

Digital eye strain during COVID-19 lockdown in Jeddah, Saudi Arabia

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Abstract

Objective This study aimed to determine the prevalence of computer vision syndrome (CVS) and associated risk factors of prolonged use of electronics.

Methods This was an online non-interventional cross-sectional study conducted over the period of COVID curfew in Jeddah city from April to June 2020, through a questionnaire. Participants were between 20 and 60 years of age and used electronic devices.

Results Totally, 1227 participants were recruited between 20 and 60 years of age. The majority of them were females (69.9%). Almost 1048 participants used smartphones or laptops. More than half (54.5%) of them used electronics for more than 4 h daily. A high symptom severity score was found in 44% of the respondents. Taking breaks during electronics use <30 minutes ($P=0.018$), viewing computers at a distance less than arm length ($P=0.001$), and the use of screen protectors ($P=0.014$) were significant factors related to the symptom's severity score.

Conclusions CVS was prevalent among the participants who used electronics for more than 4 h daily. Taking breaks during electronics use, viewing computers at an appropriate distance, and the use of screen protectors were effective practices to relieve the eye symptoms severity score.

Keywords Computer, Eyestrain, Lockdown, Symptoms, Dry eye, Vision, Saudi Arabia.

Introduction

Due to the current COVID-19 pandemic, considering isolation as the solution, many countries have gone through total lockdown. In April, approximately 3 billion people, in more than 130 countries were locked down, and nearly 90% students were stopped from going to school. This was the fact due to which numerous children and their parents were compelled to use electronic devices more frequently to connect themselves with the outside world.¹

Unfortunately, this frequent use of electronic devices lead them towards computer vision syndrome (CVS). American Optometric Association recognized CVS as a complex of eye and vision problems associated with near work experienced during computer use.² Globally, around 60 million computer workers experience discomfort from CVS.³ Approximately, 45 million workers used electronic devices by staring at the screen for hours daily.⁴ American Optometric Association found that 14.25% people who visited the optometry clinics have complained primarily of the symptoms related to computer use.⁵ CVS occurs due to an increased visual demand to the extent that it exceeds the person's visual ability.⁶ It could also be explained by reduced blinking reflex, while staring at the screen, resulting in exaggeratedly dry eyes.⁷ Dry eyes were found as a significant determinant factor in CVS.⁸

In early 2020, the World Health Organization (WHO) declared the disease COVID-19 as a global pandemic. The people of Saudi Arabia experienced many changes due to the pandemic including disruption of the daily life routine and prolonged use of electronic devices. Thereby, the study aimed to determine the prevalence of CVS, its associated risk factors, and common related symptoms associated with the prolonged use of electronic devices during the period of COVID-19 curfew in Jeddah city.

Subjects and Methods

It was a non-interventional cross-sectional study conducted among the participants from Jeddah, Saudi Arabia over a period of COVID-19 curfew from April to June 2020. Participants aged >20 years and using electronic devices were included in the study.

The electronic questionnaire used in the current study was previously used in a recent study by Abudawood et al.⁹ The questionnaire consisted of four parts. The first part included the demographic characteristics; age, gender, occupation, permission to go out during lockdown, any ocular problems, wearing eyeglasses/contact lens for vision correction during the use of electronics, any chronic illnesses, previous eye surgeries, and current medications. The second part included the participant's habits like using the computer; the third part included the frequency and intensity of eye symptoms, and the final part included habits to reduce symptoms of CVS.

Descriptive data were analyzed using SPSS version 21 program. Quantitative data were shown as mean, standard deviation (SD), and qualitative data. Numerical values expressed in n = numbers and shown as mean, SD, percentage (%), while non-numerical values were expressed as frequency and percentage. A comparison of variables between patients from different ethnicities were analyzed by independent *t*-test for continuous variables and the chi-square (χ^2) test for categorical variables. P-value <0.05 was considered statistically significant.

