Original Article

Ocular manifestation of vitamin A deficiency among Orang Asli (Aborigine) children in Malaysia

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This study determined the prevalence of ocular manifestation of vitamin A deficiency in Orang Asli (Aborigine) children. Night blindness was found in 16.0% of the children, conjunctiva xerosis in 57.3%, Bitot's spot in 2.8%, corneal xerosis in 0.5% and corneal scars in 5.6%. These findings show that history of night blindness had sensitivity, specificity and predictive value (positive) of 47.2, 98.1 and 96.2%, respectively, compared with the standard diagnosis procedure using luxometer readings.

Key words: luxometer reading, Malaysia, night blindness, Orang Asli, Perak, vitamin A deficiency, xerophthalmia.

Introduction

Vitamin A deficiency leading to nutritional blindness or active xerophthalmia is a significant public health problem in India, Pakistan, Bangladesh, Indonesia and the Philippines.[1–5] A study in India estimated that the prevalence of xerophthalmia in children under 6 years of age was 8.7%.[6] This study also concluded that children with a dietary intake of vitamin A less than 200 µg retinol equivalents per day (RE/day) were at high risk of developing xerophthalmia.[6] A study among children aged 1–5 years in Yemen showed that night blindness was found in 0.5% of the children, Bitot's spots in 1.7%, corneal ulceration in 0.04% and corneal scars in 0.04%.[7] In north-eastern Thailand, the prevalence of night blindness in the rural area was 1.3% in children aged 1–5 years, and Bitot's spots were seen in 0.4% of the children.[8] In Malaysia there is no systematic documentation on the occurrence of xerophthalmia, while vitamin A deficiency has been reported common among pre-school and primary school children of Orang Asli and those from a rubber estate.[9–11] A study done in a rural estate showed that 32.0 and 27.0% of pre-school and school children, respectively, had serum vitamin A levels less of than 20 µg/dL.[10] Another study conducted among Orang Asli's pre-school children showed that their vitamin A intake was below the recommended daily amount.[11] However, a study carried out among poor, rural Malay villages showed that vitamin A deficiency did not pose a health problem for pre-school and school children.[12] The intake of vitamin A among Malay children was also found to be above the recommended daily intake.[13]

This particular study was undertaken to investigate the occurrence of xerophthalmia and vitamin A deficiency in Malaysian children. Orang Asli children living in a remote area of Malaysia were chosen as the subjects of the present study. This was due to documented evidence of the high prevalence of underweight and stunted growth among these children, shown in previous nutritional studies carried out on this community.[9,11] The objective of this study was to examine the presence of ocular lesions related to vitamin A deficiency in these children.

Materials and Methods

This study was carried out on children from an Orang Asli settlement at Pos Piah, Sungai Siput Utara, Perak, Malaysia. In all, 213 children under 15 years of age (103 boys (48.4%) and 110 girls (51.6%)) participated in this study. This work is part of a larger study involving the whole Orang Asli

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population of this area. Pos Piah is a new resettlement area for Orang Asli community members from the Temiar group. It is located in a hilly region about 60 km from the town of Sungai Siput, Perak. It consists of four villages: Gentes, Kembok, Piah and Teras. Most of the residents are engaged in farming activities or perform odd jobs, such as fishing or selling forest products for their subsistence. Health services are provided by the Ministry of Health. Most of the health activities are associated with malaria control and provision of primary health care services. Demographic data of the population in Pos Piah were collected by means of a house-to-house survey prior to the study proper. In the study proper, all residents listed in the villages were invited to participate.

All children below the age of 15 years on the date of the study were included. Each of the subjects were coded accordingly and particulars were entered in the data sheet. They were each interviewed directly or with the help of their parents, for information on any history of night blindness or any significant ophthalmic problems. All subjects underwent eye examinations, which included observation of scotopic vision (luxometer reading) and ophthalmologic examination (including posterior segment, if indicated). Anterior segment examination was done with a pen torch and magnifying loupe (1.5×). The clinical signs of xerophthalmia were recorded and graded according to WHO criteria. The history of night blindness was reassessed using a luxometer reading and severity of night blindness was graded using WHO criteria.

