

# Eye rubbing: a survey of awareness of keratoconus and it's relation with eye rubbing in Jeddah

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Received: January 2021; Accepted: February 2021; Published: March 1, 2021.

Citation: Ahmed T. Alnahdi et al. Eye rubbing: a survey of awareness of keratoconus and it's relation with eye rubbing in Jeddah. World Family Medicine. 2021; 19(3): 141-150 DOI: 10.5742/MEWFM.2021.94018

## Abstract

**Background:** Background: Previous Saudi studies have revealed poor public awareness about keratoconus (KC) and eye rubbing as the most common associated factor among KC patients.

**Objectives:** to assess the level of awareness and knowledge of keratoconus and its relation to eye rubbing in Saudi Arabia.

**Methods:** A cross-sectional study was done on 504 of the Saudi population. A pre-designed questionnaire was used to collect data about personal characteristics, knowledge about KC, practice of eye rubbing and the cause and history of atopic or eye diseases.

**Results:** 48.8% of the participants had heard about KC. The commonest source of information was reading and lectures, 21.4% reported correctly that KC is thinning of cornea and 32.9% and 50.4% reported correctly that KC is related to allergy and myopia respectively. Only 4.8% think that there was no treatment for KC, 75.8% were rubbing their eyes and for 40.9% the cause of rubbing was itching. Only 9.3% had a family history of KC and the levels of poor, fair and good knowledge about KC were 63.3%, 31.9% and 4.8% respectively. Participants who had previous knowledge about KC from their friends and relative, those who had KC, those from the northern region and those who had previously heard about Kc had a significant higher percentage of good knowledge.

**Conclusion:** The deficient awareness about KC revealed in this study calls for health education programs to raise the public awareness about this eye disorder.

**Key words:** eye, rubbing, awareness, survey, keratoconus, Jeddah

## Introduction

Keratoconus (KC) is a Non-inflammatory ectatic ocular disease by which a progressive central corneal thinning process changes the cornea from normal dome-shaped into a cone-like protrusion (1). With genetic and environmental factors, KC aetiology is multifactorial and remains elusive (1). It is a corneal condition in which, in a cone-shaped manner, the central part of the cornea becomes thinner and bulges outward, resulting in myopia, irregular astigmatism, and ultimately visual impairment. (2,3).

Early in the disease, the patient is typically asymptomatic. As the disease progresses, visual acuity decreases and eventually the patient notices visual distortion with significant vision loss. These changes are due to the development of irregular astigmatism, myopia, and in many cases corneal scarring. In addition, the cornea becomes thinner (4,5). Most patients have bilateral keratoconus, although the progression and severity of the condition in each eye is usually asymmetric (6).

KC's approximate prevalence is about 1.38 per 1000 population (7). The definitive keratoconus cause is undetermined, but eye rubbing was found to be a well-known risk factor (4). Studies have also shown that Asian (i.e., India 18,19) or Middle-Eastern keratoconus patients tend to be younger at diagnosis, and present with severe forms of the disease (8). Compared to Europe and North America, the higher prevalence of KC in warmer, sunny countries has led to the hypothesis that the high sun exposure in these countries accounts for the high prevalence (9).

It seems that environmental factors serve as a trigger for KC in genetically predisposed individuals. These environmental factors include eye rubbing, atopy and UV exposure (10). An association between eye rubbing and KC has long been described and accepted as a risk factor, and most studies reported that about half of KC patients rub their eyes (11,12,13). This was explained by the microtrauma caused to the epithelium by rubbing KC corneas that elevate levels of matrix metalloproteinases MMP-1 and MMP-13 (14), which are secreted by epithelial and stromal cells, and inflammatory mediators including IL-6 and TNF- $\alpha$  (15). The release of these factors forms part of the process that leads to KC and its progression (15). Balasubramanian et al, 2013 performed a study to assess the influence of eye rubbing on protease expression, protease activity, and concentration of inflammatory molecules in tears, which are found to be relevant within the pathogenesis of keratoconus. The study revealed that eye rubbing for 60 seconds increased the extent of tear MMP-13, IL-6, and TNF- $\alpha$  in healthy study subjects (16). In 2014 Hashemi et al, performed a study to evaluate the prevalence of keratoconus and associated factors among one thousand and twenty-seven Iranian university students. In this study, keratoconus prevalence was 2.5%. This finding has not been highly connected with (male/female status) or age. However, the family history

was strongly related to keratoconus (17). Recently, Mazharian et al. in 2020 conducted a case-control study that assessed the relationship between eye rubbing and sleeping position in patients with Unilateral or Highly Asymmetric Keratoconus (UHAKC). This study showed a strong evidence of the relationship between eye rubbing, wrong sleeping position, and UHAKC. They also indicate the need for public health consideration of the harmful effects of excessive eye rubbing and inappropriate sleeping position (4).

