Original article

Prevalence and determinants of xerophthalmia in rural children of Uttarpradesh, India

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Abstract

Introduction: Vitamin A deficiency (VAD) is recognized as a major cause of blindness among children in India. **Objective:** To find out the prevalence of VAD in rural children of Uttar Pradesh, India. **Materials and methods:** This cross-sectional study was undertaken amongst children (0-15 years) in a rural area of Bareilly (Uttar Pradesh) where the study population was selected by simple random sampling out of villages under a Primary Health Centre. Out of 844 children, 802 participated in the study. The WHO classification of xerophthalmia was used. **Results:** Overall, the prevalence of xerophthalmia was 5.4 %. The prevalence of Bitot's spots was 0.9 % in children under six years of age and 3.3 % in children above six years. The prevalence of xerophthalmia was significantly more in older children. Overall, the prevalence of anemia was found to be 11.8 % in the study population. A significantly high prevalence of xerophthalmia (OR= 5.7; 95 % CI = 2.8 - 11.5) was observed in children suffering from anemia. **Conclusion:** The presence of a milder manifestation of xerophthalmia and a 0.9 % prevalence of Bitot's spot in children under six years of age in the present study shows a declining trend of VAD although it is still a public health problem. The higher prevalence in children above six years of age shows that apart from strengthening of Vitamin A prophylaxis programs, health education is needed for dietary diversification to include vegetables and fruits in the diet for long-term sustainability in improving the vitamin A status of children of all age groups.

Keywords: prevalence, rural children, xerophthalmia

Introduction

Vitamin A is needed in small amounts by humans for the normal functioning of the visual system and maintenance of epithelial cellular integrity. Vitamin A deficiency (VAD) can occur at any age; however, it is a disabling and potentially fatal condition for children under six years of age (Sommer, 1994). The prevalence of Bitot's spots may be highest in the school age group but their occurrence may reflect the past history of VAD more than the current (Sommer et al, 1980). Studies have shown that VAD causes not only blindness but that it also has a profound impact on general morbidity, mortality and growth (Rahamathullaji et al, 1990). VAD is regarded as a public health problem if the prevalence of Bitot's spots amongst children less than six years is 0.5 % or more (WHO 1996). The vitamin A prophylaxis program was started in India in 1970 with the aim of preventing blindness due to vitamin A deficiency. The most comprehensive and recent

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data shows that only 30 % of children had received a dose of vitamin A (Indian Institute of Population Sciences, Mumbai 2000). The prevalence of Bitot's spots (based on NNMB pooled data of seven states) was 1.8, 0.7 and 0.7 respectively, during the surveys carried out in 1975-79, 1988-90 and 1996-97. Individual studies carried out between 1950 to date revealed that the prevalence of vitamin A deficiency was 4 % during the period up to 1980. There are a couple of studies on adolescents done in south India which indicate vitamin A deficiency as 0.8 % to 1 % (Singh & Toteja, 2003). Very few studied on VAD have included school children apart from pre-school children. Therefore, the present study was undertaken amongst children 0-15 years so as to estimate the prevalence of VAD in children of all age groups, in a rural area of Bareilly (Uttar Pradesh) and with the emphasis laid on biosocial factors.

Material and methods

The present cross-sectional study was undertaken in a rural area of Bareilly (Uttar Pradesh). The study area was selected by simple random sampling out of villages under a Primary Health Center. This rural area had a total of 844 children of 0 -15 years. Out of these, 42 could not be included because of various reasons; hence, 802 children formed the study subjects. A house-to-house survey was carried out and information was obtained as per a predesigned pro forma. The information collected included the age, sex, residential address and the class in which the student was studying and the education, occupation, family size and income of the parents. The parents were inquired about night blindness. The history was accepted only when the response was definite. The standard methods and procedures for ophthalmic examination were used to detect xerophthalmia (Sommer, 1994)). Ocular examination was done by doctors with the help of a bright illuminant torch in natural light. The WHO classification of xerophthalmia was adopted in the study (WHO Technical Report Series No. 590, 1976). The WHO report has states that conjunctival xerosis (X1A) is not recommended for community diagnosis (Sommer, 1994). Because of these recommendations, conjunctival xerosis (X1A) only when accompanied by Bitot's spots (X1B) has been included in the positive clinical signs of xerophthalmia in the data presented here. The socioeconomic status of the study subjects was estimated as per the modified Kuppuswamy socioeconomic scale (Mahajan & Gupta, 1995). This scale is based on three variables of the family: education, occupation of the head of the family and the total monthly income of family. Scores have been assigned to each of the different categories under these three variables and a combined score is used for grading the socioeconomic status. Hemoglobin estimation of all children was carried out and the cut-off point of 11 g/dl for children under six years and 12 g/dl for children above six years was considered for the diagnosis of anemia (Park, 2011). Children suffering from xerophthalmia were given 200,000 IU of Vitamin A orally for two days. The statistical analysis was carried out by the chi-square test and the odds ratio with its 95% confidence interval.

