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ORIGINAL ARTICLE

Prevalence of Vernal Keratoconjunctivitis And Risk Factors in School Pupils in Jos East L.G.A of Plateau State, North Central Nigeria.

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ABSTRACT

Introduction: Vernal keratoconjunctivitis (VKC) is a unique disorder among a spectrum of allergic eye diseases. It is a chronic, bilateral, inflammatory condition most commonly involving the upper tarsal conjunctiva. It commonly affects children within the ages of 5- 16 and it is frequently observed in tropical regions where it affects both sexes. Most studies on this topic are hospital based and do not address risk factors associated with vernal keratoconjunctivitis. Thus, the objectives of this study is to determine the prevalence of VKC among school pupils in Jos East LGA, Central Nigeria, based on gender and age group and also to identify the possible risk factors in VKC within the study environment. **Methods:** This was a school-based cross-sectional descriptive study where a total of 400 participants were drawn for the study from 25 different schools within the study area. A self-developed semi-structured questionnaire was used for data collection in the study. The frequency count, simple percentage and chi square were used in analyzing the data collected for the study. **Results:** Findings from the study showed that the prevalence of VKC among school pupils was 84 (21.0%), 59 (25.8%) of them were males with a male to female ratio of 1.3:1. The prevalence of VKC was significantly higher amongst male students. Risk factors related to analysis of VKC revealed that cooking facility at home is associated with the occurrence of VKC. Other factors include individuals with siblings having VKC, previous history of allergy/atopy, family history of systemic allergy and contact with animals. **Conclusion:** Vernal keratoconjunctivitis was seen to be a common condition amongst primary school pupils and identifying the risk factors will help with reducing rate of occurrence and absenteeism from school. **Recommendation:** In view of the findings, it is recommended that there is need to reactivate school eye health programme by the state ministry of health and education in collaboration with the plateau eye care team.

Keywords:

INTRODUCTION

A myriad of diseases could affect the eyes

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because they are exposed to the external environment, one of these eye diseases is ocular allergic disease which is a disease affecting the entire ocular surface including conjunctiva, lids, cornea, lacrimal gland and tear film.¹ It comprises seasonal allergic conjunctivitis, perennial allergic conjunctivitis, giant papillary conjunctivitis, atopic keratoconjunctivitis and vernal

keratoconjunctivitis.² Vernal keratoconjunctivitis (VKC) is defined as the presence of tarsal and or limbal papillae ≥ 1 mm diameter with itching sensation and at least one of the following symptoms in the last 6 months: photophobia, sticky mucus discharge, redness, tearing and foreign body sensation. VKC is a chronic, recurrent, bilateral, severe inflammatory ocular disease affecting children and young adults living in warm climates.^{1, 3} It is typically seasonal, associated with allergies, and resulting in the inflammation of the conjunctiva and cornea lesions.^{3, 4, 5} Being mast cell-mediated, allergic conjunctivitis arises following exposure to airborne allergens.^{2, 5} VKC is a common reason for hospital attendance amongst children in Africa. Despite being more common in Africa, it has been found to be common in India and South American also. VKC has been documented in the Mediterranean, the Middle East, Europe and Australia.^{6, 7} Due to the chronicity of this disease and how it can affect the quality of life of a child and indirectly the parents, parents need to be educated on its nature, modality of treatment, control of exacerbations and the need to prevent long term complications.

Papillae size correlate positively with the persistence or worsening of symptoms over long-term follow-up.⁸

The prevalence of VKC was estimated at 7.8/ 100 000, with higher values in males compared with females (57/100 000 vs. 22/100 000) respective. At age > 16 years, the prevalence of the disease was 0.06/100 000 (3.8/ 100 000 in males, 1/100 000 in females) this was reported in a non-comparative retrospective study that included 406 VKC patients.⁴ This has been attributed to the possible hormonal link which makes VKC resolve spontaneously in adolescence.^{2, 4, 9} In Europe, the incidence is lower with an estimated VKC prevalence of 1.2–10.6% cases per 10000 population while in Africa, the prevalence of VKC ranges from 2–37%.^{10, 11,}

According to various studies done the prevalence of VKC was seen to range between 5.2%–62.8%.¹²⁻¹⁵ Bonini et al.⁸ graded VKC into five groups: grade 0 - absence of symptoms; grade 1 - presence of symptoms without photophobia; grade 2 - presence of symptoms including photophobia; grade 3 - superficial punctate keratopathy; grade 4 - diffuse superficial punctate keratopathy or corneal ulcer.