In the Kingdom of Saudi Arabia (KSA), a study was done by Assiri et al., in 2005 to explore the rate and severity of keratoconus. The study included 125 newly diagnosed patients with keratoconus. The study reported that 20 cases per 100,000, (44.8%) had a positive ocular history for eye rubbing, which is considered as one of the keratoconus risk factors (8). In 2012, a study from King Khaled Eye Specialist Hospital in Riyadh showed that the prevalence of keratoconus was 0.81/105 citizens (18). In 2016, Al-Shammari et al conducted a retrospective study in Hail region to find out the prevalence of KC and its presenting clinical features. This study showed that eye rubbing is the most common associated factor as among KC patients 44.8% had eye rubbing. The study concluded that a strong emphasis should be placed on preventive strategies such as setting up a family education program on common risks of KC (19). In 2018, a cross-sectional multicenter study was done to assess the prevalence of KC among Saudi pediatric patients (6–21 years) and reported it to be 4.79% (20).

Proper awareness of the population at risk of KC can lead to a better absorption of educational services by the community and eventually to the proper use of the available health care facilities (21,22). A careful literature search has found that only one study has been done in KSA to assess the awareness of KC. This study was done in 2020 in Abha city among non-medical students. The study found that among those who had poor awareness, the majority were female (95.7%) and belonged to the age group of 17–21 years (68.3%). More than half of the study participants have poor awareness and knowledge about the incidence, symptoms, and treatment modalities of KC. The study concluded that the level of awareness is considered a key factor for better utilization of eye health care (23). This result supports similar findings reported from urban community in Saudi Arabia that had significantly poor knowledge about specific eye diseases (24).

The aim of this study was to assess the level of awareness and knowledge of keratoconus and its relation to eye rubbing in Jeddah, Saudi Arabia.

## Methods

**Study design:** a cross-sectional study was done.

**Study setting:** all residents of KSA.

**Study Subjects:** male and female residents of KSA.

**Sampling Technique:** Random sampling methodology was used using the equation of the established formula for calculation of sample size. Where N is the population size, E is the margin of error (5%), r is the fraction of responses, and Z(c/100) is the critical value for the confidence level c, the sample size n, and margin of error E

$$x = Z(c/100)2r(100-r)$$

$$n = N x / ((N-1)E^2 + x)$$

$$E = \text{Sqrt}[(N - n)x/n(N-1)]$$

**Data Collection:** A pre-designed self-administered questionnaire was used including all eligible participants. Internal consistency and reliability of the questionnaire was assessed by Cronbach's  $\alpha$  test. The questionnaire included items on personal characteristics, knowledge about KC, practice of eye rubbing and the cause and history of atopic or eye diseases. The questionnaire included six questions that assessed participants' knowledge about KC. Every correct answer was given a score of (1) and for wrong answers a score of (0) was given leaving a total score of 6. Participants who got a score <50% of the total score were classified as having poor knowledge, those who got a 50-75% of the total score were classified as having fair knowledge and those who got >75% of the total score were classified as having good knowledge.

All questionnaire items were translated into the Arabic language by a health care physician and a translator expert fluent in both Arabic and English languages. The resulting Arabic questionnaire was then translated back into the English language by another two experts fluent in both languages. Those two experts were blinded to the questionnaire original English version. The back translated version of the questionnaire was compared with the original English one to check the translation quality which is the back-translation method recommended by the World Health Organization (WHO) (25,26).

**Ethical Considerations:** Ethical approval for the study was obtained from the research ethics committee of the ministry of health (MOH). An electronic consent was filed by all participants before participating in the study.

**Data analysis:** Data were analyzed using (SPSS) version 25. Qualitative data were presented as frequencies and percentages, and Chi-squared test ( $\chi^2$ ) was used to assess the relationship between variables. Quantitative data was expressed as mean and standard deviation (Mean  $\pm$  SD). A p-value of <0.05 was considered as statistically significant.

