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Research Article

Knowledge, Attitudes, and Practices Toward Conjunctivitis Among Medical Students at Al Neelain University During Conflict in Sudan: A Cross-Sectional Study

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Abstract:

Background: Conjunctivitis is one of the most common ocular conditions worldwide, with significant public health implications. In Sudan, ongoing conflict and displacement have exacerbated the risk of outbreaks, highlighting the need to assess awareness and preventive behaviours among future healthcare providers.

Purpose: To evaluate the knowledge, attitudes, and practices (KAP) of medical students at Al Neelain University regarding conjunctivitis, and to identify gaps that may inform educational and policy interventions.

Methodology: A descriptive cross-sectional study was conducted among 273 medical students using a structured bilingual questionnaire. Stratified random sampling ensured proportional representation across academic years. Data were analyzed using SPSS version 26, with descriptive statistics, chi square tests, t tests, and ANOVA applied. Ethical approval was obtained from the Faculty of Medicine, Al Neelain University

Results: Overall knowledge was moderate (66.1%), with high awareness of contagion (88.3%) and viral aetiology (81.5%). Attitudes were positive (mean score 4.015 ± 0.6), particularly regarding public health responsibility. Preventive practices were variable, with handwashing reported by 82.4% but symptomatic relief measures less common (64.5%). KAP scores improved significantly with academic progression (knowledge $p < 0.001$; attitude $p = 0.032$; practice $p = 0.027$).

Conclusion: Medical students demonstrated moderate knowledge, positive attitudes, and variable practices toward conjunctivitis. Strengthening ophthalmic education and empowering students as public health advocates are essential, particularly in conflict affected settings where healthcare systems are disrupted.

Keywords: conjunctivitis; knowledge attitude practice; medical students; sudan; public health

Abbreviations

KAP: Knowledge, Attitude, Practice

UNHCR: United Nations High Commissioner for Refugees

WHO: World Health Organization

ECDC: European Centre for Disease Prevention and Control

CDC: Centers for Disease Control and Prevention

Introduction

Conjunctivitis, commonly referred to as "red eye," is an inflammatory condition of the conjunctival membrane that lines the eyelids and covers the sclera. It is one of the most frequent ocular complaints worldwide, affecting individuals across all age groups and socioeconomic strata. Clinically, conjunctivitis presents with itching, hyperaemia, tearing, discharge, preauricular lymphadenopathy, sore throat, and fever. The condition may be viral, bacterial, or allergic in origin, with viral conjunctivitis accounting for nearly 80% of acute cases, most often due to adenoviruses, enteroviruses, and herpes viruses [1]. Bacterial conjunctivitis, though less prevalent, remains a significant contributor to ocular morbidity [2], while allergic conjunctivitis is often associated with allergic rhinitis and seasonal triggers [3]. Despite its generally benign course, conjunctivitis can lead to complications such as pseudo membrane formation, corneal opacification, or even blindness if left untreated [4]. Globally, conjunctivitis imposes a considerable burden on healthcare systems. In the United States alone, the annual economic cost of managing acute conjunctivitis is estimated at over $850 million, with the majority of diagnoses made by non-ophthalmologists in primary care and emergency settings [5]. Misdiagnosis and unnecessary

