Inadequate Dietary Intake of Vitamin A in Rural Bangladeshi Children: Seasonal, Locational and Ethnic Variations.

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Introduction

Vitamin A deficiency Xerophthalmia continues to be a serious public health problem of considerable importance involving half a million Asian children every year (1-3). It seems to be more widespread and serious in the rice eating countries (4). In Bangladesh thirty thousand children go blind each year due to severe deficiency of vitamin A. One half of these ill fated children dies within few months from the onset of Xerophthalmia and the other half survives with irreversible blindness (3). Of the numerous factors that contribute to vitamin A deficiency, inadequate dietary intake is generally considered to be the most important(5).

In rural Bangladesh, the existence of gross inadequacy in vitamin A intake at household level, irrespective of household socio-economic status, is well documented (6-8). Information on the individual intake of young children, 'at risk' of Xerophthalmia is, however, extremely meagre.

This study was conducted with a view to quantify the extent of dietary inadequacy in vitamin A intake among young children aged 2 to 5 years, who constitute the 'at risk' group and also to identify the seasonal, locational and ethnic variations in the intake pattern.

Materials and Methods

The field study was conducted in two ecologically different locations of rural Bangladesh covering two different seasons. Seasonal variations in the availability ol various kinds of carotene-rich foods were taken into consideration in the selection of the two seasons. Season 1 (October) coincides with lean period with regard to the availability of staples while season 2 (Jan-Feb.) corresponds with moderate availability.

The two study locations were selected from among the 100 sampling sites of the 1982-83 Xerophthalmia Prevalence Survey (3). The sampling sites of this survey were categorised as 'high' and 'low' risk areas in respect of prevalence of Xerophthalmia. One site from each of the 'high' and 'low' risk category areas were selected. The high risk site (Choto-Madhabdi) is a small cottage industrial village in the central region of the country, where agriculture plays a minor role in the economy of the area. The low risk category site consists of two adjacent villages, Dohar Tarashi and Rames-

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warpur in the low lying belt of the Western region of the country. Cent percent of the population of Dohar Tarashi is Hindu and that of Rameswarpur is Muslim. Both the communities are mainly agricultural.

The study samples included only 2-5 year old children. Under 2 year children were deliberately excluded because in rural Bangladesh a significantly large proportion of children remain mainly on breast upto 2 years of age(9) and measuring their dietary intake is unlikely to reveal anything substantial. In both the locations households with children between 2 and 5 years of age were enumerated during preliminary visits to the villages. A total of 52 households from the high risk village (Choto Madhabdi) were selected. Twenty nine and thirty one households were selected from the low risk village 1 (Dohar Tarashi) and 2 (Rameswarpur) respectively.

Household dietary survey was conducted by weighing method and then meal by meal intakes of the target children were measured separately for 3 consecutive days. The dietary surveys began early in the morning when the children first awoke and continued until they were put to sleep at night. Each member of the dietecians measured the intake of 2 to 3 children daily. Snack foods eaten by the children in-between meals were also measured or estimated by questioning. Food ingredients in the target child's share of prepared family food were converted into their raw equivalents and their vitamin A and/ or carotene values were calculated using the local Food Composition Tables (10).

Individual food items which constitute the bulk of dietary vitamin A are not usually too many. Food sources of vitamin A were identified during preliminary visits to the study location and every individual child's intake of these food sources and their contribution to the total intake of vitamin A were also analysed.

All calculations and analyses were done in the computer. Statistical treatment of data was performed using student's 't'- test to demonstrate seasonal, locational and ethnic variations.

Results

Table 1 shows the daily and three days mean intake of vitamin A. Day to day variations in the intake are large in all the three villages in both the seasons studied. There are also seasonal and ethnic differences in the intake. During season-1, in October, compared to the high risk village, intakes are as a whole higher in both the low risk villages. The difference is statistically significant ($P<.05$). In season-2 (January-February) however, the differences between the high risk village and the low risk village 1 (Hindu community) persisted in the same direction, but the same seem to have reversed with respect to the low risk village 2 (Muslim Community). During this season, except on the second day, the intakes were higher

Table 1. Daily and three days mean intake of carotene and total RE (ug/d)

Season/Day	High risk village				Low risk village-1				Low risk village-2			
	n	Carotene	Total RE	Carotene as% of total	n	Carotene	Total RE	Carotene as% of total	n	Carotene	Total RE	Carotene as% of total
Season-1 (October)												
First day	55	478	99	80.6	32	2121	360	98.4	31	2027	349	97.0
Second day	56	538	86	85.1	32	1577	275	95.8	31	732	142	86.1
Third day	57	527	118	74.6	33	1137	295	64.4	31	594	106	93.6
Mean	-	481	101	79.5		1607	310	86.6		1118	199	93.8
Percent fulfilment of basal requirement (1)			50.50				155.00				99.50	
Percent fulfilment of safe level of intake (2)			25.25				77.50				49.75	
Season-2 (Jan-Feb.)												
First day	49	933	176	88.5	30	3025	516	97.9	28	250	46	90.8
Second day	50	521	173	50.3	30	1814	313	96.8	29	1014	188	95.4
Third day	51	429	94	76.2	30	1244	217	96.0	30	225	47	79.9
Mean	-	624	147	70.9	-	2029	349	97.1		516	94	91.7
Percent fulfilment of basal requirement (1)			73.50				174.50				47.00	
Percent fulfilment of safe level of intake (2)			36.75				87.25				23.50	