## Results

Table 1 shows that 54.2% of the participants had an age ranging from 18-30 years, 77.6% were females, 54.8% were not married, 73.4% had a bachelor's degree of education, 35.9% had a monthly income of less than 3000 SR and 60.3% were from the Western region. About 53% (53.2%) had an underlying atopic disease, where skin atopy was the commonest (17.9%) followed by eye atopy (15.9%). Most of the participants (70.2%) had an underlying eye disease with Myope/hypermetropia as the commonest eye disorder (65.7%). Of the participants, 3.8% reported having KC.

Table 2 shows that 48.8% of the participants had previously heard about KC and the commonest source was reading and lectures (18.3%). Only 21.4% of the participants reported correctly that KC is thinning of the cornea. Of them, 32.9% and 50.4% reported correctly that Kc is related to allergy and myopia respectively. Only 4.8% think that there is no treatment is present for KC, 75.8% were rubbing their eyes and for most of them (40.9) the cause of rubbing was eye itching. About one third of the participants (34.3%) correctly reported that eye rubbing may lead to keratoconus.

Figure 1 illustrates that 9.3% of the participants had a family history of KC. The mean knowledge score was  $1.94 \pm 1.45$  and the levels of poor, fair and good knowledge about KC among the participants were 63.3%, 31.9% and 4.8% respectively (Figure 2).

Table 3 shows that participants who had previous knowledge about KC from their friends and relatives and who had KC had a significant higher percentage of those who had good knowledge ( $p < 0.05$ ). A non-significant relationship was found between participants' knowledge level about KC and their characteristics, having an underlying atopic or eye disease, family history of KC or eye rubbing ( $p > 0.05$ ).