The study on VKC in Plateau state to the best of the researcher's knowledge was a hospital

based retrospective study done about 10 years ago, and there is no data available on community prevalence within the state. Hence this study seeks to determine the prevalence of VKC among school pupils in Jos East LGA based on gender and age group, and also to identify the possible risk factors in VKC within the environment. Expectantly, the findings of this study will help to stimulate more research on VKC in our environment, and also serve as a guide for stakeholders on how to implement preventive and intervention programs within Jos East Local Government Area and subsequently the state at large.

METHODS

The study adopted a school-based cross-sectional descriptive survey design carried out within a four months period from September 2019 to December 2019. The population for the study comprises of all primary schools in Jos East LGA of Plateau State with a total of 113 primary schools of which 76 were public schools and 37 were private school. The total enrollment was 22,812 out of which 19698 were enrolled in the public primary schools while 3114 were enrolled in the private primary schools. A total of 400 participants were drawn as sample for the study using the Fisher's formula for sample size determination of a cross-sectional study.¹⁶

A multi-stage sampling technique was employed in selecting the schools used for the study, the schools in the local government have been grouped into five educational districts by the Jos East Local government Education Authority namely: Maigemu, Fobur, Shere, Fursum, and Feder. The List of grouped schools was obtained from the Education Authority. From each district, five schools were chosen randomly by balloting from the list of schools. . In each school, a class was chosen randomly by balloting from each arm running through primary one to primary six. In selecting the samples for the study, a systematic random sampling was used to recruit 16 students from each class depending on the number of students who are present on the day of the study.

Instruments used for the study include: Non-illuminated Snellen chart, Non-illuminated tumbling E chart, Pen torch, 2% Fluorescein strip, Direct Ophthalmoscope Heinze beta 200, Loupe 2X, 0.5% Amethocaine, Cotton wool, Pen torch with blue filter and Six (6) meter rope.

A self-developed semi-structured, interviewer-administered questionnaire with sections on demographic data of the pupil, clinical, medical history, family and personal history of allergies and atopy. History of other possible risk factors noted as well. Pupils were examined with visual acuity checked in an illuminated corridor placing the Snellen's chart at 6m from the pupil with one eye tested at time while occluding the fellow eye, those with visual acuity of $>6/18$ were considered to have normal vision. The anterior segment was examined using a pen torch and a loupe X2 for the presence of features suggestive of VKC and the severity of the diseases noted, as well as grading of VKC according to Bonini's grading system. Cornea was stained with fluorescein to assess for possible cornea erosion where indicated after instilling 0.5% amethocaine. The posterior segment was examined with an ophthalmoscope and findings noted.

Data analysis was done using the Statistical Package for Social Science (SPSS version 20) to analyze the collected data. Continuous variables such as age were reported as mean and standard deviation while categorical variables such as the risk factors associated with VKC were represented in frequency and percentages. A p-value <0.05 was considered statistically significant

Ethical clearance was obtained from the Ethical and Research Committee of the Jos University Teaching Hospital. Permission was also obtained from Area Inspectorate of Education in Jos East LGA.

Defination of terms

Vernal Keratoconjunctivitis: For this study, Vkc is the defined as the presence of conjunctival papillae of $>1\text{mm}$ over the upper tarsal plate in addition to limbal papillae with or without the presence of trantas dots with itching sensation and at least one of the following symptoms lasting six months: photophobia, sticky mucus discharge, redness, tearing and foreign body sensation.¹¹

Palpebral vernal keratoconjunctivitis is defined as presence of papillae $\geq 1\text{mm}$ on the tarsal conjunctiva without limbal involvement with itching sensation and at least one of: photophobia, sticky mucus discharge, redness, tearing and foreign body sensation in the last six months.¹²

Limbal vernal keratoconjunctivitis was defined as at least one of the following limbal findings: thickening, broadening, opacification, Horner-Trantas dot with itching sensation and at least one of the following symptoms in the last six months: photophobia, sticky mucus discharge, redness, tearing and foreign body sensation.¹²

Mixed vernal keratoconjunctivitis was defined as cases that have features of both limbal and tarsal VKC.

