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Impact of Synthetic Vitamin A and Horticulture Intervention on Vitamin A Status and Iron Status of Rural School Children

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ABSTRACT The investigation focused on vitamin A status, Iron status and impact of synthetic and horticulture intervention on vitamin A status and iron status. Vitamin A status of 153 school children of Dharwad taluk was assessed by biochemical analysis. Children with serum retinol level less than 20 µg/100ml were included in intervention study. Children from group-1 formed the control, a single massive oral dose of 2,00,000 IU of vitamin A was given to group-II, horticultural intervention was given to group-III daily for 3 months, where standardized recipes (fenugreek chapathi, drumstick leaves chapathi and carrot bhaji) met day's vitamin A allowance (2400µg/day). Serum retinol level and haemoglobin levels, were recorded before and after supplementation period. Both synthetic vitamin A and horticulture intervention improved the serum retinol and haemoglobin level. The synthetic supplementation showed high increment value for serum retinol level compared to horticulture supplementation group. Nevertheless, the increment value for haemoglobin level was high in horticulture intervention group. Horticulture intervention is cost effective, long-term, natural and sustainable strategy to solve existing vitamin A deficiency problem.

INTRODUCTION

Vitamin 'A' deficiency is the major cause of blindness among children in many developing countries (Sommer et al., 1980) being a major public health concern in India. Annually 30,000 to 40,000 children may be losing their eye-sight due to vitamin A deficiency (Reddy and Vijayaraghavan, 1995).

In order to combat the existing problem, the government of India initiated a national programme for prevention of nutritional blindness in the year 1970. Administration of massive dose of vitamin 'A' is imperative and surely effective as a short term measure for a risk group, but can not be taken as a permanent solution as it involves huge infrastructure, which is not cost effective. Conversely, an alternative strategy of providing vitamin A in the form of diet may be an answer to tackle the problem. Vitamin 'A' being fat soluble, is present abundantly only in animal origin food such as milk, butter, egg, liver and fish. These foods are expensive and beyond the reach of common man in developing country like ours. Consump-tion of green leafy, yellow vegetables and fruits, which are rich sources of vitamin A precursor, β-carotene, which are affordable by a common man appears to be an answer for the Indian population. Hence, the present investigation has been designed to study the impact of both synthetic vitamin A and dietary intervention on vitamin A status of selected rural school children.

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MATERIALS AND METHODS

Rural school children of the age group 8 - 12 years were selected for the study, Dharwad taluka was divided geographically in to almost four equal parts viz., Dharwad North, South, East and West. Two villages from each of the four parts and one village from Dharwad central, totally nine villages were randomly selected. Totally 153 rural children were assessed for serum retinol and haemoglobin status. Serum retinol was analyzed by using spectrophotometer method as suggested by National Institute of Nutrition (Anon., 1983) and the subjects were classified in to three category as acceptable, low and deficient based on serum retinol level (Anon., 1982)

Haemoglobin was analyzed by cyanome-thaemoglobin method (Varley, 1976), and the

subjects were classified in to four groups (Anon, 1986). Ninty Children, who were having serum retinol level less than 20 µg/100ml were randomly selected for the supplementation programme.

A preliminary survey was conducted in the rural families to identify the commonly used β-carotene rich foods. The identified and available three β-carotene rich foods viz., fanugreek leaves, drumstick leaves and carrot were selected for the supplementation. These vegetables were incorporated in to the common recipes of the area such as chapathi and bhaji (seasonal vegetable) and tested in the laboratory for acceptability involving 10 semi trained taste panels. Further, the recipes were also tested for consumer accepta-bility in non sample group (school children). The recipes were standardized in terms of metho-dology and β-carotene content to meet a day's allowance (2,400 µg) as recommended by Indian council of medical research (Gopalan et al., 1996) (Table 1).

The selected 90 children were divided in to three groups, group I formed the control with out supplementation of any source of β-carotene and were on the routine home diet. A single massive oral dose of 2,00,000 IU of vitamin A was given to the children of group II horticulture intervention was given to group III, where Standardized recipes were prepared daily in the laboratory and served to target subjects in rural schools of selected villager for the period of three months. The subjects were dewormed before intervention by giving Mebex tablet. Serum retinol level and haemoglobin level were determined before and after supplementation.

Table 1: β-carotene content of selected recipes

Name of recipe	*β-carotene (µg/serving)*
Fenugreek *chapathi*	2422
Drumstick leaves *chapathi*	2420
Carrot *bhaji*	2420

RESULTS AND DISCUSSION

Serum retinol levels of the children were analysed and classified into three different groups as per Anon 1982 and results are presented in Table 2. About 5.88 percent of the children were deficient, while majority (74.5%) fall in the category of low level and only 19.61 per cent of the sample were in the acceptable group.

Haemoglobin levels of children were analysed and classified into four groups as per Anon, 1986 and presented in Table 3, 1.96 per cent of them were severe anemics, 67.32 per cent were moderately anemics, 25.49 per cent were mild anemics and only 5.23 per cent were in normal group.

