Original article

Nutritional blindness in Tigrai Region, northern Ethiopia

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Abstract: A cross-sectional study was conducted in October, 1993 to determine the prevalence of vitamin A deficiency in Agebe Woreda in Tigrai `Kellel' (Region) of Ethiopia. A total of 678 children aged between 6 months and 6 years were examined for signs of xerophthalmia. In 7.8% of the children a history of night blindness (XN) was reported. Bitot's spots were seen in 3.4% of the children with a higher prevalence rate in males than in females ($P<0.01$). Anthropometric measurements were made on 662 of the children. There was a higher prevalence of stunting (42.6%) than wasting (8.0%) with an additional 11.3% of the children being both stunted and wasted. No association was observed between morbidity and occurrence of sign of xerophthalmia. The woreda is a mono-crop area and has been affected by recurrent drought. On the basis of the cut-off points set by WHO and the International Vitamin A Consultative Group, the problem of vitamin A deficiency in the Woreda is of public health significance. Urgent and continued intervention programmes (mainly supplementation with mega-dose of vitamin A and food diversification through intensive health education as well as horticultural development) are highly recommended. [*Ethiop. J. Health Dev.* 1997;11(2):157-162]

Introduction

Vitamin A deficiency, particulary xerophthalmia, has been a major public health problem which affects mainly young Ethiopian children (1,2,3,4). The National Vitamin A Deficiency Prevalence Survey revealed a Bitot's spot rate of 1% among preschool children (2). However, there was a considerable variation in the distribution with- in the country, with the highest rates in the pastoral (1.6%) and cropping (1.1%) agroecological zones and lowest in the 'enset' (*Ensete ventricosum*, false banana) agro-ecological zones (0.0%) (2). Other subsequent localized studies also have revealed relatively higher deficiency states in the cropping agro-ecological zones of the country (3). The northern part of Ethiopia in general, and Tigrai 'Kellel' (Region) in particular, are cereal producing areas.

In September, 1993 an extremely high rate of night blindness in Agebe Woreda was reported to Tigrai 'Kellel' Health Bureau by the Woreda clinic. The Ethiopian Nutrition Institute was requested to send a team to conduct a survey in this area as it seemed more likely that the problem was related to vitamin A deficiency. At the same time the National Programme for the Prevention of Blindness was also asked to react on the problem. Thus, in response to this call a team composed of members from the Ethiopian Nutrition Institute and an Ophthalmologist from National Programme for the Prevention of Blindness was sent to the area. The Team assessed the vitamin A and the general nutritional status of pre-school children to get a more complete

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nutritional picture of the area and to see if there was any association of vitamin A deficiency with general malnutrition. This survey was conducted during the first two weeks of October, 1993. The woreda is found in the northern part of Ethiopia, in Tigrai 'Kellel'. It is situated about 67 km. west of Mekele (capital city of Tigrai 'Kellel') and 18 km east of Abi-Addie (the former capital of Tembiene Province). The Woreda has been affected by recurrent drought. Agriculture, as in all parts of rural Ethiopia, is the traditional occupation of the inhabitants in the Woreda. The main

cereals cultivated in the area are sorghum *(Sorghum vulgare*), maize (*Zea mays*), teff (*Eragrostis teff*) and barely (*Hordeum vulgare*).

Methods

Sampling and study population: The woreda is administratively divided into 16 'tabias'. Each 'tabia' is further divided into two or three 'kushets' (villages). To obtain a representative sample for the survey, a cluster sample design was adopted. For the purpose of this study, six 'kushetes' were grouped into a cluster on the basis of their geographical proximity. A total of six clusters were formed and two of these clusters were selected at random. A census of households with children between the age of six months to six years was conducted in the clusters chosen. All children in this age group residing in each of these households were taken as study subjects.

All mothers or care-givers were requested to bring their children to a central place of the respective 'tabias'. Accordingly, clinics, schools and tree shades were used to undertake clinical examination and anthropometric measurements. Intensive effort was made to cover all registered subjects. The enumerators went to the houses when the subjects' mothers did not report on time. Information on the children's age, sex, history of breastfeeding, time of introduction and type of supplementary foods and history of illness were collected from mothers or care-givers using a predesigned questionnaire. They were also asked to provide such information as the main staple food of the family and presence of backyard garden.

Ophthalmological examination: The physical examination of all subjects was carried out by two of the authors. During the survey, the results obtained by each observer were checked by the other observer in order to maintain standardization. The clinical symptoms and signs were recorded based on standard WHO classification (4) for xerophthalmia.

Dietary Information: Information on the availability of vitamin A-rich food in the area and the consumption pattern of vitamin A-rich food by the study subjects were collected from mothers or care-givers using a qualitative method. In the case of under-two children, types of supplementary foods consumed were also recorded.