antibiotic prescriptions remain common, underscoring the importance of accurate knowledge and evidence-based practice [6]. In low- and middle-income countries, the burden is compounded by limited access to healthcare, poor sanitation, and inadequate public health awareness [7]. In Sudan, conjunctivitis has emerged as a pressing public health concern, particularly in the context of ongoing conflict. Since April 2023, the war between the Sudanese Armed Forces and the Rapid Support Forces has displaced millions of people, disrupted healthcare services, and severely hindered disease surveillance [8]. Overcrowding in displacement camps, coupled with poor sanitation and seasonal flooding, has created fertile ground for outbreaks of infectious diseases, including conjunctivitis [9]. Reports from the Sudanese Ministry of Health and international agencies such as UNHCR have documented thousands of conjunctivitis cases in affected regions [10,11], highlighting the urgent need for preventive strategies. Simple measures such as handwashing, avoiding the sharing of personal items, and maintaining hygiene can significantly reduce transmission [12]. Knowledge, Attitude, and Practice (KAP) studies provide a valuable framework for assessing how populations perceive and respond to health challenges [13]. By evaluating what individuals know, how they feel, and how they act regarding a specific condition, KAP studies identify gaps that can inform targeted interventions. Medical students, as future healthcare providers and trusted sources of health information, play a pivotal role in shaping community perceptions and practices [14]. Their knowledge and attitudes not only influence their own preventive behaviours but also determine their effectiveness as advocates for public health within their families, peers, and communities [15]. Despite the recognized importance of conjunctivitis as a public health issue, there is limited research in Sudan exploring the KAP of medical students toward this condition [16]. Understanding their level of awareness, attitudes, and practices is crucial for designing educational interventions, strengthening curricula, and enhancing their role as agents of health promotion. Moreover, in times of crisis such as war and displacement, medical students represent a vital resource for disseminating accurate health information and supporting preventive measures [17]. This study therefore aims to assess the knowledge, attitudes, and practices of medical students at Al Neelain University regarding conjunctivitis. By identifying strengths and gaps in their understanding and behaviour, the research seeks to contribute to improved educational strategies, public health campaigns, and policy initiatives. Ultimately, empowering medical students with comprehensive knowledge and positive practices will enhance their capacity to serve as frontline advocates in combating conjunctivitis and other communicable diseases in Sudan [18].

Material and Methods:

Study Design

This research employed a descriptive cross-sectional design, which is appropriate for assessing knowledge, attitudes, and practices (KAP) at a single point in time. The design allowed for the collection of quantitative data from medical students regarding their awareness and behaviours toward conjunctivitis, without manipulating variables or introducing interventions. Cross sectional studies are widely used in public health research to provide baseline information that can guide educational and preventive strategies.

Study Setting

The study was conducted at the Faculty of Medicine, Al Neelain University, Khartoum, Sudan, one of the country's leading medical schools. The institution enrols students from diverse backgrounds and academic levels, making it an ideal setting for evaluating KAP among future healthcare providers. The study period extended from November to December 2024, coinciding with the academic semester, which facilitated access to students across different years of study.

Study Population

The target population comprised undergraduate medical students enrolled at Al Neelain University during the 2024 academic year. Inclusion criteria were:

• Enrolment in the MBBS program.

• Willingness to participate and provision of informed consent. Exclusion criteria included:

• Students absent during the data collection period.

• Those unwilling to provide consent.

Sample Size

The sample size was calculated using standard epidemiological formulas for cross sectional studies, considering a confidence level of 95% and an expected prevalence of adequate knowledge at 50% (to maximize sample size). The final sample included 273 students, which provided sufficient statistical power to detect meaningful differences across academic levels and gender.

Sampling Technique

A proportional stratified random sampling method was employed. Students were stratified by academic year (first through fifth year), and proportional representation was ensured by selecting participants randomly within each stratum. This technique minimized selection bias and ensured that the sample reflected the distribution of students across different levels of training.

Study Variables

• Independent variables: Academic year, gender, source of information.

• Dependent variables: Knowledge scores, attitude scores, practice scores related to conjunctivitis. Knowledge was assessed through factual questions on etiology, transmission, symptoms, and treatment. Attitudes were measured using Likert scale items reflecting perceptions of conjunctivitis as a public health concern and responsibility for prevention. Practices were evaluated through self-reported behaviors such as hygiene compliance and health seeking actions.

Data Collection

Data were collected using a structured, self-administered online questionnaire developed in English and Arabic to ensure comprehension. The questionnaire was adapted from validated KAP instruments used in previous ophthalmology and infectious disease studies, with modifications to suit the Sudanese context. It comprised four sections:

1. Demographic information.

2. Knowledge items (true/false and multiple choice).

3. Attitude items (5-point Likert scale).

4. Practice items (yes/no and frequency questions).

The questionnaire was distributed electronically via secure university platforms. Prior to full deployment, a pilot test was conducted with 20 students to assess clarity, reliability, and internal consistency. Cronbach's alpha values exceeded 0.7 for attitude and practice scales, confirming acceptable reliability.

