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## Awareness of ocular complications associated with the use of cosmetic contact lenses from unlicensed vendors among Taif city, Saudi Arabia

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**ABSTRACT**

**Background:** The usage of CLs has grown significantly and it is only expected to grow. However, CLs' wearers may have risk of eye infections if they fail to wear, clean, disinfect and store their CLs as directed. To assess awareness of ocular complications associated with the use of cosmetic contact lenses from unlicensed vendors and its correlation with age, gender and education level among Taif city, Saudi Arabia. **Methods:** Cross sectional study conducted on the general population of Taif City, Saudi Arabia. An electronic questionnaire was used for data collection. The study questionnaire was uploaded online using social media platforms by the researcher and their relatives in the Taif region till no more new answers were obtained. **Results:** Twenty% of participants had previously worn contact lenses and 29.5% were currently wearing them. In 31.7% and 19.4% of cases with refractive error, contact lens use was cited as cosmetic. 13.4% of study participants reported contact lens difficulties and 55.1% of them quit wearing them as a result. When asked if they were aware of any contact lens-related complications, 23.9% said that dry eye was a frequent problem. 18.0% of people complained of redness, 16.4% itching, 11.9% discomfort, 11.7% blurred vision, 12.2% eye burning, 9.9% eye stings, 11.6% corneal infection/inflammation and 8.7% of people complained of scratches on the surface of their eyes. **Conclusion:** Users of CLs lacked sufficient training and experience. Although many of them purchased contact lenses without a prescription for cosmetic reasons, their knowledge of and attitudes concerning contact lenses were acceptable.

**Keywords:** Awareness, ocular complications, cosmetic contact lenses, unlicensed vendors, Taif city, Saudi Arabia.

## 1. INTRODUCTION

(CCL) Cosmetic contact lenses are popular among teenagers and were initially introduced in the United-States in the early 1980s, but improper use can cause eye damage (Berenson et al., 2019). The international contact lens marketplace is predicted to increase at a 6.7 percent annual rate to \$12,476.3 million by 2020. Contact lenses have enhanced people's quality of life by not only correcting refractive errors but also by giving them a better appearance and allowing them to do more things. Unfortunately, contact lenses might produce dissatisfying issues for users (Alipour et al., 2017). For that, it is important to provide proper instructions to cosmetic contact lens wearers. Users of cosmetic contact lenses should see an ophthalmologist on a frequent basis. In addition, to avoid issues caused by substandard products, illegal production and sales of cosmetic contact lenses must be strictly regulated (Park et al., 2009). Unfortunately, failing to follow medical instructions can lead to unanticipated complications such as conjunctival hyperemia, pain and papillae formation, all of which require medical attention and basic symptomatic therapy. Additionally, the most significant effect is blindness, which occurs as a result of microbial keratitis and endophthalmitis (Li et al., 2018). Contact lens-related complications are increasing and the prevalence estimates ranging from 20.58 percent (Nagachandrika et al., 2011) to 50 percent (Forister et al., 2009), about one-third of wearers polled in the USA admitting having needed emergency eye care because to a red or sore eye (Cope et al., 2001).

Cosmetic lenses are a lens-related microbial keratitis (MK) risk factor since they are rarely prescribed by an eye care professional and hence people have less understanding of correct lens care. It has been discovered that the type of contact lens disinfection system utilized affects the risk of MK (Zimmerman et al., 2016). Additionally, In Japan, a study was done in 2018. The paper showed that the microbiological tests were positive in 73.0%. Microbial keratitis was the main factor in serious contact lens-related ocular complications (Shigeyasu et al., 2022). In Kenya, a study was conducted to investigate the prevalence of contact lens use and knowledge of contact lenses showed extremely little knowledge about contact lenses. So, eye care practitioners should place a greater emphasis on contact lenses for therapeutic, cosmetic and refractive objectives (Edwards et al., 2014). A cross-sectional paper was conducted on patients with contact lens-induced corneal ulcers. The results showed Contact lens wearers have been recognized as having a higher risk of developing a corneal ulcer due to improper lens care and wear, as well as a lack of understanding about the significance of aftercare visits (Rasoulinejad et al., 2014; Basheikh et al., 2022).

