

Brief Reports

Methods for Mass Screening of Vitamin A Deficiency

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Vitamin A deficiency is a major cause of blindness in preschool and school aged children in developing countries. Common illnesses including measles, lower respiratory tract infections and diarrhea are commonly associated with vitamin A deficiency. While clinically evident vitamin A deficiency in patients with protein energy malnutrition or in sick children gets proper attention, it is likely that many cases remain undetected. It is important to diagnose cases of marginal vitamin A deficiency as early as possible so that preventive measures can be taken.

Several methods are available for diagnosis of vitamin A deficiency. The most commonly used approaches are assessment of dietary vitamin A, biochemical assessment of serum vitamin A, ophthalmological examination for clinical signs of vitamin A deficiency, Rose Bengal stain test (RBST) for early conjunctival xerosis, and conjunctival impression cytology (CIC) for preclinical vitamin A deficiency.

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In the present study the vitamin A status of the children below 12 years of age was determined using the above methods and the results compared to identify the most suitable method in the field situation.

Material and Methods

Food frequency questionnaire and 24-hr recall methods were used to estimate the nutrient intake of 2156 children aged between 0-12 years from low socioeconomic status families. Vitamin A equivalents was estimated using standard food composition tables and compared with ICMR RDA(1). The children were examined for signs of vitamin A deficiency. One hundred and ninety six children were chosen randomly for RBST and CIC tests. Mild conjunctival xerosis was detected by using RBST. The test was considered positive when there was a pink spot on the conjunctiva on staining (2). CIC was used to detect early epithelial and goblet cell changes in preclinical vitamin A deficiency (3). The serum vitamin A levels were analysed using HPLC (4). Vitamin A levels less than 20 ug/dl were considered low(5). Fifty two age-matched healthy children served as controls.

Results

All children in this study were suffering from common illnesses. The dietary nutrient intake was below the RDA level and vitamin A intake was found to be between 60-65% of RDA. For the comparison of all the methods the values obtained in 196 children only were considered. Eye examination of these children indicated that 27.5% of children had signs of vitamin A deficiency. Conjunctival xerosis was common in the

children. There were no cases of corneal xerosis and corneal scars. Serum vitamin A levels were low in 77% of the children, RBST was positive in 71%, and CIC showed abnormal impression cytology in 86% (Table 1). The RBST and CIC was normal in controls and the serum vitamin A levels in this group were between 30-50 ug/dl.

Discussion

Evaluation of the vitamin A status based on the information obtained through dietary questionnaire showed that these children were getting vitamin A below RDA level. In a dietary survey which is based on food frequency questionnaire and 24-hr recall, the possibility of false information cannot be overlooked and thus the reliability of this method is disputable.

Determination of serum levels of vitamin A is another important method for assessment of vitamin A deficiency. The serum samples showed that 77% children had levels less than 20 mg/dl. Though 23% children showed vitamin A levels >20 ug/dl these were still less than the serum vitamin A levels of the controls (30-50 ug/dl). Estimation of serum vitamin A levels poses serious problems because of the difficulties in obtaining samples in the field studies and also storage and carriage of the samples to the laboratory for analysis.

Hence, determination of serum vitamin A levels is not recommended for mass screening of vitamin A deficiency.

The clinical symptoms are the manifestations of the frank vitamin A deficiency. It is essential to detect vitamin A deficiency especially in preclinical stages so that the high-risk groups can be identified and covered under the vitamin A Prophylaxis Programme. The RBST was positive in 71% cases, 66.6% of these had low serum vitamin A levels. However, 72% of the children with a negative RBST also showed low vitamin A levels. Similarly, of the children with normal levels of vitamin A, one third showed a positive RBST. Our results, therefore, suggest that the RBST test does not correlate with the vitamin A status. Similar results have been reported previously (9).

The changes in the epithelial cells and goblet cells are very striking in vitamin A deficiency. CIC has been suggested as a simple technique for the detection of physiologically significant vitamin A deficiency (8). In the present study 86% of the children had abnormal CIC. Among the children showing abnormal CIC, 14% children had levels of vitamin A >20 ug/dl, while 12% of the children showing normal CIC had low levels. All the children in control group had normal CIC. Similar results were reported previously(9).

TABLE I – RBST and CIC as Compared to Serum Vitamin A Levels

Test	No. of patients	Vitamin A levels	
		< 20 ug/ dl	≥ 20 ug/ dl
Percent of children			
RBST			
Positive	140 (71)	66.6	33.4
Negative	56 (29)	72.0	38.0
CIC			
Normal	28 (14)	12.0	88.0
Abnormal	168 (86)	86.0	14.0

None of the tests could be considered as the 'gold standard' for the detection of vitamin A deficiency. However, the results of CIC technique were found to correlate closely to the dietary vitamin A intake or serum vitamin A levels. The CIC test does not require sophisticated instrumentation and specimens can be obtained easily and stored indefinitely. Our observations suggest that this technique is probably more useful than the other tests for detection of preclinical vitamin A deficiency.

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REFERENCES

1. Indian Council of Medical Research. Recommended Daily Allowances for Indians. New Delhi, ICMR, 1990.
2. Vijayaraghavan K, Sharma KVR, Reddy V, Bhaskaram P. Rose Bengal staining for detection of conjunctival xerosis in nutritional surveys. *Am J Clin Nutr* 1987, 31:892-894.
3. Kjolhede CL, Gandowiski AM, Wittipen J, *et al* Conjunctival impression cytology. Feasibility of a field trial to detect subclinical vitamin A deficiency. *Am J Clin Nutr* 1989, 49: 490-494.
4. Bieri GJ, Tolliver TJ, Catignani GL. Simultaneous determination of alpha-tocopherol and retinol in plasma or red cells by high pressure liquid chromatography. *Am J Clin Nutr* 1979, 32: 2143-2149.
5. Interdepartmental Committee on Nutrition for National Development (ICNND) Manual of Nutrition Surveys. Washington DC, US Government Office, 1963.
6. Rosa MD, de'Souza NV, Sonia MB, Maria GC, Indrajit DD, Jose ED de'Oliveira. Vitamin A status of young children in southern Brazil. *Am J Clin Nutr* 1986, 43: 852-858.
7. Kusin JA, Sinaga PHSR, Marpaung AM. Xerophthalmia in north Sumatra. *Trop Geog Med* 1978, 29: 41-48.
8. Hatchel D, Sommer A. Detection of ocular surface abnormalities in experimental vitamin A deficiency. *Arch Ophthalmol* 1984,102:1383-1393.
8. Amedee-Manesme O, Lzean R, Wittipen JR, Hanck A, Sommer A. Impression cytology detects subclinical vitamin A deficiency. *Am J Clin Nutr* 1988, 47: 875-878.