Mild VKC: This consist of limited number and size of papillae, a small degree of conjunctival hyperemia and minimal mucous discharge. They are treatment naïve.¹⁷

Moderate VKC: This is characterized in part by diffuse or localized limbitis (swelling or thickening of the limbal conjunctiva) which can progress to a gelatinous infiltrate and develop the white dots known as the trantas dots or previously treated, with recurrence of symptoms.¹⁷

Severe VKC was defined as presence persistent symptoms and signs (diffuse palpebral conjunctiva edema; thickening with papillary hypertrophy; giant papillary conjunctivitis; and limbal infiltration of 180 degrees or more.¹⁴

RESULTS

A total of 400 participants were recruited for this study out of which 229(57.2%) of the participants were males while 171(42.8%) were females. The overall mean age of pupils was 8.8 ± 2.9 years, with statistical significance difference ($p=0.969$). The age range was between 5 and 15 years. The ratio of males to females was 1.3:1. VKC was seen in 84 out of the 400 children, resulting in a prevalence of 21.0%. A higher percentage (25.8%) of males were found to have VKC (Table 1). VKC was seen in 62 (21.2%) of pupils aged 5 – 10 years and 22 (20.4%) in pupils aged 11 – 15 years (Table 2).

Pattern of VKC among children in the study population.

All the three types of VKC namely limbal, palpebral and mixed were seen. The most dominant sub-type seen was limbal (45.2%). (Figure 1). Pattern of VKC was not significant when compared across age-group of pupils ($P = 0.204$).

Table1: Prevalence of VKC among school pupils base on gender.

GENDER	Prevalence of VKC			
	Had VKC		No VKC	
	Frequency	%	Frequency	%
Male	59	25.8	170	74.2
Female	25	14.6	146	85.4
Total	84	21.0	316	79.0

$\chi^2 = 7.329$, P –value = 0.007

Table 2: Distribution of VKC among school pupils based on age group

Age group (years)	Prevalence of VKC			
	Had VKC		No VKC	
	F	%	F	%
5-10	62	21.2	230	78.8
11-15	22	20.4	86	79.6
Total	84	21.0	316	79.0

$\chi^2 = 0.035$, P –value = 0.851

Table 3a: Clinical grading/severity of VKC per person

Severity	Frequency (%)
Mild	56(66.7)
Moderate	22(26.2)
Severe	6(7.1)
Very severe	0(0.0)
Total	84(100.0)

A Higher proportion 67(82.7%) who had difficulty in breathing had VKC While on the

other hand, higher proportion 302(94.7%) who don't have difficulty in breathing don't have VKC. This difference was statistically significant ($\chi^2 = 233.187$, $p = 0.001$).

Table 3b: Clinical grading/severity of VKC according to eye

Severity	Left eye n(%)	Right eye n(%)
Mild	54(64.3)	60(71.4)
Moderate	24(28.6)	21(25.0)
Severe	6(7.1)	3(3.6)
Very severe	0(0.0)	0(0.0)
Total	84(100.0)	84(100.0)

Table 4: Relationship between age of pupils and pattern of VKC (n=84)

Age group (years)	Pattern of VKC		
	Tarsal f (%)	Limbal f (%)	Mixed f (%)
5-10	24(38.7)	28(45.2)	10(16.1)
11-15	5(22.7)	10(45.5)	7(31.8)
Total	29(34.5)	38(45.2)	17(20.2)

