Role of Vitamin A in Anemia

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Introduction

Over the last decades there has been an enormous increase in research, dealing with nutritional anemia and its causes. Iron deficiency has emerged as the most prevalent cause of anemia[1]. Although nutritional anemia is prevalent worldwide, it is particularly common in developing countries. Acording to the Nutrition survey of Rural Bangladesh, it was found that 70% of our people were anemic[2,3]. It also reverled that almost half of the population studied had a significant degree of anemia with 10-12 percent suffered from severe anemia[4]. Anemia most frequently results from low store of iron which may be due to inadequate dietary intake, blood loss, malabsorption of iron. However, there are many other possible causes of anemia, such as deficiency of another nutrient or inability to mobilize stored iron[5]. In Bangldesh, widely prevalent nutritional anemia (iron deficiency) was reported in spite of an adequate per capita of dietary iron intake[3]. There are other deficiencies of micronutrients like vitamin C, vitamin A and riboflavin of which the severe deficiencies of riboflavin along with vitamin A and ascrobic acid is very much important[3]. Role of vitamin C and riboflabin absorption and utilisation of iron was reported in the literature[5]. Nothing was elaborated about the role of vitamin A in reducing nutritional anemia in Bangladesh. The objective of our present study was to test the feasibility of reducing anemia among the rural children supplementing by one of the deficient microlnutrients, like vitamin A or by food containing provitamin A.

Materials and methods

School students of 6-14 years old of different places of Bangladesh were purposively selected. Blood samples were collected to sort out the anemic subjocts in the base line survey. Anemic samples were grouped by the levels of homoglobin as (1) 10 gm/ 100ml (2) 10-11 gm/100ml and (3) 11-

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12 gm/100 ml of blood. To study the effect of nutrient supplementation on hemoglobin levels the whole Children were devided into 8 grups (See Annexure-1). They were : (1) vitamin A supplementation group (2) Iron supplementation Group (3) food stuff supplementation group (4) vitamin A for 4 weeks and then iron supplementation for 4 weeks group (5) Iron supplementation for 4 weeks and then vitamin A supplementation for 4 weeks group (6) vitamin C supplementation group (7) vitamin B_2 supplementation and (8) control group, After 4 weeks supplementation of vitamin A, Iron etc. hemoglobin levels were estimated and results were statistically analysed. Individual treatments were compared by two correlated sample means and other tests were done by simple mean test for significance at different P levels. The field team consisted of a field manager (Nutritionist), two medical technologists and a field research assistant. They visited the different locations to collect blood samples for estimation of hemoglobin. Blood samples were collected by finger prick into 1.5 mm heparinized microhematocrit tubes scaled in one side, centrifuged at 1250 R.P.M. for five minutes. Hemoglobin was calculated from hematocrit values miltiplying by factor 0.34 (1% hematocrit = 0.34 gm Hb/100 ml blood)[6]. WHO indices suggestive of anemia were used to identify the classes of anemia for estimated hemoglobin values of the population of different areas. WHO expert group recommended that anemia could be considered to exist when the hemoglobin concentration of any person was below the minimum acceptable level as noted in the annexure-2.

Results

Percent change of Hemoglobin levels after supplementation of vitamin A were found to be 8.94% and 5.94%. The mean differences in both levels (10 to 11 gm per 100 ml of blood and 11 to 12 gm per 100 ml of blood) were statistically significant. ($P<0.1$) (Table-1). Percent change of Hemoglobin levels were hgih (11.74%, 11.27% and 7.3%) when children were supplemented by provitamin-A containing food stuffs (Table-2) while percent change of Hemoglobin levels were found to be more or less low (8.5%,. 4.45%, 5. 76% and 2.56%) when the children were supplemented by iron, vitamin-B2 and vitamin-C (Table-3, Table -4, table-5). Intervention by iron for 4

Intervention by iron for 4 weeks then vitamin-A, and vitamin-A then Iron supplementation for 4 weeks showed that an increase of Hemoglobin levels were better Hemoglobin levels were better after supplementation of vitamin-A than iron supplementatin (Table-6), The increase was statistically significant (P <0.01).

