

RESEARCH LETTERS

Vitamin A Deficiency in Schoolchildren in Urban Central India: The Central India Children Eye Study

Vitamin A deficiency is a severe condition particularly in malnourished children and women in developing countries.^{1,2} It has been estimated that approximately 250 000 to 500 000 malnourished children go blind each year from a deficiency of vitamin A, approximately half of whom die within a year of becoming blind. The most recent survey data obtained from 8 state surveys in 2003 suggest that 62% of preschoolers in India are vitamin A deficient, having serum retinol concentrations lower than 20 µg/dL (to convert to micromoles per liter, multiply by 0.0349).³ Against this background of rural deficiency, we conducted this study to assess the prevalence of symptoms of vitamin A deficiency in schoolchildren in urban central India.

The Central India Children Eye Study was performed in all government schools run by the local government authority in Nagpur, a city of about 3 million inhabitants in central India. Children attending government schools usually come from low to lower middle socioeconomic strata. The study included 11 829 schoolchildren. The mean (SD) age was 13.0 (1.9) years (range, 7-21 years). The Medical Ethics Committee of the Suraj Eye Institute in Nagpur approved the study. All examinations were carried out in the schools. Experienced social workers filled out a questionnaire including questions on the professions of the parents, presence of visual and ocular symptoms, and eating habits. Social workers particularly trained in refractometry measured uncorrected and corrected visual acuity. A trained ophthalmologist examined the ocular motility and searched for strabismus, performed slitlamp-based biomicroscopy of the external eye and anterior segment, and carried out an ophthalmoscopic examination. Ocular signs assessed for the presence and severity of vitamin A deficiency were xerosis of the conjunctiva, Bitot spots, corneal xerosis, and reported night blindness.

Data on the presence of ocular signs of xerophthalmia were available for 11 601 (98.1%) of the children (Table). The mean (SE) rate of xerophthalmia was 6.5% (0.2%) with the definition based on Bitot spots and/or night blindness and 13.4% (0.3%) with the definition based on any morphological parameter and/or night blindness (Table). In binary logistic regression analysis, xerophthalmia as defined by Bitot spots and/or night blindness was significantly associated with male sex ($P < .001$; odds ratio=0.69; 95% confidence interval, 0.60-0.81), low intake of green vegetables ($P = .003$; odds ratio=0.29; 95% confidence interval, 0.18-0.47), and presence of visual impairment or blindness (defined as visual acuity $< 20/60$ in the better eye) ($P < .001$; odds ratio=2.26; 95% confidence interval, 1.25-4.08).

Table. Prevalence of Features of Xerophthalmia in 11 601 Children in the Central India Children Eye Study

Clinical Sign or Symptom ^a	Children, No.	Prevalence, Mean (SE), %	95% Confidence Interval
Conjunctival xerosis	830	7.2 (0.2)	6.7-7.6
Bitot spots	283	2.4 (0.1)	2.2-2.7
Corneal xerosis	2	0.02 (0.01)	0.01-0.03
Night blindness	493	4.2 (0.2)	3.7-4.7
Xerophthalmia ^b	749	6.5 (0.2)	6.0-6.9
Xerophthalmia ^c	1116	9.6 (0.3)	9.1-10.2
Xerophthalmia ^d	1555	13.4 (0.3)	12.8-14.0

^a For the clinical signs and symptoms, only the most severe finding among conjunctival xerosis, Bitot spots, and corneal xerosis (as examined by an ophthalmologist at the slitlamp) was noted. The presence of night blindness as reported by the child was noted separately.

^b Defined by Bitot spots and/or subjective night blindness.

^c Defined by 1 of the 3 clinical signs and symptoms.

^d Defined by 1 of the 3 clinical signs and symptoms and/or night blindness.

The results suggest that in urban central India, the mean (SE) prevalence of xerophthalmia is about 6.5% (0.2%) based on Bitot spots and/or night blindness (Table). The data are in agreement with another study from Nagpur by Khandait et al,⁴ who reported a prevalence rate of 8.7% in children living in low-income regions in Nagpur. In another study performed in 2002 of rural populations in northern states of India,⁵ the prevalences of Bitot spots and night blindness were also relatively high (4.7% and 0.5%, respectively) and comparable with our results (Table). Because most other studies have usually focused on children aged 6 to 72 months, which is the young population most at risk, the finding of a high prevalence of vitamin A deficiency in older children in our study is of concern and warrants further investigation.

The study has some limitations. In some children, Bitot spots can persist after the vitamin A deficiency has been corrected, so one cannot accurately assume that the sign was indicative of current vitamin A deficiency. Also, data on systemic vitamin A supplementation were not collected. In agreement with previous population estimates, our study indicates that xerophthalmia, a direct ocular consequence of vitamin A deficiency, remains a public health

problem in urban children of low to lower middle socioeconomic strata in India.^{4,6}

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1. Sommer A. Vitamin A deficiency and clinical disease: an historical overview. *J Nutr.* 2008;138(10):1835-1839.
2. Checkley W, West KP Jr, Wise RA, et al. Maternal vitamin A supplementation and lung function in offspring. *N Engl J Med.* 2010;362(19):1784-1794.
3. World Health Organization. WHO global database on Vitamin A deficiency. http://who.int/vmnis/vitamina/data/database/countries/ind_vita.pdf. Accessed July 15, 2010.
4. Khandait DW, Vasudeo ND, Zodpey SP, Ambadekar NN, Koram MR. Vitamin A intake and xerophthalmia among Indian children. *Public Health.* 1999;113(2):69-72.
5. Toteja GS, Singh P, Dhillon BS, Saxena BN. Vitamin A deficiency disorders in 16 districts of India. *Indian J Pediatr.* 2002;69(7):603-605.
6. Khan MA, Gilbert C, Khan MD, Qureshi MB, Ahmad K. Incidence of blinding vitamin A deficiency in North West Frontier Province and its adjoining Federally Administered Tribal Areas, Pakistan. *Ophthalmic Epidemiol.* 2009;16(1):2-7.

