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Research article

Community-level awareness of proper immediate steps regarding ocular chemical injury in the Jazan region, Saudi Arabia

Ahmad Y. Alqassim [a], Mohammed O. Shami [a,*], Saeed Abu Sabah [b], Abdulrahim A. Hassan [b], Abduaelah A. Hassan [b], Abdulelah Y. Asiri [b], Khalid Y. Muqri [a], Abdullah M. Alshahbi [b], Naif M. Asiri [b], Mohammed S. Mahfouz [a]

[a] Faculty of Medicine, Jazan University, Jazan City, Jazan, Saudi Arabia
[b] Faculty of Medicine, King Khalid University, Abha City, Aseer, Saudi Arabia

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ABSTRACT

Background: Although the eyes represent 0.1% of the total human body, they are exposed to many injuries, some of which may cause blindness. Ocular chemical injury is a true ocular emergency requiring immediate assessment and initiation of treatment. The present study targeted the general population in the Jazan region, Saudi Arabia, to evaluate knowledge of chemical injuries to the eye and the immediate management of the injury.

Materials and methods: A cross-sectional design was employed using a convenience sample of 536 residents of the Jazan region who completed an online, self-administered, anonymous, and pre-validated questionnaire.

Results: Most of the respondents were 18–30 years of age (66.0%), and 274 (51.1%) were female. Respondents had an average score of 7.70 (standard deviation: 1.78) out of a total score of 16, indicating an overall lack of knowledge of ocular chemical burns. The majority (95.1%) agreed that ocular complications could result from ocular chemical injury. Regarding the first action in ocular chemical injuries, 317 (59.1%) thought that eye irrigation with a large amount of water, 155 (28.9%) chose to go to the emergency department, 40 (7.5%) chose irrigation of the eye with a small amount of water, 13 (2.4%) chose using eye drops, and 11 (2.1%) chose to cover the eye.

Conclusion: The knowledge of ocular chemical burns is lacking in the general population of the Jazan region. There are several knowledge gaps, some of which are serious, necessitating rigorous efforts to correct them through educational programs at the community level.

1. Introduction

The eyes are arguably the most important sensory organ to the human body. The eyes make up 0.27% of the anterior body surface and 0.1% of the overall body surface. Following cataract as the most common cause of vision impairment, eye damage is the major cause of monocular blindness in the United States [1]. The most prevalent reason for ophthalmic emergency department (ED) visits is injury [2]. The majority of eye injuries can be prevented with the proper use of protective eyewear. Eye injuries, whether physical or chemical, present a severe risk to eyesight if not appropriately treated within an appropriate time period [3, 4]. knowledge about proper action in case of a chemical agent injury to the eye is pivotal to promoting a safer community. Chemical injuries account for about 7% of all work-related eye injuries treated in hospital emergency rooms in the United States [5]. Chemical damages to the eyes are real ophthalmic emergencies that must be evaluated and treated immediately. Ocular or thermal burns account for 7.7%–18% of ocular trauma [6]. Chemical eye injuries cause significant damage to the cornea, ocular surface epithelium, limbal stem cells, and anterior segment leading to long-term unilateral or bilateral vision loss [7]. A chemical burn occurs when a liquid or powder chemical contacts the eye. Most commonly, the injury happens when a chemical splashes over the face. It also results from rubbing your eyes after handling chemicals. Chemical injuries can involve alkaline and acidic injuries. Alkaline burns are more common and result in more severe injuries due to the widespread use of alkaline chemicals in industrial and household cleaners [10]. Any chemical burn should be treated rapidly at the time and area of the injury. The damaged eye(s) should be irrigated copiously with any

* Corresponding author.
E-mail address: Medm.shami@gmail.com (M.O. Shami).

