PREVALENCE AND ERGONOMIC RISK FACTORS OF COMPUTER VISION SYNDROME AMONGST MEDICAL ACADEMIC STAFF: A CROSS-SECTIONAL STUDY

By

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Abstract

Introduction: Computer vision syndrome (CVS) is a common condition among individuals who extensively use computers. **Aim of Work:** To determine the prevalence of CVS amongst academic staff members of a Medical faculty and to identify potential risk factors associated with this syndrome. **Materials and Methods:** A cross-sectional study was carried out among academic staff members at Faculty of Medicine, Suez Canal University (No=268) using stratified random sampling technique. A self-administered questionnaire-based approach was used to collect data on socio-demographic factors, eye medical history, computer usage patterns, CVS symptoms, and ergonomic risk factors. **Results:** The prevalence of CVS among the studied academic staff members was found to be 63.4%. The symptoms most often experienced were eye strain, burning sensation, dryness of the eyes, neck and shoulder pain, back pain, and headache. Furthermore, several predictors of CVS were identified. Being female (OR=2.055, p=0.037), longer duration of daily computer usage (OR=1.627, p<0.001), presence of refractive errors (OR=2.228, p=0.007), insufficient illumination in the work environment (OR=2.679, p=0.003), and not using chair that provides support for the lower back (OR=2.327, p=0.012) were significantly associated with a higher likelihood of experiencing CVS symptoms. **Conclusion and Recommendations:** This research revealed that academicians commonly experienced CVS. The gender, duration of daily computer use, workplace lighting, presence of refractive errors, and lack of a chair with back support were all factors that significantly influenced the manifestation of CVS. Interventions are needed to address CVS in academic settings, including optimizing lighting, educating on eye health, computer use, and creating supportive work environment.

Keywords: Academic staff, Computer vision syndrome, eye symptoms and Ergonomic risk factors.

Introduction

Computer vision syndrome (CVS) is an emerging public health issue in the current era due to the increased use of computers at both work and home every day (Turkistani et al., 2021). While, using computers has improved work speed and efficacy, the resulting CVS can contribute significantly to reduced work productivity, low job satisfaction, high mistake rate, and diminished visual abilities (Derbew et al., 2021).

A computer screen including computer itself, tablet, and smart phone is generally known as Video Display Terminal (VDT). Prolonged exposure to VDTs has been the cause of an ergonomic and visual disorder known as CVS (Sengo et al., 2023). The latter refers to a complex eye and vision problem that is associated with activities that strain the close-range vision while using a computer (AOA, 2020). It occurs due to the interaction between the computer display and its surroundings, and can be evidenced by symptoms such as dryness, itching, burning, headache, blurred vision, and double vision that occur during or immediately after the workday (Lemma, et al., 2020).

Academic professionals do not just educate students; they are also engaged in various tasks that involve long and repetitive computer usage. These tasks include reading, writing, preparing manuscripts for publication, as well as participating in administrative duties and community service initiatives. All of these activities have the potential to worsen symptoms of CVS (Rochmayani and Cahyaningsih, 2021; Setyowati et al ,2021). According to a study conducted on Ethiopian instructors, computer vision syndrome prevalence was 70.4% (Zenbaba et al., 2021). Another Ethiopian study found that 67.4 % of secretary employees were suffering from CVS (Tesfaye et al., 2021). Furthermore, an Iranian research indicated that the prevalence of CVS among university employees and graduate students including faculty members was 48.7%. The study also discovered a notable and significant association between the overall CVS score and the amount of time spent using a computer (Qolami et al., 2021).

With regard to the risk factors of CVS, the most commonly reported ones include age, past history of ophthalmic diseases, poor sitting posture, inappropriate viewing distances, poor lighting, poor resolution, difference

between surrounding light and computer screen, slow refresh rate, number of hours working with computer, and glare of the screen (Lemma, et al., 2020). As far as a know, the CVS and its associated factors have not been extensively researched in Ismailia governorate. Consequently, the objective of this study is to evaluate the prevalence of CVS and the factors that may predict it among the medical faculty staff members who are currently employed.

