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VITAMIN B12 LEVELS IN CHILDREN WITH MODERATE AND SEVERE ACUTE MALNUTRITION ADMITTED IN A TERTIARY CARE HOSPITAL.

Paediatrics

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ABSTRACT

Purpose: Malnutrition is a serious predicament for Vitamin B12 deficiency which can result in anemia and various neurological manifestations. It can also predispose children to various infections, developmental delay and early death. This study aims to assess and estimate the Vitamin B12 deficiency in moderate and severe acute malnutrition children admitted in a tertiary care centre. **Methodoloy:** This is a descriptive study conducted for a duration of 18 month in a tertiarty care hospital in Mysuru. Vitamin B12 levels are estimated in children with severe acute malnutrition and moderate acute malnutrition. **Results:** Out of 146 subjects, 13% had vitamin B12 level <197pg/ml. 78.9% of these patients followed strict vegetarian diet. Among those with B12 levels <197 pg/mL, 5.3% had GDD and 5.3% had motor delays. A significant association was found between Vitamin B12 and weight (p=0.01) and height (p=0.02). A significant proportion of individuals with SAM had lower Vitamin B12 levels, while those with MAM tended to have normal or high Vitamin B12 levels(p-value=0.05). **Conclusion:** Vitamin B12 deficiency is seen more in severe acute malnutrition and initiation of Vitamin B12 deficiency treatment in SAM children can prevent neurological manifestations.

KEYWORDS

severe acute malutrition, moderate acute malnutrition, vitamin B12 deficency, anemia

INTRODUCTION

Malnutrition is a concerning issue on a global level. Joint Child Malnutrition Estimates, 4.5 crore children under 5 were wasted in 2022; an estimated 1.4 crore children below 5 years had severe wasting and the rest had moderate wasting.[1]

The prevalence of micronutrient deficiency in SAM is not well studied. 58.5 % of children under the age of 5 are anaemic. Nutritional anemia is chiefly caused by iron deficiency anemia (66%).[4] However there is lack of data on acute malnutrition and vitamin B12 deficiency from South India. The present study was conducted to assess the burden of vitamin B12 deficiency in children with moderate and severe acute malnutrition admitted in a tertiary care hospital.

Objectives

To estimate Vitamin B12 levels in children with moderate and severe acute malnutrition admitted in a tertiary care centre. And clinical manifestations in children with Vitamin B12 deficiency.

Methodology

This is a descriptive study done in Department of Paediatrics, JSS Hospital, Mysuru from January 2023 to June 2024. A total of 146 Children, aged between 6 months and 60 months who were admitted for management of Severe or Moderate acute malnutrition, were included. After obtaining an informed consent from parents, appropriate history and detailed clinical examination were done to identify clinical manifestations. Complete hemogram and serum Vitamin B12 levels were assayed using ECLIA (Electrochemiluminescence) in the fully automated ROCHE COBAS 6000 integrated system analyzer. Serum Vitamin B12 levels of 197-771 pg/mL range was considered normal. Children who have received Vitamin B12 supplementation and with gastrectomy, ileal resection, and malabsorption syndromes were excluded.

Formula used in calculation sample size: Sample size = z^2pq, d^2, where, z is a constant of 1.96, p- prevalence (According to NFHW, total prevalence of moderate and severe acute malnutrition is 19.5% (3)), q= 1-p and d= margin of error 7% (0.07).

Statistics: Quantitative data were represented as mean, SD, frequency and percentage. To assess the association among the qualitative variables the Chi-square test, Fischers test were used. Values were considered statistically significant if p-value was less than 0.05. Statistical software like SPSS version 28 was used for analysis.

RESULTS

Out of 146 subjects, only 13% had vitamin B12 deficiency (<197pg/ml). Younger children (6-12 months) suffered more with Vitamin B12 deficiency than older children (25-36 months). The association between age and Vitamin B12 levels was found to be statistically significant(p-value - 0.03). There was no significant gender difference in Vitamin B12 levels. There was statistically significant association between strict vegetarian diet(78.9%) and B12 deficiency. (p=0.02). Among SAM cases, 50.9% followed a mixed diet and 49.1% a vegetarian diet. Similarly, 50.7% of MAM cases followed a mixed diet and 49.3% a vegetarian diet. The association was not statistically significant (p=0.96), suggesting diet type did not influence malnutrition severity.

Table 1- Association Of Complimentary Feed Initiated And Vitamin B12

Complimentary Feed Initiated	Vitamin B12						Total	
	<197		197-771		>771			
	N	%	N	%	N	%	N	%
At 6 Months	15	78.9	105	98.1	20	100.0	140	95.9
>6 Months	4	21.1	2	1.9	0	0	6	4.1
Total	19	100.0	107	100.0	20	100.0	146	100.0
Fisher's Exact value = 9.79, p-value =**0.01***, Inference : Is Statistically Significant								

This table shows that early initiation of complementary feeding may be linked to better Vitamin B12 status.

Table 2-Association of SAM/MAM and Vitamin B12

SAM/ MAM	Vitamin B12						Total	
	<197		197-771		>771			
	N	%	N	%	N	%	N	%
SAM	12	63.2	36	33.6	7	35.0	55	37.7
MAM	7	36.8	71	66.4	13	65.0	91	62.3
Total	19	100.0	107	100.0	20	100.0	146	100.0
Chi-Square value = 6.06, p-value =0.05, Inference : Is Statistically Significant								

A significant proportion of individuals with SAM had lower Vitamin B12 levels, while those with MAM tended to have normal or high Vitamin B12 levels. The association between SAM/MAM status and

Vitamin B12 levels was statistically significant (p-value=0.05).

