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RELATIONSHIP OF VITAMIN A DEFICIENCY AND XEROPHTHALMIA AMONG SCHOOL-AGED CHILDREN (5–15 YEARS) AND ITS TREATMENT

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ABSTRACT

Background: Among the most significant nutrition deficiencies in developing countries, vitamin A deficiency is the one that influences children. It may cause ocular complications, which are collectively referred to as xerophthalmia, which may further cause blindness or visual impairment when it is not addressed in good time. The children in schools are one group that is prone to it because of poor eating habits and low awareness of nutrition.

Objective: To determine the relationship between vitamin A deficiency and xerophthalmia among school-aged children and to evaluate the response to vitamin A supplementation.

Methodology: This is an analytical cross-sectional research study that will be carried out at the Gomal Medical College, Dera Ismail Khan during the period January 2025 to June 2025. A population of 72 children (5-15 years old) was selected by using a consecutive method of sampling. Demographic data and nutritional status were taken. Vitamin A measures in serum were taken and ophthalmological assessment done to find evidence of xerophthalmia according to WHO system. Children who were diagnosed to have vitamin A deficiency were given vitamin A supplement and diet counseling. Analysis of data was done by use of SPSS version 26 and Chi-square test was conducted to determine the association between xerophthalmia and vitamin A deficiency.

Results: Among the 72 children, a considerable proportion showed varying degrees of vitamin A deficiency. Clinical manifestations of xerophthalmia included conjunctival xerosis, Bitot's spots, and corneal changes. The frequency of xerophthalmia increased with the severity of vitamin A deficiency, showing a statistically significant association. After vitamin A supplementation, more

than half of the affected children demonstrated complete improvement in ocular symptoms, while others showed partial recovery.

Conclusion: Vitamin A deficiency is strongly associated with xerophthalmia among school-aged children. Early screening and prompt vitamin A supplementation can significantly improve ocular health and prevent progression to severe visual complications. Nutritional education and community-based supplementation programs are essential to reduce the burden of vitamin A deficiency.

Keywords: Vitamin A deficiency, Xerophthalmia, School-aged children, Nutritional deficiency, Vitamin A supplementation

INTRODUCTION

Vitamin A is a vital fat-soluble vitamin, which is important in vision, immunity, cell differentiation and epithelial tissue maintenance. The vitamin A requirements are sufficient to support the functioning of the retina and safeguard of the ocular surfaces. Lack of vitamin A in the body can result in a cascade of ocular symptoms, which are all known as xerophthalmia. Such effects may include night blindness and conjunctival dryness but more serious effects may include corneal ulceration and keratomalacia which can result in permanent blindness in case of untreated cases [1-3].Vitamin A deficiency remains to be one of the most important public health issues in numerous low- and middle-income countries, especially among children. This deficiency is also caused by poor dietary intake, malnutrition, and insufficient accessibility to vitamin A rich foods. Global health estimates show that there are millions of children at risk of vitamin A deficiency annually and a large percentage of them develop ocular complications related to xerophthalmia [4-6].Children of school-going age are a vulnerable population due to growth and development, where their nutritional needs are high. The poor nutritional awareness, insufficient intake of vitamin A containing foods can result in inadequate intake of vitamin A containing foods like dairy products, eggs, fruits, and green leafy vegetables. Consequently, children can experience such early symptoms as night blindness, conjunctival dryness, and the emergence of Bitot spots, which are typical features of vitamin A deficiency[7-9].One of the most preventable causes of childhood blindness is Xerophthalmia. Most of the early ocular changes can be reversed with early diagnosis and prompt intervention by vitamin A supplements thus preventing advancement to severe corneal damage. In most countries, the focus of the public health programs has thus focused on the vitamin A supplementation and nutritional education as the important measure to decrease the deficiency burdenb[10, 11].In spite of these preventive strategies, vitamin A deficiency is still very high in some parts in Pakistan, especially in areas where malnutrition and poverty are widespread. There is a dearth of local information on the correlation between vitamin A deficiency and xerophthalmia among school children. This relationship is significant as it helps to create an effective screening and prevention strategy.Therefore, the present study was conducted to evaluate the relationship between vitamin A deficiency and xerophthalmia among school-aged children and to assess the improvement in ocular manifestations following vitamin A supplementation. The findings of this study may contribute to improved nutritional awareness and early intervention strategies aimed at protecting the visual health of children.