In a retrospective review of all patients diagnosed with *Acanthamoeba* keratitis (AK) at the Sydney Eye Hospital Sydney, Australia, contact lens use was the most common probable predisposing factor. In addition, CL wearers' behaviour patterns were assessed. The most documented behaviour was water exposure, which was almost evenly shared between tap and swimming water (Hollhumer et al., 2020). A retrospective study was conducted in Egypt to assess the awareness level of patients with contact lens-related microbial keratitis (CLRMK). It was found that overnight use and unhealthy storage of contact lenses were associated with an increased incidence of CLRMK (Khater and El-Shorbagy, 2015). Another study measures the attitudes and knowledge among medical students of King Faisal University, Saudi Arabia. Although the majority of female undergraduates had a positive attitude toward contact lenses and overall good understanding, there was still inadequacy in knowledge when specific elements such as CL cleaning and CL use in active inflammation/infection were considered (Boqursain et al., 2021). A cross-sectional study regarding general public awareness about contact lens care in Saudi Arabia revealed that the level of awareness of the general public about contact lens care was satisfactory, with half of the participants having a good level of awareness (Abahussain et al., 2020).

A survey measures CL using awareness and habits among adult Saudis living in cities. The over-the-counter CL shoppers' users lacked the necessary knowledge and attitude towards CLs compared to prescribed CL users had much superior knowledge and practice. Those who use contact lenses for cosmetic purposes and obtain them without a prescription must pay special attention to health promotion in order to enhance their CL practice and reduce ocular issues (Alobaidan et al., 2018). Between April 14, 2017, and May 16, 2018, a study in Southeast Texas a survey to inquire about CCL knowledge and hygiene was used, revealed that the vast majority of CCL users did not exercise sufficient hygiene and were unaware of how to care for their lenses appropriately (Berenson et al., 2019). A cross-sectional study was done to determine the level of soft contact lens wear and care awareness & practice among female students at King Saud University. The majority of participants were aware of contact lens cleaning and hygiene practices, but the majority were not aware of contact lens case cleaning. As a result, all contact lens providers should improve their understanding of contact lens care in order to lower the prevalence of ocular issues among contact lens wearers (Maqsood and Algalban, 2018).

Although the studies indicate a low level of awareness and knowledge of cosmetic contact lens complications and practices, no study yet assessed the awareness of residents in Taif city regarding this problem. Our study objectives are to assess Taif

population's awareness and knowledge about cosmetic contact lens complications and practice and if there is a correlation with nationality, age, gender, social status, residency, education level, employment and income. And also, to assess if getting the complications from cosmetic contact lenses would limit their use in the future by the user or not. Our study aimsto assess Taif population practices and knowledge regarding ocularcomplications associated with the use of cosmeticcontactlenses, to assess the correlation between the knowledge and awareness regarding ocular complications associated with the use of cosmetic contact lenses with age, gender and education level andto assess the difference between the awareness of cosmetic and noncosmetic contact lens users of practices and knowledge regarding ocular complications associated with the use of contact-lenses.

## 2. SUBJECTS AND METHODS

### Study design

Random cross-sectional study among the general population of Taif City, Saudi Arabia. The paper was finished during the period from July 2021 to October, 2022.

### Sample size

The minimum sample size for this study has been decided according to Swinscow, as follows:  $n = Z^2 \times P \times Q/D^2$

Were, n: Calculated sample size

Z: The z-value for the selected level of confidence (1-  $\alpha$ ) = 1.96.

P: An estimated prevalence of having positive KAP towards neonatal sepsis

Q: (1 - 0.50) = 50%, i.e., 0.50

D: The maximum acceptable error = 0.05.

So, the calculated minimum sample size was:  $n = (1.96)^2 \times 0.50 \times 0.50 / (0.05)^2 = 384$

### Inclusion criteria

Males and females who used CLs for cosmetic and non-cosmetic purposes and who never used CLs, aged 18 years and above.

### Exclusion criteria

Those who are less than 18 years old or residing outside of Taif city.

### Data collection tool

An electronic questionnaire was used for data collection. The study questionnaire was constructed by the researchers after intensive literature review and consulting experts on the study issue till the final format was obtained. The study questionnaire included patients' demographic data, work data, data about the awareness of ocularcomplications associated with the use of cosmetic contactlenses from unlicensed vendors. The researcher and their family in the Taif region kept posting the study questionnaire online via social media platforms until no fresh responses were received.

### Pilot study

The researcher conducted a pilot study on 20 Saudi individuals. The pilot study helped in finalization of the study questionnaire and assessment of the reliability of its statements. Data collected within the pilot study were not be included in the main study.