1. Basal requirement for this age group is 200 ug RE/d and refers to the level of intake necessary for prevention of clinically demonstratable impairment of function. At this level of intake there is a risk of functional impairment due to short-term dietary inadequacy

2. Safe level of intake (400 ug RE/d) is synonymous with 'recommended intake' as used in earlier FAO/WHO reports and refers to the level of intake for appropriate reserves with low risk of depletion due to short-term inadequacy.

in the high risk village than in the low risk Muslim village. Within the low risk area, the intakes are significantly higher in the Hindu community than in the Muslim one, in both the seasons (P<.05). The apparent seasonal differences in vitamin A intake are not statistically significant. The reason might be that with regard to the availability of food sources of vitamin A the two chosen seasons are not significantly different, even though they are so with regard to the availability of staples.

In terms of adequacy the intakes in the high risk village were far below the basal requirement in both the seasons. In low risk village 1 (Hindu) the intakes seem to be satisfactory. These are substantially above the basal requirement level but below the safe level of intake. In the second low risk village (Muslim) the mean intake is barely enough to meet the basal requirement during season-1. In season-2, however, the intake is far below the basal requirement as well as the safe level of intake.

Table 2 shows the three days' mean intake of vitamin A of the children whose dietary intakes included some kind of food(s) identified as the major sources of vitamin A on any day (s) during the three day period and the contribution of these sources to carotene, preformed vitamin A and total RE intake. Table 2 demonstrates that carotenes constitute to be the principal sources of vitamin A activity in the diet of children and food items identified to be the major sources of vitamin A account for well over 90% of the intake.

Table 2 : Vitamin A (Carotene, pre-formed vitamin A and total RE) intake of children whose diet included food sources of vitamin A and their contribution to total intake.

Season	High risk village			Low risk village-1			Low risk village-2		
	Carotene (ug)	Vit. A (IU)	Total RE (ug)	Carotene (ug)	Vit. A (IU)	Total RE (ug)	Carotene (ug)	Vit. A (IU)	Total RE (ug)
1. Three days mean	1262	151	261	2994	34	510	2171	54	380
Contribution of food sources of vitamin A.	1216 (96%)	138 (91%)	248 (95%)	2963 (99%)	17 (50%)	499 (98%)	2120 (98%)	52 (96%)	371 (98%)
2. Three days mean	959	197	225	2660	42	452	919	40	167
Contribution of food sources of vitamin A.	862 (90%)	189 (96%)	207 (92%)	2542 (96%)	41 (98%)	437 (96%)	855 (93%)	39 (98%)	144 (86%)

Table 3. Percent distribution of children by number of days of intake of food sources of vitamin A during the 3 consecutive days.

Season	n	Season-1 No. of days of intake of food sources of Vit. A				n	Season-2 No. of days of intake of food sources of Vit. A			
		1 day	2 days	every day	never		1 day	2 days	every day	never
High risk village	57	38.6	19.3	8.8	33.3	51	25.5	33.3	27.5	13.7
Low risk village-1	33	30.3	30.3	24.3	15.2	30	20.0	33.3	46.7	0
Low risk village-2	31	48.4	22.5	19.4	9.7	30	40.0	30.0	16.7	13.3

Table 3 shows the distribution of study children by number of days of intake of food sources of vitamin A in the two seasons. In season 1 only 8.8% of the children in the high risk village had some kind of vitamin A and/or carotene rich food in their diet every day during the three-day period. Some 19.3% and 38.6% respectively had some kind of these foods on two and one days during the observed period. One third of the children in this study did not have any kind of food sources of vitamin A on any of the three days observed.

Although the intake pattern is better in the low risk villages, yet some 10-15% children did not have any kind of food sources of vitamin A on any of the three days observed. In season-2 the situation seems to have improved in all the three villages. During this season the proportion of children taking some kind of vitamin A and/or carotene rich food doubled in the low risk and trebled in the high risk village. In the low risk village-1 (Hindu community) there was no child whose dietary intake did not include some kind of vitamin A or carotene rich food at least once during the three observed days.

Table 4 shows the contribution of plant and animal sources in the intake of vitamin A. Animal foods contributed 19% to 26% of the total vitamin A intake in the high risk village as against (3% to 8%) in the low risk villages. The ethnic difference in the intake of plant and animal sources of vitamin A is statistically significant ($P < .05$).