METHODOLOGY

The study is an analytical cross-sectional study, which was carried out at the Department of Community Medicine and Ophthalmology, Gomal Medical College, Dera Ismail Khan (DI Khan), Pakistan, over period of six months of January 2025 and June 2025. The purpose of the study was to determine the relationship between vitamin A deficiency and xerophthalmia among school-aged children (5–15 years) and to evaluate the clinical improvement following vitamin A supplementation.The study sample included 72 children that were selected using non-probability consecutive sampling method. The study included school-aged children and adolescents of between

5 and 15 years of age who attended the outpatient department or were screened on school health visits. Children who gave indications of possible vitamin A deficiency or those who complained about dry eyes or night blindness were evaluated to take part. Excluded in the study were children with congenital eye problems, active infections of the eyes that were not due to vitamin A deficiency, chronic systemic disease as well as those who had already received vitamin A supplements within the past three months.Informed consent was obtained with parents or guardians after which demographic data such as age, gender, residence, and nutritional status data were collected using a structured data collection form. A qualified clinician was involved in a precise clinical and ophthalmological examination as an indicator of xerophthalmia. The eye results were classified using the World Health Organization (WHO) classification of xerophthalmia which included conjunctival xerosis, Bitot spots, corneal xerosis, and keratomalacia.To undertake biochemical analysis, venous blood samples were taken with aseptic conditions to determine the serum levels of vitamin A (retinol) by standard laboratory techniques at the institutional diagnostic laboratory. Depending on reference values of vitamin A, the status was defined as normal, mild deficiency, moderate deficiency and severe deficiency. Also, the guardians provided dietary history with an emphasis on the intake of foods rich in vitamin A like green leafy vegetables, dairy products and eggs, and fruits.Children diagnosed as having vitamin A deficiency were given oral vitamin A supplementation as per WHO recommended doses as well as nutritional counseling to parents on consumption of vitamin A rich foods. Follow-up evaluation was conducted to check the progress in the ocular symptoms and xerophthalmia signs.Statistical package of social sciences (SPSS) version 26 was used to enter and analyze the collected data. Categorical variables (frequency and percentages) were subjected to descriptive statistics. The Chi-square test was used to determine the relationship between the vitamin A deficiency and the xerophthalmia and the p-value of 0.05 was regarded as statistically significant.

RESULTS

A total of 72 children aged 5-15 years were sampled in the study so as to determine the relationship between xerophthalmia and vitamin A deficiency. To describe the profile of the participants, demographic factors such as age group, gender, residence and nutritional status were captured. Most children were of the age group 8-11 years, and there was a little more males.

Table 1: Demographic characteristics of study participants (n = 72)

Variable	Category	Frequency (n)	Percentage (%)
Age group	5–7 years	16	22.2
	8–11 years	31	43.1
	12–15 years	25	34.7
Gender	Male	38	52.8
	Female	34	47.2
Residence	Rural	44	61.1
	Urban	28	38.9
Nutritional status	Normal	29	40.3
	Underweight	43	59.7

All the participants were tested on serum vitamin A levels to establish the vitamin A status distribution in the children. A significant percentage of the respondents were deficient to varying degrees with moderate and mild deficiencies being very frequent. A very few children had normal amounts of vitamin A.

Table 2: Vitamin A status among children (n = 72)

Vitamin A status	Frequency (n)	Percentage (%)
Normal	24	33.3

Mild deficiency	21	29.2
Moderate deficiency	17	23.6
Severe deficiency	10	13.9

Ocular inspection was done to determine the symptoms of xerophthalmia. In some children, early signs of ocular involvement were conjunctival xerosis and Bitot spots, whilst fewer showed corneal involvement. Nonetheless, not all the participants had any apparent ocular abnormality on examination.

Table 3: Clinical manifestations of xerophthalmia (n = 72)

Clinical finding	Frequency (n)	Percentage (%)
No ocular signs	29	40.3
Conjunctival xerosis	18	25.0
Bitot's spots	14	19.4
Corneal xerosis	7	9.7
Corneal ulceration / keratomalacia	4	5.6

The correlation between serum vitamin A status and the occurrence of xerophthalmia was also studied. The increased percentage of ocular manifestations was noted in children with moderate and severe deficiency of vitamin A in relation to normal vitamin A levels. Chi-square test was used to statistically analyze the data, and found that there was significant correlation between the vitamin A deficiency and xerophthalmia.

Table 4: Association between vitamin A deficiency and xerophthalmia (n = 72)

Vitamin A status	Xerophthalmia present n (%)	Xerophthalmia absent n (%)	Total
Normal	3 (12.5)	21 (87.5)	24
Mild deficiency	7 (33.3)	14 (66.7)	21
Moderate deficiency	11 (64.7)	6 (35.3)	17
Severe deficiency	8 (80.0)	2 (20.0)	10

Chi-square = 16.82
p-value = 0.001

Vitamin A supplementation and dietary counseling was given to all children diagnosed with vitamin A deficiency. Follow-up assessment showed that a significant number of children improved in terms of ocular symptoms during treatment. Most of the participants had full or partial disappearance of the effects of xerophthalmia.