Data Analysis

Responses were coded and entered into SPSS version 26 for statistical analysis. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize demographic characteristics and KAP scores. Inferential statistics included:

• Chi square tests to examine associations between categorical variables (e.g., knowledge level vs. academic year).

• Independent t tests and ANOVA to compare mean scores across groups.

• Correlation analysis to explore relationships between knowledge, attitudes, and practices. A p value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Department of Community Medicine, Faculty of Medicine, Al Neelain University. Informed consent was secured electronically from all participants prior to data collection. Confidentiality was maintained by anonymizing responses and restricting access to data to the research team only. Participation was voluntary, and students were assured that refusal to participate would not affect their academic standing. The study adhered to the principles of the Declaration of Helsinki (2013 revision) regarding research involving human subjects.

Results:

Participant Demographics

A total of 273 medical students participated in the study. The majority were female (193 students, 70.7%) while males accounted for 29.3% (n = 80) (Figure 2).

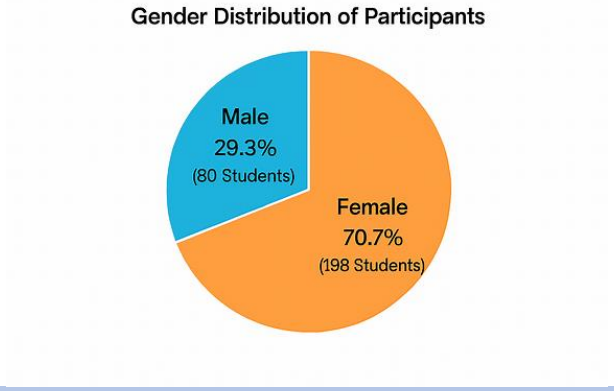

Figure 2: Gender Distribution of Participants

Most students were aged between 20 and 24 years (65.9%), with smaller proportions under 20 (16.5%) or over 24 (17.6%). Distribution across academic years was relatively balanced, with the highest representation from fifth-year students (n = 71, 26%) and the lowest from fourth-year students (n = 45, 16.5%) (Figure 1, Table 1).

Variable	Frequency (n)	Percentage (%)
Gender: Male	80	29.3
Gender: Female	193	70.7
Age < 20	45	16.5
Age 20–24	180	65.9
Age > 24	48	17.6
Academic Year 1st	55	20.1
Academic Year 2nd	50	18.3
Academic Year 3rd	52	19.0
Academic Year 4th	45	16.5
Academic Year 5th	71	26.0
Source: Curriculum	127	46.6
Source: Internet	85	31.1
Source: Friends	40	14.7
Source: Other	21	7.6

Table 1: Demographic Characteristics of Participants (N = 273)

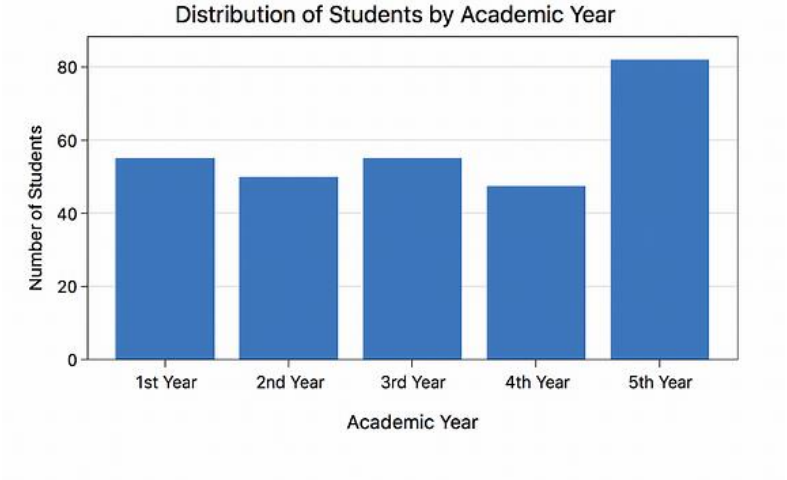

Figure 1: Distribution of Students by Academic Year

Regarding sources of information about conjunctivitis, 46.6% of students cited the university curriculum, followed by internet (31.1%), friends (14.7%), and other sources (7.6%) (Figure 3).