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available noncaustic fluid at the injury site and during the transfer to the hospital. The Irrigation should be continued in the hospital until the ocular surface pH has returned to a normal range of 7.0–7.2 [8]. According to a previous study conducted in Saudi Arabia, the Saudi population needs to be more aware of immediate corrective action in the event of ocular chemical injuries [9]. According to the previous points, we noticed the chemical substances carry a significant harmful effect on the eye, and as we know that the eye is a vital sense organ and vision loss has a negative impact on one's quality of life because it can lead to dramatic changes in lifestyle, loss of job, and face disfigurements [9]. Assuming the Saudi population's level of awareness is humble regarding the proper steps and actions that should be taken in case of a chemical injury to the eyes. It is of great importance to recognize areas of shortcomings by health care workers to provide accurate and understandable medical facts about ocular chemical injuries. Therefore, we desire to highlight the most crucial points of weaknesses in the knowledge of the Jazan community about the study objectives. Our purpose in this study is to measure the community awareness about the chemical injures to the eye and the immediate management regarding the injury, we also want to know if the health care workers carry out their role as health promoters regarding eye emergencies and their immediate corrective.

2. Materials and methods

2.1. Study procedure and data collection

This was a cross-sectional study targeting the general population of the Jazan region, Saudi Arabia. The study was conducted between February and March 2022. A convenient random sample of 385 participants was estimated for this study. The sample size was calculated using the Raosoft sample size calculator (Raosoft Inc., Seattle, WA, USA) (http://www.raosoft.com/samplesize.html) based on the total population and estimated population in Jazan region which is about two million according to General Authority for statistics in the kingdom of Saudi Arabia, with a 95% confidence interval, 5% margin of error, 50% response distribution; thus, the minimum sample size was set to be 385. However, to reduce sampling bias in our method, as this study was based on an online questionnaire distributed by using social media, we increased the sample size to include 536 participants who agreed to be part of an online survey distributed through e-mail and social media websites (Facebook, Twitter, and WhatsApp).

The questionnaire was developed by the study authors based on previous research [9, 10]. It included questions assessing demographic data (sex, age, job, education, and income) and questions assessing knowledge of ocular chemical burns and proper immediate steps. The questionnaire was reviewed by two experts with expertise in occupational health to assess the face validity of the instrument. Reliability based on Cronbach's alpha produced an acceptable value for the final version of the questionnaire.

2.2. Data management and statistical analysis

After data collection, data were verified manually, and then coding was carried out within an excel sheet. All data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS version 25). Data were analyzed using descriptive and comparative statistics. Descriptive statistics were calculated for study variables, i.e., frequency and percentage for qualitative variables and mean and standard deviation for quantitative variables. A total score was calculated given 1 for any correct answer, 2 for at least two correct answers, and 0 for incorrect answer (collection of answers). The total score ranged from 0 to 16. A score of 9 and more indicated a good knowledge level, and a score of less than 9 indicated poor knowledge. The tests of association (Chi Square and Fisher's exact test) were applied as appropriate. A logistic regression model was used to evaluate the socio-economic predictors of the knowledge level. The dependent variable is the knowledge level, dichotomized into Good and Poor levels of knowledge. A p. value less than 0.05 was used to indicate statistical significance.

2.3. Ethical consideration

Authors have no conflict of interests, and the work was not supported or funded by any drug company. The research involved human participants and was ethically approved by the Standing Committee for Scientific Research at Jazan University with a reference number (REC-43/06/139). All procedures performed in our study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

3. Results

Table 1 shows the main characteristics of the respondents. Table 1 shows the demographic details of the sample. The study enrolled 536 participants from different regions in Jazan Province, Saudi Arabia. Most of them were aged 18–30 years (66.0%), and 274 (51.1%) were female. Three hundred thirty-eight participants had an educational level of college or above (63.1%), and 310 (57.8%) had a monthly income of less than 5000 Saudi Riyals. Participants were employed in different sectors, with 250 (46.6%) being a student (Table 1).