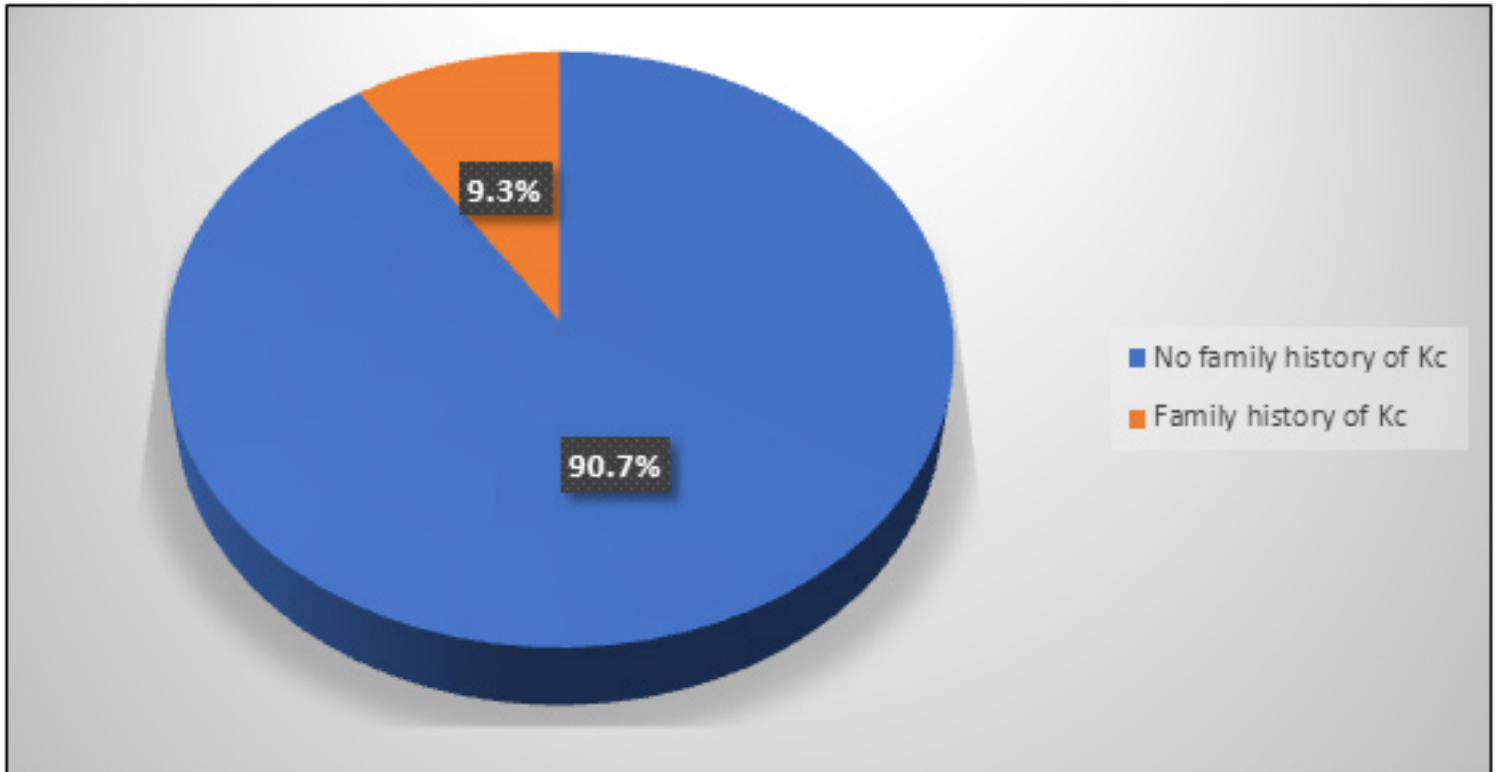
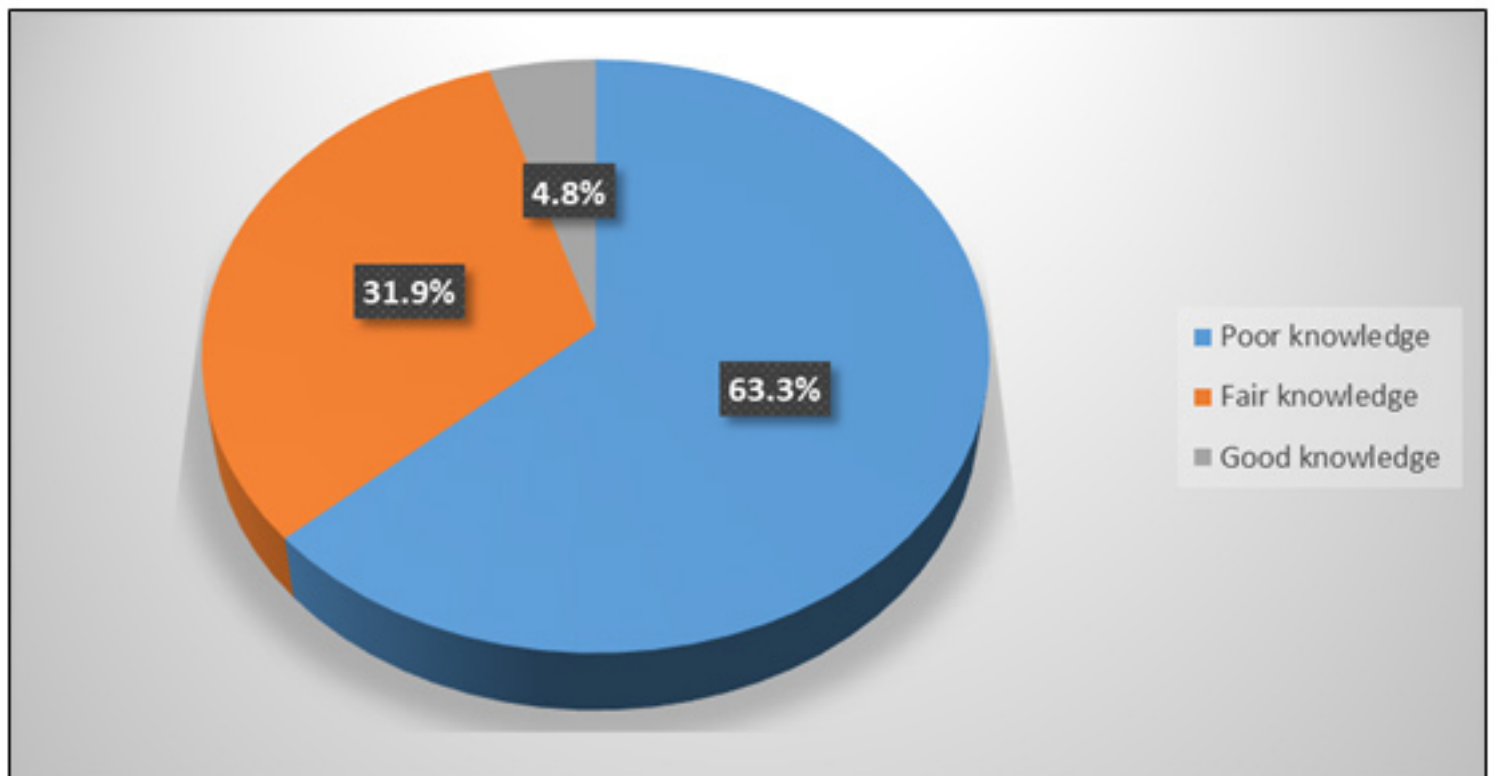
Figures 3 and 4 show that participants from the northern region and participants who had previously heard about KC had a significant higher percentage of those who had good knowledge ( $p < 0.05$ ).