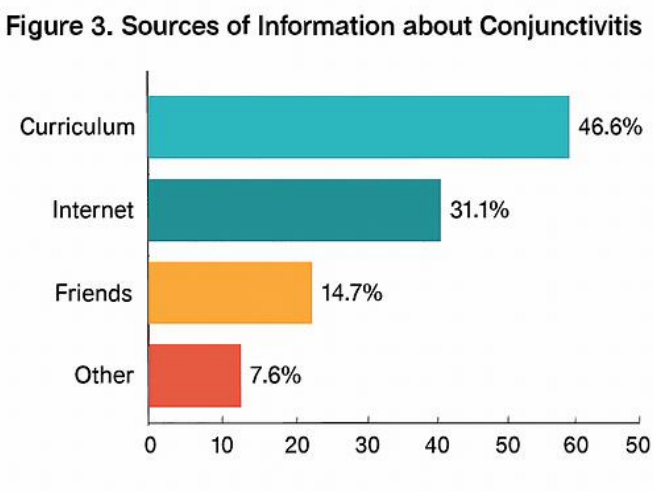

Figure 3: Sources of Information about Conjunctivitis

Knowledge about Conjunctivitis

Overall, students demonstrated moderate knowledge, with a mean correct response rate of 66.1% across knowledge items. Awareness that conjunctivitis is contagious was high (88.3% correct), and most students correctly identified viral etiology (81.5%) and transmission via contaminated surfaces (74.2%) (Table 2).

Knowledge Item	Correct Response (%)	p-value (Academic Year)
Conjunctivitis is contagious	88.3	0.021*
Spread through contaminated surfaces	74.2	0.034*
Caused by viruses	81.5	0.041*
Caused by bacteria	69.7	0.052
Caused by allergy	63.4	0.067
Common symptoms (redness, pain, discharge)	90.1	0.018*
Can be vision-threatening if untreated	72.8	0.029*

Table 2: Knowledge about Conjunctivitis

*Significant at $p < 0.05$

Knowledge improved significantly with academic progression. Fifth-year students had the highest mean knowledge score (70.9 ± 7.2), compared to first-year students (61.2 ± 8.4), with a statistically significant trend ($p < 0.001$) (Table 5). Specific knowledge items such as "vision-threatening potential" and "common symptoms" also showed significant differences across academic years ($p < 0.05$).

Attitudes toward Conjunctivitis

Students expressed positive attitudes, with a mean attitude score of 4.015 ± 0.6 on a 5-point Likert scale. Most agreed that conjunctivitis is a significant public health concern (mean: 4.21 ± 0.6) and that medical students have a responsibility to educate others (mean: 4.22 ± 0.5) (Table 3).

Attitude Statement	Mean ± SD	p-value (Academic Year)
Conjunctivitis is a significant public health concern	4.21 ±0.6	0.043*
Maintaining social distance helps prevent spread	4.05 ±0.7	0.051
Avoiding sharing personal items is essential	4.18 ±0.5	0.037*
Covering mouth/nose when sneezing prevents spread	4.09 ±0.6	0.049
Medical students are responsible for educating others	4.22 ±0.5	0.032*

Table 3: Attitudes toward Conjunctivitis (Mean ± SD)

Attitude scores increased with academic level, from 3.89 ± 0.7 in first-year students to 4.21 ± 0.5 in fifth-year students ($p = 0.032$) (Table 5). Statements related to social distancing, hygiene, and avoiding shared items also showed statistically significant differences across years ($p < 0.05$).