Knowledge scores were calculated and compared across demographic variables of the sample. Respondents had an average score of 7.70 (standard deviation: 1.78) out of a total score of 16, indicating an overall lack of knowledge of ocular chemical burns (using a cut-off point of 9 for good knowledge). In other terms, the analysis detected 173 (32.3%) of participants as having good knowledge of ocular chemical burns. Table 1 summarizes the knowledge level in each subgroup of the sample. Knowledge level did not differ in different age groups ($P > .05$), sex ($P > .05$), an education level ($P > .05$), and monthly income ($P > .05$). One exception is the type of job that showed that knowledge of ocular chemical burns was more likely to be higher among students than employed respondents ($P = .034$). Students constituted a higher proportion (42.2%) of respondents with good knowledge scores, followed by employees of the education sector (19.1%), and employees of the health sector (14.5%), while employees of the industrial sector and retired respondents (both 0.6%) had the least knowledge scores (Table 1).

Table 2 showed that 169 (31.5%) of respondents reported that they or someone they know had chemical eye injury (Table 2).

Table 3 lists responses to the items assessing the level of knowledge of ocular chemical burns and immediate action. A total of 510 (95.1%) respondents agreed that ocular complications can result from ocular chemical injury. However, regarding the type of those complications, 374 (69.8%) chose multibed incorrect answers. Most of the respondents (418, 78.0%) correctly detected the three materials commonly causing ocular burns. A total of 317 (59.1%) thought that eye irrigation with a large amount of water is the immediate action in ocular chemical injury, and 374 (69.8%) correctly chose water in both alkalic and acidic ocular chemical injuries. Regarding the type of management of different materials in ocular chemical injury, 433 (80.8%) were correct that it does not vary with different materials. Regarding the duration of eye washing following ocular chemical injury, only 39 (7.3%) correctly chose the optimal duration. Most of the respondents were not aware that rubbing after chemical exposure increases the severity of ocular injury (463, 86.4%), that wearing contact lenses do not protect against ocular chemical injury (334, 62.3%), that wearing goggles lowers the risk of ocular injury (488, 91%), or that after handling chemical materials, they should wash their hands before touching the eye (509, 95.0%) (Table 3).

Table 1. Knowledge of ocular chemical burns in the study subgroups, by demographic characteristics.

Characteristics	Total N (%)	Poor knowledge N (%)	Good knowledge N (%)	Chi-square	P value
Age (Years)					
<18	67 (12.5)	45 (67.2)	22 (32.8)	7.062	.070
18–30	354 (66.0)	247 (69.8)	107 (30.2)		
31–40	66 (12.3)	46 (69.7)	20 (30.3)		
>40	49 (9.1)	25 (51.0)	24 (49.0)		
Sex					
Male	262 (48.9)	183 (69.8)	79 (30.2)	1.057	.311
Education					
Middle school	57 (10.6)	38 (66.7)	19 (33.3)	1.366	.714
High school	128 (23.9)	89 (69.5)	39 (30.5)		
College level	338 (63.1)	229 (67.8)	109 (32.2)		
Other	13 (2.4)	7 (53.8)	6 (46.2)		
Monthly income (in Saudi Riyals)					
<5000	310 (57.8)	215 (69.4)	95 (30.6)	.909	.635
5000–9000	120 (22.4)	79 (65.8)	41 (34.2)		
>9000	106 (19.8)	69 (65.1)	37 (34.9)		
Type of job					
Student	250 (46.6)	177 (70.8)	73 (29.2)	15.159	.034
Military sector	56 (10.4)	38 (67.9)	18 (32.1)		
Education sector	66 (12.3)	33 (50.0)	33 (50.0)		
Health sector	90 (16.8)	65 (72.2)	25 (27.8)		
Private sector	33 (6.2)	20 (60.6)	13 (39.4)		
Industrial sector	11 (2.1)	10 (90.9)	1 (9.1)		
Retired	2 (0.4)	1 (50.0)	1 (50.0)		
None employed	28 (5.2)	19 (67.9)	9 (32.1)		

Figure 1 illustrates the knowledge of immediate action after an ocular chemical injury among the study subjects. Irrigation of the with a large amount of water was chose by the majority of respondents (59.1%).