Anthropometry: Weight and height of all the study subjects were measured. However, the data was incomplete in 17 children. Weight was measured to the nearest 100 g using a hanging scale (Salter, UK) for children less than 24 months old and using beam balance (Seca, Germany) for children over the age of 24 months. The scales were checked and calibrated with a known weight at the start and at regular intervals each day. Height was measured to the nearest 0.5 cm using a height stick with a movable head piece and flat wooden base. For children who can not yet walk or below the age of two years, length was measured in a supine position to the nearest 0.5 cm with length board. To record the exact age of the subjects in months, a local calender was developed which was used as reference and exhaustive interviews were made with the mothers.

Analysis: The standard deviation scores (Z-scores) were calculated with the help of software (CASP) developed by WHO (5) and the National Centre for Health Statistics (NCHS) (6,7,8). ZWH score of 2.00 or -2.00 means that the child is 2 SD above or below the median weight-for-height, respectively, while a ZHA refers to the Z-score for height-for-age. Based on these scores, children were classified according to Waterlow's classification (9) as normal (ZWH > -2.00 and ZHA > -2.00), wasted (ZWH < -2.00 and ZHA > -2.00), stunted (ZWH > -2.00 and ZHA < -2.00), or wasted and stunted (ZWH < -2.00 and ZHA < -2.00).

To test statistical significance of differences, Chi-square was employed.

Results

Clinical examination of xerophthalmia: A total of 330 (48.7%) boys and 348 (51.3%) girls were examined for ocular manifestations of vitamin A deficiency. The overall prevalence of xerophthalmia was 11.6%. The proportion of clinical symptoms and signs by age group and sex are presented in Table 1.

Table 1: **Distribution of xerophthalmia by age group and sex of children in Agebe, October 1993.**

Symptom / signs	Sex	Age (month)						
		6-11	12-23	24-35	36-47	48-59	60-72	Total
Night blindness	M	0	1	3	2	10	20	36
	F	0	1	2	1	2	11	17
	M + F	0	2	5	3	12	31	53
Bitot's Spots	M	0/0[a]	0/1	0/0	3/0	4/3	6/1	18
	F	0/0	0/0	1/0	0/0	1/0	1/2	5
	M + F	0/0	0/1	1/0	3/0	5/3	7/3	23
Corneal lesion	M	0/0	0/0	0/0	0/0	0/0	1/0	1
	F	0/0	0/0	0/0	0/0	0/0	1/0	1
	M + F	0/0	0/0	0/0	0/0	0/0	2/0	2
Corneal scar	M	0/0	0/0	0/0	0/0	1/0	0/0	1
	F	0/0	0/0	0/0	0/0	0/0	0/0	0
	M + F	0/0	0/0	0/0	0/0	0/0	0/0	1
Total eye symptom & signs	M	0	2	3	5	18	28	56
	F	0	1	3	1	3	15	23
	M + F	0	3	6	6	21	43	79
Total examined	M	42	73	65	24	43	83	330
	F	49	85	78	26	38	72	348
	M + F	91	158	143	50	81	155	678

a: monocular/biocular respectively

The most severe signs were picked and included in the data as depicted in Table 1. Night blindness (XN) was reported in 7.8% of the study population and 15% of night blindness was reported together with severe signs of xerophthalmia. The community has a local term, known as "he'ma", to describe the condition of night blindness. The rate of Bitot's spots (XIB) was 3.4%. A higher prevalence rate was observed in boys (5.4%) than in girls (1.4%). The difference is statistically significant ($P < 0.01$). Unilateral Bitot's spots was observed in seven children while 16 exhibited bilateral Bitot's spots. Corneal ulceration (X3A) covering less than one third of the corneal surface and which is one of the active corneal lesions (corneal xerosis [X3B]) was observed in one boy and one girl. The ulceration was bilateral in both

cases. Corneal scar was seen in 0.3% of boys and 0.0% of girls. The boy with the scar was reported not to have a history of trauma or any other events which could have contributed to the scaring of the cornea. No xerophthalmic child was seen below the age of one year and the rate of xerophthalmia was found to be low (1.8%) in the second year.

A history of diarrhoea during the last one month was reported in 90 (13.3%) of the children, while measles was reported in 17 (2.5%). However, corneal signs as a consequence of measles complications was not reported. The incidence of diarrhoea during the last month did not show significant difference ($P=0.076$) in vitamin A deficient and non-deficient children.

Dietary assessment: The backyard gardening practice of the community, especially in terms of production of vitamin A-rich food was poor. During the time of conducting of the survey it was

learnt that some vitamin A-rich fruits including those seasonally maturing ones, such as papaya are grown in the area. However, during the survey period they were not available even in local market. With the exception of the under- two children, the consumption of animal products such as milk was very minimal. More than 97% of the under-two children were found to be breastfed.

Anthropometry: Anthropometric measurements were made on 662 of the children. Of these, 322 (48.6%) were males and 340 (51.4%) were females. The results show that the number of children with wasting and stunting (75 or 11.3%) was higher than those with wasting alone (53 or 8.0%). The overall prevalence of malnutrition in the area was about 62.0%.

The most affected age group was that between one and three years although not statistically significant, and no difference was observed between the sexes. Nutritional status as assessed by anthropometric measurements was not associated with the clinical symptoms and signs of xerophthalmia.