Table 3 Comparison of the Anthropometry Measures and Vitamin B12

Variables	Vitamin B12			F Value	p-Value
	<197	197-771	>771		
Weight	7.33±1.69	9.72±2.99	13.22±15.7	4.39	0.01*
Height	75.76±8.62	86.26±14.26	82.37±22.07	4.15	0.02*
MUAC	12.53±0.82	12.93±0.93	12.77±0.77	1.79	0.1
Head Circumference	43.79±3.15	45.5±3.09	45.49±2.89	2.57	0.08

Table 3 showed a significant association between Vitamin B12 and weight (p= 0.01), Vitamin B12 and height (p=0.02), with higher B12 levels linked to better weight and height. No significant association was found for MUAC (p=0.1) or head circumference (p=0.08),

Table 4-Association of Weight for Height (SD) and Vitamin B12

Weight for Height (SD)	Vitamin B12						Total	
	<197		197-771		>771			
	N	%	N	%	N	%	N	%
-2 to -3 SD	7	36.8	71	66.4	13	65.0	91	62.3
<-3SD	12	63.2	36	33.6	7	35.0	55	37.7
Total	19	100.0	107	100.0	20	100.0	146	100.0
Chi-Square value = 6.06, p-value =0.05, Inference : Is Statistically Significant								

In Table 4, Bmany individuals in normal and high B12 categories fell within the -2 to -3 SD range (moderate malnutrition), 63.2% of those with Vitamin B12 deficiency had severe acute malnutrition. The association between 12 levels and SAM/MAM was statistically significant (p = 0.05).

Pallor was observed in 84.2% of individuals with low B12 levels (<197 pg/mL) and remained similar in mid-range and high B12 groups(p = 0.8). Hyperpigmentation was observed in 47.4% of individuals with B12 levels below 197 pg/mL, compared to 8.4% in mid-range and 15.0% in high B12 levels (p<0.001).

Among children with SAM, 10.9% had Global Developmental delay (GDD) and 7.3% had motor delays, while children with MAM, only 3.3% had GDD, and none had motor delays. This indicates a stronger link between SAM and developmental delays. Among those with B12 levels deficiency (<197 pg/mL), 5.3% had GDD and 5.3% had motor delays.

Interestingly, 10.0% of subjects with B12 levels >771 pg/mL exhibited GDD. However, most subjects across all B12 levels showed normal development, with no statistically significant association (p=0.8).

DISCUSSION

In our study, 73.3% had Vitamin B12 levels between 197-771 pg/mL, 13.0% had levels below 197 pg/mL, and 13.7% had levels above 771 pg/mL, indicating moderate B12 deficiency. Previous studies by Murthy et al.[5] and Vaid et al. [6] reported higher deficiency rates in SAM children (45% and 58% respectively). Saranappa and Wu [7] also noted widespread deficiencies, linked to socioeconomic factors. The lower deficiency rate in our study may be due to different nutritional interventions or less severe malnutrition.

This study found that Vitamin B12 deficiency (<197pg/mL) was more common in younger children (6–12 months), with nearly half of deficient cases under 1 year, while older children (25–36 months) had higher levels (>771pg/mL). Similarly results were found in studies by Vaid et al. [6], Saranappa and Wu [7] and patel et al. These findings suggest age is a key factor, with younger children at higher risk due to delayed complementary feeding or prolonged exclusive breastfeeding. Early initiation of complementary feeding (at 6 months) was linked to higher Vitamin B12 levels, with nearly 100% of children initiating feeding on time having levels above 197 pg/ml. Similar results were found in studies done by Murthy et al[5] where 63.9% of B12-deficient children had delayed complementary feeding, leading to prolonged exclusive breastfeeding without B12-rich foods.

In our study, children with developmental delays, especially global developmental delay (GDD) and motor delay, were more likely to have low Vitamin B12 levels (<197 pg/mL), though the association was not significant (p = 0.8). Children with SAM were more likely to have developmental delays than those with MAM. In the present study, neurological symptoms such as hypertonia and spastic quadriplegia were rare, and no neurological symptoms were reported in individuals with low or high Vitamin B12 levels. (p-value = 1). Murthy et al [5] study found that neurological symptoms were common in children with severe Vitamin B12 deficiency. 45% of the deficient children exhibited neurological impairments, including developmental delays and motor dysfunction.

This study found a significant positive association between Vitamin B12 levels and both weight (p=0.01) and height (p=0.02), indicating better growth outcomes with higher B12 levels. No significant links were observed for MUAC or head circumference. Similarly, Murthy et al. [5] reported lower weight and height in SAM children with B12 deficiency and a positive correlation between B12 levels and improved anthropometric measures.

A significant association between SAM/MAM status and Vitamin B12 levels was found in this study. Vitamin B12 deficiency was more prevalent in children with SAM (63.2%) compared to MAM (36.8%), with MAM cases tending to have normal or high B12 levels. Similarly, Murthy et al.[5] reported that 45% of SAM children were B12 deficient, highlighting the link between severe malnutrition and low B12 levels.

CONCLUSION

This study highlights the significant impact of Vitamin B12 deficiency on the health and development of malnourished children. Although the occurrence of deficiency was lower in this study compared to others, Vitamin B12 deficiency remains a critical concern,

The study reinforces the need for targeted nutritional programs, particularly in rural and low-resource settings, to address the underlying causes of malnutrition and ensure adequate Vitamin B12 intake in vulnerable populations.

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