Table 4 demonstrates the factors associated with knowledge regarding ocular chemical burns. Females were more likely to be knowledgeable about ocular chemical burns than males (OR = 1.21, 95% CI = 0.84–1.74), but without statistical significance (p = 0.304). Those who are old than 30 years were significantly more knowledgeable about ocular chemical burns compared with participants less than 30 years (OR = 2.22, 95% CI = 1.22–4.03), (p = .009). Working respondents were found to be associated with patients' good level of knowledge (OR = 1.31, 95% CI = 0.91–1.72), (p = .148).

4. Discussion

Ocular chemical injuries affect 1.25–4.4% in developing countries and extensively impact patients' visual functioning and overall quality of life [11, 12, 13, 14]. In Saudi Arabia, chemical burns constitute 2.8% of burn injuries, with 83% occurring at home [15]. The present study investigated the ocular chemical injuries prevalence using a community-based sample of the Saudi population in Jazan Province. The main objective was to assess current knowledge of immediate action following ocular chemical injuries. This study revealed that despite the high prevalence of ocular chemical injuries in the general population of Jazan, there is a lack of knowledge of several first steps after ocular burn. The average knowledge score in the surveyed population was 7.7 out of 16 (SD: 1.78), indicating that only 32.3% had adequate knowledge of the subject. There are some limitations in this study that should be taken into account when generalizing and interpreting its findings. First, the study was based on cross-sectional studies, which could limit the interpretation of any correlations found in this study. Also, the study used an electronic questionnaire which may predispose it to selection bias. Moreover, future studies should utilize various methods, like interviews, to establish a self-reported questionnaire in this study. Furthermore, the convenience sampling used in this study may affect the generalizability of the study results. Finally, when compared to other study methods, the cross-sectional investigation's findings may be seen as less definitive. On the other hand, this is the first study investigating ocular chemical injuries in the area, which make our study can be consider an important observation in our region. Finally, in this study, 51.1% of the participants were female and 48.9% were males revealing nearly an equal sex ratio, which strengthens the generalizability of our study results.

The study showed that 31.5% of subjects had or knew someone who had a chemical eye injury. In a similar investigation of chemical eye injuries among the general population of Jeddah, Seraj et al. reported half this prevalence rate (15.5%) [9]. This may be explained by different

Table 2. History of chemical eye injury.

Characteristics	Total N (%)	Poor knowledge N (%)	Good knowledge N (%)	Chi-square	P value
Do you or your acquaintances have a history of chemical eye injury?					
Yes	169 (31.5)	106 (62.7)	63 (37.3)	2.825	.111
No	367 (68.5)	257 (70.0)	110 (30.0)		

Table 3. Knowledge of ocular chemical injuries and proper immediate action.