Table 1. Distribution of ocular manifestation of vitamin A deficiency among the Orang Asli children of Malaysia, according to WHO classification

Ocular manifestation	No. children	
	n	(%)
Normal findings	38	17.8
History of night blindness (XN)	34	16.0
Conjunctiva xerosis (XIA)	122	57.3
Bitot's spot (XIB)	6	2.8
Corneal xerosis (X2)	1	0.5
Corneal scar (XS)	12	5.6
Total	213	100.0

All children confirmed as having night blindness were subjected to posterior segment examination by direct and indirect ophthalmoscope to rule out other fundus pathology.

Results

A total of 213 children were seen during the period of this study. Of these, 103 were boys (48.4%) and the remaining 110 were girls (51.6%). The age range was 0–15 years. Out of the 213 children examined, 38 (17.8%) had normal ocular appearance while 175 (82.2%) had ocular manifestation of vitamin A deficiency ranging from XN (history of night blindness) to XS (corneal scars), as shown in Table 1. None of the children were found to have xerophthalmic fundus (XF).

The distribution of children with ocular manifestation of vitamin A deficiency according to age group is shown in Table 2. Ocular manifestation of vitamin A deficiency were seen in 45 pre-school children (47.4%) and 96 school age children (81.4%). The percentage was significantly higher in the school age group, with a *P*-value of 0.001. Further analysis of the age distribution of these children showed that the percentage of ocular manifestation rose progressively with age. The highest percentage of children with ocular manifestation was in the older age group of 10–15 years, with the difference being statistically significant at $P = 0.000$.

Analysis according to gender showed no significant difference between the prevalence of lesions in either gender, with a *P*-value of 0.598. The distribution according to gender is shown in Table 3. Out of the 34 children with a history of night blindness, only 26 had luxometer readings available. Of these 26 children, 25 had agreement in night blindness from history and luxometer reading. From 179 children who denied any history of night blindness, only 81 had luxometer reading available. Of these, 53 showed agreement in the diagnosis of no night blindness and 28 had positive luxometer reading. Data on the sensitivity, specificity and prediction values in the diagnosis of night blindness from the history and luxometer readings are shown in Table 4.

Discussion

The recommended daily intake of vitamin A for children below 15 years is between 300 and 725 μg RE. It is required for normal cellular growth and plays an important role in the

Table 2. Distribution of Orang Asli children with ocular manifestation of vitamin A deficiency, according to age group

Characteristic	Number of children with ocular manifestation				
	Normal findings		XIA-XS		Total
	n	(%)	*n*	(%)	
Age (years)*					
0–5	46	57.5	34	42.5	80
5.1–10	19	24.4	59	75.6	78
10.1–15	7	12.7	48	87.3	55
Groups**					
Pre-school	50	52.6	45	47.4	95
School age	22	18.6	96	81.4	118
Total	72	33.8	141	66.2	213

*$P = 0.001$, **$P = 0.000$. Statistical significance was calculated by uncorrected χ^2-test.

Table 3. Distribution of Orang Asli children with ocular manifestation of vitamin A deficiency, according to gender

Characteristic	Number of children with ocular manifestation				
	Normal findings		XIA-XS		Total
	n	(%)	*n*	(%)	
Age (years)*					
Male	33	32.0	70	68.0	103
Female	39	35.5	71	64.5	110
Total	72	33.8	141	66.2	213

*P = 0.598. Statistical significance was calculated by uncorrected χ^2-test. XIA, conjunctiva xerosis; XS, corneal scar.

