SUBCLINICAL VITAMIN A DEFICIENCY IN UNDERSIX CHILDREN IN NAGPUR, INDIA

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Abstract. The present cross sectional study was carried out to estimate prevalence of subclinical vitamin A deficiency among undersix children by using conjunctival impression cytology in urban slums of Nagpur city in central India. The study population included 308 non-xerophthalmic undersix children selected randomly. Conjunctival impression cytology was performed by standard procedure. Out of 308 children 110 (35.7%) had subclinical vitamin A deficiency. Increasing prevalence of subclinical vitamin A deficiency was non-significantly associated with advancing age. Higher prevalence of subclinical vitamin A deficiency was observed in severely malnourished children. The prevalence of subclinical vitamin A deficiency observed in this study (35.7%) is much more than the criteria laid down by WHO, which warrants community wide intervention. This problem assumes more significance because they are apparently healthy and if timely vitamin A supplementation is not given, any intercurrent infection is likely to worsen the vitamin A status and result in known consequences of xerophthalmia.

INTRODUCTION

Vitamin A deficiency has long been recognised as a major public health problem and it is one of the common causes of blindness in preschool children in many developing countries including India (Sommer *et al*, 1981). Majority of the studies related with vitamin A deficiency are mostly concerned with clinical signs and symptoms of vitamin A deficiency. However, subclinical vitamin A deficiency (*ie* physiologic deficiency without ocular manifestations of xerophthalmia) is often missed, particularly in apparently normal children who do not have any obvious signs and symptoms of vitamin A deficiency. Moreover, subclinical vitamin A deficiency is associated with increased mortality and morbidity (Sommer *et al*, 1986). This problem assumes more significance because these children are apparently healthy and if timely vitamin A supplementation is not given, any intercurrent infection is likely to worsen the vitamin A status and result in known consequences of xerophthalmia. However, very few studies estimating prevalence of subclinical vitamin A deficiency in preschool children have been performed in the developing countries including India. Since Egbert *et al* (1977) described and recommended use of conjuctival impression cytology (CIC) to detect subclinical vitamin A deficiency in apparently normal children, four studies (Reddy *et al*, 1989; Mehra *et al*, 1994; Dewan *et al*, 1995; Aspatwar *et al*, 1996) have been conducted in India. Of these, three studies were reported from Delhi (North India) and one from Hyderabad (South India).

With this background, and fortified by the fact that no comprehensive information is available related to prevalence of subclinical vitamin A deficiency in preschool children accross the country, including Central India, we have carried out a cross sectional study to estimate prevalence of subclinical vitamin A deficiency among undersix children by using conjunctival impression cytology in Nagpur, Central India.

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MATERIALS AND METHODS

The present cross sectional study was undertaken in two urban slums (Hasanbagh and Shivankarnagar) which were selected randomly out of 23 slums which are attached to the field practice area under Urban Health Centre, Department of

Preventive and Social Medicine, Government Medical College, Nagpur. The study population comprised of all the undersix children residing in two selected urban slum areas, *ie* 1,144. Out of these 50 (4.4%) could not be included due to various reasons. A total of 95 (8.7%) undersix children were found to have obvious signs and symptoms of xerophthalmia. This has left 994 undersix children for assessment of subclinical vitamin A deficiency.

Because of feasibility and cost, conjunctival impression cytology (CIC) was done randomly in every third non-xerophthalmic child. Thus 328 non-xerophthalmic children were subjected for CIC, but results could be interpreted in only 308 children. CIC was performed by standard procedure (Amedee-Manesme *et al*, 1988; Natadisastra *et al*, 1988). The cellulose-acetate filter paper (HAWP 304; Milli-pore, Bedford) was precut into 25 × 5 mm strips. After parental consent was obtained, one half of the filter paper was grasped with fingers and the opposite half was applied to temporal bulbar conjunctiva for 3-5 seconds. The paper was removed by peeling. The temporal bulbar conjunctiva of the opposite eye was sampled with a second piece of paper. The paper with the adherent epithelial cells was immediately transferred to a fixative solution containing 70% ethyl alcohol, 37% formaldehye and glacial acetic acid in a 20:1:1 volume ratio. After fixation the CIC specimens were stained by periodic acid Schiff and Hematoxylin (Natadisastra *et al*, 1987). All impression cytology specimens were examined by pathologist in a blinded fashion. Specimens were graded as normal if goblet cells or abundant mucin spots were present (previous stages 0 and 1) or abnormal if enlarged epithelial cells were present and goblet cells and mucin spots were absent (previous stages 2-5) (Natadisastra *et al*, 1987; Amedee-Manesme *et al*, 1988). If the specimen from either eye was normal, the child was graded as normal.