Aim of Work

This study aims to determine the prevalence of CVS amongst academic staff members of a Medical faculty and to identify potential risk factors associated with this syndrome.

Materials and Methods

Study design: It is an analytical cross-sectional study.

Place and duration of the study: The study was undertaken amongst academic personnel of the Faculty of Medicine at Suez Canal University; from April 2022 to February 2024.

Study sample:

A sample size of 268 academic staff members was calculated using the Epi Info program version 7.1 (Epi InfoTM for Windows| Center for Disease Control and Prevention, 2022)based on a 95% confidence level, with the prevalence of CVS set at 70.2% (Zenbaba et al., 2021). The academic staff was recruited using the stratified random sampling technique. A representative sample was drawn from each department at the Medical Faculty at Suez Canal University by using simple random sampling. Both male and female faculty members with at least one year of work experience were included. Those with migraines, systemic diseases like diabetes or hypertension, ophthalmic disorders in the past year, or vision corrective surgery were excluded.

Study methods:

The data was collected via an English self-administered questionnaire comprising including five sections.

Part one: Personal information such as gender, age, level of education, and marital status,

Part two: Occupational history including professional title, and duration of employment in years.

Part three: Eye medical history including any refractive errors and used methods for vision correction.

Part four: Evaluation of computer

vision syndrome: The symptoms of computer vision syndrome were divided into two categories: ocular symptoms and extraocular symptoms (Abudawood et al., 2020). The participants were inquired about the existence of the aforementioned symptoms over the course of the preceding year. In order to be classified as a symptom of CVS, the symptom (whether intermittently or continuously) must persist for a minimum of one week during the preceding year (Ranasinghe et al., 2016).

Part five: Ergonomic risk factors including the duration of VDT utilization and the ergonomics of the computer workstation. A self-assessment checklist created by the national institutes of health was used to examine the ergonomic qualities of the office chair, keyboard and mouse worksurface, and breaks (National Institutes of Health, 2020).

Consent

Participants gave informed verbal consent before data collection and were informed about the study's purpose and confidentiality of their information.

Ethical Approval

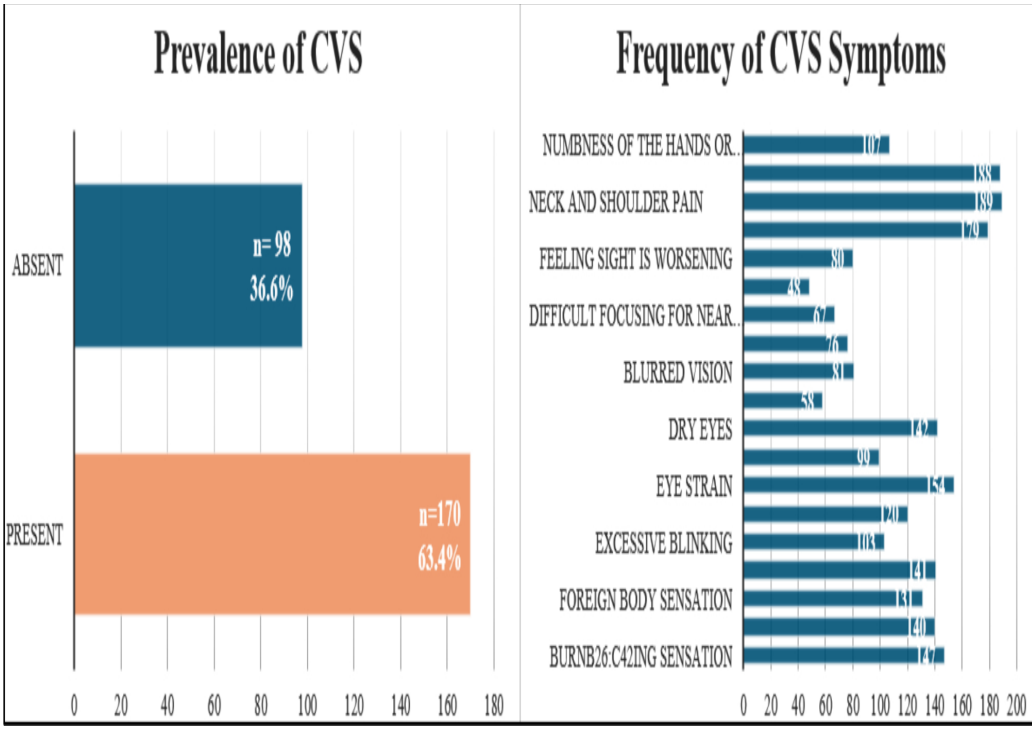
Ethical approval from the Ethical Committee at the Faculty of Medicine, Suez Canal University was obtained on March 29, 2022, under approval number #4835, and adhered to ethical protocols.