Table 2: **Number of children classified by nutritional status and sex, Agebe, October 1993.**

Sex	Normal	Wasted	Stunted	Wasted and Stunted	Total
M	125	29	126	42	322
	(38.8)	(9.0)	(39.1)	(13.1)	
F	127	24	156	33	340
	(37.7)	(7.1)	(45.9)	(9.7)	
M+F	252	53	282	75	662
	(38.1)	(8.0)	(42.6)	(11.3)	

NB. Numbers in parenthesis are percentages.

Discussion

The threshold criteria developed by WHO (4) and IVACG (10) for determining vitamin A deficiency as a problem of public health significance among children between six month and six years are a prevalence of night blindness (XN), Bitot's spots (X1B), active corneal lesion (X2/X3A/X3B), and corneal scar (XS) exceeding 1%, 0.5%, 0.01% and 0.05%, respectively. The findings of the present survey compared to the criteria is about eight-fold or 7.8% for night blindness, seven-fold or 3.4% for Bitot's spots, 29-fold or 0.29% for corneal lesion and three-fold or 0.14% for corneal scar.

The prevalence of mild xerophthalmia is higher in boys than in girls ($P<0.01$). This greater vulnerability of boys has been reported in Ethiopia and abroad (2,3,11,13,14). Although the cause of this difference is not well understood, studies conducted on pigs suggest that it might be due to hormonal differences (15) or, in the case of humans, it might be due to cultural factors which predispose the male to lower intake for being out of home for most parts of the day and the reverse for females (13). In the literature, it has been indicated that in most societies children of both sexes are equally affected by active xerophthalmia (corneal ulceration and keratomalacia) (17). The number of children in the present study with these severe signs of vitamin A deficiency was so small to conclude on the basis of the earlier statement. Prevalence rate of vitamin A deficiency increases as age increased and the maximum was recorded in children 60-72 months and both corneal ulceration cases were found in older children. This observation of the increase in prevalence as age increases is consistent with previous findings in Ethiopia and elsewhere (2,3,11,14).

Breast milk provides sufficient vitamin A to prevent clinical manifestation of vitamin A deficiency throughout the first year of life even in poorly-nourished population in developing countries (17). Such protection of breast milk against vitamin A deficiency in under-one children was also reported from Ethiopia (11) and the Sudan (17). Similarly, in the present study, no xerophthalmic child was found below the age of one year. Of the children with ocular manifestation of vitamin A deficiency

only nine (11.4%) children were below the age of three years, while the remaining were above three. The difference is statistically significant ($P<0.001$) which is in accordance with the observations reported earlier in Ethiopia (11). However, this proportion is much lower than the observations in Asia (18,19). The contrast may possibly be explained by the extended breastfeeding practices of the rural Ethiopian mothers. From our interviews, we learnt that mothers breastfeed their children up to the age of three years and some times until the next pregnancy or until the child refuses to be breastfed. Presumably breastmilk is the major source of vitamin A which grants considerable protection against vitamin A deficiency for children of this age group.

In the literature, it has been stated that extended drought may precipitate vitamin A deficiency (13,20,21). Studies conducted during the 1984/85 famine on children at several feeding centres in Ethiopia, showed prevalence rates of 2% of xerophthalmia excluding night blindness and 0.75% of corneal scars and blindness (22). The same researcher who examined Ethiopian refugees in camps in the Sudan revealed a rate of 4.8% xerophthalmia (23). In the current study, the woreda of Agebe has been affected by recurrent drought. Thus, the observed high prevalence of xerophthalmia in the woreda can be partly attributed to this situation.

Although the incidence of xerophthalmia in protein-energy malnourished young children varies greatly in different areas, PEM usually accompanies xerophthalmia (13). A study conducted in Sri Lanka (18) showed that malnourished children were affected by the deficiency more than their normal counterparts. However, in the present study nutritional status as assessed by anthropometric measurement did not show significant association with xerophthalmia. This finding is consistent with previous studies conducted in the country (4).

The prevalence of xerophthalmia may be higher during certain times of the year, based on the severity and occurrence of various factors that impair vitamin A status (16). These factors include food production and morbidity pattern of disease such as measles and intestinal parasites (13,16,17,24). During the dry season, the availability of dark green leafy vegetables and fruits is low (13,17) and measles and diarrhoea are common (13). In the present study, no significant association was found between vitamin A status of the children and the incidence of either diarrhoea or measles. The lack of significant relationship between vitamin A deficiency and diarrhoea or measles might suggest that insufficient dietary intake of vitamin A might be an important factor more than any other cause. Hence, seasonal factors leading to poor dietary intake and mono-crop culture as suggested by De Sole et al (3) could be major contributors and more important to the vitamin A deficiency problem in the woreda.

There is no doubt that vitamin A deficiency is a very serious health problem in the area. Since vitamin A deficiency is usually found in clusters, the problem might also be serious in the neighbouring woredas. Thus, it calls for urgent concerted control programmes including the supplementation of mega-dose of vitamin A capsules as a short term intervention and food-based or dietary diversification through health education and horticulture development as longterm control schemes of the deficiency disease.

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