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ORIGINAL ARTICLE

Effect Of Vitamin-A Supplementation Among 2-5 Years Children In A Slum Area Of Dhaka City

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Abstract

A cross- sectional intervention study was conducted among 30 children of 2-5 years of age, residing in the Agargaon slums of Dhaka City. Majority of the subjects were between 3 & 4 years. The result showed that supplementation of Vit-A had a noticeable effect on the elevation of retinol level of pre school children. Base line mean serum retinol level of the children was 19.70± 5.26 µg/dl. After one month of vitamin-A supplementation in the form of biscuits (containing 6 µg beta carotene per biscuit), the serum retinol was raised to 26.66 ± 5.17 µg/dl on an average. Taking 20 µg/dl of serum retinol as deficient level, it was observed that initially 21 children were in the deficient group. After one month supplementation about 86% of them were found to have improved retinol level while 3 children still remained in the deficient group. Beta carotene rich biscuit is a cheap, easy and effective way to increase serum retinol level in children.

Introduction

Vitamin-A deficiency is one of the major nutritional problems in pre school children in developing countries. It was estimated that 500,000 pre school children become blind each year because of vitamin-A deficiency[1]. In addition, more than 100 million children suffer from vitamin-A deficiency although clinical signs of acute deficiency are not present[2]

In Bangladesh vitamin-A deficiency is a disabling condition in children. Survey reports showed that vitamin-A intake decreased from 1870 IU to 763 IU / person / day between 1962-63 and 1981-82[3]. Which then increased to 1558 IU / person / day. in 1991-92[4] (recommended intake 2013 IU / person / day).

In 1995-96 survey report it was observed that intake of vitamin-A was 1571 .22 IU[5]. Around 1.7% of children aged between 6-71 month were suffering from night-blindness. In 1989 [6,7] more than one million children (6-71 month) have visible signs of vit- A deficiency and about half a million suffer from night-blindness. Around 30,000 children (6- 71 month) go blind every year due to chronic vit- A deficiency and almost half of them die within a year of becoming blind coupled with PEM[8].

Vitamin A deficiency and its consequences, including blindness, poor growth, severity of infection and death are fully preventable. Govt. of Bangladesh introduced vitamin -A capsule distribution program to combat vit- A deficiency in early 1970, among the targeted children aged 6- 7 months. High potency vit-A capsule (VAC) coverage among children aged 6-7 months was 46% in 1982-83, which decreased to 32.2% in 1989[8] due to weakness of the program management.

As a long-term measure in order to solve vitamin-A deficiency, a food-based approach is of utmost importance. Since vegetable sources are not accessible equally to all the people at all seasons, red palm oil (RPO) which is the richest natural sources of beta- carotene- a pro vitamin-A, may be an easy solution to this problem. RPO derived from the mesocarp of the oil palm

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(Elias Guinness), although categorized as a saturated fat, can serve as dual role of providing pro-vitamin A and fulfilling the fat energy needs of developing countries. Bangladesh, a poverty stricken developing malnourished nation with a population of 128 million, is the most densely populated country of the world. Malnutrition is endemic in this country, more so in urban slums, where people live in a primitive condition with poverty, infections and malnutrition, which contributes to high infant, under five and maternal morbidity and mortality. So, vitamin A in red palm oil may be used in the diet to reduce the morbidity and mortality incidence rate. Sommer of Indonesia showed 20% diarrhoeal death could be averted by adding vitamin -A in treatment of Diarrhea[9]. Therefore, lowest dietary intake may be of great importance to increase morbidity and mortality related to vitamin -A deficiencies. So the present study has been designed to investigate the impact of dietary intervention of low cost biscuits having 6 µg Beta-carotene of red palm oil (RPO) per biscuit among slum children of 2-5 years of age with no visible signs of vitamin-A deficiency.

Methodology

The study was carried out using a cross sectional intervention design. Samples were selected on systematic random allocation from a slum of Agargaon at Sher- E Bangla Nagar in Dhaka city. This is a large slum inhabited by about 50,000 people, situated in the North Western area of Dhaka city and adjacent to the local Government and Environmental department office.