### Ethical considerations

Prior to start of data collection, all necessary official approvals were secured from the research ethics committee of Taif University, southern Saudi Arabia, with letter number 43-773. All physicians were informed that their participation is optional. All collected data were kept confidential.

### Data entry and analysis

All collected data were coded and verified before data entry into a personal computer. Data entry and statistical analysis were conducted using the Statistical Package of Social Sciences (SPSS version 23). Descriptive statistics, (e.g., mean, frequency) were calculated. Frequency and per cent distribution was done for all variables. Crosstabulation was used to assess the distribution of patients' complaints of OSA and their biodemographic data. Tests of significance e.g., Chi-test was applied. P-values less than 0.05 were considered as statistically significant.

### 3. RESULTS

The study included 1693 participants, 58.7% of them were females and 41.3% were males. 68.3% of all participants were in the age group 18- 30 years old, 14.9% were between 31- 40 years old and 11.6% were 41- 50 years old. 63.1% of all participants had poor family income (less than 5000 S.R/ per month), 25.2% had moderate family income (5000- 15000 S.R/ per month) and only 11.7% had good family income (more than 15000 S.R/ per month). As for education, 70.3% of our sample had university education while 25% had secondary school education. Knowledge of determinants of contact lenses among study participants was illustrated in Table 4, 63.3% of participants reported that users should avoid sleeping with lenses in during naps or all night long, 54.6% reported the most of always washing the blindfold of the hand before putting on and removing the lenses, 59.8% generally avoid contact lenses, 55.5% avoid wearing contact lenses while swimming and 48.7% avoid rinsing the lenses with water.

**Table 1** Sociodemographic characteristics of participants (n=1693)

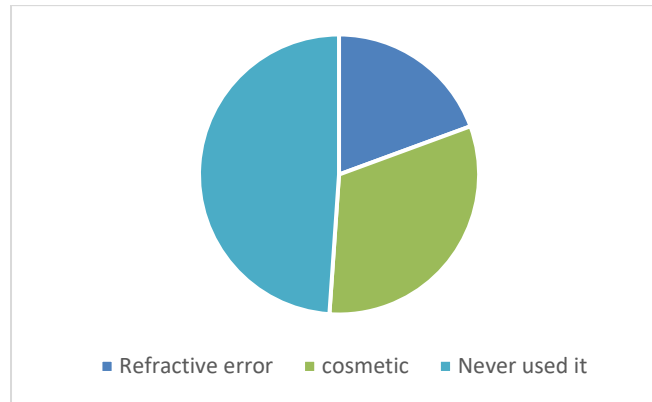
| Parameter       |                      | No.  | %    |
|-----------------|----------------------|------|------|
| Gender          | Male                 | 700  | 41.3 |
|                 | Female               | 993  | 58.7 |
| Age             | 18-30                | 1157 | 68.3 |
|                 | 31-40                | 252  | 14.9 |
|                 | 41-50                | 196  | 11.6 |
|                 | 51-60                | 70   | 4.1  |
|                 | More than 60         | 18   | 1.1  |
| Monthly income  | Less than 5000       | 1068 | 63.1 |
|                 | 5000 - 15000         | 427  | 25.2 |
|                 | More than 15000      | 198  | 11.7 |
| Education level | Primary              | 24   | 1.4  |
|                 | Preparatory          | 56   | 3.3  |
|                 | Secondary            | 423  | 25.0 |
|                 | University and above | 1190 | 70.3 |

As illustrated in (Table 2), 29.5% of participants were current users of contact lenses and 20.1% were former contact lenses users. Reasons for using contact lenses were reported as cosmetic in 31.7% and 19.4% refractive error. Duration of use of contact lenses was 1-5 years in 19.9% of participants and less than one year among 17.4% of participants. 58.1% of participants visit an ophthalmologist when necessary while 6.4% visit and ophthalmologist regularly (Figure 1). Complications from contact lenses were reported by 13.4% of study participants (55.1% of them stopped using it due to complications).