Nutritional assessement was done by using Indian Academy of Pediatrics (IAP) 1971-1972 classification on the basis of weight for age. (Nutrition Subcommittee) of IAP, 1971-1972). Statistical analysis was carried out by chi-square test as a test of significance.

RESULTS

Out of 308 children, 110 (35.7%) had abnormal CIC, thus showing prevalence of sub-clinical vitamin A deficiency as 35.7%. Minimum (25%) prevalence of subclinical vitamin A deficiency was found in below one year age group, gradually increasing with age and reaching maximum at 5-6 years of age group (Table 1). Comparing impression cytology findings in under three and above three year age group, it was observed that older children had a higher prevalence (40.5% *vs* 30.6%), but the difference was statisticaly insignificant.

Table 1

Subclinical vitamin A deficiency according to age of study subjects.

Age groups (years)	Study subjects	CIC done	Abnormal CIC	Prevalence of subclinical vitamin A deficiency
0+	184	40	10	25.0
1+	146	37	11	29.7
2+	204	73	25	34.2
3+	138	37	14	37.8
4+	135	41	16	39.0
5+	192	80	34	42.5
Total	999	308	110	35.7

X^2 (< 3 years *vs* ≥ 3 years) = 3.24, df = 1, $p > 0.05$, Non significant

Table 2

Subclinical vitamin A deficiency according to nutritional status of study subjects.

Nutritional status	Study subjects	CIC done	Abnormal CIC	Prevalence of subclinical vitamin A deficiency
Normal	606	173	40	23.1
grade I	242	86	37	43.0
grade II	108	40	25	62.5
grade III	33	07	06	85.7
grade IV	10	02	02	100.00
Total	999	308	110	35.7

X^2 (Malnourished *vs* normal) = 27.26, df = 1, $p < 0.001$, highly significant.

Maximum prevalence of subclinical vitamin A deficiency was found in severely malnourished children (grade III and IV), whereas the minimum prevelence was observed in nutritionally normal children (23.1%) (Table 2).

Statistically significant higher prevalence of subclinical vitamin A deficiency was observed in children with protein energy malnutrition than nutritionally normal children.

DISCUSSION

In the recent past the advent of conjunctival impression cytology (CIC) has opened a new chapter in the field of detection of subclinical vitamin A deficiency. This non invasive and easy to perform test, which is reported to be having 93% sensitivity and 94% specificity has proved to be a reliable and valid measure of physiologically significant vitamin A deficiency, especially in view of serious short – comings associated with other approaches. Measurement of vitamin A in serum poses significant logistic problems as well as non cooperative from people in field conditions and requires sophisticated equipment and trained personnel for analysis. Moreover, serum vitamin A levels suffer from poor correlation with body stores except under conditions of severe depletion and thus are not direct indicator of individual physiological status.

Subclinical vitamin A deficiency as suggested by abnormal CIC (previous stages 2-5) in the present study is found to be 35.7%. The observed prevalence of subclinical vitamin A deficiency is reported in the range of 25% to 86% (Reddy *et al*, 1989; Mehra *et al*, 1994; Dewan *et al*, 1995; Aspatwar *et al*, 1996), though they included various ages groups. The findings of current study agrees with these findings.

In the present study, 25% children below one year of age were found to have subclinical vitamin A deficiency, though minimum in all age groups. This may be because of the fact that though breast milk is protective against vitamin A deficiency in this age group, because of improper/late/no weaning children may be having physiologically significant vitamin A deficiency.

Though the criteria for abnormal CIC denoting a public health problem has not yet been established, Sommer (1995) reported that abnormal CIC in 20% or more children may signify vitamin A deficiency sufficiently severe and prevalent to warrant community wide intervention. Thus, this prevalence (35.7%) is much more than the criteria laid down by Sommer (1995). This problem assumes more significance because they are apparently healthy and if timely vitamin A supplementation is not given, any intercurrent infection is likely to worsen the vitamin A status and result in known consequences of xerophthalmia.

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