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Web Based Survey of Adult Population of West and Central Saudi Arabia about Cause and Management of Keratoconus

Sultan Alzuhairy[1], Raghad Hamza[2], Moaz Alharbi[3], Mohammed Alqadi[4], Atheer Alharthi[2], Khames Torki Alzahrani[5], Ali Hassan Alshehri[2]

[1]Department of Ophthalmology, Qassim University, Buraidah, Saudi Arabia
[2]Medical College, Taif University, Taif, Saudi Arabia
[3]Faculty of Health Sciences, King Abdul Aziz University, Jeddah, Saudi Arabia
[4]Medical College, Najran University, Najran, Saudi Arabia
[5]Ministry of Health, Jeddah, Saudi Arabia
Email: dr.sulzuh@gmail.com

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Abstract

Background: Keratoconus (KC) causes visual disability in young adults. To improve its early detection and compliance, improving the awareness of patients and their relatives is crucial. We present the level of awareness about KC among the adult population of western Saudi Arabia and its determinants. **Methods:** This web-based survey was carried out from June to August 2020 in urban and semi-urban areas in western Saudi Arabia. Demographic and eye ailment profiles were collected. To generate responses on the presentation, causes, management and prevention of KC, a five-point Likert scale was used. The logit values were calculated and graded into good and poor awareness. Awareness was associated with other determinants. **Results:** We surveyed 420 Saudi adults. The median logit score of awareness about KC among participants was 2.86 (inter quartile range (IQR) 0.86; 2.95). The median score of knowledge about the causes and presentation of KC was 2.86 (IQR 1.1; 2.86) and for management, it was 0.00 (IQR 0.00; 0.18). The level of awareness was good in 286 participants (68.1%) and poor in 134 (31.9%). Residents of major cities ($P < 0.04$) and women ($P < 0.001$) had significantly better awareness about KC. Knowledge about KC mainly came from friends and reading about it. The mass media and social media were rarely used to seek knowledge. **Conclusions:** Awareness about the presentation, causes and management of KC was good in two-thirds of adults but with some variation. Strategies to involve the community and stress health education need to be urgently implemented. Campaigns should target the male and semi-urban population in western Saudi Arabia.

Keywords

Keratoconus, Public, Saudi Arabia, Awareness

1. Introduction

Keratoconus (KC) is an ectatic disease characterized by the mainly bilateral but occasionally unilateral progressive thinning and protrusion of the cornea, resulting in irregular astigmatism and sometimes scarring and thereby leading to significant visual impairment [1]. Worldwide, the annual incidence of KC ranges from 1 to 50 patients per 100,000 [2] [3]. In Saudi Arabia, regional studies have reviewed the epidemiology of KC and its management outcomes [4] [5]. In Hail area, it was 4 per 100,000 adult population [4]. In Asir province, it was 20 per 100,000 population [5]. Regional variation of KC incidence is noted in a large country [6]. The rate of KC in the Saudi population is higher than that reported in other parts of the world [7] [8]. There is wide variation in its modes of management depending on its stage at presentation and the resources available [9] [10] [11]. The inherent pathology and rate of progression also determine the change from non-invasive to surgical management of eyes with KC [12].

High quality eye services are available free of charge to the Saudi population. To further reduce visual disabilities, strategies such as health promotion, local organ donation and improved compliance should be planned. Both service providers and eye patients are stakeholders in this task. KC management includes periodic eye checkups, prescriptions for spectacles and contact lenses, collagen cross-linkage, refractive surgery and keratoplasty [13]. An eye bank at a tertiary eye center in central Saudi Arabia provides donor material for keratoplasty to different institutions.

The western region, one of five regions in Saudi Arabia, has large cities such as Jeddah, Makah and Medina as well as many small but well-developed semi-urban areas. The total population of this region is around 9.5 million. Nearly 187 ophthalmologists provide secondary and tertiary eye care to this population [14].

To the best of our knowledge, there is limited information on awareness among the general Saudi population about KC, which is a disease mainly affecting young adults in their productive life. To provide effective and timely intervention for KC, it is essential to support the population and encourage KC patients to comply with eye professionals' advice. We discuss the awareness of KC of adults in western Saudi Arabia as well as its prevention and management and the source of their information.