**Table 2** Use of contact lenses and its determinants among study participants (n=1693)

| Parameter                                 |                    | No. | %    |
|---|--------------------|-----|------|
| Current use of contact lenses             | current user       | 499 | 29.5 |
|   | former user        | 340 | 20.1 |
|   | Never used it      | 854 | 50.4 |
| Reasons for using contact lenses (CLs)    | Refractive error   | 329 | 19.4 |
|   | cosmetic           | 536 | 31.7 |
|   | Never used it      | 828 | 48.9 |
| Duration of use of contact lenses         | less than one year | 295 | 17.4 |
|   | 1 to 5 years       | 337 | 19.9 |
|   | 5 to 10 years      | 134 | 7.9  |
|   | More than 10 years | 74  | 4.4  |
|   | Never used it      | 853 | 50.4 |
| Frequency of visits to an ophthalmologist | If necessary       | 984 | 58.1 |
|   | irregularly        | 235 | 13.9 |

|                                   |           |      |      |
|-----------------------------------|-----------|------|------|
|                                   | Regularly | 109  | 6.4  |
|                                   | Start     | 365  | 21.6 |
| Complications from contact lenses | yes       | 227  | 13.4 |
|                                   | no        | 1466 | 86.6 |
| If yes, stopped using it          | yes       | 125  | 55.1 |
|                                   | no        | 102  | 44.9 |

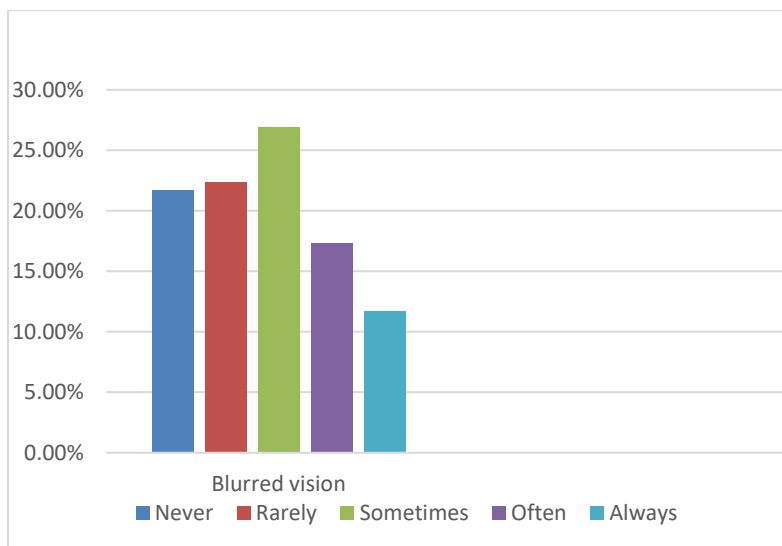


**Figure 1** Reasons of using contact lenses among participants (n=1693)

As for knowledge of complication associated with contact lenses use among study participants, (Table 3) show that 23.9% reported dry eye as a regular complication of wearing contact lenses, 18.0% reported redness, 16.4% itching, 11.9% discomfort, 11.7% blurred vision, 12.2% eye burning, 9.9% stings in the eye, 11.6% corneal infection/inflammation and 8.7% eye surface scratches (Figure 2).

**Table 3** Knowledge of complications of contact lenses among study participants (n=1693)

| Parameter                      | Never        | Rarely       | Sometimes    | Often        | Always       |
|--------------------------------|--------------|--------------|--------------|--------------|--------------|
| Dry eye                        | 249<br>14.7% | 224<br>13.2% | 372<br>22.0% | 443<br>26.2% | 405<br>23.9% |
| Redness                        | 226<br>13.3% | 238<br>14.1% | 459<br>27.1% | 465<br>27.5% | 305<br>18.0% |
| Itching                        | 268<br>15.8% | 296<br>17.5% | 447<br>26.4% | 404<br>23.9% | 278<br>16.4% |
| Discomfort                     | 398<br>23.5% | 398<br>23.5% | 404<br>23.9% | 350<br>20.7% | 201<br>11.9% |
| Burning in the eye             | 378<br>22.3% | 308<br>18.2% | 487<br>28.8% | 313<br>18.5% | 207<br>12.2% |
| Stings in the eye              | 490<br>28.9% | 355<br>21.0% | 433<br>25.6% | 247<br>14.6% | 168<br>9.9%  |
| Difficulty in the vision       | 576<br>34.0% | 390<br>23.0% | 357<br>21.1% | 204<br>12.0% | 166<br>9.8%  |
| Corneal infection/inflammation | 750<br>44.3% | 367<br>21.7% | 294<br>17.4% | 165<br>9.7%  | 117<br>6.9%  |
| Synechiae                      | 553<br>32.7% | 386<br>22.8% | 321<br>19.0% | 236<br>13.9% | 197<br>11.6% |
| Increased refractive error     | 718<br>42.4% | 404<br>23.9% | 292<br>17.2% | 161<br>9.5%  | 118<br>7.0%  |
| Eye surface scratches          | 659<br>38.9% | 370<br>21.9% | 320<br>18.9% | 196<br>11.6% | 148<br>8.7%  |