**Table 1. Disruption of studied participants according to their characteristics and having an underlying atopic or eye disease (No.: 504)**

Variable	No. (%)
Age/ years	
18-30	273 (54.2)
31-39	86 (17.1)
40-49	86 (17.1)
50-60	48 (9.5)
>60	11 (2.2)
Gender	
Female	391 (77.6)
Male	113 (22.4)
Marital status	
Not married	276 (54.8)
Married	228 (45.2)
Educational level	
Primary	9 (1.8)
Intermediate	9 (1.8)
High school	113 (22.4)
Bachelor's degree	370 (73.4)
Not educated	3 (0.6)
Monthly income	
less than 3000 SR	181 (35.9)
3000-10000 SR	163 (32.3)
More than 100 00SR	160 (31.7)
Residence region	
Southern	56 (11.1)
Eastern	57 (11.3)
Western	304 (60.3)
Central	61 (12.1)
Northern	26 (5.2)
Do you have an underlying atopic disease?	
No	268 (53.2)
Yes	236 (46.8)
If yes, where is this atopic disease:	
Nose	9 (1.8)
Skin and eye	3 (0.6)
Chest	39 (7.7)
Eye and chest	3 (0.6)
Skin	90 (17.9)
GIT	12 (2.4)
Eye	80 (15.9)
Do you have underlying eye disease	
no	150 (29.8)
yes	354 (70.2)
If yes, what is this disease?	
KC	19 (3.8)
Dry eye	4 (0.8)
Myope/hypermetropia	331 (65.7)

**Table 2. Disruption of studied participants according to their knowledge about KC and practice of eye rubbing (No.: 504)**