Preventive Practices

Practice scores were generally positive, with 68.7% of students reporting good compliance. The most common preventive behaviors included regular handwashing (82.4%), avoiding sharing towels/makeup (76.8%), and seeking healthcare when symptomatic (68.7%) (Table 4).

Practice Item	Positive Response (%)	p-value (Academic Year)
Regular handwashing	82.4	0.027*
Avoiding eye rubbing	70.2	0.061
Avoiding sharing towels/makeup	76.8	0.044*
Seeking healthcare when symptomatic	68.7	0.052
Using warm cloth/artificial tears for relief	64.5	0.071

Table 4: Preventive Practices

Use of symptomatic relief measures such as warm compresses and artificial tears was reported by 64.5% and 61.2% respectively. Practice scores improved with academic progression, rising from 65.1 ± 9.2 in first-year students to 72.4 ± 7.9 in fifth-year students (p = 0.027) (Table 5).

Academic Year	Knowledge Score (Mean ± SD)	Attitude Score (Mean ± SD)	Practice Score (Mean ± SD)	p-value (Knowledge)	p-value (Attitude)	p-value (Practice)
1st Year	61.2 ± 8.4	3.89 ± 0.7	65.1 ± 9.2	0.041*	0.052	0.049
2nd Year	63.5 ± 7.9	3.95 ± 0.6	66.8 ± 8.7	0.038*	0.047*	0.043*
3rd Year	65.8 ± 8.1	4.01 ± 0.6	68.2 ± 8.5	0.031*	0.041*	0.039*
4th Year	67.4 ± 7.5	4.08 ± 0.5	69.5 ± 8.1	0.026*	0.037*	0.034*
5th Year	70.9 ± 7.2	4.21 ± 0.5	72.4 ± 7.9	0.018*	0.032*	0.027*
Overall (ANOVA)	—	—	—	*	*0.032 **	*0.027 **

Table 5: Correlation between Academic Year and KAP Scores (N = 273)

*Significant at p < 0.05; ***Highly significant at p < 0.001

Correlation Between Academic Year and KAP

Table 5 summarizes the correlation between academic year and KAP scores. All three domains—knowledge, attitude, and practice—showed statistically significant improvement with academic advancement.

• Knowledge: p < 0.001

• Attitude: p = 0.032

• Practice: p = 0.027

These findings suggest that medical education and clinical exposure contribute positively to students' understanding and behaviour regarding conjunctivitis.

Discussion

This This study assessed the knowledge, attitudes, and practices (KAP) of medical students at Al Neelain University regarding conjunctivitis, revealing moderate knowledge levels, generally positive attitudes, and variable preventive practices. These findings align with recent global KAP studies that underscore persistent gaps in awareness and behavior, even among educated populations [19,20].

