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Assessment of role of Vitamin B12 and folic acid in iron deficiency anaemia

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Abstract
The association of vit-B12 and folate deficiency with anaemia in the studied population from the eastern part of India becomes important because despite the state initiative to supplement iron to the population at large during the last 40 years (since 1970) a significant decline in the incidence of anaemia has not been seen. Based on the above complication this study was done with the objective to study the association of folic acid and vitamin B12 deficiency in patients with iron deficiency anaemia in Indian children.

The 50 childrens enrolled in the present study were diagnosed with the anaemia. These were referred to Department of Paediatrics, Darbhanga Medical College and Hospital, Darbhanga from July 2010 to July 2011. Laboratory investigations were done like mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), serum ferritin, serum iron, total iron binding capacity (TIBC), serum transferrin (TRF), serum folate assay and serum vitamin B12 assay.

The likely causes predisposing is delayed weaning and inappropriate complementary feeds. Maternal malnutrition contributes to poor stores of Vitamin B12 and Folic acid in infancy. The findings of our study support the need for a broad public health strategy for the control of anemia among Indian children beyond delivering iron supplementation alone.

Keywords: iron deficiency anaemia, folic acid and vitamin B12, nutritional anaemia

Introduction

The most common cause of anaemia worldwide is iron deficiency. Iron is needed to form hemoglobin. Iron is mostly stored in the body in the hemoglobin. About one-third of iron is also stored as ferritin and hemosiderin in the bone marrow, spleen, and liver.

Normal Hemoglobin Levels

Hemoglobin is measured in grams per decilitre of blood.

The normal levels are: Women: 12.1 to 15.1 gm/dl; Men: 13.8 to 17.2 gm/dl; Children: 11 to 16 g/dl; Pregnant women: 11 to 15.1 g/dl [1].

Iron deficiency anaemia can be caused by:

- Anaemia caused by destruction of red blood cells (Haemolysis): Inherited conditions, such as sickle cell anaemia and thalassemia, stressors such as infections, drugs, snake or spider venom, or certain foods.
- Blood loss: Blood contains iron within red blood cells. So if a person loses blood, he or she will lose some iron. Women with heavy periods are at high risk of iron deficiency anaemia as blood is lost during menstruation. Slowly, chronic blood loss within the body such as from a peptic ulcer, a hiatus hernia, a colon polyp or colorectal cancer can also cause iron-deficiency anaemia. It can also be due to conditions like hemorrhoids, gastritis (inflammation of the stomach), and cancer, use of non-steroidal anti-inflammatory drugs (NSAIDS) such as aspirin or ibuprofen, which can cause ulcers and gastritis.
- Lack of iron in the diet: The body regularly gets iron from the food we eat. If a person consumes too little iron, over time the body can become iron-deficient. Examples of iron-rich foods include meat, eggs, leafy green vegetables and iron-fortified foods. For proper growth and development, infants and children need iron from their diet.
- An inability to absorb iron: Iron from food is absorbed into the bloodstream in the small intestine. An intestinal disorder such as celiac disease, which affects the intestine's ability to absorb nutrients from digested food, can lead to iron-deficiency anaemia. If part of the small intestine has been bypassed or removed surgically, that may affect the ability to absorb iron and other nutrients.
- Pregnancy: Without iron supplementation, iron deficiency anaemia occurs in many pregnant women because iron stores need to serve their own increased blood volume as well as be a source of Hemoglobin for the developing fetus [2].

Iron deficiency anaemia may be suspected from general findings on a complete medical history and physical examination of your child, such as complaints of tiring easily, pale skin and lips, or a fast heartbeat (tachycardia). Iron deficiency anaemia is usually discovered during a medical examination through a blood test that measures the amount of hemoglobin, or number of red blood cells, present and the amount of iron in the blood. The American Academy of Paediatrics currently recommends universal screening for anaemia at one year of age with a hemoglobin test, and an assessment for risk factors associated to iron deficiency. In addition to a complete medical history and physical examination of your child, diagnostic procedures for iron deficiency anaemia may include: Additional blood tests for iron and Bone marrow aspiration and/or biopsy. A procedure that involves taking a small amount of bone marrow fluid (aspiration) and/or solid bone marrow tissue (called a core biopsy), usually from the hip bones, to be examined for the number, size, and maturity of blood cells and/or abnormal cells [3].