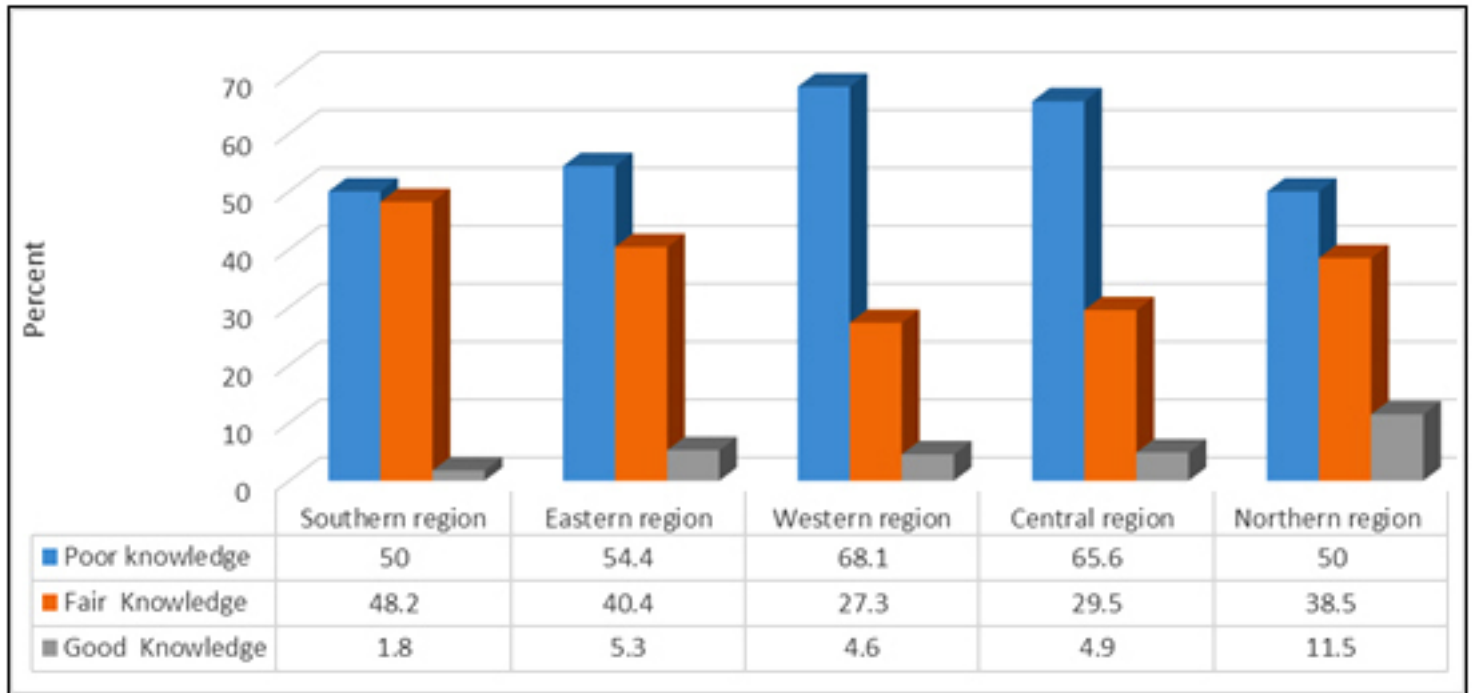
Variable	No. (%)
<b>Knowledge about keratoconus:</b>	
Have you ever heard about KC?	
no	258 (51.2)
yes	246 (48.8)
If yes, how did you hear about KC?	
The doctor	43 (8.5)
Readings and lectures	92 (18.3)
Friends and relative	51 (10.1)
Internet and social media	60 (11.9)
In your opinion, what is KC?	
Corneal inflammations	73 (14.5)
Increase thickness of cornea	85 (16.9)
Don't know	232 (46)
Immunological diseases	6 (1.2)
Thinning of cornea (correct answer)	108 (21.4)
In your opinion, is KC related to allergy?	
No	48 (9.5)
I do not know	290 (57.5)
Yes (correct answer)	166 (32.9)
In your opinion, does KC lead to myopia?	
No	14 (2.8)
I do not know	236 (46.8)
Yes (correct answer)	254 (50.4)
In your opinion, how is KC treated?	
Glasses	27 (5.4)
Contact lens	26 (5.2)
Eye drops	27 (5.4)
Surgery	144 (28.6)
Don't know	256 (50.8)
No treatment present (correct answer)	24 (4.8)
Eye rubbing is classified as:	
One of the safe habits	33 (5.6)
Normal but if increased lead to allergy	1 (0.2)
Cause eye contamination	1 (0.2)
Causes corneal problems	4 (0.8)
Bad habit	7 (1.4)
May lead to keratoconus (correct answer)	173 (34.3)
I do not know	285 (56.5)
<b>Practice of eye rubbing</b>	
Do you rub your eyes?	
no	122 (24.2)
yes	387 (75.8)
If the answer of the previous question is yes, why do you rub your eye?	
stress or headache	102 (20.2)
allergy	69 (13.7)
itching	206 (40.9)
all of the above	5 (1)

**Figure 1. Percentage distribution of the participants according to having a family history of KC****Figure 2. Percentage distribution of the participants according to their knowledge level about KC**

**Table 3. Relationship between knowledge level about KC and participants' characters, having an underlying atopic or eye disease, family history of KC, source of hearing about KC and eye rubbing**

