



## **The Level of Keratoconus Awareness among the Saudi Population in Riyadh**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Authors TA, SA, SAM, FA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. All Authors managed the analyses of the study and managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aims:** This study aims to reveal misconceptions about keratoconus, to assess the level of knowledge among Saudi nationals and to compare the level of awareness of keratoconus between affected and unaffected individuals.

**Methodology:** A cross-sectional study was conducted through an online survey on a study population that consisted of Saudi nationals over the age of 18 from November until December 2020 in Riyadh, Saudi Arabia to assess the level of knowledge of keratoconus among the Saudi population.

**Results:** Three hundred and ten responses were obtained, the age range of the participants was between 18 to 50 years old of which 182 were females and 128 were males. Thirty percent of participants stated that they had acquired their knowledge of keratoconus from the internet, while 29% stated that they had no knowledge of keratoconus at all. The majority of the sample (38.4%) had a high level of knowledge about keratoconus, 31.3% had a moderate level of knowledge and 30.3% had a low level of knowledge. A significant correlation between the level of knowledge and the diagnosis of keratoconus was found, in which keratoconus patients had a higher level of

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knowledge (44.2%) ( $p$  value < .05). Moreover, males (60.1%) had a higher level of awareness compared to females (23.1%) ( $p$  value < .05). Age had no significant effect on the level of knowledge ( $p$  value > .05).

**Conclusion:** The level of knowledge about keratoconus among the Saudi population in Riyadh is moderate to high. Keratoconus patients had a higher level of knowledge compared to unaffected participants. We recommend further assessment of the level of knowledge about keratoconus with a larger sample size in different provinces of the Kingdom of Saudi Arabia.

*Keywords: Awareness; keratoconus; level, riyadh.*

## 1. INTRODUCTION

The term keratoconus is derived from the Greek language, in which kerato stands for cornea and konos stands for cone. Keratoconus is an eye disorder that causes central thinning and forward bulging of the cornea in a cone-shaped fashion, leading to myopia, irregular astigmatism, and visual impairment [1]. It is believed that genetics and environmental factors play a role in the etiology and progression of keratoconus [2]. The pathophysiology is unknown; however, the relatively high prevalence of patients with a positive family history deduces the involvement of a hereditary component in its pathogenesis [3] and there is strong evidence that genetic predisposition to KC plays a role [4]

Keratoconus first appears in adolescence and young adulthood and therefore has an impact on patients during their most productive years. It usually presents with frequent glasses or contact lens prescription changes, reduced and fluctuating vision with one-directional distortion of images, corneal astigmatism, and increasing higher order aberrations in the advanced stages of the disease [5,6].

The signs and symptoms of keratoconus are variable despite the prevalence that increases with the progression of the disease [6]. It is most commonly unilateral, but a study in the United States has reported that half of keratoconus cases progress to the other eye within 16 years of diagnosis [5].

The extent of the condition ranges greatly, from mild to moderate at early stages to extreme progressive conical protrusion and vision impairment that necessitates corneal transplantation [7].

The management of keratoconus relies on the severity of the disease. It is initially treated with spectacles, but as the disease progresses, that rapidly becomes insufficient. The next step of

treatment is usually by the prescription of hard contact lenses [6]. More novel invasive treatment options include corneal collagen cross-linking (CXL), which is an approach used to modify the corneal stroma. It is effective in delaying disease progression, reducing corneal ectasia, and increasing corneal rigidity in advanced cases of keratoconus. Another invasive treatment option is corneal transplantation or keratoplasty in patients that show inadequate vision correction with other methods of treatment [5]. Early detection and treatment improve the prognosis in KC [8] because it is generally linked to a negative effect on the patient's quality of life [9].

Patients' awareness of the nature, progression and complications of keratoconus is vital as it sheds light on some unhealthy daily habits that may worsen their condition and educates them on the prognosis of the disease. For example, constant eye rubbing, which is usually due to atopy, can increase the risk of disease progression and secondary corneal scarring. A rare but important complication patients must also be aware of is acute corneal hydrops, which is the sudden edema of the cornea and which usually reflects the advanced state of the disease.