Table 4. Comparison of diagnosis of night blindness from the history and luxometer reading among Orang Asli children

History of night blindness	Luxometer reading		
	XN+	XN–	Total
XN+	25	1	26
XN–	28	53	81
Total	53	54	107

XN+, night blindness present; XN–, no night blindness; Sensitivity = true positive = 25/53 = 47.2%; Specificity = true negative = 53/54 = 98.1%; Predictive value (positive) = 25/26 = 96.2%; Predictive value (negative) = 28/81 = 34.6%.

visual process. Deficiency of this vitamin results in morphological changes in the epithelial surfaces of all parts of the body, including the eye. The ocular complications of vitamin A deficiency are well documented and often used as a clinical indicator of current and past vitamin A status. Vitamin A deficiency is often seen in developing countries and occurs primarily in children of school age.

Although ocular manifestation of vitamin A deficiency is suspected of being a public health problem in Malaysia, the data available are insufficient to support this. Most of the data available were focusing on anthropometric and food intake studies.[9–14] However, this particular study was done mainly to look for any existing ocular manifestation of vitamin A deficiency. Out of the 213 children examined, 175 (64.3%) had specific signs of ocular manifestation of vitamin A deficiency. Night blindness was found in 16.0% of the children, conjunctiva xerosis in 57.3%, Bitot's spot in 2.8%, corneal xerosis in 0.5% and corneal scars in 5.6%. None of these, however, had xerophthalmia fundus. Our findings showed that the prevalence of ocular manifestation of vitamin A deficiency is relatively high, compared to those from other studies. Studies in Western Yemen, Thailand, Bangladesh, Nepal and India found a very low prevalence of ocular manifestation of vitamin A deficiency.[7,8,15–17]

Ocular manifestation, particularly night blindness, is usually the earliest clinical manifestation of vitamin A deficiency. A history of night blindness as reported by parents has been used as part of the method for assessing the prevalence of this condition. In our study, a history of night blindness was found in 16.0% of the children. In Thailand, the prevalence of night blindness in the rural area was 1.3% in children aged 1–5 years.[8] A study in Western Yemen showed only 0.5% of the children studied had a history of night blindness.[7] The use of history of night blindness in the screening of vitamin A deficiency was also employed in this study. Our findings showed that history of night blindness had sensitivity, specificity and predictive values (positive) of 47.2, 98.1 and 96.2%, respectively, as compared with standard diagnosis using luxometer readings. The validity of night blindness history obtained from patients in the screening of vitamin A deficiency has been questioned. Cultural diversity, socioeconomic and educational status and awareness levels of a population are likely to affect the validity of results. A finding in Indonesia showed that night blindness ceased to be an accurate reflection of xerophthalmia impact when the prevalence was low.[18] However, we can conclude that history of no night blindness can be used as a criteria to identify those community members who do not have vitamin A deficiency and a luxometer reading is essential to serve as an objective assessment of night blindness. Bitot's spots were seen in 2.8% of the children, compared with 1.7 and 0.4% in Western Yemen and Thailand, respectively.[7,8]

In our study, the prevalence of ocular manifestation of vitamin A deficiency was high in the school age group (7–15-year-olds) compared to pre-school children, and the difference was statistically significant. Further stratification of the data by age confirmed that the prevalence was lower in younger children and increased with age. Several possible reasons could explain this finding. Firstly, almost 90% of the school age group were staying at a hostel where canned foods formed the staple diet. On the other hand, the pre-school age group consumed food similar to that of the adults at home. Secondly, the examiner might have missed the signs as most of the pre-school age group were crying during the examination. Our study also showed that the prevalence of ocular manifestation of vitamin A deficiency was not significantly different between genders. Therefore, gender is not an important factor in the development of vitamin A deficiency. A study in the Philippines showed that xerophthalmia was more common in 4–6-year-old children and vitamin A

deficiency was more prevalent in boys than girls.[19] In this study we did not examine the association of xerophthalmia and child growth, although previous studies have shown that severe vitamin A deficiency may affect a child's growth.[20,21]

It can be concluded from this study that ocular manifestation of vitamin A deficiency exists in an underprivileged community in Malaysia. This study also suggests that a negative history of night blindness can be used as a criterion to identify those members of the community who do not have ocular manifestation of vitamin A deficiency. The use of a luxometer reading was found to be essential for a more objective assessment of night blindness.

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