Table 5: Treatment outcomes after vitamin A supplementation (n = 72)

Treatment outcome	Frequency (n)	Percentage (%)
Complete improvement	39	54.2
Partial improvement	21	29.2
No noticeable improvement	12	16.6

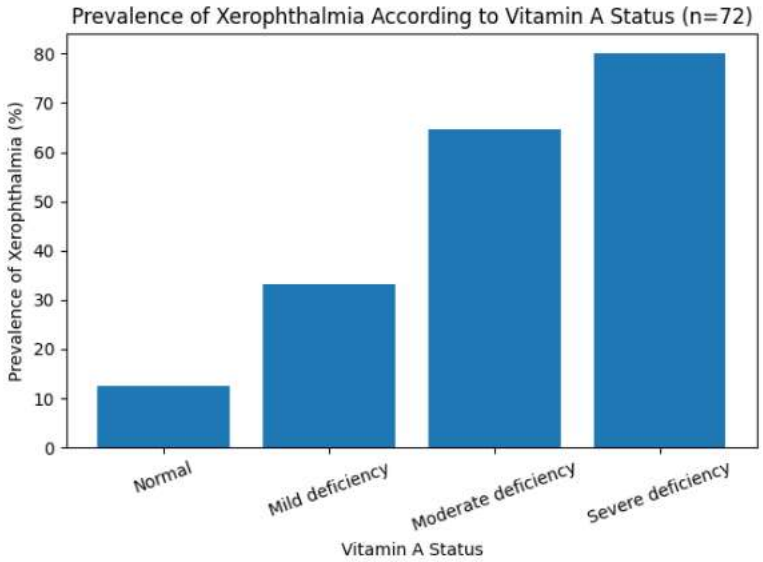

Figure 1: Prevalence of xerophthalmia according to vitamin A status among school-aged children (n = 72). The frequency of xerophthalmia increased progressively with worsening vitamin A deficiency, with the highest prevalence observed among children with severe deficiency.

DISCUSSION

Vitamin A deficiency is a significant issue in the public health problem in most developing nations and it has persisted to affect the health and sight of children. The current research assessed the correlation between vitamin A deficiency and xerophthalmia in school going children. The results showed that a significant number of children were having different levels of vitamin A deficiency and that ocular manifestations were more common in children with lesser vitamin A levels. These results point to the nutritional susceptibility of children and the need to detect and intervene early [12, 13].In this research, most of the participants were aged 8-11 years old and slightly over half of the children were of the male gender. The same demographic patterns have been observed in other studies that have been carried out amongst the South Asian populations where the school going children are the most at risk group of micronutrient deficiency as a result of poor dieting and their socio-economic status. Malnutrition itself was also prevalent among the participants of the current study, which might lead to the decreased vitamin A-stores and high vulnerability to deficiency [14, 15].The findings of this research indicated that a considerable percentage of children were found to have mild to moderate deficiency of vitamin A and a smaller percentage had severe deficiency. Similar results have been presented in recent nutritional surveys, which found vitamin A deficiency as a chronic issue among children in low-resource environment. Lack of dietary variety and inadequate consumption of vitamin A containing foods including dairy products, eggs, fruits, and green leafy vegetables are regarded as some of the leading contributing factors [16, 17].The clinical examination showed that there were various ocular signs associated with xerophthalmia, such as xerosis of the conjunctiva, Bitot spots and corneal alterations. These are the progressive features of the ocular damage due to a chronic vitamin A deficiency. Symptoms like conjunctival dryness were more prevalent but severe corneal complications were rare. This is in line with past researches who have reported that earlier phases of xerophthalmia are more common among community based populations [18].

The analysis of association showed that children with moderate and severe vitamin A deficiency possessed a much more important frequency of xerophthalmia than the children with normal levels of vitamin A. This observation has confirmed the established biological functions of vitamin A in ensuring epithelial integrity and the normal functionality of the visual system. The loss of vitamin A causes disruptions in photosensors pigments regeneration, destruction of conjunctival epithelial cells, which eventually causes xerophthalmia and eye disturbances [19].After taking vitamin A

supplements and dietary education, the majority of the children used in the study demonstrated improved ocular symptoms. Over fifty percent of the subjects reported a total disappearance of clinical manifestations with others reporting a partial response. These data demonstrate the importance of early timely therapy with vitamin A to turn back the initial signs of ocular manifestations and avert the development of corneal lesions into more serious forms. These results are also observed in clinical and community-based intervention programs in which vitamin A supplementation had a significant effect of reducing prevalence of xerophthalmia and enhancing visual health of children [20].Overall, the results of the present study reinforce the importance of nutritional screening, early diagnosis, and preventive supplementation programs in school-aged children. Strengthening community nutrition programs and increasing awareness among parents about vitamin A rich diets may help reduce the burden of deficiency and its associated complications.

CONCLUSION

The present study demonstrated a clear relationship between vitamin A deficiency and the occurrence of xerophthalmia among school-aged children. Children with lower serum vitamin A levels were more likely to develop ocular manifestations such as conjunctival xerosis and Bitot's spots. Early identification and appropriate management are therefore essential to prevent the progression of ocular damage and potential visual impairment.Vitamin A supplementation combined with nutritional counseling proved to be effective in improving ocular symptoms in the majority of children. These findings emphasize the need for regular nutritional screening, school health programs, and community-based vitamin A supplementation initiatives to reduce the prevalence of vitamin A deficiency. Promoting dietary intake of vitamin A–rich foods and improving nutritional awareness among parents and caregivers can play a crucial role in protecting the visual health and overall well-being of children.

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