2. Methods

The ethical and research committee of our university approved this survey-based cross-sectional study. Given the Covid-19 pandemic, the responses of participants were collected using Google between June and August 2020. Written in-

formed consent was obtained. Adults aged 18 years and older agreeing to participate were included. They were approached through social media, personal contacts and WhatsApp groups. Those not consenting to participate were requested to leave the survey. Participants were requested to complete all the survey questions. The questionnaire was prepared in the local language. To ensure translation consistency, reverse translation and a pilot of the survey tool was undertaken. The tenets of the Helsinki Declaration were strictly abided by during all stages of the research.

We assumed that the level of awareness among the five million Saudi adults in western KSA was 57% [15]. To achieve a 95% confidence interval and 7% acceptable error margin, with a study design effect of 2, we needed at least 380 participants. To compensate for incomplete responses, we increased the sample by 10%. We used Open Epi software to calculate the sample for this cross-sectional study [16].

Five medical students were involved in the study. They approached the adult population in three major cities and semi-urban areas using social media to encourage them to participate and then sent a link for the web-based questionnaire.

The demographic information collected included age group, sex, occupation, literacy rate and social status. Information on KC among participants and relatives, other eye medication, surgeries and systemic ailments were collected. Residents of Makkah, Medina and Jeddah were considered urban and the rest were grouped as semi-urban dwellers.

Sixteen questions were related to KC grouped as 1) KC as a disease (11 questions), 2) treatment of the condition (4) and 3) prevention of KC (1) (Appendix: 1). We had undertaken quality control measures like pilot of the measurement tool, reverse translation, monitoring of the data collection. We also performed Cronbach alpha test (>0.75) to study internal reliability of the questionnaire for awareness. Participants responded using a five-point Likert scale [17]. The scores for correct responses compared with the gold standard (three consultant replies) were awarded as follows: −2.63 for full disagreement, −1.1 for disagreement, 0 for neutral, 0.09 for agreement and 2.83 for full agreement. The logit values of each participant were summed to determine the overall awareness score. This was further graded as good and poor depending on whether the score was 50% or more of the correct score. The good and poor awareness groups were correlated to different demographic and ocular ailments.

The collected data were entered into a Microsoft Excel spreadsheet. After cleaning the data and undertaking consistency checks, they were transferred into the Statistical Package for Social Studies (SPSS 25) (IBM, NY, USA). Univariate analysis was performed using the parametric method. The continuous outcome variable (logit score of awareness) was plotted to study the distribution. For normally distributed variables, the mean and standard deviation were calculated. For non-normal variables, the median and inter quartile range (IQR) were estimated. The qualitative data were presented as the number and percentage. The comparison of good and poor awareness was associated with the determinants.

Two-sided P values were calculated for statistical significance. A P value of <0.05 was considered statistically significant.

3. Results

We surveyed 420 adult residents of western Saudi Arabia. Their profile is given in Table 1. There was an adequate distribution of participants by age group and gender. The proportion of urban participants was more than semi-urban participants. Three forth of the participants were college graduates and employed. The ocular profile of participants is given in Table 2. Nearly one-third were using spectacles for distance viewing. One in eight participants is using contact lenses and a similar proportion had undergone refractive surgery. Nine participants were suffering from KC, representing a prevalence of 2.1% (95% confidence interval 0.7; 3.5). Twenty-four (5.7%) had a relative who had KC.

The source of their information included friends (42; 9%), social media (49; 11.7%), relatives with KC (28; 6.7%), lectures (14; 3.3%) and reading (52; 12.4%). The median logit score of awareness about KC among participants was 2.86 (IQR 0.86; 2.95) Figure 1.

The logit score of three sub-groups of awareness cause and presentation of KC, management and prevention were also analyzed separately. The median logit score of knowledge about cause and presentation of KC among adult population of western Saudi Arabia was 2.86 (IQR 1.1; 2.86). The median logit score of knowledge about management of KC among adult population of western Saudi Arabia was 0.00 (IQR 0.00; 0.18). The median logit score of knowledge about prevention of KC was 0.00 (IQR 0.00; 0.00)