The serum retinol levels of all the selected children for the supplementation study were below 15 µg/100ml (Table 4). All the children were regarded as having low body pool of vitamin A as per the interpretation and recommendations of world Health organizations.

The serum retinol level did not show marked change in the control group during the study period but increase in retinol values were apparent in both synthetic vitamin A group and horticulture intervention group. Supplementing with a single

Table 2: Serum retinol level of children classified by gender

Serum retinol	*Gender*				*Total*	
	Boys		*Girls*			
	N	*%*	*N*	*%*	*N*	*%*
Deficient(<10 µg/100ml)	5	3.27	4	2.61	9	5.88
Low(10-20 µg/100ml)	59	38.56	55	35.96	114	74.51
Acceptable(>20 µg/100ml)	15	9.80	15	9.80	30	19.61
Total	79	51.63	74	48.37	153	100.00

Table 3: Haemoglobin status of children classified by age and gender

Haemoglobin status (g/100ml)	*Age (years)*								*Gender*				*Total*	
	8 – 9		*9 – 10*		*10 – 11*		*11 - 12*		*Boys*		*Girls*			
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Normal (≥12)	2	3.71	4	6.35	2	7.14	-	-	4	5.06	4	5.41	8	5.23
Mild anemic (10-11.9)	15	28.30	14	22.22	8	28.57	2	22.23	21	26.58	18	24.32	39	25.49
Moderate anemic (8-9.9)	34	64.16	44	69.84	18	64.29	7	77.77	53	67.09	50	65.57	103	67.32
Severe anemic(<8)	2	3.77	1	1.59	-	-	-	-	1	1.27	2	2.70	3	1.96

Anon. 1986.

Table 4: Mean serum retinol levels of children before and after supplementation

Group	*Serum retinol level (µg/100ml.)*		*Mean difference*	*'t' Vlue*
	Initial	*Final*		
Control	13.08	13.34	+00.26	2.73
Synthetic Vitamin A supplementation	14.10	31.20	+17.10	30.65**
Horticulture supplementation	12.68	23.13	+10.45	23.23**
't' values between control & synthetic Vitamin A supplementation	-	-	-	15.44**
Between control & horticulture supplementation	-	-	-	10.16**
Between synthetic Vitamin A supplementation & horticulture	-	-	-	6.66**

**Significant at 1% level

massive does of vitamin A (2 lakh IU), increased serum retinol from 14.10 to 31.20µg/100ml. Similarly supplementation in the form of β–carotene rich vegetable to the extent of 2400 µg incorporated in 'chapathi and bhaji' revealed a substantial increase in serum retinol value from the base line of 12.68 to 23.13 µg/100ml evidencing an increment of 10.45 µg/100ml. Devadas and Saroja (1987) and Chandrashekar and George (1990) have observed similar increase in serum retinol levels in pre school children after feeding of β-carotene rich foods.

The haemoglobin levels of all the selected children in the supplementation study were below 10g/100ml (Table 5) indicating they were in moderate anemic category (Anon., 1986). There was a significant improvement in the haemoglobin status in both the experimental group after supplementation, but increase was highest in the dietary intervention group indicating the increment of 2.44 g / 100 ml. On the other hand, the haemoglobin level did not show any significant variation in the control group.

The results clearly indicate that the serum retinol level increased significantly in both the experimental groups. Increment in retinol level was highest in the synthetic vitamin A supplemented group compared to horticulture intervention. The increase in haemoglobin level significantly was highest in dietary intervention group compared to synthetic vitamin A supplementation group. Increase evidenced in haemoglobin level may be attributed to the role of vitamin A in haemopoiesis. Nevertheless it is fact that food supplementation also provides other vital nutrients such as protein, ascorbic acid, Vitamin B_{12}, folic acid and iron along with β-carotene which has a role in haemoglobin synthesis.

Though synthetic vitamin 'A' supple-mentation improved both serum and haemoglobin level significantly, it can not qualify as a permanent answer to the VAD problem since it involves huge infrastructure, which is not cost effective. Hence, an alternative strategy of providing in the form of diet, a natural way seems to be most appropriate. Food is always better choice than a capsule or solution because people enjoy food, since it provides satiety value.

This study points out towards a fact that consumption of available, inexpensive β-carotene rich foods is the only rational sustainable, natural and durable solution to solve VAD problem.

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Table 5: Mean haemoglobin levels of children before and after supplementation

Group	*Haemoglobin level (g/100ml)*		*Mean difference*	*'t' value*
	Initial	*Final*		
Control	9.09	8.95	-0.17	3.03
Synthetic Vitamin A supplementation	9.58	11.00	+1.42	24.59**
Horticulture supplementation	9.19	11.63	+2.44	37.28**
't' values between control & synthetic vitamin A supplementation	-	-	-	11.47**
Between control & horticulture supplementation	-	-	-	15.19**
Between synthetic vitamin A & horticulture supplementation	-	-	-	4.02**

**Significant at 1% level

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