Question/Statement	Frequency	Percent
Ocular chemical injury can cause ocular complications		
I agree*	510	95.1
I don't agree	7	1.3
I don't know	19	3.5
What damage can ocular chemical injury cause?		
Blindness*	76	14.2
Perforation*	7	1.3
Scarring*	9	1.7
Blindness, perforation, Scarring	47	8.8
Cancer	6	1.1
Keratoconus	8	1.5
Cataract	9	1.7
Multiple incorrect choices	374	69.8
What are materials that commonly cause ocular injuries?		
Chloride and detergents*	81	15.1
Battery materials*	20	3.7
Vinegar*	1	.2
One or more correct choices	418	78.0
Water	16	3.0
What is your immediate action when exposed to ocular chemical injury?		
Irrigation of eye with a large amount of water*	317	59.1
Going to emergency department	155	28.9
Irrigation of eye with small amount of water	40	7.5
Using eye drops from pharmacy	13	2.4
Covering the eye	11	2.1
What will you use to treat ocular chemical injury?		
An acidic substance if the injury substance is alkalic (Example: vinegar)	40	7.5
An alkalic substance if the injury substance is acidic (Example: soap)	25	4.7
Water in both cases*	374	69.8
An acidic substance if the injury substance is alkalic (ex: vinegar)	40	7.5
I don't know	97	18.1
Management varies according to the substance of ocular injury		
I agree	64	11.9
I don't agree*	433	80.8
I don't know	39	7.3
What is the optimal duration of eye washing following ocular chemical injury?		
5–15 min	247	46.1
<5 min	148	27.6
30 min or more*	39	7.3
I don't know	102	19.0
Severity of pain indicate severity of ocular chemical injury		
I agree	72	13.4
I don't agree*	371	69.2
I don't know	93	17.4
Eye rubbing after chemical exposure increases the severity of ocular injury		
I agree*	51	9.5
I don't agree	463	86.4
I don't know	22	4.1
What is the most serious sign of ocular injury?		
Eye redness	173	32.3
Eye whit discoloration*	66	12.3
Eyelid sticking	171	31.9
Severe pain	126	23.5
Do you think that wearing contact lenses protect against ocular chemical injury?		
I agree	92	17.2
I don't agree*	110	20.5
I don't know	334	62.3
In case of ocular chemical injury, you should remove contact lens		
I agree*	138	25.7
I don't agree	321	59.9
I don't know	77	14.4
Do you think that wearing goggles lowers the risk of ocular injury?		
I agree*	29	5.4
I don't agree	488	91.0
I don't know	19	3.5
After handling chemical materials, you should wash your hands before touching the eye		
I agree*	17	3.2
I don't agree	509	95.0
I don't know	10	1.9

methodological approaches to the question regarding the history of ocular chemical injuries. In our study, the question included participants and their acquaintances while in the study of Seraj et al., the question included participants and their close friends and family members. These high prevalence rates warrant research into community's level of knowledge of chemical eye injuries to reduce their incidence and complications. The analysis showed that the vast majority (95.1%) agreed that chemical injuries to the eye can cause ocular complications; a finding consistent with studies from Jeddah [9] (88.3%) and Aseer region (86.9%) [10].

In cases of ocular chemical injuries at home, the mainstay of treatment is immediate irrigation with water to reduce consequent damage and prevent loss of vision [16]. In our study, however, 7.5% thought that acidic solutions should be used in alkaline burns and 4.7% thought alkalic solutions to be used in acidic burns. Both washing regimens are extremely hazardous and may cause an exothermic reaction leading to secondary thermal injury [8]. Similar misconceptions are reported in other studies. The correct immediate action in ocular chemical injuries was observed in 59.1%, followed by 28.9% who believed that the first action needs to be to go to the closest emergency department. The remaining 12.0% failed to recognize the proper immediate action.

The overall knowledge of ocular chemical injuries in this study is inadequate. Respondents had a mean knowledge score of 7.70 (SD: 1.78), indicating poor knowledge of ocular chemical burns and immediate action following chemical injuries to the eye. Several gaps of knowledge existed in our study. Concerning the duration of eye irrigation, only 7.3% reported a minimal duration of 30 min. If reaching a health facility is not possible, irrigation with a large amount of water should be performed in at least 30 min, ensuring that water reaches the whole eye surface [17]. Another gap of knowledge was found in 86.4% of respondents who disagreed that eye rubbing after chemical injury increases the severity of the damage. Indeed, eye rubbing increases the chances of spreading the chemical substance into the eye surface and possibly makes the burn worse. Furthermore, Furthermore, most were unaware that goggles (91%), not contact lenses (62.3%), protect against ocular chemical injury. A more serious misconception was that 95% thought that one does not need to wash hands with water before touching the eye following chemical injury, which may lead to further tissue damage.

This study's findings suggest that taking serious efforts to improve the knowledge of ocular chemical injuries and appropriate immediate action by increasing the awareness campaigns and using social media to reach as many people as possible to increase the awareness of this problem which will decrease the ocular burns which have significant complications including blindness. Finally, the online sampling employed in the study might limit the generalizability of the study results.