**Figure 2** Knowledge of Blurred vision complications among participants (n=1693)

Knowledge of determinants of contact lenses among study participants was illustrated in (Table 4), 63.3% of participants reported that users should avoid sleeping with lenses in during naps or all night long, 54.6% reported the most of always washing the blindfold of the hand before putting on and removing the lenses, 59.8% generally avoid contact lenses, 55.5% avoid wearing contact lenses while swimming and 48.7% avoid rinsing the lenses with water.

**Table 4** Knowledge of determinants of contact lenses among study participants (n=1693)

| Parameter   | Never        | Rarely       | Sometimes    | Often        | Always        |
|---|--------------|--------------|--------------|--------------|---------------|
| Avoid sleeping with lenses in during naps or all night long                 | 203<br>12.0% | 115<br>6.8%  | 119<br>7.0%  | 185<br>10.9% | 1071<br>63.3% |
| Washing the blindfold of the hand before putting on and removing the lenses | 194<br>11.5% | 151<br>8.9%  | 188<br>11.1% | 235<br>13.9% | 925<br>54.6%  |
| Avoid contact lenses  | 193<br>11.4% | 127<br>7.5%  | 168<br>9.9%  | 193<br>11.4% | 1012<br>59.8% |
| Avoid swimming wearing contact lenses                                       | 201<br>11.9% | 156<br>9.2%  | 158<br>9.3%  | 238<br>14.1% | 940<br>55.5%  |
| Avoid storing lenses in water   | 253<br>14.9% | 173<br>10.2% | 180<br>10.6% | 218<br>12.9% | 869<br>51.3%  |
| Avoid rinsing the lenses with water   | 239<br>14.1% | 156<br>9.2%  | 204<br>12.0% | 270<br>15.9% | 824<br>48.7%  |
| Replace lenses as often as recommended                                      | 214<br>12.6% | 154<br>9.1%  | 216<br>12.8% | 235<br>13.9% | 874<br>51.6%  |
| Avoid mixing the new lens solution with the old one                         | 239<br>14.1% | 183<br>10.8% | 184<br>10.9% | 237<br>14.0% | 237<br>14.0%  |

#### 4. DISCUSSION

The global burden of eye refractive disorders is increasing (Konne et al., 2019). Since more than a century ago, doctors have been recommending contact lenses (CLs) to treat corneal diseases, correct refractive problems and for cosmetic reasons (Zeried et al., 2020). The usage of CLs has grown significantly and more growth is anticipated. Furthermore, failure to wear, clean, disinfects and store CLs in accordance with instructions could result in wearers of CLs developing eye infections. It was reported in 2016 that about 41 million citizens of the USA wear CLs and more than 99% of them reported at least one behavior that placed them at risk of eye infection (Zhu et al., 2018). Patients with refractive error can replace eyeglasses with CLs which help them to enhancing the standard of living and to provide flexibility during activities, which is a more preferable option in younger age groups (Bui et al., 2010).

Since CLs are easily obtained without a prescription over the counter, it is possible that the public is unaware of the hazards and benefits of using them. For all age groups, including health professionals, the educational level about the safety use of CLs should be raised to include the proper use, cleanliness procedures and potential risks that may come from CLs being misused (Li et al., 2018). Unfortunately, Failure to follow medical advice may cause unintended effects, some of which may be minor like conjunctival hyperemia and pain and papillae formation requiring medical observation and simple symptomatic treatment. Moreover, the most serious complication is blindness which evolves from microbial keratitis and endophthalmitis. In 2015 the Centers for Disease Control (CDC) reported the number and prevalence of adult CLs users in the United States and identified the population at risk for contact related eye infections. The most frequent risk factors for severe problems included sleeping with lenses in, sleeping in water, reusing sterilizing treatments and not following replacement schedules (Lim et al., 2018). Several studies showed that adolescents and young adults were more prone to develop complications than older adults (Jones et al., 2009). Aim of the study is to assess Awareness of ocular complications associated with the use of cosmetic contact lenses from unlicensed vendors and it's correlation with age, gender and education level among Taif city, Saudi Arabia.