Table 1. Change of hemoglobin levels by intervention of vitamin A among anemic children.

Intervention of nutrint	Level of Hb. (gm 100 ml)	No of samples	Mean Hb level Before	After	Mean diffe-rence	% change
Vitamin A	10-11	20	10.63	11.58	0.95	8.94
Vitamin A 11<12	78	1.62	12.31	0.69	5.94	
Untreated	11<12	14	11.70	11.73	.030	0.23

P< 0.01

Table 2. Change of hemoglobin levels by intervention of food stuffs in anemic students.

Intervention of food—stuffs	Levelof Hb (gm/ 100 ml) blood	No.of samples	Mean Hb Level Before	After	Mean difference	% change
Food stuff	10	58	8.77	9.80	1.03	11.74
Food stuff	10-11	29	10.38	11.55	1.17	11.27
Food stuf	11<12	25	11.48	12.32	0.84	7.3
Unterated	11<12	14	11.70	11.73	.030	0.231

P<0.01)

Table 3. Difference in hemoglobin levels by intervention of iron among anemic children.

Intervention of nutrition	Level of Hb, gm 100 ml	No of samples	Mean Hb Before	Levels After	Mean differ-ence	% Change nge
Iron	10-11	9	10.6	11.55	0.9	8.5
Iron	11<12	46	11.69	12.21	0.52	4.45
Untreated	11-<12	14	11.70	11.73	0.30	0.23

P< o.o l

Table 4. Difference of hemoglobin levels by intervention of riboflavin in anamic school children.

Intervention of nutrition	Level of Hb. gm 100 ml blood	No of samles	Mean Hb Before	Levels After	Mean diff-erece	% Change
Vitamin B_2	11-<12	18	11.65	12.32	0.67	5.76
Untreated	11-<12	14	11.70	11.73	.03	0.23

$P < 0.01$

Table 5. Change of hemoglobin levels by intervention of vitamin C in anemic students.

Intervention of nutrients	Level of Hb. gm 100 ml blood	No of samples	Mean Hb Before	Levels After	Mean diff-erece	% Change
Vitamin C	10-11	14	11.70	12.00	0.30	2.56
Untreated	11-11	14	11.70	11.73	0.03	0.23

$P < 0.01$

Table-6. Difference in hemoglobin levels by intervention of iron then vitamin A and vitamin A and then iron among anamic school children.

Intervention of nutrients	No of samples	Mean Hb levels Before	/ After	Super imposed after 4 weeks	Mean diff. and test y-x=d1	z-x-D_2	z-y-d3.	% change x & y.	y & z.	x & z
Iron for 4 Weeks then Vit.. A	16	11.71	12.20	13.26	0.491X t=3.38 P. 01	1.55 t=9.10 P.01	1.06 t=7.54 P.001	4.20	8.67	13.23
Vitamin -A for 4 weeks then Iron for 4	17	11.64	12.50	12.65	0.86 t=6.14 p. 001	1.01 t=6.36 p.001	0.15 t=2.12 Insigni-ficant.	7.39	1.2	8.67

Annexure—I. Type and dosage of supplements received by groups.

Group	NO. of samples	Supplements given and level of Hb gm/ 100 ml of blood	Amounts of supplemented nutrients	
1.	a) 20	vitamin A (1011)	2. 00000 Unite	Once
	b) 78	Vitamin A (10-12)		
2.	a) 6	Iron (10-11)	20 mg. Daily	
3.	a) 29	* Food stuffs (10<11)	Pro-Vit. A 5945 I.U.	
	b) 25	(11<12)	Vit. B2 0.073. mg	
	c) 58	10	Iron 25.5 mg	Daily
			Vit. C 30 mg.	
			calories 238	
4.	a) 16	Iron 4 week + Vit. A 4 weeks	20 mg. iron daily for 4 weeks then 2. 00000 units. Vit. A only	
5.	a) 17	Vi. A 4 weeks then Iron4 weeks (11—12)	2.00000 units vit. A for 4 weeks + then 20 mg. iron dalily for 4 weeks.	
6.	a) 14	Vit. C (11<12)	125 mg Vit daily.	
7.	a) 18	B_2 (11<12)	1.25 mg. daily	
8.	14	Untreated (11—12)	—	

* Food staff list: Lal sak (Amaramthus gangctius) 50 gm.
Kamranga (Averrhtion camfola) equivalent (one piece) to 30 mg vitamin C.
Chapli-50 gm.

