

Xerophthalmia among hospitalized Iraqi children

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جفاف المتلحمة عند الأطفال في مستشفيات العراق

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الخلاصة: بغرض تحديد آثار العقوبات على الحالة التغذوية للأطفال العراقيين دون سن السادسة، فقد تم اختيار عينة عشوائية من 700 مريض تتراوح أعمارهم بين (وقت الولادة و6 سنوات) من مستشفى الأطفال في محافظة ديالى. وتم إجراء الفحص العيني لتحري وجود جفاف المتلحمة. كما تم تجميع المعطيات عن سوابق العدوى ونمط الرضاعة والعسى الليلي. وقد أظهرت الدراسة أن معدل انتشار جفاف المتلحمة يبلغ نحو 29% أكثرها بين الأطفال الذين تتراوح أعمارهم ما بين سنة وثلاث سنوات. كما كشفت الدراسة أن هناك ترابطاً عكسياً بين جفاف المتلحمة وبين الرضاعة الطبيعية، في حين أنها تتربط ترابطاً وثيقاً مع الإصابة بالعدوى الشائعة في مرحلة الطفولة مثل الحصبة والإسهال والتهابات الجهاز التنفسي. وبما أن جفاف المتلحمة يمثل أحد المشاكل الصحية الشائعة بين أطفال العراق المرضى، فلا بد من كشف وتقييم ورصد عَوَز الفيتامين A وتبني خطة لاستئصال شأفته.

ABSTRACT To determine the impact of sanctions on the nutritional status of Iraqi children aged < 6 years, a random sample of 700 patients (age range: 0–6 years) from the Saddam Paediatric Hospital, Diyala Province, Iraq were examined ophthalmologically for evidence of xerophthalmia. Data on the history of infection, feeding and night blindness were also collected. The prevalence of xerophthalmia was 29%, mostly among children aged 1–3 years. Xerophthalmia was significantly inversely associated with breastfeeding and highly associated with common childhood infections such as measles, diarrhoea and respiratory tract infection. Xerophthalmia is a common problem among sick Iraqi children. Efforts to identify, evaluate and monitor vitamin A deficiency and to advocate and plan its eradication should be implemented.

La xérophtalmie chez des enfants irakiens hospitalisés

RESUME Afin de déterminer l'impact des sanctions sur l'état nutritionnel des enfants irakiens âgés de moins de six ans, un échantillon aléatoire de 700 patients (fourchette d'âge : 0-6 ans) de l'Hôpital pédiatrique Saddam, Province de Diyala (Iraq), a été soumis à un examen ophtalmologique à la recherche de signes de xérophtalmie. Des données sur les antécédents d'infection, l'alimentation et la cécité nocturne ont également été recueillies. La prévalence de la xérophtalmie était de 29 %, principalement chez les enfants âgés de 1 à 3 ans. Il y avait une association inverse significative entre la xérophtalmie et l'allaitement au sein et une association très importante avec les maladies infantiles courantes telles que rougeole, diarrhée et infection des voies respiratoires. La xérophtalmie est un problème courant chez les enfants irakiens malades. Des efforts doivent être engagés pour identifier, évaluer et surveiller l'avitaminose A ainsi que pour promouvoir et planifier son éradication.

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Introduction

Xerophthalmia, or dry eye, resulting from mucin deficiency secreted by conjunctival goblet cells is the most readily recognized clinical manifestation of vitamin A deficiency (VAD) and has been the most widely employed criterion for assessing the public health significance of VAD in a particular region. Xerophthalmia includes all ocular manifestations of VAD such as night blindness through corneal ulceration, scarring and resultant blindness [1,2].

Vitamin A is a fat-soluble substance stored in the liver and released as needed into the blood stream from where it is drawn for use by epithelial cells throughout the body, including those of the eye [3,4]. As vitamin A status diminishes, total body reserves of vitamin A are depleted first, followed by a reduced concentration of serum retinol, which in turn leads to abnormalities of tissue function. The World Health Organization (WHO) cut-off value indicative of sub-clinical VAD is a serum retinol level of $< 20 \mu\text{g/dL}$ ($< 0.70 \mu\text{mol/L}$). Where clinical eye signs are present, a serum retinol level of $< 10 \mu\text{g/dL}$ ($< 0.35 \mu\text{mol/L}$) is strong corroborative evidence of clinical observations [5,6].