Data Management

The SPSS software version 22 was used for data entry and analysis. Descriptive statistics were used to summarize data, including mean and standard deviation for continuous variables, and frequency and percentage for categorical variables. Normality was checked using the Kolmogorov Smirnov test. Chi-square or Fisher's exact test were used to analyze the association of participants' characteristics with CVS. Logistic regression was done to find CVS predictors. Statistical significance was set at $p<0.05$.

Results

Figure 1: Prevalence of computer vision syndrome and its symptoms among the studied participants (No=268).



CVS: Computer Vision Syndrome

A total of 268 academic staff of Faculty of Medicine, Suez Canal University was invited to participate in the study. About 63% of them experienced CVS in the past year. Figure 1 displayed that the most frequently reported ocular symptom was eye strain (57.5%) followed by burning sensation (54.9%), and eye dryness (53.0%). Whereas, the least reported symptom was colored halos around objects (17.9%). The most frequently reported extraocular symptom was neck and shoulder pain (70.5%).

Table 1: Association between socio demographic variables, visual history and prevalence of computer vision syndrome among the studied participants.

Socio demographic and visual history variables	No. (%)	Total (No=268)	CVS positive (No=170)	CVS negative (No= 98)	p-value
		No. (%)	No. (%)		
Age (years)	25-	148 (55.2)	95 (55.9)	53 (54.1)	0.431[c]
	35 -	94 (35.1)	56 (32.9)	38 (38.8)	
	45 -55	26 (9.7)	19 (11.2)	7 (7.1)	
Gender	Male	75 (28.0)	40 (23.5)	35 (35.7)	**0.032*[c]**
	Female	193 (72.0)	130 (76.5)	63 (64.3)	
Marital status	Married	213 (79.5)	132 (77.6)	81 (82.7)	0.218[f]
	Single	50 (18.7)	36 (21.2)	14 (14.3)	
	Divorced /widow	5 (1.9)	2 (1.2)	3 (3.0)	
Educational level	Bachelor	74 (27.6)	47 (27.6)	27 (27.6)	0.99[c]
	Master	86 (32.1)	55 (32.4)	31 (31.6)	
	Doctorate	108 (40.3)	68 (40.0)	40 (40.8)	
Duration of employment (years)	1-	68 (25.4)	47 (27.6)	21 (21.4)	0.186[c]
	5-	97 (36.2)	58 (34.1)	39 (39.8)	
	10-	53 (19.8)	29 (17.1)	24 (24.5)	
	³15	50 (18.7)	36 (21.2)	14 (14.3)	
Presence of refractive error	Yes	142 (53.0)	104 (61.2)	38 (38.8)	**<0.001*[c]**
Type of refractive errors (No = 142)	Myopia	85 (59.9)	57 (54.8)	28 (73.7)	**0.008*[f]**
	Hypermetropia	22 (15.5)	14 (13.5)	8 (21.0)	
	Astigmatism	11 (7.7)	9 (8.7)	2 (5.3)	
	Myopia and Astigmatism	18 (12.7)	18 (17.3)	0 (0.0)	
	Hypermetropia and Astigmatism	6 (4.2)	6 (5.7)	0 (0.0)	

CVS: Computer vision syndrome

*: Statistically significant p-value (<0.05)

[c]: Chi-square Test

[f]: Fisher Exact Test

Table 1 showed that females have a significant higher prevalence of CVS (p = 0.032). There is no significant association between age, marital status, educational level or duration of employment and the prevalence of CVS. The prevalence of CVS was significantly higher among participants who have refractive error (p<0.001) and had Myopia. Nevertheless, there was no significant association between the prevalence of CVS and the method of vision correction used (p=0.329) (results were not tabulated).