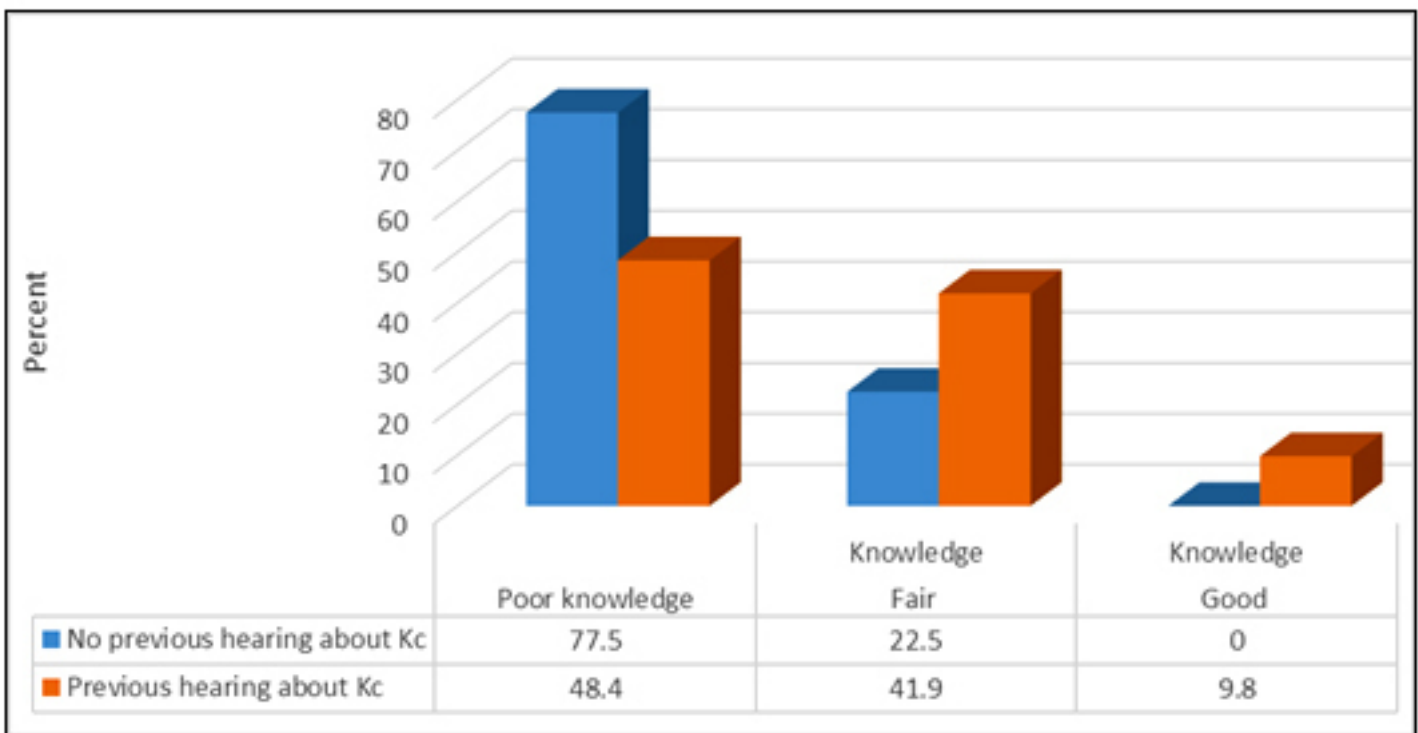
Variable	Knowledge level			$\chi^2$	p-value
	Poor No. (%)	Fair No. (%)	Good No. (%)		
Age					
under 18	166 (60.8)	94 (34.4)	13 (4.8)	7.31	0.503
19-30	51 (59.3)	29 (33.7)	6 (7)		
31-39	59 (68.6)	25 (29.1)	2 (2.3)		
40-49	34 (70.8)	11 (22.9)	3 (6.3)		
50 or more	9 (91.8)	2 (18.2)	0 (0.0)		
Gender					
Female	254 (65)	122 (31.2)	15 (3.8)	4.2	0.122
Male	65 (57.5)	39 (34.5)	9 (8)		
Marital status					
Not married	169 (61.2)	93 (33.7)	14 (5.1)	1.11	0.571
Married	150 (65.8)	68 (29.8)	10 (4.4)		
Educational level					
Primary	7 (77.8)	2 (22.2)	0 (0.0)	2.88	0.941
Intermediate	7 (77.8)	2 (22.2)	0 (0.0)		
High school	72 (63.7)	37 (32.7)	4 (3.5)		
Bachelor's degree	231 (62.4)	119 (32.2)	20 (5.4)		
Not educated	2 (66.7)	1 (33.3)	0 (0.0)		
Income					
less than 5000 SR	113 (62.4)	58 (32)	10 (5.5)	0.79	0.939
5000-10000 SR	106 (65)	51 (31.3)	6 (3.7)		
More than 100 00SR	100 (62.5)	52 (32.5)	8 (5)		
Do you have an underlying atopic disease?					
No	170 (63.4)	86 (32.1)	12 (4.5)	0.1	0.95
Yes	149 (63.1)	75 (31.8)	12 (5.1)		
Do you have underlying eye disease					
no	105 (70)	40 (26.7)	5 (3.3)	4.29	0.117
yes	214 (60.5)	121 (34.2)	19 (5.4)		
If yes, what is this disease?					
Kc				14.1	0.029
Dry eye	6 (31.6)	11 (57.9)	2 (10.5)		
Myope/hypermetropia	4 (100)	0 (0.0)	0 (0.0)		
	204 (61.6)	110 (33.2)	17 (5.1)		
Family history of Kc					
No	296 (64.8)	140 (30.6)	21 (4.6)	4.6	0.1
Yes	23 (48.9)	21 (44.7)	3 (6.4)		
Source of hearing about KC					
The doctor	16 (37.2)	25 (58.1)	2 (4.7)	70.42	<0.001
Readings and lectures	42 (45.7)	37 (40.2)	13 (14.1)		
Friends and relative	28 (54.9)	18 (35.3)	5 (9.8)		
Internet and social media	33 (55)	23 (38.3)	4 (6.7)		
Do you rub your eyes?					
no	78 (63.9)	34 (27.9)	10 (8.2)	4.83	0.089
yes	241 (63.1)	127 (33.2)	14 (3.7)		