In our study, we found that about 85% of the studied population have experienced dry eye and about 88% experienced redness and 84% experienced itching and about 56% have experienced corneal infection/inflammation and about 78% experienced blurring of vision and about 77% experienced eye discomfort. A study from the USA (Unnikrishnan and Hussain, 2018), revealed that symptoms as burning, itching or tearing eyes were reported among those who continued wearing CLs and that dry eyes were frequently reported between teenagers. A study done in a tertiary eye care center of Nepal (Sapkota et al., 2009), revealed that, 4.9percent of the overall soft CL wearers had problems. With 36.9% of all patients experiencing problems, CLPC was by far the most frequent complication. Superior punctate keratitis (SPK), conjunctivitis (18.2%), Meibomian gland dysfunction (8.6%), contact lens induced peripheral ulcer (CLPU), corneal vascularization (3.5%) and microbial keratitis (3%) were the other frequently observed problems. After starting to wear contact lenses, issues typically took  $14.3 \pm 11.4$  months to manifest.

Regarding knowledge of determinants of contact lenses among our study participants, 63.3% of participants reported that users should avoid sleeping with lenses in during naps or all night long, 54.6% reported the most of always washing the blindfold of the hand before putting on and removing the lenses, 59.8% generally avoid contact lenses, 55.5% avoid wearing contact lenses while swimming and 48.7% avoid rinsing the lenses with water. Another study conducted among medical students (Ibrahim et al., 2018) found that before putting on lenses, 71.9% of CL users cleansed their hands. As ADH got guidelines regarding CLs' hygienic standards, a greater proportion (89.4%) was observed from that city. Regarding reasons for using contact lenses, 31.7% were reported as cosmetic and 19.4% for refractive error. Nearly two-thirds of individuals in a Saudi study by Alobaidan et al., (2018) used CLs for cosmetic-reasons (Abokyi et al., 2017). Similar proportions of CLs users utilized them for cosmetic purposes in another study by Abahussin et al., (2014) amongst Saudi-university students. Furthermore, a study done in Riyadh, to evaluate prevalence and awareness of female university students and those who attended beauty stores about CLs' usage revealed that 38.7% of the wearers used CLs without consulting an eye care practitioner (Bamahfouz et al., 2016). Regarding gender, in comparison to men, women reported considerably higher usage prevalence (OR=8.38; 95% CI: 5.2-13.3) (Swanson, 2012).

According to a study done in Saudi Arabia (Wu et al., 2010), young individuals had a higher level of understanding regarding safety precautions and the problems associated with using CLs than people over the age of 30. Alobaidan et al., (2018) had a similar finding that younger people, being more educated, having a wider scope of accessing knowledge and preferring practice norms for CL use, were at less risk of complications. The level of education is reflected in the knowledge about safety measures; the average knowledge was higher in participants with a bachelor's degree compared to those with high school and primary education. High monthly income showed higher knowledge about the complications of CLs than low monthly income. On the other hand, Alobaidan et al., (2018) reported that neither gender nor the level of education significantly correlates with having high knowledge scores of CLs use in their Saudi general population, however, younger ages less than 25 years old did. Moreover, a previous registry-based study reported that male participants were better users of CLs than females in terms of fewer symptoms. However, the authors justified this by reporting that female participants tend to promptly report the symptoms and frequently report to their healthcare professionals. Moreover, the same study showed that higher CL related hygienic practices were seen more frequently among females. This indicates that female individuals have more knowledge about CLs care and use than males.

## 5. CONCLUSION

Users of CLs had less than acceptable knowledge and practice. Many of them used contact lenses for aesthetic reasons and procured them without prescription, but knowledge and attitudes toward contact lenses among adolescents were in acceptable levels. Female participants had higher total mean knowledge scores than males. There is a need for CLs consumers to have more knowledge about

CLs care and complications, which should be provided by all CLs providers. Consequently, the prevalence of eye complications will be lessened among CLs wearers.

### Recommendations

We recommend that further educational campaigns should be inaugurated to raise awareness about taking care of CLs and warn against the possible associated complications.

### Ethical approval

The research proposal was approved by the Regional Research and Ethics committee of Taif University, southern Saudi Arabia, with letter number (43-773).

### Funding

This study has not received any external funding.

### Conflict of interest

The authors declare that there is no conflict of interests.

### Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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