Annexure—2 . Minimum acceptable haemoglobin level for different age and sex

Age and sex	Minimum acceptable hemoglobin levels gm/100 ml blood
Children. both sex	11
(6 months to 6 yrs.) Children. both sex 16-14 yrs.)	12
Adult males (15 yrs. and above)	13
Adult females	12
(15 yrs. and above Adult females. Pregnant. lactating (P.L. or PL)	11

In accordance with the WHO criteria any child of 6-14 year age has been considered to be anemic having a hemoglobin level below 12 gm/100 ml blood.

Discussion

Among the individual nutrient supplementation to the students of 6-14 years old in reducing anemia, percentage of increase of haemoglobin levels were found to be highest in vitamin A supplementation in all levels of haemoglobin e.g. 10, 10-11, 11-12 gm/100 ml of blood as mentioned in the tables earlier (Table-1,2,3,4,5,). Role of vitamin A in reducing anemia was also supported by Susan Donoghus et al[8] and Robert E. Hodges et al[9] in their studies in animals and humans. The role of iron is already established as iron is needed for hemoglobin formation and reducing anemia and also supported by Robert E. Hodges et al[9]. The role of vitamin C is also established in reducing anemia by influencing the formation of hemoglobin and deposition of iron in liver tissue. According to George M. Briggs et al[5] anemia was a 'new' symptom, due to riboflavin deficiency. So it appears that riboflavin deficiency interferes with the production of red blood cells in man and alos has been reported in animals and reversed after supplementation of riboflavin. We also found riboflavin supplementation as the significant improvement of reducing anemia. To justify the role of vitamin A in reducing anemia among the school children, we did two more experiments. (Table-6) One group of anemic students were supplemented with iron for four weeks and hemoglobin levels were estimated before and after iron supplementation. Then vitamin A supplemented for 4 weeks and again Hemoglobin levels were estimated to compare their individual effect on anemia. In another group of anemic students vitamin A was supplemented for 4 weeks and Haemoglobin levels were estimated before and after Vitamin A supplementation, then iron was supplemented for 4 weeks and again Haemoglobin levels were estimated to compare their individual effect on anemia (Table-6). After Vitamin A supplementation, increase of Haemoglobin was better than iron supplementation. From these two experiments, it can be assumed that, along with other important role of Vitamin A in human being, it also plays an important role in roducing Anemia.

Summary

The research was conducted in Bangaldesh to ascertain the role of vitamin A and other limiting micronutrients in producing the best Hb response in the age group

of (6-14) years old school students after 4 weeks supplementation. In the base line survey, anemic students (> Hb 12 gm/dl) were grouped into 8 groups. The first group was given 2000,000 I.U. Vitamin A once, group 2 was given 20 mg iron daily (ferrous sulfate) for 4 weeks, group 3 was given daily food stuffs containing provitamin. A 5945 I. U., Vit. B2 0.073 mg, iron 25.5 mg, Vit. C 30 mg daily for 4 weeks, group 4 was made up of students who received 20 mg iron daily for 4 weeks, and then was given 200,000 I.U. of Vitamin A, group 5 received vitamin A and after 4 weeks was given 20 mg of mg of iron dalily for another 4 weeks, group 6 was given vitamin C 125 mg daily for 4 weeks, group 7 was given vitamin B_2, 1.25 mg daily for 4 weeks and group 8 was control. Hemoglobin levels for each nutrient was estimated before and after 4 weeks supplementation. The Hb levels rose in all the supplemented subjects. After statistical analysis, it showed that the role of Vitamin A was the most signifiant of all the treatments. From this study, it can be concluded that Vitamin A plays an important role in reducing anemia in the population.

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