Results

One thousand two hundred twenty-seven (1227) participants from Jeddah city were included in the present study. The participants were between 20 and 60 years old. The majority of them

were females (69.9%). Most of them had eye diseases (63.6%), myopia (41.2%), astigmatism (20.9%), dry eye (15.5%), and other eye diseases. Almost, 43.8% participants were wearing glasses, and 8.9% were wearing contact lenses. Out of 1227, 1048 participants were using smartphones or laptops. More than half (54.5%) of them were using electronic devices for more than 4 h daily. Majority of the participants (87.3%) were taking breaks during the use of electronic devices and lifting distance from the screen was less than the arm's length (76.3%). A high symptom severity score was found in 44% individuals in the present study (Table 1).

The common symptoms associated with the prolonged use of electronic devices during the period of COVID-19 curfew was assessed. Burning sensation in the eyes, itchy eyes, increased sensitivity to light, headache, and pain in the neck or back were the most common symptoms associated with prolonged use of electronics during the period of COVID-19 curfew (Tables 2–4).

Table 1. Description of different study variables (n=1227).

	Frequency (%)
Age	
20-30	411 (33.5)
31-40	271 (22.1)
41-50	239 (19.5)
51-60	227 (18.5)
>60	79 (6.4)
Gender	
Male	369 (30.1)
Female	858 (69.9)
Occupation	
Medical	171 (13.9)
Non-medical	490 (39.9)
Housewife	190 (15.5)
Not working	34 (2.8)
Retired	96 (7.8)
Student	246 (20)
Permission to break lockdown	381 (31.1)
Eye diseases	780 (63.6)
Myopia*	506 (41.2)
Astigmatism*	256 (20.9)
Dry eye*	190 (15.5)
Hypermetropia*	148 (12.1)
Cataract*	35 (2.9)
Glaucoma*	7 (0.6)
Keratoconus*	7 (0.6)
Wearing glasses	537 (43.8)
Wearing contact lenses	109 (8.9)
Diabetes Mellitus	121 (9.9)

(Continued)

Table 1. Continued

Hypertension	160 (13)
Previous Eye operations	183 (14.9)
Use of medications affecting vision	57 (4.6)
Use of laptop or tablets	1048 (85.4)
Frequency of use of smartphones or laptops (n=1048)	
<1 hr	54 (5.2)
1-2 hrs	152 (14.5)
3-4 hrs	271 (25.9)
>4 hrs	571 (54.5)
Taking breaks during use (n=1048)	915 (87.3)
Frequency of breaks (n=1048)	
No breaks	133 (12.7)
< 30 minutes	343 (32.7)
30-60 minutes	318 (30.3)
> 60 minutes	254 (24.2)
Distance to screen (n=1048)	
Less than arm length	800 (76.3)
More than arm length	248 (23.7)
Position during use (n=1048)	
Sitting	453 (43.2)
Supine	30 (2.9)
Both	565 (53.9)
Level during use (n=1048)	
Below eye level	514 (49)
Same eye level	521 (49.7)
Above eye level	13 (1.2)
Light source (n=1048) *	
Ceiling / wall	849 (81)
Windows	334 (31.9)
Lampshades	228 (21.8)
Light source (n=1048)	
Single	765 (73)
Multiple	283 (27)
Screen brightness (n=1048)	
Faint	377 (36)
Pale	23 (2.2)
Bright	584 (55.7)
Very bright	64 (6.1)
Use of screen protector (n=1048)	138 (13.2)
Symptoms severity score (n=1048) \$	
High	461 (44)
Low	587 (56)

*More than one answer allowed, \$ developed from the following questionnaire.