India faced the recent global fiscal crisis impressively and is relentlessly marching forward on the economic and development fronts. However, these economic gains have not translated into substantial nutritional benefits, which is acutely embarrassing and disconcerting. Protecting lives and promoting optimum development of undernourished children is a human rights issue that can no longer be swept under the carpet. Moreover, supplementation of only folic acid in children having deficiency of both vitamin B12 and Folic acid can worsen the neurological status of the child.

Based on the above complication this study was done with the objective to study the association of folic acid and vitamin B12 deficiency in patients with iron deficiency anaemia in Indian children.

Methodology

The 50 childrens enrolled in the present study were diagnosed with the anaemia. These were referred to Department of Paediatrics, Darbhanga Medical College and Hospital, Darbhanga from July 2010 to July 2011. Laboratory investigations were done like mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), serum ferritin, serum iron, total iron binding capacity (TIBC), serum transferrin (TRF), serum folate assay and serum vitamin B12 assay.

The approval of the institutional committee was taken prior to conduct of this study. All patients were informed consents. The aim and objective of the present study were informed to the parents.

WHO Expert group suggested that anaemia should be considered to exist when Haemoglobin is below the following levels in venous blood.

- 6 months to 6 years 11 gm / dl,
- less than 12 g/dL for girls from 6 to 18yrs and boys from 6 to 14 years, and
- Less than 13 g/dl for boys from 15 to 18 yrs of age [10].

Exclusion Criteria

Children with history of oral or parenteral supplementation of vitamin B12 in previous 6 months, folic acid supplementation, proton pump inhibitors and H2 (antihistaminic receptor 2) blockers were excluded. Children diagnosed with haemolytic anaemia, liver disease, and gastrointestinal disorders

Inclusion Criteria

Children's s with Haemoglobin levels less than the WHO cut off levels for anaemia.

In those patients found to have anaemia, the following laboratory investigations were done like mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), serum ferritin, serum iron, total iron binding capacity (TIBC), serum transferrin (TRF), serum folate assay and serum vitamin B12 assay.

Results

The data from the 50 patients admitted to Department of Paediatrics were collected and presented as below.

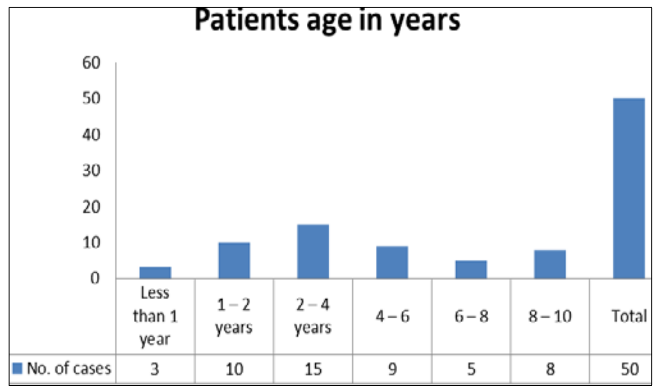

Fig 1: Age of the patient and number of cases

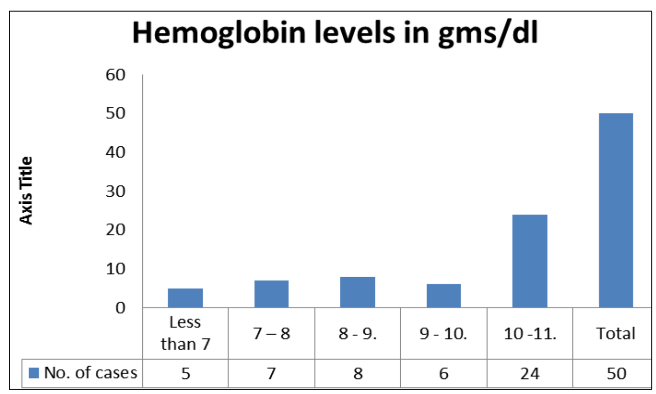

Fig 2: Haemoglobin Levels

Table 1: Observed Value of the Serum Markers

Marker	Observed Value
Blood Folate pg/ml	3.2 – 18.5
Serum B12 ng/ml	89 – 1320
Serum Iron mcg / dl	26 – 240
TIBC mcg/dl	210 – 580
Serum Ferritin mcg / l	143 - 678
Serum Transferrin mg/dl	183 – 563

