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RESEARCH ARTICLE

VITAMIN B12 LEVELS IN CHILDREN WITH MACROCYTIC ANAEMIA

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ABSTRACT

Purpose of study- This study was conducted to evaluate B12 levels in children with macrocytic anaemia and to know the etiology of macrocytosis in children,
Materials and the methods-This study was a cross-sectional study carried out over a period of 18 months on 50 children up to 18 years of age of macrocytic anaemia. Children were identified as macrocytic having MCV > 95fl (mean corpuscular volume).
Result- In this study for mean haemoglobin of 11 g/dl the RBC volume was at a mean of 95.7. As the haemoglobin level fell the mean MCV increased to 99.93 which was statistically significant
Conclusion-Nutritional deficiency is the most common cause of macrocytic anaemia. Vitamin B12 deficiency is a major cause as nutritional anaemia among adolescent females.

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INTRODUCTION

Anaemia is defined as a reduction of the haemoglobin concentration or red blood cell (RBC) volume below the range of values occurring in healthy persons. A macrocytic anemia is an anemia (defined as blood with an insufficient concentration of hemoglobin) in which the red blood cells (erythrocytes) are larger than their normal volume (MCV 70-95). Megaloblastic anaemia is a Macrocytic anaemia (MCV >95fl) that is usually accompanied by leucopenia and thrombocytopenia. It is characterized by specific megaloblastic bone marrow morphology that affects erythroid, myeloid and platelet precursor .There are many causes of megaloblastic. Anemia, but the most common cause in children occurs from a vitamin deficiency of folic acid or vitamin B12.Deficiency of vitamin B 12 or folic acid which leads to impaired DNA synthesis gives rise to macrocytic RBCs, ineffective erythropoiesis & intramedullary haemolysis. This leads to rise in unconjugated bilirubin, LDH & also variable degree of cytopenias. Vitamin B12 is a water soluble vitamin that has an extremely important role for our brain development and maintaining integrity of central nervous system. It is also responsible for the metabolic activity of the various cells in the human body.

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The recommended dietary allowance (RDA) of Vitamin B12 is Acc to institute of medicine review and analysis of dietary reference intakes (Nathan and Oski's 2015 edition)

0.4 microgram/day in 0-6 mths
0.6 microgram/day in 7-12 mths
0.9 microgram/day in 1-3 yrs
1.2 microgram/day in 4-8 yrs
1.8 microgram/day in 9-13 yrs
2.4 microgram/day in 14-18 yrs

B12 SOURCES

Beef liver and clams, which are the best sources of vitamin B12:- Fish, meat, poultry, eggs, milk, and other dairy products, which also contain vitamin B12.Some breakfast cereals, nutritional yeasts and other food products that are fortified with Vitamin B12.

Causes of VIT.b12 Related Megaloblastic Anaemia

Inadequate Nutrition

- Strict vegetarian (vegans)
- maternal deficiency affecting in the foetus and infants

Defects in absorption

- Inadequate gastric intrinsic factor

- Pernicious anaemia
- Gastritis

Drugs

Cytotoxic Drugs (eg-hydroxyurea)
Antifolate drugs (eg- methotrexate), Immunosuppressive (eg-azathioprine)

CAUSES OF RED BLOOD CELL MACROCYTOSIS

- Megaloblastic Anaemia.
- Disorders of Erythroid Production- Aplastic anaemia, Myelodysplasia.
- Reticulocytosis-Chronic haemolytic anaemia.
- Drugs and toxins-Alcohol abuse, some antiviral drugs, some anticonvulsant drugs.
- Non hematologic diseases-Chronic liver disease, Hypothyroidism, Copper deficiency.

Vitamin B12 is known as the 'feel good' vitamin because it ensures the healthy functioning from the nervous system. Megaloblasticanemia (MA), results from deficiency of vitamin B12 or folic acid in diet .Over the last few years, incidence of MA seems on a rise. Deficiency of B12 is been seen frequently. In addition to anemia, it is associated with neutropenia and thrombocytopenia.

AIMS AND OBJECTIVES

- To study B12 levels in children with macrocytic anaemia
- To know the aetiology of macrocytosis in children.

MATERIALS AND METHODS

This study was a cross-sectional study carried over a period of 18 months on 65 children (age <18 years) out of which 50 children of macrocytic anaemia on peripheral smear treated in a large teaching hospital of central India were included in the study. Other patients of anaemia and having non macrocytic picture were excluded from the study Patients having clinical anaemia had undergone haemoglobin estimation and typing of anaemia. All participants having macrocytosis on peripheral smear were enrolled in the study. Their Serum Cobalamin levels was estimated by venous blood sampling.

The following investigations were done in all patients found to be clinically anaemic

Complete blood count (CBC), Hemoglobin, RBC count, MCV, RDW, TLC, Platelet Count, reticulocyte count, peripheral smear, Sr. Cobalamin levels.

Statistical Analysis: The obtained data was statistically analyzed by applying descriptive (Mean, Standard Deviation, t-test, Average) of significance of mean differences in term of various variable. We have entered all data and further Statistical Analysis was done with the help of IBM- SPSS-25 software.

RESULT

Anaemia: Clinically if the skin of the child's palm is paler than that of the examiner, then the Hemoglobin, estimation was done.