Table 2. **Presence of symptoms questionnaire (n=1048).**

	Never	Sometimes	Often	Always
Burning sensation in the eyes	371 (35.4)	479 (45.7)	156 (14.9)	42 (4)
Itchy eyes	368 (35.1)	508 (48.5)	127 (12.1)	45 (4.3)
A sense of dust inside the eye	674 (64.3)	272 (26)	72 (6.9)	30 (2.9)
Flooding of tears	639 (61)	304 (29)	70 (6.7)	35 (3.3)
Too much blinking	624 (59.5)	322 (30.7)	79 (7.5)	23 (2.2)
Redness of the eye	538 (51.3)	395 (37.7)	86 (8.2)	29 (2.8)
Pain in the eye	518 (49.4)	404 (38.5)	95 (9.1)	31 (3)
Eyelid heaviness	714 (68.1)	266 (25.4)	51 (4.9)	17 (1.6)
Blurred vision	389 (37.1)	486 (46.4)	132 (12.6)	41 (3.9)
Double vision	756 (72.1)	220 (21)	58 (5.5)	14 (1.3)
Impaired near vision	622 (59.4)	240 (22.9)	111 (10.6)	75 (7.2)
Increased sensitivity to light	485 (46.3)	367 (35)	143 (13.6)	53 (5.1)
Seeing rainbows or halos around lights	745 (71.1)	222 (21.2)	52 (5)	29 (2.8)
Vision deterioration	802 (76.5)	189 (18)	42 (4)	15 (1.4)
a headache	284 (27.1)	418 (39.9)	237 (22.6)	109 (10.4)
Pain in the neck or back	161 (15.4)	433 (41.3)	277 (26.4)	177 (16.9)
Numbness in the fingers of the hands	463 (44.2)	336 (32.1)	164 (15.6)	85 (8.1)

Table 3. **Severity of symptoms questionnaire (n=1048).**

	Never	Intermediate	Severe
Burning sensation in the eyes	561 (53.5)	453 (43.2)	34 (3.2)
Itchy eyes	578 (55.2)	434 (41.4)	36 (3.4)
A sense of dust inside the eye	771 (73.6)	259 (24.7)	18 (1.7)
Flooding of tears	778 (74.2)	238 (22.7)	32 (3.1)
Too much blinking	778 (74.2)	248 (23.7)	22 (2.1)
Redness of the eye	669 (63.8)	347 (33.1)	32 (3.1)
Pain in the eye	685 (65.4)	330 (31.5)	33 (3.1)
Eyelid heaviness	828 (79)	206 (19.7)	14 (1.3)
Blurred vision	600 (57.3)	405 (38.6)	43 (4.1)
Double vision	858 (81.9)	178 (17)	12 (1.1)
Impaired near vision	704 (67.2)	299 (28.5)	45 (4.3)
Increased sensitivity to light	636 (60.7)	372 (35.5)	40 (3.8)
Seeing rainbows or halos around lights	850 (81.1)	180 (17.2)	18 (1.7)
Vision deterioration	860 (82.1)	167 (15.9)	21 (2)
a headache	388 (37)	543 (51.8)	117 (11.2)
Pain in the neck or back	327 (31.2)	538 (51.3)	183 (17.5)
Numbness in the fingers of the hands	616 (58.8)	359 (34.3)	73 (7)

Table 4. Practices to relieve symptoms (n=1048).

	Never	Rare	Sometimes	Often	Always
You position the screen 50-71 cm from the eye (more than arm's length) and below eye level	182 (17.4)	307 (29.3)	366 (34.9)	146 (13.9)	47 (4.5)
An anti-glare screen is used to reduce the amount of light reflected from the screen	416 (39.7)	373 (35.6)	135 (12.9)	70 (6.7)	54 (5.2)
An overhead lighting opens from the ceiling plus a desk lamp or light hits your eyes	260 (24.8)	250 (23.9)	267 (25.5)	182 (17.4)	89 (8.5)
Take short breaks every 20 minutes for 20 seconds and look at objects at least 20 feet away (the 20-20-20 rule)	186 (17.7)	277 (26.4)	316 (30.2)	176 (16.8)	93 (8.9)
You do eye exercises moving them with frequent blinking	298 (28.4)	316 (30.2)	251 (24)	124 (11.8)	59 (5.6)
Avoid sitting in a place where air hits your eyes directly	208 (19.8)	242 (23.1)	214 (20.4)	183 (17.5)	201 (19.2)

The determinant factors associated with the symptom's severity score were also assessed. Age (40-50 or >60 years), male gender, retired people, and having permission to break lockdown were statistically significant determinant factors related to the symptom's severity score ($P < 0.05$). Additionally, the symptoms severity score was significantly associated with having eye diseases ($P=0.000$), wearing glasses ($P=0.000$), or contact lenses ($P=0.001$), and spending more than 4 h on electronic devices ($P=0.048$). Moreover, taking breaks during electronic devices use <30 min ($P=0.018$), viewing computers at a distance less than an arm's length ($P=0.001$), and the use of screen protectors ($P=0.014$) were also significant factors related to the symptom's severity score in the current study (Table 5).