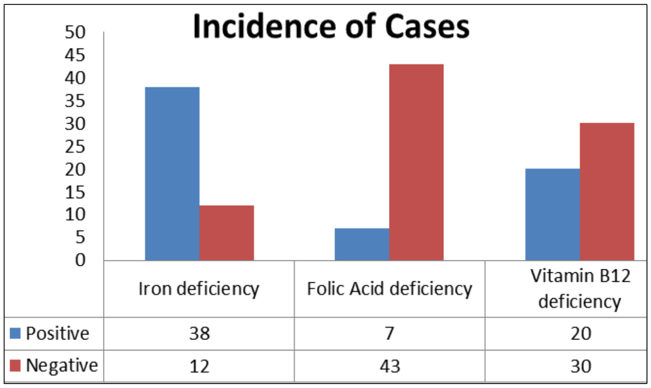

Fig 4: Incidence of Iron deficiency, Folic Acid levels, and Vitamin B12 levels of

Although the mechanisms underlying the effect of maternal folate status on neural tube development are not well understood, the shared metabolism between folate and vitamin B12 suggests that deficiencies in one vitamin may alter the metabolism of the other. This is perhaps related to the roles that vitamin B12 plays in myelination, or in the synthesis of methionine from homocysteine in combination with folic acid. Pasricha *et al.* [4] in 2011, studied the micronutrients such as vitamin B12, folate, iron and vitamin A concentrations of 396 children in the age group of 12 – 23 months in rural Karnataka in south India. They found that 65.6% had at least one micronutrient deficiency and those children between 1-2 years who are breast feeding should be targeted during micronutrient supplementation programs. Ahmed F *et al.* [5] in 2008 studied the prevalence of selected micronutrient deficiencies amongst anaemic adolescent school girls in rural Bangladesh, and they found that 28% of the girls had depleted iron stores, 25% had folic acid deficiency, 89% had vitamin B2 and 7% had vitamin B12 deficiencies. They concluded that there is coexistence of micronutrient deficiencies among anaemic adolescent girls in rural Bangladesh, although they do not suffer from energy deficiency. Of all micronutrients only iron and vitamin B2 concentrations were found to be related to the Hb concentration.

Gadowsky SL *et al.* [6] estimated the prevalence of biochemical iron, folate, and vitamin B12 depletion among a group of Canadian pregnant adolescents. They found that 22% of the pregnant adolescents had anaemia, 78 % had depleted iron stores and 25% had plasma vitamin B12 values in the sub-optimal range. Metz J [7] reviewed the prevalence of anaemia based on biochemical evidence. He found that the overall contribution of vitamin B12deficiency to the global burden of anaemia was not significant, except in women and their infants and children in vegetarian communities. He also found that it was unlikely that folate deficiency makes a major contribution to the burden of anaemia in developing countries. Iron-deficiency anaemia may coexist with vitamin B12 and especially folate deficiency, and may confound the haematological features of the vitamin deficiencies whose prevalence would then be underestimated. Van der Westhuyzen J *et al.*. [8] investigated the prevalence of anaemia and deficiencies of iron, folate and vitamin B12 in 140 rural black preschool children aged 3-5 years living in five different villages in the Letaba area, near Tzaneen. 39.2% were anaemic having hemoglobin levels below 11.1 g/dl. Approximately 10% were considered to be iron-deficient. On the basis of subnormal red cell folate values, 1 in 4 children was folate-deficient, and suggested the need for intervention at the community level such as enrichment of the staple foodstuff, maize meal with folic acid.

The association of vit-B12 and folate deficiency with anaemia in the studied population from the eastern part of India becomes important because despite the state initiative to supplement iron to the population at large during the last 40 years (since 1970) a significant decline in the incidence of anaemia has not been seen, especially among children and pregnant women [9]. Even if allowance is made for operational inadequacies in the implementation of this programme [10]. there is valid reason to believe that there are major factors, other than, or along with, iron that cause anaemia at such large scale in Indian population. We contend, high frequency of vit-B12 deficiency all through the cross section of population in India is one of the reasons of ineffectiveness of iron supplementation in reducing the rate of anaemia.

Conclusion

The likely causes predisposing is delayed weaning and inappropriate complementary feeds. Maternal malnutrition contributes to poor stores of Vitamin B12 and Folic acid in infancy. The findings of our study support the need for a broad public health strategy for the control of anemia among Indian children beyond delivering iron supplementation alone.

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