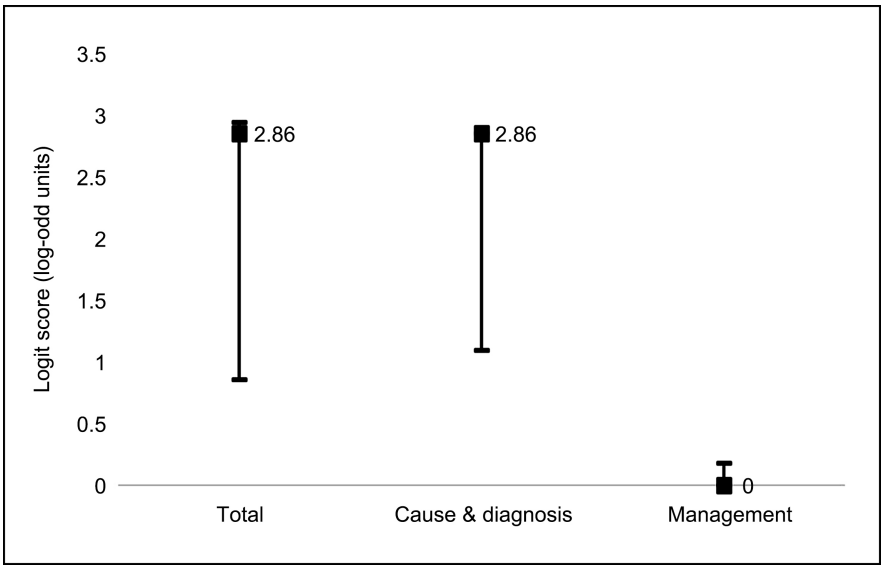

Figure 1. Awareness score of keratoconus among adult population of Western Saudi Arabia. The logit score of all questions related to awareness, logit score of awareness about causes and diagnosis and score about knowledge of management of keratoconus is given in X axis. Vertical bar shows value of median logit score upper end of bar is 75% quartile while lower end of the bar depicts 25% quartile value.

Table 1. Profile of surveyed adult Saudi population of Western Saudi Arabia for awareness about keratoconus.

		Number	Percentage
Age group	18 to 25	98	23.3
	26 to 30	65	15.5
	31 to 40	106	25.2
	More than 40	151	36.0
Gender	Male	202	48.1
	Female	218	51.9
Residence	Makkah (city)	39	9.3
	Jeddah (city)	143	34.0
	Madina (city)	34	8.1
	Taif (semi-urban)	114	27.1
	Yanbu (semi-urban)	60	14.2
	Khulayas (semi-urban)	30	7.1
Literacy	Elementary	2	0.5
	Middle school	3	0.7
	High school	77	18.3
	University	308	73.3
	High education	30	7.1
Occupation	Student	79	18.8
	Employed	206	49.0
	Housewife	33	7.9
	Retired	66	15.7
	Unemployed	36	8.6
Social status	Married	255	60.7
	Single	148	35.2
	Divorced	10	2.4
	Widow	7	1.7

The level of awareness was good in 286 (68.1%) and poor in poor in 134 (31.9%) participants. Of the former, only 6 (1.4%) participants had an excellent grade of awareness.

The good and poor grades of awareness of participants were associated with different independent variables (Table 3). Female gender ($P < 0.001$) and residents of major cities ($P = 0.03$) were significantly associated to good awareness about KC.

Table 2. Ocular profile of adult Saudi population of Western Saudi Arabia participating in survey for awareness about keratoconus.

	Number	Percentage
Using spectacles for distance viewing	136	32.4
Using contact lens for viewing	55	13.1
Refractive surgery done	51	12.1
Eye allergy	105	25
Taking eye medication	19	4.5
Other Eye surgery in past	16	3.8
Systemic health ailment	96	22.9
Diagnosed with keratoconus	9	2.1
Keratoconus in other family member	24	5.7

Table 3. Factors associated with good and poor awareness about keratoconus among surveyed adult population of western Saudi Arabia.