Figure 3. Relationship between knowledge level about KC and participants' residence



N.B.: ( $\chi^2=16.16$ , p-value=0.04)

Figure 4. Relationship between knowledge level about KC and previously hearing about KC



N.B.: ( $\chi^2=56.89$ , p-value=<0.001)



## Discussion

This study aimed to assess the awareness level of keratoconus and its relationship with eye rubbing in the Saudi population. The identification and risk factors of KC at an early stage can lead to a better prognosis. Consequently, a lack of knowledge among the population adversely affects the early diagnosis and management of KC.

This study found that 48.8% of the participants had heard about KC and only 21.4% of them correctly defined the disorder as thinning of the cornea. In a previous study study, 42.2% of the participants had heard about KC and 34.3% correctly defined the disorder (23).

Of our participants, 5.4%, 5.2%, 5.4% and 28.6% reported that eye glasses, contact lens, eye drops and surgery are methods of treatment. In comparison to a previous Saudi study surgical intervention was mentioned as a way of management for KC by 61.8% of the participants, 46.6% reported that wearing glasses limits KC progression, 49.2% reported eye glass or lenses with surgery and 42% said that they don't know about management methods.

The most obvious finding to reveal from the analysis is that the level of awareness about KC was poor in two thirds of the surveyed adult population of Saudi Arabia and only one-third knew that eye rubbing may lead to keratoconus. Similar findings were reported in the urban community in Saudi Arabia with significantly poor knowledge about specific eye diseases (23, 24). Only 4.8% of the participants in this work had a good level of knowledge regarding KC. While, in the previously mentioned Saudi study, the good awareness was detected among 18.7% of the participants (23).

In the present study, most of the participants (75.8%) were rubbing their eyes and for most of them (40.9%) the cause of rubbing was eye itching. The most frequently reported risk factors to develop KC were family history and eye rubbing. However, other studies found that KC has a multifactorial etiology with a strong genetic predisposition and several genomic loci and genes have been identified in this regard (24).

The results of this study do not show any significant relationship between knowledge level about KC and the subjects' characteristics, having an underlying atopic or eye disease, family history of KC or eye rubbing. This outcome is contrary to that found in a previous study (18). Frequent complications of untreated KC are myopia, loss of vision and in this study 49.5% of the participants reported correctly that KC is related to allergy and myopia.

The awareness about management was less compared to the knowledge about causes. The source of knowledge about KC was mainly through lectures and reading about it and mass media, social media and interaction with health personnel were not the main sources of information. This disagrees with a previous Saudi study, where the main sources of information were family and friends, the internet and health care workers (23).

The expected lifetime cost of surgical treatment for KC continues to be a significant burden on the health-care system (27,28). And the treatment of KCN is determined by the stage of the disease and its progression. The earlier onset, steeper cornea, vernal keratoconjunctivitis, and a history of eye rubbing are all risk factors that increase the need for keratoplasty in the affected subject (29).

## Limitations

In this study, we faced several limitations regarding the distributed survey through different channels of social media. One of them was that the survey might not have been distributed enough to cover all the different social classes of the population. In addition, the use of a self-reported questionnaire could have recall bias.

## Conclusion

This study found that only 4.8% of the participants had a good knowledge about KC, while those who had poor and fair knowledge were 63.3% and 31.9% of the participants. Saudi public awareness about KC was found to be a poor matter that calls for health education programs to raise the public awareness, and directed to all the Saudi community.

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