamin B12 levels (>300 pg/ml). The mean vitamin B12 level was 247.92 ± 172.19. Similar findings were reported by Vaid A et al. [10], where 58% of children were vitamin B12 deficient and 42% were non- deficient. Younger children, particularly those under 2 years old, were found to be more vulnerable to vitamin B12 deficiency. Pathak et al. [11] also reported similar findings in their study, with vitamin B12 levels decreasing as the age of infants increased. A negative correlation ($r = -0.313$) was found between age and vitamin B12 deficiency, and the prevalence of vitamin B12 deficiency in this study was 48%. Murthy KA et al [12] found that vitamin B12 deficiency (45%) was more prevalent than folic acid deficiency (3.8%).

Among the infants diagnosed with SAM and pallor, 81.7% had low or borderline vitamin B12 deficiency. There was a significant association ($p < 0.001$) between clinical signs of anemia and vitamin B12 deficiency. Of the infants with hyperpigmentation of the skin.

CONCLUSION

Based on the findings of the study, it can be concluded that severe acute malnutrition affects infants aged less than 6 months, with the prevalence increasing as the age increases within the first six months of life. Prevalence of vitamin B12 deficiency in less than six-month infants with SAM in 48% that seems to be because of maternal malnutrition and non-supplementation of hematinic in post-delivery period.

Recommendation

Hence we recommended that again maternal weight monitoring, dietary as well as hematinic supplementation during antenatal and postnatal life should ensure to all mothers. It can prevent SAM under six months and vitamin B12 deficiency.

Funding: No funding services

Conflict of Interest: None declared.

Ethical Approval: The study was approved by the Institutional Ethics Committee, Rabindra Nath Medical College and attached hospital, Udaipur (Rajasthan).

REFERENCES

1. International Institute for Population Science (IIPS) and ICF. National Family Health Survey(NFHS-5) India, 2019-21;1:374-5
2. Choudhary TS, Srivastava A, Chowdhury R, et al. Severe wasting among Indian infants <6 months: findings from the National Family Health Survey 4. Matern Child Nutr. 2019;15: e12866
3. KE Elizabeth. Protein energy malnutrition and severe acute malnutrition. Nutrition and Child Development. 5th edition. Hyderabad: Paras Publication; 2015:200-203
4. Rasmussen SA, Fern Hoff PM, Scanlon KS. Vitamin B12 deficiency in children and adolescents. J. Pediatr. 2001; 138:10-7.
5. Allen LH. Causes of vitamin B12 and folate deficiency. Food Nutr Bull. 2008;29 (Suppl1): S20-S34.
6. Kühne T, Bubl R, Baumgartner R Maternal vegan diet causing a serious infantile neurological disorder due to vitamin B12 deficiency. Eur J Pediatr 1991;150: 205-208
7. Adhualia A, Maurya M, Tewari AD. Development delay in children with severe acute malnutrition and its association with Vitamin B12 deficiency. Int J Contemp Pediatr 2019; 6:2484-8.
8. Goyal S, Tiwari K, Meena P, Malviya S, Mohd A. studied Cobalamin and folate status in malnourished children. Int J Contemp Pediatr 2017; 4:1480-4.
9. Ali S, Meshram H. A hospital-based study of severe acute malnutrition in infants less than six months and comparison with severe acute malnutrition in children 6–60 months. Sri Lanka Journal of Child Health 2017; 46(3): 234-7
10. Vaid A, Sharma M, Jamunashree B, Gautam P. Serum vitamin B12 levels in severe acute malnutrition hospitalized children between age group 6 months to 59 months in Kangra, India. Int J Contemp Pediatr 2018; 5:1997-2001.
11. Pathak GH, Chauhan AV, Pandya D. Clinical profile of patients with infantile tremor syndrome in a tertiary care center. Int J Contemp Pediatr 2020; 7:2172-5.
12. Murthy KA, Malladad A, Kariyappa M. Estimation of serum folate and vitamin B12 levels in children with severe acute malnutrition. Int J Contemp Pediatr 2020;7
13. El C, Celikkaya ME. Infants with vitamin B12 deficiency-related neurologic dysfunction and the effect of maternal nutrition. Ann Med Res 2019;26(1):63-7