		Good awareness of KC (n = 286)		Poor awareness of KC (n = 134)		Validity
Gender	Male	131	45.8	87	64.9	OR = 2.2 (95% CI 1.4; 3.3) P < 0.001
	Female	155	54.2	47	35.1	
Age group	18 to 30	118	41.3	45	33.6	OR = 0.7 (95% CI 0.5; 1.1) P = 0.1
	31 and more	168	58.7	89	66.4	
Residence	Major city	157	54.9	59	44.0	OR = 1.5 (95% CI 1.0; 2.3) P = 0.04
	Semi urban	129	45.1	75	56.0	
Occupation	Students	51	17.8	28	20.9	$\chi^2 = 0.1$ Df = 4 P = 0.8
	Housewife	22	7.7	11	8.2	
	Employed	146	51.0	60	44.8	
	Retired	43	15.0	23	17.2	
	Unemployed	24	8.4	12	9.0	
Literacy	Not school graduates	58	20.3	24	17.9	OR = 0.85 (95% CI 0.5; 1.5) P = 0.6
	College & higher	228	79.7	110	82.1	
Social status	Married	167	58.4	88	65.7	OR = 0.7 (95% CI 0.5; 1.1) P = 0.2
	Not married/single	119	41.6	46	34.3	
KC status	With KC in family	6	2.1	3	2.2	OR = 0.9 (95% CI 0.2; 3.8) P = 0.9
	No KC in family	280	97.9	131	97.8	
Eye allergy	Yes	67	23.4	38	28.4	OR = 0.8 (95% CI 0.5; 1.2) P = 0.3
	No	219	76.6	96	71.6	
Eye surgery	Yes	9	3.1	7	5.2	OR = 0.6 (95% CI 0.2; 1.6) P = 0.3
	No	277	96.9	127	94.8	

4. Discussion

The level of awareness about KC was good in two third of the surveyed adult population of Western Saudi Arabia. One in seventeen surveyed participants had KC in family. Females and residents of the major cities had better awareness about KC compared to males and residents of semi-urban population. The awareness about prevention and management were less compared to the knowledge about causes and presentation. The source of knowledge about KC was mainly through friends and reading about it. Mass media, social media and interaction with health personnel were not the main source of information about KC.

This is perhaps the first such survey in Saudi Arabia inquiring adult Saudi population about keratoconus. There was a good representation of both genders, age groups and urban and semi-urban population. There seems to be a strong need for health education using population preferred mode of delivering these messages. The score system used in the present study for evaluating five graded response seems to be better than qualitative method of describing the responses of participants. This was because there was a wide variation in non-response for individual questions related to awareness.

Two thirds of participants had a good level of awareness about KC in present study. This matched with the level of awareness among non-medical students of Abha province of Saudi Arabia [15]. A study to inquire about blinding eye diseases in Saudi Arabia had an exceptionally low level of awareness among Saudi population [18]. The knowledge about common eye diseases among adult Saudi resident of Riyadh was high [19]. It seems that KC; a less known than other common eye diseases but more prevalent eye ailment in western Saudi Arabia needs more awareness for its early detection, better compliance of the eye professionals' advice.

The rate of KC in participants of present study and their family was 5.7%. This was close to 4.8% in pediatric age-group noted in Saudi Arabia [20]. This is much higher than the global incidence documented suggesting more stress on public health approach to deal with visual disabilities due to KC including health promotion.

Health promotion to improve awareness among patients, their relatives and population at large has been advocated in Brazil and then globally by Violet June [21]. This campaign included education for avoiding proven risk factors like frequent and vigorous rubbing of eyelids. It also stresses on two hit theory suggesting genetic factor and rubbing precipitating development of keratoconus [22].

There was wide difference in level of awareness among urban (city dwellers) compared to other participants in present study. This was also noted by Dondana *et al.* [23] in South India. Even in northern province of Saudi Arabia with less urban population, the level of knowledge about eye diseases was low [24]. The study stresses to have better reach of health promotion campaigns to the popula-

tion beyond major cities of Saudi Arabia.

In our study, females had better knowledge than males about KC. This was in contrast to the less awareness about blinding eye diseases in females compared to males noted in the developing country like Nepal and Pakistan [25] [26]. The knowledge about hypertension and its health effect was better in Saudi females compared to males [27]. Even the knowledge about dry eye disease and cataract among Jordanian females was better than males [28]. It seems that better education in females of Arab countries has made adult females more conscious about knowledge of important eye diseases.

There were a few limitations in the present study. Use of web-based survey tool during Covid Pandemic perhaps could have resulted in a bias population that was smartphone computer users in the study area. Therefore, extrapolating the study results to the entire population especially adult semi-urban population not well versed with digital knowledge seeking tools should be done with caution.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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