Table 5. Comparison regarding symptoms severity score (n=1048).

	Symptoms severity Score		P value#
	High (n=461)	Low (n=587)	
Age			
20-30	172 (37.3)	218 (37.1)	0.954
31-40	95 (20.6)	139 (23.7)	0.236
41-50	99 (21.5)	96 (16.4)	0.034\$
51-60	83 (18)	86 (14.7)	0.143
>60	12 (2.6)	48 (8.2)	0.000\$
Gender			
Male	102 (22.1)	213 (36.3)	0.000\$
Female	359 (77.9)	374 (63.7)	
Occupation			
Medical	65 (14.1)	90 (15.3)	0.577
Non-medical	199 (43.2)	237 (40.4)	0.363
Housewife	58 (12.6)	69 (11.8)	0.684
Not working	15 (3.3)	11 (1.9)	0.154
Retired	17 (3.7)	48 (8.2)	0.003\$
Student	107 (23.2)	132 (22.5)	0.782

(Continued)

Table 5. Continued

Permission to break lockdown	129 (28)	201 (34.2)	0.030\$
Eye diseases	358 (77.7)	305 (52)	0.000\$
Myopia*	234 (50.8)	208 (35.4)	0.000\$
Astigmatism*	136 (29.5)	100 (17)	0.000\$
Dry eye*	119 (25.8)	48 (8.2)	0.000\$
Hypermetropia*	56 (12.1)	52 (8.9)	0.082
Cataract*	19 (4.1)	8 (1.4)	0.005\$
Glaucoma*	3 (0.7)	1 (0.2)	0.326
Keratoconus*	4 (0.9)	1 (0.2)	0.175
Wearing glasses	237 (51.4)	207 (35.3)	0.000\$
Wearing contact lenses	61 (13.2)	42 (7.2)	0.001\$
Diabetes Mellitus	44 (9.5)	47 (8)	0.380
Hypertension	65 (14.1)	60 (10.2)	0.055
Previous eye operations	73 (15.8)	83 (14.1)	0.444
Use of medications affecting vision	30 (6.5)	25 (4.3)	0.105
Frequency of use of smartphones or laptops (n=1048)			
<1 hour	25 (5.4)	29 (4.9)	0.726
1-2 hours	61 (13.2)	91 (15.5)	0.300
3-4 hours	108 (23.4)	163 (27.8)	0.111
>4 hours	267 (57.9)	304 (51.8)	0.048\$
Taking breaks during use (n=1048)	403 (87.4)	512 (87.2)	0.925
Frequency of breaks (n=1048)			
No breaks	58 (12.6)	75 (12.8)	0.925
<30 min	133 (28.9)	210 (35.8)	0.018\$
30-60 min	145 (31.5)	173 (29.5)	0.489

(Continued)

Table 5. Continued

>60 min	125 (27.1)	129 (22)	0.054
Distance to screen (n=1048)			
Less than arm length	375 (81.3)	425 (72.4)	0.001[§]
More than arm length	86 (18.7)	162 (27.6)	
Position during use (n=1048)			
Sitting	185 (40.1)	268 (45.7)	0.073
Supine	13 (2.8)	17 (2.9)	0.942
Both	263 (57)	302 (51.4)	0.071
Level during use (n=1048)			
Below eye level	212 (46)	302 (51.4)	0.079
Same eye level	239 (51.8)	282 (48)	0.222
Above eye level	10 (2.2)	3 (0.5)	0.016[§]
Light source (n=1048) *			
Ceiling/wall	385 (83.5)	464 (79)	0.067
Windows	152 (33)	182 (31)	0.498
Lampshades	99 (21.5)	129 (22)	0.845
Light source (n=1048)			
Single	324 (70.3)	441 (75.1)	0.079
Multiple	137 (29.7)	146 (24.9)	
Screen brightness (n=1048)			
Faint	161 (34.9)	216 (36.8)	0.531
Pale	12 (2.6)	11 (1.9)	0.424
Bright	257 (55.7)	327 (55.7)	0.989
Very bright	31 (6.7)	33 (5.6)	0.459
Use of screen protector (n=1048)			
	74 (16.1)	64 (10.9)	0.014[§]

*More than one answer allowed, #Chi square test, §statistically significant.