Table 1. Laboratory parameters compatible with who recommended hb thresholds

Age or gender group	Haemoglobin threshold (g/l)
Children (0.50–4.99 yrs	110
Children (5.00–11.99 yrs	115
Children (12.00–14.99 yrs)	120
Non-pregnant women (≥15.00 yrs	120
Pregnant women 110	110
Men (≥15.00 yrs)	130

Macrocytic Anaemia: Defined as Mean Corpuscular Volume > 95fl
Vitamin B12 Deficiency: Serum Vitamin B12 < 200pg/ml

Table 2. MCV and VIT. b12 levels

	Range	N	Mean	SD	P value	level
MCV		37	100.59	5.414		
B12	<95-105	37	148.99	2486.25	-5.897	p < 0.05
MCV		8	109.5	5.142		
B12	106-110	8	97.4	613.72	1.288	p> 0.05
MCV		5	113.8	7.2		
B12	>110	5	148.6	1933.8	-1.766	p >0.05

*MCV -**Mean corpuscular volume**
At an mean MCV of 100 the vitamin B12 levels had a mean value of 150.Higher the MCV (mean >100) was hardly affected by lower vitamin B12 levels (mean 148)

Table 3. Causes of macrocytic anaemia in children

Causes	*n- 50*	Percentage
1. Nutritional	37	74%
2. Infantile tremor syndrome	3	6%
3. Hypothyroidism	5	10%
4. Drugs	5	10%

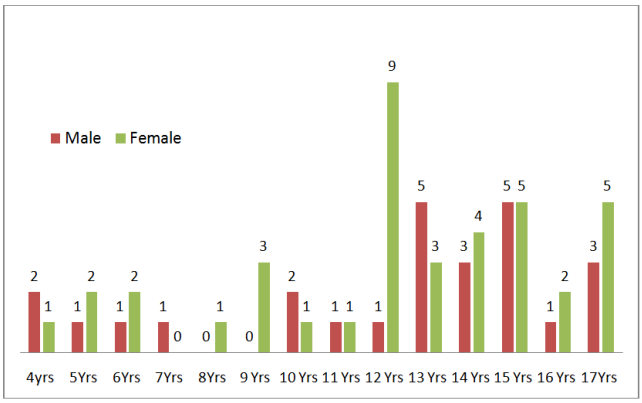

Figure 1. Nutritional deficiency is the commonest cause in the observed population

Above graph shows the demographic profile of patients with macrocytic anaemia. According to the observations there is increased incidence among adolescent females.

Table 4. Hb (hemoglobin) and b12

	Range	N	Mean	SD	P value	level
HB	5gm	16	3.80	0.456	-10.230	p < 0.05
B12		16	148.71	321.99		
HB	5.1 -	15	5.88	0.428	-9.560	P < 0.05
B12	7gm	15	125.12	2328.24		
HB	7.1-	23	8.430	0.77	-16.725	p < 0.05
B12	10gm	23	159.49	1858.51		
HB	>10	11	11.172	1.072	-3.873	p < 0.05
B12		11	190.09	23356.69		

* Hb–Hemoglobin

In the table above we can see that for a haemoglobin of > 10 g/dl, the mean vitamin B12 levels were 190 pg/dl. The falling trend of haemoglobin corresponded to the Vitamin B12 levels

also which was statistically significant. However the lowest mean of vitamin b12 of 125 was found in the haemoglobin range of 5.1 – 7g/dl.

Table 1. Hemoglobin and mean corpucular volume

	Range	N	Mean	SD	P value	level
HB	5gm	16	3.956	1.070	-37.821	p < 0.05
MCV		16	99.93	98.062		
HB	5.1 -7gm	15	5.72	0.4288	-30739	P < 0.05
MCV		15	99.06	141.63		
HB	7.1-10gm	23	8.430	0.775	-51.055	p < 0.05
MCV		23	99.86	73.209		
HB	>10	11	11.172	1.0721	-46.722	p < 0.05
MCV		11	95.727	36.618		

* Hb–Hemoglobin, *MCV -Mean corpuscular volume

In this study for mean haemoglobin of 11 g/dl the RBC volume was at a mean of 95.7.As the haemoglobin level fell the mean MCV increased to 99.93 which was statistically significant.

Conclusion

As the haemoglobin levels fell the vitamin b12 values also showed a downfall trend and the mean corpuscular volume showed a rising trend, which is statistically significant in various groups. Hence if anaemia shows macrocytosis, supplementing with vitamin b12 should be done where facilities of quantification of vitamin B12 are not available. As we are aware of growth surge which occurs twice i.e. first in infancy and second during adolescence, where in deficiency states are frequently encountered. Similarly in our study the commonest age of occurrence of b12 deficiency was noted in the adolescent age with female preponderance, where nutritional deficiency was the commonest cause (74%).So in a developing country like India where rural population where adolescent group makes a major census nutrition should be of utmost prime importance, and our government of India should fortify not only with iron and folic acid but vitamin b12 also. We can conclude through our study that macrocytosis cannot be equated with megaloblastosis, similar findings were observed in study by Vineetha Unnikrishnan et al.

Limitations

Area based research -further research required to delineate and characterise the prevalence and frequency of vitamin b12 deficiency and its etiology, and small sample size.

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Conflict of Interest: The authors declare that they have no conflict of interest.

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