Results

Table 1 describes the prevalence of xerophthalmia according to age. The overall prevalence of xerophthalmia was found to be 5.4 %. Only the milder manifestations of xerophthalmia, viz night blindness and Bitot's spots, were observed. Not a single case of active corneal involvement was seen. The prevalence of xerophthalmia was found to increase with increasing age, reaching its maximum in the 13-15 year age group (11.6 %). Though the prevalence of xerophthalmia was 5.4 %, the overall prevalence of signs and symptoms was 4.4 % as eight study subjects had more than one sign/ symptom. The prevalence of Bitot's spot was 0.9 % in children under six years of age and 3.3 % in children above six. The increase in the prevalence of xerophthalmia with the increase in age group was found to be statistically significant.

Table 1: Different manifestations of xerophthalmia, according to age

Age-group(years)	Study subjects	Only Night blindness(XN only)	Only Bitot's spots(XIB only)	Both XN and XIB	Total number with xerophthalmia
0 - 3	154	0(0)	1(0.6)	0(0)	1(0.6)
4 - 6	170	2(1.2)	2(1.2)	1(0.5)	5(2.9)
7 - 9	182	3(1.6)	3(1.6)	1(0.5)	7(3.8)
10 - 12	158	5(3.2)	6(3.8)	3(1.9)	14(8.9)
13 - 15	138	6 (4.3)	7 (5.1)	3 (2.2)	16 (11.6)
Total	802	16 (2.0)	19 (2.4)	8 (1.0)	43 (5.4)

Figures in parenthesis are percentages; $X^2 = 23.9$; Df = 4; P = 0.001

Table 2: Prevalence of xerophthalmia according to socio-demographic factors

Factor	Study subjects	xerophthalmia	P value
Gender			
Male	445	27(6.1)	0.98
Female	357	16(4.5)	
Socioeconomic status			
Middle	275	11(4.0)	1.53
Lower	527	32(6.1	
Family Size			
Less than 5	425	21(4.9)	0.31
More than 5	377	22(5.8)	

(Figures in parenthesis are percentages.)

Table 3: Distribution of xerophthalmia with anemia

Anemia	With xerophthalmia	Without xerophthalmia	Total
With Anemia	17 (17.9)	78 (82.1)	95 (11.8)
Without Anemia	26 (3.7)	681 (96.3)	707 (88.2)
Total	43 (5.4)	759 (94.6)	802 (100.0)

Figures in parenthesis are percentages; $X^2 = 30.6$; P = 0.00 (Highly significant) OR = 5.71; 95 % CI = 2.8-11.5

Table 2 describes the prevalence of xerophthalmia according to sociodemographic factors. A higher prevalence of xerophthalmia was observed in boys, lower socioeconomic status and children with family size of five and above; however, the difference was not significant. The overall prevalence of anemia was in the study population 11.8 %. A high prevalence of xerophthalmia was observed in children suffering from anemia (Table 3). Estimates of odds ratios and their 95% confidence intervals confirmed significant association between xerophthalmia and anemia.

Discussion

Vitamin A deficiency has been long recognized as a major cause of blindness and an important public health problem among children in India. Although many studies have been conducted to assess the prevalence of xerophthalmia in different parts of the country, very few studies have included children of all age groups. The current study observed a 5.4 % prevalence of xerophthalmia in children up to 15 years. The earlier-conducted studies have reported a prevalence of xerophthalmia in the range of 1.1 % to 22.3 % in different population groups and in different parts of the country (Garg S et al, 1984; Sharma SK et al, 1985; Katiyar GP, et al 1986; Kartha GP et al, 1991; Sampathkumar V et al, 1993; Fakhir S, et al 1993; Chamani N et al, 1994; Pal R et al, 2008). The Garg study (Garg S, et al 1984) carried out in the rural area near Nagpur in central India estimated the prevalence of xerophthalmia to be 16.8 %, which is much higher than what we observed. The decrease in the prevalence may be due to the Vitamin A deficiency prophylaxis program. The prevalence of Bitot's spots (0.9 %) in children under six years of age in this study is closer to the prevalence observed by NNMB (0.7 % pooled data of seven states) in 1996-97 and shows that VAD prevalence has declined over the years but that it is still a public health problem since the prevalence is more than the WHO guidelines (0.5 % in preschool children).

The presence of the milder manifestations of xerophthalmia shows that the prevalence of VAD is on the decline. In the present study, a significantly higher prevalence of VAD was found in the older age groups. Similar findings (Sharma SK, et al 1985; Fakhir S, et al 1993) are have also been reported by other investigators. The observed association between various the sociodemographic factors (lower socio-economic status and large family size)

and xerophthalmia was also endorsed by the results of previous studies (Sharma SK et al, 1985; Katiyar GP et al, 1986). In the current study, the prevalence of xerophthalmia was found more in children suffering from anemia. This may be because anemia is associated with a low intake of nutrients and is generally associated with various infections which further precipitate or aggravate vitamin A deficiency.

Conclusion

The presence of milder manifestation of xerophthalmia and a 0.9 % prevalence of Bitot's spots in children under six years of age in the present study shows a declining trend of VAD but that it is still a public health problem since the prevalence exceeds the WHO guideline of 0.5 %. Health education is needed for dietary diversification to include vegetables and fruits for long-term sustainability in improving the vitamin A status of children of all age groups. Such an approach will improve the intake of vitamin A and other micronutrients in a balanced manner.

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