Discussion

The aim of the present study was to determine the prevalence of CVS, its associated risk factors, and common symptoms associated with prolonged use of electronic devices during the period of COVID-19 curfew in Jeddah city. Out of 1227 participants recruited in the current study, 1048 participants used smartphones or laptops, and more than half (54.5%) of them used electronic devices for more than 4 h daily. A high symptom severity score was found in 44% participants in the present study.

Burning sensation in the eyes, itchy eyes, increased sensitivity to light, headache, and pain in the neck or back were the most common symptoms associated with prolonged use

of electronic devices, during the period of COVID-19 curfew. Similarly, these symptoms were found in a recent study carried out by Abudawood et al, who assessed the prevalence of CVS among medical students.⁹

In the current study, age particularly between 40 and 50 or >60 years old, was a determinant factor associated with CVS. In agreement with this result, a significant high prevalence of CVS was found among patients aged more than 40 years as compared to patients aged less than 20 years.³ In another study, significantly higher tear film evaporating rate was found in patients older than 45 years as compared to younger ones, which showed exaggerated symptoms of dryness related to CVS.¹⁰

In the current study, the symptoms severity score was significantly associated with eye diseases and astigmatism (P=0.000). Similarly, a significant increase in CVS was found in people with uncorrected residual astigmatism.^{11, 12}

Wearing glasses (P=0.000) or contact lenses (P=0.001) were significant factors associated with the symptom's severity score among the current study participants. Similar results were found by Ranasinghe et al. that showed a significant high eye symptoms severity score among contact lens wearers; moreover, contact lens wearers were more prone to dryness, which increased their CVS symptoms.^{3, 13} In another study, it was found, people who wore glasses had a significant effect on CVS symptoms.¹⁴ Another study carried out in Chennai found a significantly higher risk of having a headache and blurred vision among individuals wearing glasses or contact lenses.¹⁵

In the present study, spending more than 4 h on electronic devices (P=0.048) was a statistically significant risk factor associated with CVS. Similar results were found by Abudawood et al, who reported that the duration of studying using computers was the most significant risk factor correlated with CVS.⁹ Additionally, students who use computers for more than 4 h daily had significantly high risk of CVS.^{14, 16}

The current study results revealed that, taking breaks during computer use of <30 min (P=0.018) was significantly associated with CVS. In consistence, Hassan et al found that taking short breaks decreased visual discomfort.^{17, 18} Students who were not taking breaks during using computers were associated significantly with visual symptoms and neck and shoulder pain. In previous studies, CVS found significantly among the computer users who did not take frequent breaks.^{14, 19}

The American Optometric Association recommended viewing computer at a distance 20–28 inches.²⁰ The current results revealed that viewing a computer at a distance less than arm length (P=0.001) had a significant effect on eye symptoms severity score. In agreement with this result, recently it was found that most students who used computers at a distance of less than arm length significantly had high CVS symptoms.²¹ Additionally, it was reported that the frequency of headache was decreased in computer users who watched the screen from a long-distance.²²

Further, the use of a screen protector (P=0.014) was also significant factor related to the eye symptoms severity score in the current study. This could be explained as using screen filters might help reduce glare and reflections from the screen.²² Ranasinghe et al found significantly high CVS among patients who do not use screen filters.³ Moreover, it was reported that the risk of eye diseases was increased among students who do not use screen filters.²³

Conclusion

CVS was prevalent among individuals who used electronic devices for more than 4 h daily. Taking breaks during electronics use, viewing computers at appropriate distance, and the use of screen protectors were significant practices to relieve the eye symptoms severity score.

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Abbreviations

Computer vision syndrome (CVS)
World Health Organization (WHO)
Standard deviation (SD)

Conflict of interests

The authors declare that there is no conflict of interest regarding the publication of this article.

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None

Consent to participate

Informed consent was obtained from all participants.

Ethical Approval

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