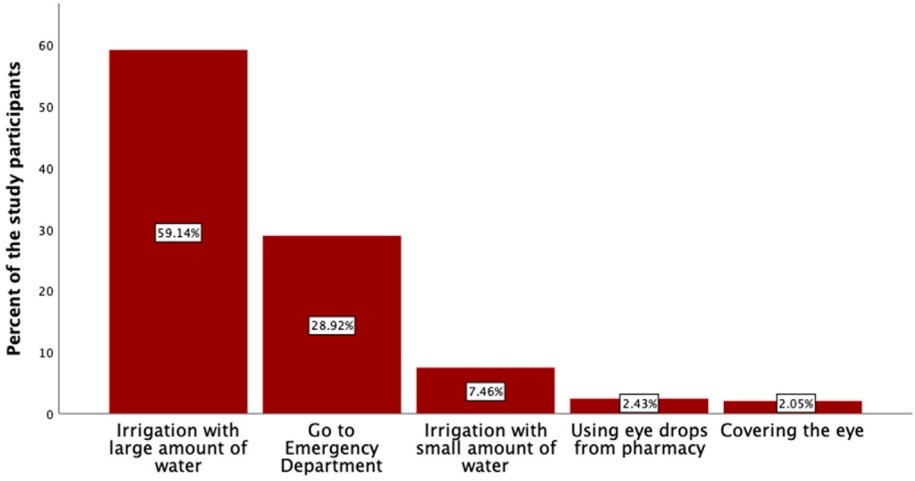

Figure 1. Knowledge of immediate action after an ocular chemical injury among the study subjects.

Table 4. Socio-demographic factors associated with level of Knowledge regarding ocular chemical burns.

Factors	Logistic Regression Model			
	p value	**OR**	95 % C.I. **OR**	
			Lower	Upper
Gender				
Male (REF)		1		
Female	0.304	1.21	0.84	1.74
Age groups				
Less than 30 years (REF)		1		
31 years and more	.009	2.22	1.22	4.03
Educational Level				
Secondary or less (REF)		1		
University and above	.740	1.07	.73	1.56
Work Status				
Not working (REF)		1		
Working	.148	1.31	.91	1.89
Monthly income (in Saudi Riyals)				
Less than 5000 SR (REF)		1		
5000 SR and more	.344	1.19	.83	1.72

#OR: Odds ratio; CI: confidence interval, REF = reference category; the dependent variable is the level of knowledge which is dichotomized into Good and Poor levels of knowledge

5. Conclusion

This study revealed that despite the high prevalence of ocular chemical injuries in the general population of Jazan, there is a lack of knowledge of several first steps after an ocular burn. The average knowledge score in the surveyed population was 7.7 out of 16 (SD: 1.78), indicating that only 32.3% had adequate knowledge of the subject. Some warning findings exist, including the using of alkalic or acidic solutions to irrigate the eye according to the substance pH. In addition, the current study and several local studies found serious knowledge gaps regarding immediate action after an ocular chemical injury. These gaps could be bridged by extensive public education through awareness campaigns better to understand ocular chemical injuries and appropriate immediate action and, therefore, reduce ocular burns, which have significant complications, including blindness.

Declarations

Author contribution statement

Ahmad Y. Alqassim, Mohammed O. Shami: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed materials, analysis tools or data; Wrote the paper.

Saeed Abu Sabah: Conceived and designed the experiments; Wrote the paper.

Abdulrahim A. Hassan, Abduaelah A. Hassan, Abdulelah Y. Asiri, Khalid Y. Muqri: Analyzed and interpreted the data; Contributed materials, analysis tools or data.

Abdullah M. Alshahbi, Naif M. Asiri: Conceived and designed the experiments; Contributed materials, analysis tools or data.

Mohammed S. Mahfouz: Conceived and designed the experiments; Contributed materials, analysis tools or data.

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Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

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