As the incidence of keratoconus is high in our country [10], This study aims to reveal and correct misconceptions about keratoconus, to assess the level of knowledge among the Saudi population and to compare the level of awareness of keratoconus between affected and unaffected individuals.

## 2. MATERIALS AND METHODS

A cross-sectional study was conducted through an online survey distributed on social media platforms such as Twitter and Telegram, for a period of eight weeks starting from November until December 2020. The inclusion criteria consisted of Saudi males and females with or without keratoconus based on their answers,

aged between 18-50 years old living in Riyadh, Saudi Arabia. We asked patients with keratoconus about the history and the diagnosis of their conditions. Those who did not meet this criterion or complete the survey were excluded.

A self-administered questionnaire was used for data collection to determine the level of awareness and to identify factors that affect the participant's knowledge and attitude towards keratoconus. The questionnaire was pre-tested by a pilot study on ten random individuals to assure comprehension and ease of administration and to determine the time needed to fill the questionnaire. Final adjustments were made after the pilot had been reviewed.

### 2.1 Sample Size and Technique

The sample size was calculated using OpenEpi v.3 (Mini & Nobili, 2017) and was found to be 114 participants, based on the following parameters: a confidence level of 95% and a power of 80% with an 8% prevalence of awareness among patients from a previous study. A simple random sampling was achieved by distributing the survey amongst different Telegram and Twitter accounts and messaging groups. The participants' demographics such as their age and nationality

were obtained initially through the questionnaire in order to exclude ineligible individuals.

### 2.2 Statistical Analysis

The data was analyzed using the Statistical Package for Social Sciences Program (IBM SPSS Statistics, Version 24). Descriptive statistics were used to describe the study population's demographic data. The Chi-square test was used to determine associations between categorical variables. Multiple logistic regression tests were conducted to examine the factors that are associated with the participants' knowledge about keratoconus. A  $p$  value of less than .05 was considered statistically significant.

## 3. RESULTS

A total of 310 participants between the ages of 18-50 years old completed the survey. The majority were over the age of 35 (44.5%). The study sample was comprised of 182 females (58.7%) and 128 males (41.3%). More than half of the participants lived in the central region of Riyadh (61.3%). Furthermore, it was found that 66.5% of the sample were married, 62.9% were employees, and 69.4% had a university level of education (Table 1).

**Table 1. Demographic factors**

		Items	Frequency	Percent	
<b>Age</b>		18-22 years	28	9.0	
		23-27 years	47	15.2	
		28-32 years	45	14.5	
		33-35 years	52	16.8	
		35-50 years	138	44.5	
<b>Gender</b>			Male	128	41.3
			Female	182	58.7
<b>Residency</b>	Northern	12	3.9		
	Southern	52	16.8		
	Eastern	38	12.3		
	Western	18	5.8		
	Central region	190	61.3		
<b>Marital status</b>	single	104	33.5		
	married	206	66.5		
<b>Profession</b>			Student	48	15.5
	Employee	195	62.9		
	Retired	12	3.9		
	Unemployed	55	17.7		
<b>Education</b>	High school or less	54	17.4		
	University	215	69.4		
	Postgraduate	41	13.2		

According to Fig. 1, participants mostly acquired their knowledge of keratoconus from the internet (30.6%), ophthalmologists (29.4%), family members (7.4%), health professionals (2.9%) or magazines (0.6%). However, 29% of the sample indicated that they had no previous knowledge regarding keratoconus at all.

Overall, 156 participants (50.3%) had keratoconus of which 60 (19.4%) were diagnosed 15-20 years ago and 51 (16.5%) were diagnosed 25-30 years ago. In addition, 126 participants indicated that they had no family history of keratoconus (59.4%) (Table 2).

Out of the total participants, 38.4% had a high level of knowledge about keratoconus (nine or more correct answers), 31.3% had a moderate

level of knowledge (six to nine correct answers) and 30.3% had a poor level of knowledge (five or less correct answers) (Fig. 2).