Table 4. Percent contribution of plant and animal sources to the mean RE intake.

Season	High risk village		Low risk village-1		Low risk village-2	
	Plant	Animal	Plant	Animal	Plant	Animal
Season-1 (October)	81	19	97	3	94	6
Season-2 (Jan. Feb.)	74	26	97	3	92	8

Table 5. Total dietary fat and edible oil intake (gm/person/day)

Season	High risk village	Low risk village-1	Low risk village-2
1. Total dietary fat	2.81	1.06	0.93
Edible oil	2.15	0.87	0.83
2. Total dietary fat	3.27	1.40	1.74
Edible oil	1.99	1.07	0.94

Dietary fat is an important element affecting the absorption and utilization of carotenes in the diet. Table 5 shows that fat intakes are extremely low in both the seasons. Some improvement in the intake is noted during season-2.

Discussion

The dietary study presented here was undertaken to investigate the vitamin A intake by young children in two ecologically different locations of rural Bangladesh and also to identify the variations across seasons and between ethnic groups. Of the numerous factors that contribute to vitamin A deficiency complications, inadequate dietary intake is generally considered the most important (5). Attempts were made to quantify the amount of vitamin A intake by major food sources which usually provide the bulk of dietary Vitamin A. This study confirms that according to FAO standard(11) the intake of vitamin A is grossly insufficient in the high risk village in both the seasons. In the low risk location the intake seems to be some what satisfactory in the Hindu community. Like most of the developing countries, (12,13) the bulk of vitamin A intake comes through consumption of carotenoids, especially the beta-carotene. This study revealed significant differences in the carotene consumption pattern between the two different rural settings and also between the two different ethnic groups.

Pre-formed Vitamin A is provided by foods of animal origin. Compared to the low risk villages the intake of pre-formed vitamin A was higher in the high risk village (Choto Madhabdi). Higher intake of foods of animal origin may be attributed to higher purchasing power of households in a cottage industrial village like Choto Madhabdi.

Although the observed seasonal difference in the intake of vitamin A is not statistically significant, the existence of seasonal variations in vitamin A intake, demonstrated in other studies in Bangladesh (6-8, 14) and elsewhere (15-17), cannot be overlooked. Edible oil is necessary for efficient absorption and utilization of dietary carotenes (18,19,20), but the fat intake by the children studied is very low. The situation would be more or less similar throughout rural Bangladesh in the event of extremely low per capita intakes documented in the national surveys (7,8). Extremely low intake of fat is likely to reduce further the utilization of already inadequate dietary intake of carotenoids.

It is ironic that children in many developing countries are suffering from vitamin A deficiency where there is an abundance of green plants.

In rural Bangladesh, though the main source of dietary vitamin A are carotenes from dark green leafy and yellow vegetables and seasonal fruits, the dietary intake of vitamin A is grossly inadequate.

Vitamin A deficiency disorder is primarily due to lack of knowledge and ignorance rather than lack of purchasing power. In order to combat effectively the vitamin A deficiency malnutrition of a very high magnitude prevailing in the country a pragmatic nutrition education campaign should be instituted on a national scale, so as to educate people to make best use of already available as well as potentially available food sources of vitamin A. Various government agencies concerned with health and family planning, agricultural extension, rural development, social welfare and women's affairs can play important role in nutrition education dissemination. Non-government organisations (NGO's) concerned with the development and welfare of disadvantaged population groups and community leaders and religious leaders like Imams could also be involved in the campaign. Mass media should take a leading role in information dissemination and motivation. Due importance must also be given to nutrition in the curriculla of formal education, especially at the primary and secondary levels. Existing lessons on nutrition should be reappraised and made more appropriate to suit our social, cultural, religious and economic conditions.

It must not however, be overlooked that vitamin A deficiency does not occur in isolation. Manifest vitamin A deficiency is concomitant with low food intake and other socio-environmental constraints. Vitamin A malnutrition cannot be eliminated in a sustained way without simultaneously addressing the underlying socio-economic and environmental causes of malnutrition.

Summary

Individual intake of 121 children aged 2-5 years was studied by weighing method for 3 consecutive days in two ecologically different locations of rural Bangladesh. Food intake data were converted into vitamin A intakes and analysed by seasonal and ethnic attributes of the study locations.

The study demonstrated the existence of gross inadequacy in the dietary intake of vitamin A. Only a small number of children were found to have had some kind of vitamin A or carotene rich food in their diet regularly. Carotenoids constituted the bulk of the total R.E. intake. The intake of fat which affects the absorption and utilization of carotenoids was very low. The mean R.E. intake differed significantly ($P < 0.05$) between the two different ecological settings and also between the two ethnic groups. Seasonal variation in the availability and intake of vitamin A was evident.

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