Xerophthalmia, perhaps more than any other disease, is an indication of a disastrous nutritional situation, landlessness and poverty [2]. Inadequate vitamin A intake is a major public health problem among preschool children in many less-developed countries in Africa, Asia, the Middle East and Latin America [5,7]. Preschool children are at especially high risk of VAD because their rapid growth rate increases their requirement for vitamin A. All too often after weaning, they have nutritionally inadequate diets and find green leafy vegetables unappealing [8,9].

Studies have demonstrated that mild xerophthalmia is strongly associated with increased morbidity and mortality among children in developing countries. In a study in Sumetara, VAD was the cause of death for one-third of young children, which was similar to the effects of diarrhoea [10].

We aimed to assess the prevalence of xerophthalmia in hospitalized preschool children. Due to the shortage of foodstuffs as a result of the United Nations sanctions imposed on Iraq and their impact on the nutritional situation of the Iraqi population, we expected to find a significant prevalence among this vulnerable group.

Methods

Our study included children in Diyala Province and followed the latest WHO criteria for the diagnosis of VAD. Diyala Province is about one hour's driving time east of Baghdad.

For this study, 700 randomly selected preschool children (male to female ratio = 1:3.1; age range 0–6 years) who had been admitted to Saddam Paediatric Hospital in Diyala for different illnesses, during May–August 1995, were examined. The children were examined ophthalmologically for evidence of xerophthalmia and for the assessment of its stages, using diffuse illumination and hand magnifier. Vital stains, i.e. rose Bengal test and fluorescein paper, were used to detect conjunctival xerosis Bitot spots and corneal ulcerations respectively.

The children's mothers were interviewed using a standardized questionnaire for demographic data and history of infection including measles, diarrhoea and upper respiratory tract infection. Information was also obtained on the child's feeding,

history and any recent onset of night blindness, particularly difficulties locating food or toys after dusk or in a poorly lit room. A history of night blindness was accepted only if the response was definite and positive.

Estimation of serum levels of vitamin A was not possible due to the unavailability of reagents for laboratory diagnosis. Statistical analyses were performed using the chi-squared and Student *t*-test distribution. *P*-value < 0.05 was statistically significant.

Results

Of the 700 children enrolled in the study, 203 (29.0%) had evidence of xerophthalmic changes of different stages: of these, 63 (31.0%) with history of night blindness; 116 (57.1%) with conjunctival xerosis; 22 (10.8%) with Bitot spots; and 2 (0.98%) with corneal scars. None had corneal ulceration or keratomalacia.

Age and xerophthalmia prevalence were statistically significant with the highest prevalence among children 1–2 years of age (82 children, 40.4% of this age group) and the lowest among those aged 4–5 years (8 children, 16.7% of this age group) (Table 1). Of 382 illiterate mothers of 121 (31.7%) had a child with xerophthalmia. Mother's level of education and the likelihood of her child having xerophthalmia were significantly associated (Table 1).

Among the 175 breastfed children aged ≤ 2 years, 50 (28.6%) had xerophthalmia and among the 231 bottle-fed children, 95 (41.1%) had xerophthalmia. A significant relationship was observed between feeding type and xerophthalmia (Table 2).

We examined the possibility of an association between xerophthalmia and common infections in children. Among the 700 children in the sample population, 481 had diarrhoea, of whom 121 (25.2%) had xerophthalmia; 103 had measles, of whom 62 (60.2%) had xerophthalmia; and 116 had

Table 1 Presence of xerophthalmia according to age and maternal education in the 700 randomly chosen children

Variable	Xerophthalmia		No xerophthalmia		Total	Significance
	No.	%	No.	%		
<i>Age (years)</i>						$\chi^2 = 28.5, P < 0.005$
0–1	63	34.4	120	65.6	183	
> 1–2	82	36.8	141	63.8	223	
> 2–3	33	21.3	122	78.7	155	
> 3–4	17	18.7	74	81.3	91	
> 4–5	8	16.7	40	83.3	48	
Total	203	29.0	497	71.0	700	
<i>Educational level of mothers with xerophthalmic children</i>						$\chi^2 = 53.8, P < 0.001$
Illiterate	121	31.7	261	68.3	382	
Primary	65	34.4	124	65.6	189	
High	17	13.2	112	86.8	129	
Total	203	29.0	497	71.0	700	

Table 2 Presence of xerophthalmia according to feeding method in the 406 children \leq 2 years of age

Infant feeding method	Xerophthalmia		No xerophthalmia		Total no.
	No.	%	No.	%	
Breast	50	28.6	125	71.4	175
Bottle	95	41.1	136	58.9	231

$$\chi^2_1 = 6.9, P < 0.01.$$

upper respiratory tract infections, of whom 20 (17.2%) had xerophthalmia. The associations between xerophthalmia and diarrhoea, measles and upper respiratory infections were statistically significant (Table 3).