$\chi^2 = 3.177$, P –value = 0.204

Table 5: Risk factors associated with VKC

Risk Factors	Had VKC F (%)	No VKC F (%)	OR	χ^2	P-value
Exposed to smoke Yes No	76(21.3) 8(18.2)	280(78.7) 36(81.8)	1.221	0.237	0.627
Difficulty in breathing Yes No	67(82.7) 17(5.3)	14(17.3) 302(94.7)	85.017	233.187	0.000
Recurrent nasal discharge Yes No	28(22.4) 56(20.4)	97(77.6) No	1.129 219(79.6)	0.215	0.643
Recurrent skin itching Yes No	83(57.6) 1(0.4)	61(42.4) 255(99.6)	346.967	182.063	0.000
Cooking facility at home Kerosene Firewood Gas cooker Electric cooker	32(23.0) 46(22.4) 2(6.5) 1(4.0)	139(77.0) 159(77.6) 29(93.5) 24(96.0)	-	9.012	0.029
Cooking room Separated/Kitchen Open field	77(20.8) 7(24.1)	294(79.2) 22(75.9)	0.823	0.186	0.667
Sleeping material Foam Hay Others	83(21.6) 1(16.7) 0(0.0)	302(78.4) 5(83.3) 9(100.0)	-	2.157	0.300*
Animal contact Yes No Total	77(26.8) 7(6.2) 84(21.0)	210(73.2) 106(93.8) 316(79.0)	5.552	20.809	0.000

* = Fisher's Exact Test

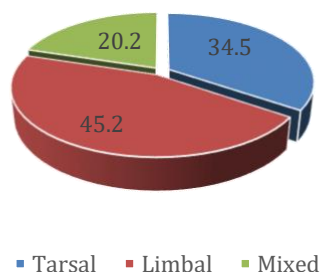


Figure 1: Pattern of VKC

In addition, a higher proportion 83(57.6%) had recurrent skin itching and VKC compared to those who don't have recurrent skin itching and don't have VKC. This difference was statistically significant ($\chi^2 = 182.063$, $p = 0.001$). (Table5).

DISCUSSION

The prevalence of VKC among school pupils in this study was seen to be 21.0%. The high prevalence seen in this study corroborated with other population based studies carried out in primary school children in Nigeria that had similar

prevalence¹⁴. However, this is much higher than other population based studies in other African countries.¹¹ Most information available on the prevalence of VKC in most countries including Nigeria were hospital-based with a prevalence between 2-6% among patients of all ages.^{2, 3, 15}. The high prevalence seen in this study might be as a result of it being a population based study, with an unbiased selection of subjects where children with mild, moderate and severe forms of the VKC were included in the study. Unlike the hospital based studies where parents are unlikely to take children with mild to moderate VKC to the hospital to access care, hence this can contribute to the underreporting of the prevalence in hospital-based studies.²⁰ A lower prevalence was recorded in a retrospective hospital based study done in Jos by Adenuga et al,¹⁸ where they obtained less than 20% prevalence. This lower prevalence in the hospital-based study from the same city might be as a result of children with VKC not coming to seek medical care because of lack of knowledge about availability of management or parents not willing to bring them to the hospital or parents neglecting the mild and moderate forms in their children.

The prevalence of VKC among school pupils based on their gender from this study showed a higher prevalence in males which was almost twice as that seen in females, there was no difference in the prevalence of VKC based on the age of the pupil in this study. This contradicts findings from other studies that found a reduce prevalence of VKC in the older age children and adults, this has been attributed to a possible hormonal link which makes VKC to resolve spontaneously in adolescence and only rarely persists beyond the age of 25 years.^{2, 4, 14, 19} However, a Nigeria study showed a higher prevalence of VKC in older children stating that they are more vulnerable to VKC²⁴ This variation in frequency of VKC has been attributed also to different environmental and geographical factors.

Generally the high prevalence of VKC from this study is a call for action for ophthalmic practice within the state to sensitize the public on this condition and on the need to seek prompt medical attention.

On VKC risk factors among school pupils, the study revealed that there was male preponderance for pupils with VKC in this study with a male to female ratio of 1.3:1. This corroborated the information that males are said to be more affected in Nigeria^{14, 20} and other countries.⁴ In a study done in Yemen involving 406 participants, the male-to-female ratio of VKC was 3.3: 1.4,⁴ while in an Ethiopian study, the male: female ratio was 2:1.^{13, 21} However, on the contrary a Nigerian study by Ukponmwan³ found female predominance (M: F ratio of 1: 1.3). Male predominance was much higher in European and Asian countries^{22, 23} than what was obtained from this study, as it was thought to be due to ultraviolet exposure since male children tend to spend more time outdoors playing with friends unlike the female child in these countries. However, in Africa, the girls also spend a lot of time outside the house running errands, hence the difference in ultraviolet exposure may be less marked. It has been found that unlike in healthy individuals, estrogen and progesterone can be detected in the receptors within the epithelium and subepithelium of both the tarsal and bulbar conjunctiva in patients with VKC;¹⁹ this shows an immunoreactivity component to VKC associated with hormonal factors. In addition, VKC patients have different circulating sex hormonal levels relative to non-allergic subjects which suggest a role of sex hormones in the pathogenesis.¹⁹

