

Original Research Article

Role of vitamin A supplementation in management of iron deficiency anemia in children

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ABSTRACT

Background: The objective of the study were to study the effect of the supplementation of vitamin A along with standard dose of iron on hematopoiesis in children with documented iron deficiency anemia, a hospital based prospective study is carried out for 6 months on children with documented iron deficiency anemia in OPD and indoor patients of the department of paediatric medicine, Medical College Kolkata..

Methods: Thirty children (1-12 years age) presenting with iron deficiency anemia (hemoglobin less than 10 g/dl, mean corpuscular volume (MCV) <75 fl, and serum iron <55 mcg/dl) were studied in two groups of 15 each. Group I was supplemented with iron (ferrous sulphate 3 mg/kg/d) while group II in addition to iron was also supplemented with vitamin A (5000 IU/d). Collected data were expressed as mean±SE. Comparison of variables was done by using student t test or chi square test as applicable. P<0.0001 was taken as statistically significant.

Results: Hemoglobin concentration was found to be significantly increased after 4 weeks of iron supplementation. Rise in hemoglobin was comparatively more in group II, as compared to group I, after 4 and 8 weeks.

Conclusions: The result of this study suggests that supplementation of vitamin A improves hematopoiesis.

Keywords: Vitamin A, Anemia, Iron

INTRODUCTION

Iron deficiency anemia is a major public health problem among the school going children of our country along with other population group. Iron deficiency not only reduces the vitality of life, it is also held responsible for growth retardation, decreased working capacity and increased chance of contracting infection in children. Furthermore, it leads to complications during the child birth in a girl child. Growth retardation is an important extra ocular manifestations of vitamin A deficiency as pointed out by Marcus and Coulston, 1996).¹ Role of vitA in iron deficiency was studied in both human and rats.²⁻⁴ and role of vitamin A deficiency as a contributing factor to anaemia has also been examined in human.⁵ In a study

by Gamble et al among preschool children in the Republic of the Marshall Islands, it was shown that both iron and vitamin A deficiencies were independent risk factors for anemia, but inflammation was not a significant risk factor for anemia among these preschool children.⁶ Hashizum et al in his study also concluded that anemia among school-aged children in rural Kazakhstan appears to be related to iron indices and vitamin A status.⁷ None of the above studies had demonstrated the effect of vitamin A therapy on iron deficiency status in children. Coexistence of multiple micronutrient deficiency is a widespread public health problem in many regions of the India, including West Bengal. It was planned to study the effect of the supplementation of vitamin A along with standard dose of iron on hematopoiesis in children with

documented iron deficiency anemia. The study was approved by the ethical committee of medical college and hospital.

METHODS

This prospective study was done for one year on the children in the age group 1-12 year who had attended the outpatient department of Medical College and Hospital, Kolkata due to any reasons. All children with clinically suspected anemia were advised to do a complete hemogram before prescribing any forms of therapy. Thirty children in the age group 1-12 year with documented iron deficiency anemia as evidenced by hemoglobin less than 10 g/dl, mean corpuscular volume (MCV) <75 fl, red cell distribution width (RDW) <10 gm/dl, and serum iron <55 mcg/dl were studied in two groups of 15 each. Children having congestive heart failure, any infection or symptoms and signs of vitamin A deficiency were not included.

Group I (the control group) was supplemented with iron as ferrous sulphate, at a dose of 3mg/kg/d, as a single dose for four weeks. Group II (the study group), in addition to iron (as in group I) was also supplemented with vitamin A (5000 IU/d).

Hemoglobin levels were assayed before the start and after four weeks and eight weeks of therapy. Besides hemoglobin, red cells count, reticulocytes counts, mean corpuscular volume (MCV), serum iron were also determined. Collected data were analyzed using statistical package for social sciences (SPSS 11.5) program and expressed as mean±SE. Comparison of variables was done by using student t test or chi square test as applicable. $P < 0.0001$ was taken as statistically significant.

RESULTS

The results show that baseline values of hemoglobin and serum iron, both were higher for group I, though with treatment there was a change in trend, as evident by higher values of these two parameters at 4th and 8th week for group II. But for RBC count the initial value was higher for Group II and the same trend was maintained throughout the treatment period.

Now, on individual analysis, for RBC count, the rise is significant for both group I ($p=0.006$) and group II ($p < 0.001$) individually, but more for group II. When we compare the two groups at 4th week and 8th week, there is significant increase ($p=0.0004$) in RBC count at 8th week in the group II.

Serum iron analysis shows that, with almost same baseline value for both groups, the rise in the level of serum iron at 8th week for group II was significantly higher (p value < 0.0001) than group I though in both groups separately the rise in serum iron from the baseline value is quite significant (p value < 0.0001 for both).

Also, hemoglobin concentration was significantly increased after 4 weeks of supplementation of iron in children. Mean hemoglobin concentrations after 8 weeks was significantly higher in-group II ($p < 0.001$) (10.09 and 12.37 g/dl, respectively), as compared to group I (9.73 and 10.56 g/dl respectively). Again at 8th week the changed trend from the baseline was also significant ($p < 0.0001$) though initially the value of hemoglobin in two groups were not same. Also, the overall rise in hemoglobin in all the 30 patients were significant ($p < 0.0001$) vide Table 1-3.