Discussion

Night blindness is a reliable test for the diagnosis of mild VAD both in individual children and in a target population [11–13]. A history of night blindness is used as a standard WHO criterion for VAD diagnosis. In our study the prevalence of night blindness was higher than that of Bitot spots. This finding was similar to previous studies that suggested that a properly elicited history of night blindness was as valid as the presence of Bitot spots [7] and that its prevalence tended to approximate or exceed that of Bitot spots.

Xerophthalmia and age were significantly associated in our study as in other studies [3,10,14]. Xerophthalmia has been most commonly detected among children aged 1–3 years as they were weaned to diets virtually devoid of vitamin A and frequently low in fat [15]. Neonates usually have good liver stores of vitamin A from the mother and receive vitamin A from breast milk during the breastfeeding period. As growth accelerates, the infant requires vitamin A supplementation unless the new diet has sufficient supplies. Otherwise, the liver's store decreases and unless replenished leads to xerophthalmia [7].

Breast milk is generally the newborn's sole source of vitamin A and breastfeeding has been found to be protective [15]. Xerophthalmia is more likely to occur when breast milk is not available and diluted cow's milk, bottle formula or rice gruel is substituted [16]. Breastfeeding practices

Table 3 Presence of xerophthalmia according to occurrence of diarrhoea, measles and respiratory tract infections

Disease type	Xerophthalmia		No xerophthalmia		χ^2_1	P-value
	No.	%	No.	%		
Diarrhoea	121	25.2	360	74.8	11.80	< 0.005
Measles	62	60.2	41	39.8	57.01	< 0.005
Respiratory tract infection	20	17.2	96	82.8	9.23	< 0.005

were significantly inversely associated with the risk of xerophthalmia in our study; this is similar to reports from Malawi and Bangladesh [17,18].

The role of vitamin A in maintaining the differentiation and integrity of epithelial cells is well documented [14]. It is likely that this role accounts for its influence on the morbidity and mortality of infectious diseases. There is also some evidence of a direct effect on the immune system in which cellular immunity might be disturbed while humoral immunity remains intact [12,14]. On the other hand, acute decompensation of borderline cases of VAD occurs in patients with systemic infection [15,19-22].

Infections, particularly measles, acute respiratory tract infections and diarrhoea may trigger VAD [23,24]. Many studies have suggested that acute infection may lead to VAD through a variety of mechanisms, including impaired absorption, altered liver mobilization and transport increasing the requirement for vitamin A and increased urinary loss [25-27]. We examined the association between xerophthalmia and common infections, as children who developed xerophthalmia frequently had one of these associated diseases.

Measles is one of the diseases associated with xerophthalmia [16]. Measles is the most common precipitating factor for VAD in Africa where it is usually associated with anorexia, vomiting and diarrhoea, all of which reduce the supply of vitamin A available to the child. At the same time, measles is associated with a greater demand for vitamin A. This combination of decreased supply and increased demand may tip the balance in a child who may already have only marginal liver stores of vitamin A [15]. These observations support our finding of

a highly significant relationship between xerophthalmia and measles.

Diarrhoeal disease for which hospitalization was required was also strongly associated with xerophthalmia in our study. This finding was consistent with the hypothesis that diarrhoea causes depletion of retinol stores and consequent xerophthalmia in children. It also agreed with the results of other studies, including those of Mahalanabis et al. [25], who reported prolonged diarrhoea to be the strongest risk factor for xerophthalmia in Bangladeshi children [16,27-30].

Acute respiratory infections and measles have been strongly implicated in VAD [23]. A study by Sommer [30] in Indonesia found that respiratory infection increased the prevalence of xerophthalmia by increasing metabolic demands and interfering with normal feeding. Our results suggested that respiratory infection was a major contributor to xerophthalmia in children.

Conclusion

This hospital-based study demonstrated a highly significant occurrence of xerophthalmia among sick children and the need for a sound national, population-based survey to assess the status of vitamin A in Iraq. Detection of sub-clinical cases of VAD is recommended to reduce morbidity and mortality among preschool-age children.

In addition to measures such as immunization against measles, we emphasize the need to promote breastfeeding, environmental sanitation, food safety and personal hygiene to reduce the incidence of diarrhoea. We recommend supplementation of vitamin A upon diagnosis of measles in areas where xerophthalmia is prevalent.

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