More than half of the pupils seen in this study had some risk factor for VKC. The use of

Kerosene and fire wood for cooking contributed to the development of VKC in some of the pupils due to the increase exposure to smoke, dust and heat., this is seen to corroborate the study done in Ethiopia¹², India¹⁰ and Nigeria^{24, 25} respectively. The study in Nigeria by Bekibele et al²⁵ further stressed that the risk is increased when the cooking is done using kerosene or fire wood within the living room. This study was conducted during the last quarter of the year into the first quarter which is the dry season in Plateau state, similar to the time a similar study in Southeastern Nigeria was conducted, and VKC has been reported to occur more during the hot weather. The catalyst for progression to more severe disease as well as the occurrence of exacerbation is still to be well defined; however, suggested causes of excacerbation are said to be from allergenic exposure and/ or sunlight, wind and dust.¹⁴

All pupils who reported VKC admitted to exposure to dust, and more than three quarters had exposure to smoke. Dusty weather usually experienced during the dry season in most part of northern Nigeria has been reported to contribute to allergic conjunctivitis, when this dust gets in contact with the eyes it causes unease and subsequent itching, redness. Same has also been reported for smoky and dry weather.²⁴ This also collaborates the report from the study done in Rwanda that showed that in severe VKC exposure to dust is the main risk factor.⁹ Also the dry season has been identified as the main season or time of the year with increased incidence of allergic conjunctivitis.²⁴ This could be due to the fact that dust particles especially in the dry and hot season have a greater capability of harboring inflammatory particles.¹

Family and personal history of allergies like difficulty with breathing and having skin allergies were also seen to be associated with increased risk for VKC in this study. This correlates with findings by Seth, M. et al¹⁰ in India and Hayilu D et al¹² in Ethiopia and Olusanya BA in Nigeria who also reported family history allergy and personal atopy as a strong risk factor.²⁶ This might be due to the fact that patients with systemic allergic conditions like eczema, bronchitis and asthma have similar immunopathology with VKC which is carried out by adherence of IgE molecules on the surfaces of mast cells which in turn releases inflammatory mediators like prostaglandins in the conjunctiva that probably leads to VKC.²⁷

Less than a quarter of the pupils with VKC had contact with domestic animals. Animal contact was seen to be statistically significant, as this might be due to the fact that animals and their danders have a high probability of harboring different allergen sources which can lead to type 1 hypersensitivity reaction, and further causing allergic reactions in those individuals.¹ The communities in this study are agrarian with high pollen generation which can also be contributory to the development of VKC. This collaborates with study done by Alemayehu AM et al¹ that also found an increase in the risk of developing VKC in individuals who had contact with animals. The knowledge of these risk factors and how they contribute to the development of VKC in children is important so as to help educate parents and children on how to avoid such risk factors to minimize the occurrence of VKC in children.

All three forms of VKC were seen in this study with the limbal form being the commonest form seen in all age groups, this was also seen to be more predominant in males.²⁸ This contradicts reports from duke et al in southeastern Nigeria who found the mixed form to be more predominant.¹⁴

CONCLUSION

Vernal keratoconjunctivitis is a common ocular disease in Jos East LGA of Plateau state. There was a significant male preponderance and the limbal variant was the commonest presentation. Exposure to smoke, use of kerosene, and contact with animals, personal and systemic allergic history were seen to be great contributors to the development of VKC.

RECOMMENDATION

The school eye health programme needs to be reactivated by the state ministry of health and education, and more teachers trained on visual acuity assessment as well as identifying eye diseases for early referral.

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