More than half of the total participants were aware of the definition (55.2%) and causative factors (57.1%) of keratoconus. Around 38% and 41% of participants stated that the use of contact lenses and frequent use of electronic devices can negatively affect keratoconus, respectively. Moreover, 249 participants concurred that patients needed to visit an ophthalmologist regularly. A hundred and eighty-one participants (58.4%) reported that lenses and glasses are the first treatment options used in keratoconus, while only 32 participants knew that corneal ring implantation is the best treatment option for advanced stages of keratoconus (10.3%)

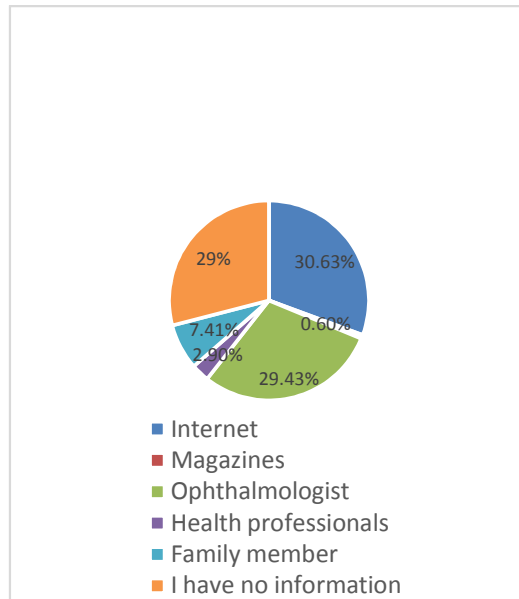
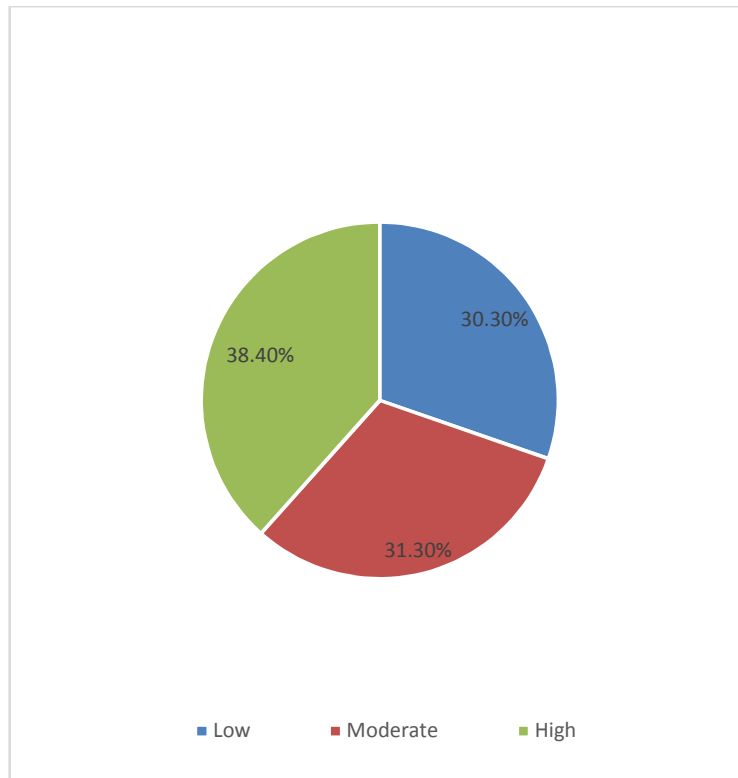


Fig. 1. Information source about keratoconus

Table 2. Prevalence of Keratoconus among participants

	Items	Frequency	Percent
Have you ever been diagnosed with keratoconus?	yes	156	50.3
	no	154	49.7
Do you have a family member with keratoconus?	yes	126	40.6
	no	184	59.4
How long have you been diagnosed with keratoconus?	10-15 years	25	8.1
	15-20 years	60	19.4
	25-30 years	51	16.5
	30-35 years	19	6.1
	More than 35 years	12	3.9



**Fig. 2. Level of knowledge about keratoconus**

Keratoconus patients had a significantly higher level of knowledge (44.2%) compared to unaffected participants (32.4%) ( $p$  value = .024). Those who had a family member with keratoconus had a higher level of knowledge (43.7%) compared to those with no family history (34.8%) ( $p$  value = .021). Furthermore, males (60.2%) were more aware of keratoconus compared to females (23.1%) ( $p$  value = .00). Age had no significant effect on the level of knowledge ( $p$  value = .38) (Table 3).