The slum houses were numbered and every third house were selected if it has child between 2-5 years. A total of 30 apparently healthy looking children of age 2-5 years were selected. The purpose of the study was explained to the family head and with the permission of the parents a sample of blood was obtained by vein puncture using a baby needle. Serum vitamin-A (retinol) was estimated by modified HPLC method used by Bieri et al [10], before and after intervention. A questionnaire was developed to obtain information on age, height, weight, socio- economic and other related factors.

Intervention program was made by supplementation of vitamin-A (retinol) enrich biscuits to usual diet among the sample children for a period of 30 days. The goal of the supplement was to provide 80% retinol equivalent (RE) in the form of biscuit to the children. The composition of one biscuit was: carbohydrate 59.8%, protein 9.1%, Fat 17.1%, and β-carotene 6 µg. analysis was done by using SPSS soft ware package. Various statistical tools were used. Mean, standard deviation and Skewness were determined. T-test, chi-square test, Odds ratio and Relative risk were performed to explain the results.

Results

A total of thirty children aged 2-5 years were studied. Majority of the subjects were between 3 and 4 years of age. Out of 30 children, 36.70 % were male and 63.30 % were female (Table 1).

Small values of Skewness of different indicators indicated that the sample indicators were normally distributed and are represented of the population (Table 2). The mean height was 100.47 cm and the mean weight was 11.63 kg which were 104.54% and 76.60% of the NCHS standard. Considering -2SD cut-off points, WFA, WFH and HFA Z-score data showed that the children were underweight and severely wasted but not stunted. Average monthly household income and family size were Tk.2193.33 ± 463.07 and 5.23±1.68 respectively.

Table 3 shows that the mean increment in blood retinol level over baseline was 6.96 µg/dl (range 6.79-7.45 µg/dl). The mean concentration of retinol at baseline had almost equal distribution, though on marginal level. But after intervention it was observed that the children were benefited in increasing resume retinol level.

Table 4 shows that mean retinol level (26.66 ± 5.17 µg/dl) of the children after vitamin-A supplementation was significandy higher (P<0.000) when compared with baseline mean retinol level (19.70±5.26) µg/dl of the children. After intervention 25 children out of 30 had higher retinol level over baseline level (Figure 1).

Table 5 shows that before intervention, the children were underweight as their mean WFA Z-score was -2.16 (cut-off point -2 SD). After intervention it was found that the children were not underweight (mean WFA Z-score – 1.91). Mean weight-for-height Z-Score shows that the children were severely wasted (mean – 3.14, cut-off point < – 3 SD). After intervention it was found that the children were wasted (mean WFA– 2.88 cut-off point > – 2 SD).

Table 6 shows that prevalence of deficient retinol level (< 20 µg/dl) was not equally common in baseline and after intervention (λ^2 = 20.07, P<0.000). Odds ratio (RR=21.0) shows shows that odds of retinol level (< 20 µg/dl) of exposure was 21.0 times higher than non exposure (>20 µg/dl). Initially 21 children were in the deficient group. After one month vitamin-A supplementation only 3 children remained in deficient group. Thus, an 85.7% improvement in the deficient group was observed.

Age	Male		Female		Total	
	n	%	n	%	n	%
2	0	0	3	10%	03	10.00%
3	5	06.6%	5	16.66%	10	33.33%
4	2	06.66%	9	30.09%	11	36.66%
5	4	13.33%	2	06.66%	06	20.90%
Total	11	36.70	19	63.30	30	100

Table 1: Age and sex distribution of study subjects

Indicators	Mean	Stan. Dev.	Skewness
Height (cm)	100.47	18.30	– 5.40
Weight (kg)	11.63	3.15	– 0.84
Height-for-age Z score	1.17	2.02	0.97
Weight-for-age Z score	–2.16	1.44	– 0.18
Weight-for-height Z score	– 3.14	1.80	0.04
Monthly household income	2193.33	463.07	1.01
Family size	5.23	1.68	0.64

