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Original Research Article

A Hospital Based Prospective Observational Study to Investigate the Effects of Vitamin A Supplementation on Iron Therapy in Anaemic Adolescent Girls

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Abstract

Aim: The aim of the present study was to investigate the effects of vitamin A supplementation on iron therapy in anaemic adolescent girls.

Methods: It was a Prospective study conducted at Department of Physiology within a period of 1 year. The study population were school going young girls of age 13-16 years. The students of classes 8th, 9th and 10th, aged from 13 to 16 years, were included in the study. 200 girls were included in the study.

Results: Severely anaemic students were excluded from the study and referred to medicine and gynaecology OPD for active therapy. Before the study, 68 patients had normal anemia, 44 patients had mild anemia and 88 patients had moderate anemia. The difference between before and after intervention was extremely significant ($p<0.0001$). In group B mean baseline value for blood haemoglobin was 10.505+1.100 gm/dL and after intervention value was 11.804+1.076 gm/dL. This difference was very significant. In group C, the mean baseline value for blood haemoglobin was 12.664+0.402 gm/dL and after the study duration it was 13.000+0.400 gm/dL. This difference was significant.

Conclusion: The present study was conducted to evaluate whether vitamin A supplementation helps to restore the blood haemoglobin level along with iron therapy and helps to improve the status of anaemia. So, further studies involving large population need to be done to establish the definitive role of vitamin A supplementation in anaemia and to recommend it as a standard additive therapeutic agent.

Keywords: Iron deficiency anaemia, Vitamin A, Haemoglobin, Adolescence

Introduction

Iron deficiency anaemia (IDA) is reported to be the most common nutritional deficiency in the world. [1,2] It affects almost one-third of the world's population and it is common in young children. [3] Prevalence of IDA has been reported as high as 50% among East-Asian children of school age [4] and 60% among children less than 5 years. [5] Furthermore, the prevalence of IDA in children living at the periphery of large cities in the USA was found to be similar to that observed in developing countries. [6] Overall, preschool and school-age children, adolescent females and pregnant women are the groups at risk to develop IDA. [1,7] Iron deficiency anaemia in children is associated with decreased physical capacity and growth, impaired immune system, and reduced cognitive functions and learning capacities. [8,9]

Iron deficiency anaemia, vitamin A deficiency (VAD) and helminthes infections, mainly soil-transmitted helminths (STH) coexist among low-income populations. A possible association between vitamin A and iron has been suggested previously and serious attention has been given to this relationship. [10-13] For logistic reasons, the World Health Organization (WHO, Geneva, Switzerland) has recommended that vitamin A capsules and anthelmintic tablets be delivered together. [14]

In recent years it has been documented that-notwithstanding the ability of young women to catch up on growth-cephalopelvic disproportion in adolescent girls who become pregnant before skeletal growth is complete is related to an increased risk of maternal and fetal mortality. [15] Teen-age mothers are at increased risk of having preterm deliveries, stillbirths, and neonatal deaths. [16] This has been attributed to competition between the nutritional requirements of the developing fetus and the requirements for maintaining skeletal maturation after menarche. These observations draw attention to the possibility that girls with chronic under nutrition in the post-menarcheal years, even when non-pregnant, may be at increased risk because their bodies are still catching up rather than preparing for the demands of the reproductive period ahead.

Very few studies have investigated how particular nutrients, such as iron and vitamin A, promote adolescent growth or questioned whether the effort of catching up on growth may result in a reduction of iron and vitamin A stores. The nutritional intake of these nutrients probably does not rise along with maturational requirements in many developing countries. Although there are some cultures in which puberty is a time for the girl to be fattened up and rested [17], in many settings adolescent girls have a heavy work load, low social status, low priority in food distribution, and high infectious-disease rates, because adult levels of immunity still have to be acquired.

The aim of the present study was to investigate the effects of vitamin A supplementation on iron therapy in anaemic adolescent girls.

Materials and Methods

It was a Prospective study conducted at Department of Physiology, Anugrah Narayan Magadh Medical College, Gaya, Bihar, India within a period of 1 year. The study population were school going young girls of age 13-16 years. The students of classes 8th, 9th and 10th, aged from 13 to 16 years, were included in the study. 200 girls were included in the study.

Inclusion Criteria: Students who were willing to participate in the study voluntarily after being informed in details about the study procedure and providing consent were included in the study.

Exclusion Criteria: Students having following clinical features were excluded from the study.

1. Irregular menstrual bleeding.
2. Severe malnourishment.
3. Known haemolytic disease like sickle cell anaemia, thalassemia.
4. Haematuria.
5. Any other bleeding disorders.
6. Any chronic disease.
7. Features of vitamin A deficiency.

Written consent of the parents was taken before the study. De-worming of all the girl students was done. After obtaining relevant clinical history, blood samples of the participants were collected, for determining haemoglobin level. The level of haemoglobin was estimated by using Cyan-meth-haemoglobin method using Drabkin's solution. Universal precautions were followed for the collection of sample and for discarding the biomedical waste.

Students who were diagnosed as Anaemia on the basis of investigation were categorised randomly into two interventional groups. Students diagnosed non-anaemic formed the third group. Vitamin A supplementation (2,00,000 IU single dose) along with Iron in the form of FeSO4 was given for 100 days to the students of group A. Only Iron supplementation was given twice a week for a period of same 100 days to group B. Group C students were given only placebo in the form of white coloured candies. Vitamin A was given in the form of red coloured oil-based gelatinous capsule, obtained from medical college OPD. Both iron and Vitamin A supplementation were given to the participants under direct observation.