Table 1: Hemoglobin percentage.

Hemoglobin (%)	Baseline	End of 4 th wk	End of 8 th wk	P value
Control group (iron only)	9.1	9.73	10.56	0.0001
Study group (iron+vitamin A)	8.46	10.09	12.37	<0.0001
P value	0.0056	0.1594	<0.0001	

Table 2: Total RBC count.

RBC count	Baseline	End of 4 th wk	End of 8 th wk	P value
Control group (iron only)	4.07	4.48	4.87	0.0006
Study group (iron+vitamin A)	4.08	4.77	5.46	<0.0001
P value	0.97	0.117	0.0004	

Table 3: Serum iron.

Serum iron	Baseline	End of 4 th wk	End of 8 th wk	P value
Control group (iron only)	52.01	54.42	56.99	<0.0001
Study group (iron+vitamin A)	51.08	58.40	63	<0.0001
P value	0.7186	0.0007	<0.0004	

Thus, from this study we find that supplementation of vitamin A with iron has better effect in treatment of iron deficiency anemia as reflected by the values of serum iron and RBC count and for hemoglobin it may be said that the effect may be evident in the near future, if further follow up done.

DISCUSSION

Numerous studies using humans have supported the notion that vitamin A has an impact on iron status and, in turn, iron-deficiency anemia, both in human and in animal like rats.^{9,10} Early research suggested that people deficient in vitamin A were prone to anemia that was reversed when sufficient doses of vitamin A were taken. A study by Mohanram et al showed that apart from deficiency of iron, vitamin A deficiency may also have a contributory role in the development of anemia in children.¹¹ Another study by Wieringa et al showed that due to redistribution of retinol after iron supplementation, which might induce vitamin A deficiency, iron supplementation in infants should be accompanied by measures to improve vitamin A status.¹²

Many studies in humans have been performed in countries where nutritional anemia and vitamin A deficiency are major public health problems.¹³ One study focused on pregnant women in Indonesia who were anemic due to nutritional status, which the authors reported to affect 50-70% of all pregnant women in that country.¹⁴

In another study the relationships between biochemical indicators of vitamin A and iron status and the intestinal helminthes *Ascaris lumbricoides* and hookworm in primary school children in Bangladesh was explored.¹⁵

Another study of this type focused on children in Guatemala, with four groups of children receiving either vitamin A, iron, vitamin A and iron, or placebo for two months. Various hematological measures were taken, and the results supported an effect of vitamin A on iron status. The major finding in this study was that vitamin A raised the level of serum iron in anemic children, which, according to the authors, could lead to greater hematopoiesis and thus recovery from anemia. Also, the increase in serum iron is maximal when both vitamin A and iron are administered, with either alone resulting in an increase of lesser magnitude.¹⁶

In a comparable cross-sectional study with children in north-east Thailand, serum retinol was positively associated with haematocrit and serum iron.

An association was found between serum retinol and serum transferrin or serum ferritin, but none between serum retinol and haemoglobin.¹⁷ In a study in Ethiopian children, however, a significant correlation was found between serum retinol levels and haemoglobin.¹⁸

While these authors imply that nutritional-deficiency anemia might be best treated using both vitamin A and iron, their conclusions are not drawn directly from the hemoglobin data, since there was no significant difference between the iron group and the vitamin A and iron group in many studies. Perhaps the observed changes in hemoglobin concentration represent physiological maximums, and the iron available for hematopoiesis, as indicated by serum iron, is greatest when both vitamin A and iron are supplemented in one's diet, even though it may not be used immediately for hematopoiesis.

A study has shown the effects of supplementation with vitamin A and iron for nutritional anemia in pregnant women in West Jawa, Indonesia.¹⁴ In a study by Zimmerman et al, it was concluded that in children deficient in vitamin A and iron, vitamin A supplementation mobilizes iron from existing store to support increased erythropoiesis, an effect likely mediated by increase in circulating erythropoietin.¹⁹ Furthermore, an African study, where it was shown, that retinyl palmitate added to the labelled test meals significantly decreased erythropoietin incorporation of iron in children with vitamin A deficiency at baseline but had no statistically significant effect 3 week after vitamin A supplementation. In another study based on effects of vit. A fortification and iron absorption fails to provide conclusive data and thus indicates the complexity of the interaction between vitamin A status, dietary vitamin A and iron metabolism.²⁰ Comparatively more rise in hemoglobin with the supplementation of iron along with vitamin A also supports the interaction between iron and vitamin A metabolism even in the present study.

CONCLUSION

Results of our study showed that supplementation of vitamin A along with standard iron therapy are beneficial in terms of long term outcome in children with documented iron deficiency anemia.

Since iron and vitamin A deficiencies are common nutritional problems in this part of the world, it is suggested that both the nutrients should be given simultaneously to overcome the problem of microcytic hypochromic anemia, even if the symptoms and signs of vitamin A deficiency are not apparent.

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Conflict of interest: None declared

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