Table 2: Mean standard deviation and skew ness of anthropometric indicators, monthly household income and family size of the subjects

Age	No.	Male	Female	Base line retinol Mean ± SD	Intervention Mean ± SD	Difference µg/dl
2	3	--	3	20.54 ± 5.78	27.51 ± 5.27	-6.79
3	10	5	5	19.73 ± 5.33	26.61 ± 5.39	-6.88
4	11	2	9	19.25 ± 5.63	26.43 ± 5.26	-7.18
5	6	4	2	19.02 ± 6.7	26.47 ± 5.76	-7.45
Overall	30	11	19	19.70 ± 5.26	26.66 ± 5.17	-6.96

Table 3: Retinol levels µg/dl (before and after) by age and sex

Retinal Level	No. of Pairs	Mean ±SD	Increase Mean diff.	SE of mean	t-value	2-tail sig.
Base line	30	19.70 ± 5.26	6.96	0.94	7.39	0.000
After 1 month intervention		26.66 ± 5.17				

Table 4: Comparison of retinol level between baseline and after intervention

Nutritional indicators	Baseline	After intervention
	Average Z-score	Average Z-score
Weight-for-age Z score	–2.16±1.44	–1.91±1.12
	Underweight	Normal
Weight-for-height Z score	– 3.14±1.80	–2.88±1.32
	Severely wasted	Wasted

Table 5: Comparison of nutritional status between baseline and after intervention by weight-for-age Z-score (WAZ) and weight-for-height Z-score (WHZ) classification

Serum retinol level	Baseline (n=30) No.	%	After 1 month (n=30) No.	%
<20 µg/dl	21	70	3	10
≥ 20 µg/dl	9	30	27	90

Table 6: Improvement of retinol level taking deficient level at 20 µg/dl)

Overall improvement after intervention =85.7%

χ^2 = 20.07 P<0.000 OR = 21.0

RR = 3.5

Discussion

There is 86.7% improvement of blood retinol level after intervention along with improvement of nutritional status. During the study, none of the children showed any visible signs of vitamin-A deficiency, but biochemically 70% of

the children were deficient (<20 µg/dl) at baseline. After one-month supplementation with biscuits having 6µg β-carotene each, serum vitamin-A level in all age groups was raised by 6.96 µg/dl and nutritional status of the children by weight-for-age Z-score and Weight-for-height Z-score were improved over the baseline. There was 86% improvement among vitamin-A deficient children.

Benade[11] observed that the incorporation of red palm oil (good source of vitamin-A) into snacks and biscuits providing from 50 to 400 % RDA, showed significant improvement in plasma retinol levels in 7-9 years old children after 30 days. We also found increment of blood retinol level after vitamin-A supplementation in the form of biscuits for 30 days. Incorporating red Palm oil as baking fat proved to be a effective way of producing a biscuit fortified with β-carotene. This is ideally suited for addressing vitamin-A deficiency in school aged children of South Africa[11].

Consumption of carotenoid containing food may be as important as dietary intake of preformed vitamin-A in protecting children and other members of households from vitamin-A deficiency. This is the important reason for making biscuits for supplementing vitamin-A deficiency group. These biscuits were made by using the naturally existing richest source of beta-carotene, red palm oil.

In our study, where socio-economic conditions and other facilities are poor, 86% improvement in blood retinol level was observed. Ramakrisna[12-13] observed in two separate studies in India that vitamin-A supplementation does not reduce common morbidity in children with mild to moderate vitamin-A deficiency in areas where access to health care and immunization are good.

Moderate to severe vitamin-A deficiency is likely to impair normal physical growth but milder stages of deficiency may not have this effect as seen in a study in rural South Asia[6]. Our findings collaborate with this study.

One of the challenges of meeting vitamin-A deficiency is food-based approach, which has been attempted in this study. This study indicated that short-term intervention with popular food item like biscuits, enriched with β-carotene are acceptable to the children of 2-5 years age group.

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