Haemoglobin level of each participant was measured twice during the study: Before the initiation of the intervention and on the completion of the intervention i.e. 100 days. The cut-off level for haemoglobin concentration to be diagnosed as anaemia is 12 gm/ dL for this concerned age group of 13 to 16 years in adolescent girls and were categorized as mild (11-11.9 gm/dL), moderate (8-10.9 gm/dL) and severe (<8gm/ dL) according to WHO criteria (2001).

Statistical Analysis

The data was analyzed using SPSS version 20. Normality of the scalar data was tested using Shapiro– Wilk test. Distribution of grading of anaemia was compared using Chi-Square test. The comparison of the distribution of grading of anaemia in various groups before and after intervention was done using McNemar- Bowker test. Comparision of pre and post intervention haemoglobin parameters among different groups was studied using Wilcoxon Signed Ranks Test. Significant level was set at p-value of <0.05.

Results

Table 1: Comparison of the distribution of grading of anaemia in various groups before and after intervention

Anaemia Grading		Before			Total	p-value
		Normal	**Mild**	**Moderate**		
After	Normal	62	40	22	124	<0.001
	Mild	6	4	30	40	
	Moderate	0	0	36	36	
Total		68	44	88	200	

Severely anaemic students were excluded from the study and referred to medicine and gynaecology OPD for active therapy. Before the study, 68 patients had normal anemia, 44 patients had mild anemia and 88 patients had moderate anemia.

Table 2: Comparison of the Haemoglobin level in various groups before and after intervention

Group	Intervention	Haemoglobin concentration (g/dl)		p-value
		Median (Mean)	QD (SD)	
Group A (n=64)	Before	10.304 (10.128)	1.000 (1.108)	<0.001
	After	12.402 (12.216)	0.950 (1.214)	
Group B (n=64)	Before	10.505 (10.141)	1.100 (1.187)	<.0.001
	After	11.804 (11.766)	1.076 (1.235)	
Group C (n=72)	Before	12.664 (12.809)	0.402 (.576)	0.007
	After	13.000 (13.018)	0.400 (.695)	

The difference between before and after intervention was extremely significant (p<0.0001). In group B mean baseline value for blood haemoglobin was 10.505+1.100 gm/dL and after intervention value was 11.804+1.076 gm/dL. This difference was very significant. In group C, the mean baseline value for blood haemoglobin was 12.664+0.402 gm/dL and after the study duration it was 13.000+0.400 gm/dL. This difference was significant.

Discussion

Anaemia is most common form of malnutrition globally and is the eighth leading cause of disease in girls and pregnant women in developing countries, [18] where the prevalence ranges from 40-60% as per WHO. [19] Half of those are supposed to be suffering from iron deficiency anemia. [20,21] The risk factors for iron deficiency anaemia includes low intake, malabsorption of iron from diets and periods of life when iron requirements are especially high (growth and pregnancy). [22,23]

Severely anaemic students were excluded from the study and referred to medicine and gynaecology OPD for active therapy. Before the study, 68 patients had normal anemia, 44 patients had mild anemia and 88 patients had moderate anemia. The difference between before and after intervention was extremely significant (p<0.0001). In group B mean baseline value for blood haemoglobin was 10.505+1.100 gm/dL and after intervention value was 11.804+1.076 gm/dL. This difference was very significant. In group C, the mean baseline value for blood haemoglobin was 12.664+0.402 gm/dL and after the study duration it was 13.000+0.400 gm/dL. This difference was significant. Mwanri Lillium et al (2000) [24] found similar results in a randomized controlled trial of the effects of dietary supplements on anemia in anemic school children. The supplements were vitamin A alone, iron and vitamin A, iron alone or placebo in four sample groups respectively, administered in a double-blinded design for 3 months. Vitamin A supplementation increased the mean hemoglobin concentration by 13.5 g/L compared with 3.5 g/L for placebo (P<0.0001). However, the group of children who received combined vitamin A and iron supplementation had the greatest improvements as compared with placebo (18.5 g/L, P<0.0001).

The influence of vitamin A and iron supplementation was studied by Suharno D et al (1993) [25] in anaemic pregnant women. Maximum haemoglobin was achieved with both vitamin A and iron supplementation, with one-third of the response attributable to vitamin A and two-thirds to iron. They concluded that improvement in vitamin A status may contribute to the control of anaemic pregnant women. In comparison, the mean increments in Hb concentration among vitamin A-supplemented children reported by the present study were much lower than that reported by Mwanri et al [24] for the same period of time. This could be due to the scope of their study which is confined to anaemic children who show more improvements than non-anaemic children or the difference in the daily intake of iron. Strong correlations between vitamin A status and haemoglobin levels have been demonstrated. [26] Prolonged vitamin A deficiency in animals negatively affects haematopoiesis, with a gradual replacement of the bone marrow by fibrous tissue. [27] A depression of iron uptake by the bone marrow was postulated to be one of the mechanisms in these studies. [24,28] Some recent studies have shown that vitamin A deficiency leads to ineffective erythropoiesis by the down-regulation of renal erythropoietin expression in the kidney, resulting in erythrocyte malformation and the consequent accumulation of the heme group in the spleen. [29] Vitamin A deficiency indirectly modulates systemic iron homeostasis by enhancing erythrophagocytosis of undifferentiated erythrocytes. [30]

Conclusion

The present study was conducted to evaluate whether vitamin A supplementation helps to restore the blood haemoglobin level along with iron therapy and helps to improve the status of anaemia. So, further studies involving large population need to be done to establish the definitive role of vitamin A supplementation in anaemia and to recommend it as a standard additive therapeutic agent.

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