The overall knowledge score of 66.1% is comparable to findings from China, where Song et al. reported that only 62% of allergic conjunctivitis patients correctly identified viral etiology [20]. Similarly, Charters et al. found that patients in outpatient clinics had limited understanding of conjunctivitis transmission and complications [21]. While our study focused on medical students rather than patients, the knowledge gaps observed—particularly in early academic years—suggest that foundational ophthalmic education may be insufficiently emphasized in preclinical curricula [22]. Attitude scores in our study were encouraging, with a mean of 4.015 on a 5-point scale. This mirrors findings from Latin America, where Gonzalez and Ramirez reported strong public concern about conjunctivitis but limited engagement in preventive behaviors [23]. The positive correlation between knowledge and attitude observed in our cohort supports the KAP model's hypothesis that improved understanding fosters more responsible health perceptions [24]. However, attitude alone may not translate into consistent practice, as seen in our data and in similar studies from Pakistan and Saudi Arabia [25,26]. Preventive practices such as handwashing and avoiding shared items were reported by most students, yet symptomatic management behaviors (e.g., use of artificial tears or warm compresses) were less common. This discrepancy reflects findings from a multicenter study in India, where hygiene compliance was high but self-care knowledge was limited [27]. The relatively low uptake of symptomatic relief measures may be due to misconceptions about treatment efficacy or lack of exposure to clinical ophthalmology [28]. Importantly, our study revealed a statistically significant improvement in KAP scores with academic progression. Fifth-year students consistently outperformed their junior peers in all domains (p < 0.05), suggesting that clinical exposure and curriculum depth play a critical role in shaping conjunctivitis-related competencies. This trend is consistent with findings from Riyadh, where Al-Dawood and Al-Harbi observed higher KAP scores among senior healthcare students [29]. The Sudanese context adds a unique layer to these findings. Since April 2023, the war between the Sudanese Armed Forces and the Rapid Support Forces has disrupted healthcare delivery, displaced millions, and created conditions conducive to infectious disease outbreaks [30]. Conjunctivitis, often overlooked in emergency settings, has emerged as a significant public health concern in displacement camps, where overcrowding and poor sanitation accelerate transmission [31]. In such settings, medical students can serve as frontline educators and advocates for hygiene promotion, especially when formal health systems are compromised [32]. Policy implications of this study are multifaceted. First, there is a clear need to strengthen ophthalmic education within medical curricula, particularly in preclinical years. Integrating conjunctivitis modules into community medicine and public health courses could enhance early awareness and preventive capacity [33]. Second, universities should empower students to participate in outreach campaigns, especially during crises. Evidence from refugee health programs in East Africa shows that student-led hygiene education can significantly reduce conjunctivitis incidence [34]. Third, digital platforms should be leveraged to disseminate accurate information. While 31.1% of our participants cited the internet as a source, studies show that online content on conjunctivitis is often incomplete or misleading [35]. Institutions must curate and promote evidence-based resources tailored to local contexts. Finally, national health authorities should recognize conjunctivitis as a priority in emergency preparedness frameworks, ensuring that hygiene kits, educational materials, and surveillance tools are included in humanitarian responses [36].

Strengths

This study is among the first to explore conjunctivitis knowledge, attitudes, and practices among Sudanese medical students during a period of national crisis. Its strengths include a robust sample size, proportional representation across academic years, and the use of a validated bilingual questionnaire.

The integration of statistical analysis with demographic stratification enhances reliability. By situating findings within the context of war and displacement, the study provides unique insights with both academic and policy relevance.

Limitations

Limitations include reliance on self-reported practices, which may introduce recall or social desirability bias. The cross-sectional design restricts causal inference. Data were collected from a single institution, limiting generalizability. Additionally, the online survey format may have excluded students with limited internet access, potentially underrepresenting marginalized groups affected by conflict and displacement.

Conclusion

Medical students at Al Neelain University demonstrated moderate knowledge, positive attitudes, and variable practices regarding conjunctivitis. KAP scores improved significantly with academic progression, underscoring the importance of curriculum depth and clinical exposure. Strengthening ophthalmic education and empowering students as public health advocates can enhance conjunctivitis prevention, particularly in crisis settings where healthcare systems are disrupted.

Recommendations

Curricula should integrate conjunctivitis modules early in medical training, emphasizing aetiology, transmission, and preventive practices. Universities should encourage student participation in outreach campaigns, especially in displacement camps and conflict affected communities. National health authorities must prioritize conjunctivitis in emergency preparedness frameworks, ensuring hygiene kits and educational materials are available. Digital platforms should be leveraged to disseminate accurate information, counter misinformation, and empower students as frontline educators in promoting ocular health.

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Ethical Approval

Ethical clearance was obtained from the Department of Community Medicine, Faculty of Medicine, Al Neelain University. Informed consent was secured electronically from all participants. Confidentiality was maintained throughout, and the study adhered to the principles of the Declaration of Helsinki (2013 revision).

Authors' Contributions

All authors contributed to study conception, design, data collection, analysis, and manuscript drafting. Each author reviewed and approved the final version and accepts responsibility for the integrity of the work.

Funding and Conflict of Interest

This research received no external funding. The authors declare no conflicts of interest.

Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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