#### 4. DISCUSSION

This study aims to identify the misconceptions related to keratoconus, to assess the level of knowledge of keratoconus among the Saudi population in Riyadh as well as to compare the level of awareness between affected and unaffected individuals. An online questionnaire was distributed in which we received 310 responses.

**Table 3. Relation between the level of knowledge and the following**

		Low	Moderate	High	p- value
<b>Have you been diagnosed with keratoconus?</b>	yes	25.6 %	30.2 %	44.2 %	0.024*
	no	35.1 %	32.5%	32.4 %	
<b>Is there a family member with keratoconus?</b>	yes	31.7 %	24.6 %	43.7 %	0.031*
	no	29.3 %	35.9 %	34.8 %	
<b>Gender</b>	male	14.8 %	25 %	60.2 %	0.000*
	female	41.2 %	35.7 %	23.1 %	
<b>Age</b>	18-22 years	42.8 %	35.7 %	21.5 %	0.380
	23-27 years	66 %	21.3 %	12.7 %	
	28-32 years	22.2 %	27.8 %	50 %	
	33-35 years	21.2 %	30.7 %	48.1 %	
	35-50 years	30.4 %	31.8 %	37.8 %	

In this study, 29% of the sample reported that they had no previous knowledge of keratoconus, which was lower than what was reported in a similar study conducted on non-medical students in Abha, Saudi Arabia (57.5%) [11]. Approximately 45% of our participants had no knowledge of keratoconus's definition while 57% were aware that genetics contributed to its development; in contrast, Al-Amri et al. (2020) reported that 60.6% of students did not know the definition of keratoconus and 21.4% believed that keratoconus has a genetic cause [12].

Our study showed a high level of awareness of keratoconus (38.4%) (answered nine or more questions *correctly*) among participants, which generally indicates a good level of knowledge among the total sample. Furthermore, there was a significant relationship between the level of knowledge and keratoconus patients, as they demonstrated greater awareness. In addition, having a family member affected with keratoconus was also related to a higher level of knowledge. This is in concordance with the assumption that keratoconus patients and those with a family history may tend to learn more about the disease through research and ophthalmology visits.

This study showed that there was a statistically significant difference between genders in which males had a higher level of knowledge compared to females. This is in contrast to the study by Al-Amri et al. (2020) which demonstrated that there was no difference in the level of knowledge between males and females [11]. Moreover, our results indicate that age had no significant effect on the level of knowledge. Al-Amri et al. (2020) found that younger age was associated with a poor level of knowledge about keratoconus. On the contrary, a study conducted in Nigeria showed that older participants had a higher level of knowledge about ophthalmic disorders compared to young people [11,12]. Some studies show that females and younger individuals generally had lower levels of knowledge about eye conditions [13,14]. The older population is usually at a higher risk for many diseases, urging them to collect information and to visit health professionals more frequently. However, keratoconus is a condition that mainly affects young adolescents and, therefore, it may not be of much importance to older people. The majority of our sample was over the age of 35; this may explain why our study did not reveal any significant difference in the level of knowledge among different age groups.

Our study is considered to be the first to assess the level of knowledge of keratoconus among the population in Riyadh, Saudi Arabia. Our study limitations include the uneven distribution of demographic factors as most of our sample were of older age, had a university level of education, and were from the central region of Riyadh. Therefore, this might affect the results if generalized on the entire province and might explain the higher level of knowledge among our participants in comparison to other studies. This study was conducted in the Riyadh province only; therefore, the results can not be generalized to the entirety of Saudi Arabia.

## 5. CONCLUSION

This study showed that the Saudi population in Riyadh, particularly those diagnosed with keratoconus, have a moderate-to-high level of knowledge about keratoconus. Further assessment of the awareness level with a larger sample size in other provinces of the Kingdom of Saudi Arabia is recommended. More education is required to improve the outcomes of keratoconus and to decrease the need for invasive treatments such as corneal transplants.

## CONSENT AND ETHICAL APPROVAL

The study was approved by the Institutional Review Board of Imam Mohammad Ibn Saud Islamic University. Written informed consent was obtained from all participants.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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