Peripapillary Choroidal Thickening and Cavitation

In the February 2003 issue of the *Archives*, we described a new fundusoscopic lesion that we termed *peripapillary detachment in pathologic myopia*.¹ Clinically, these lesions were seen as a well-circumscribed yellow-orange thickening at the inferior border of the myopic conus. First-generation optical coherence tomographic imaging appeared to show a peripapillary detachment of retinal pigment epithelium and retina. The lesions remained stable during a multiyear follow-up period and did not appear to affect visual

function. Further studies, including one in the *Archives* by Shimada et al,² supported our findings and added that peripapillary detachment in pathologic myopia could surround the entire optic disc and may be associated with abnormalities of retinal vasculature and with visual field defects. With newer-generation optical coherence tomographic imaging, Toranzo et al³ reevaluated these lesions and observed an intrachoroidal hyporeflective space with normal overlying retinal pigment epithelium and retina. This finding was inconsistent with our original description. They suggested a new term for the lesion, *peripapillary intrachoroidal cavitation*.



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We have followed the literature regarding these lesions and agree that our initial interpretation was inaccurate. We have reexamined this entity using enhanced depth imaging spectral-domain optical coherence tomography as de-

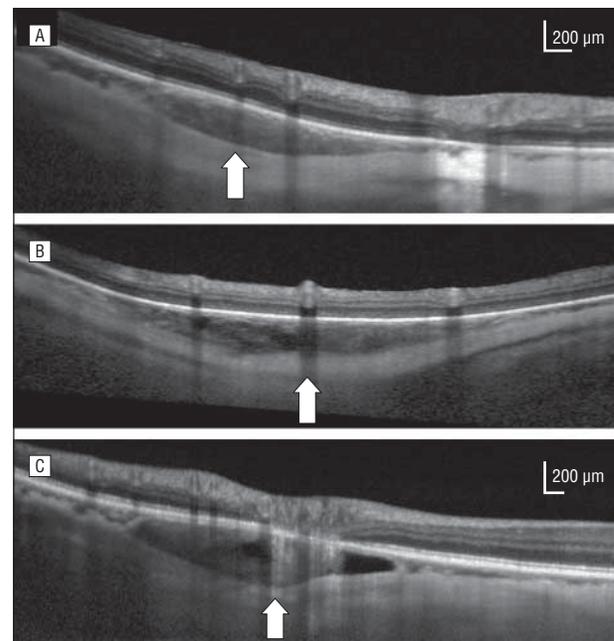


Figure 2. Enhanced depth imaging spectral-domain optical coherence tomography reveals a spectrum of findings in peripapillary choroidal thickening and cavitation, including choroidal thickening without cavitation (arrows) in patient 1 (A) and patient 2 (B) and choroidal thickening and hyporeflective choroidal cavitation (arrow) in patient 3 (C).

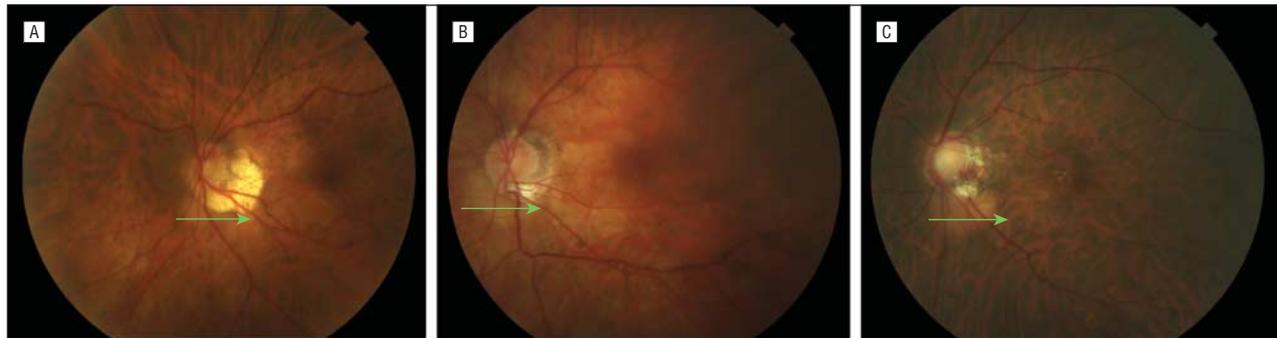


Figure 1. Peripapillary choroidal thickening and cavitation. Color photographs from patient 1 (A), patient 2 (B), and patient 3 (C) with high myopia (≥ -8 diopters) reveal well-circumscribed yellow-orange lesions at the inferior border of the myopic conus. The arrows correspond to the scan locations in Figure 2.