Table 2: Association between screens used, other variables and the prevalence of computer vision syndrome among the studied participants.

Variables No. (%)		Total (No=268)	CVS positive (No = 170)	CVS negative (No = 98)	p-value
		No. (%)	No. (%)		
Wear spectacles while working at the computer	Yes	98 (36.6)	69 (40.6)	29 (29.6)	0.072[c]
	NO	170 (63.4)	101 (59.4)	69 (70.4)	
Wear contact lenses while working at the computer	Yes	49 (18.3)	33 (19.4)	16 (16.3)	0.529[c]
	NO	219 (81.7)	137 (80.6)	82 (83.7)	
Working hours with computer/day	< 5 hours	126 (47.0)	70 (41.2)	56 (57.1)	**0.012***c
	³5 hours	142 (53.0)	100 (58.8)	42 (42.9)	
Time spent on mobile (rather than calling)	< 4 hours	118 (44.0)	77 (45.3)	41 (41.8)	0.583[c]
	³ 4 hours	150 (56.0)	93 (54.7)	57 (58.2)	
View reference material while working at the computer	Yes	65 (24.3)	48 (28.2)	17 (17.3)	**0.045*[c]**
	NO	203 (75.7)	122 (71.8)	81 (82.7)	

CVS: Computer vision syndrome *: Statistically significant p-value (<0.05)

[c]: Chi-square Test [f]: Fisher Exact Test

Table 2 demonstrated that 53.0% of the participants work on computer for 5 and more hours per day, with mean duration 4.78 ± 2.12 working hours per day (results were not tabulated). The prevalence of CVS was significantly higher among participants who spent 5 and more hours per day working on the computer (p=0.012). Additionally, the act of viewing a reference material while using a computer also exhibits a significant relationship with the prevalence of CVS (p=0.045).

Table 3: Association between ergonomic aspects of the workstation of the studied participants and prevalence of computer vision syndrome.

Ergonomic aspects	Yes	CVS positive (No= 170)	CVS negative (No= 98)	p-value Chi-square Test
	No. (%)	No. (%)	No. (%)	
Chair				
Can the height, seat and back of the chair be adjusted?	143 (53.4)	87 (51.2)	56 (57.1)	0.346
Are your feet fully supported by the floor when you are seated?	197 (73.5)	125 (73.5)	72 (73.5)	0.991
Does your chair provide support for your lower back?	117 (43.7)	63 (37.1)	54 (55.1)	**0.004***
Keyboard and Mouse				
Are your keyboard, mouse and work surface at your elbow height?	126 (47.0)	77 (45.3)	49 (50.0)	0.457
Is the mouse comfortable to use?	141 (52.6)	88 (51.8)	53 (54.1)	0.714

Workstation environment and monitor				
Is your monitor and work surface free from glare?	102 (38.1)	55 (32.4)	47 (48.0)	**0.011***
Do you use screen filter/antiglare screen	69 (25.7)	35 (20.6)	34 (34.7)	**0.011***
Do you have appropriate light for reading or writing documents?	148 (55.2)	76 (44.7)	72 (73.5)	**<0.001***
Break				
Do you take postural breaks every 30 minutes?	122 (45.5)	68 (40.0)	54 (55.1)	**0.017***
Do you take regular eye breaks from looking at your monitor?	120 (44.8)	68 (40.0)	52 (53.1)	**0.038***
Accessories				
Is there a sloped desk surface or angle broad for reading and writing tasks if required?	77 (28.7)	52 (30.6)	25 (25.5)	0.376

CVS: Computer vision syndrome *: Statistically significant p-value (<0.05)

As shown in Table 3, the prevalence of CVS was significantly lower among participants who use a chair that support the lower back, who are using work surface free from glare, using antiglare screen and had appropriate light for reading and writing documents. Moreover, taking postural breaks every 30 minutes and regular eye breaks from looking at the monitor were significantly linked with the decrease in the prevalence of CVS (p= 0.017 and 0.038 respectively).

Table 4. Regression analysis for the predictors of computer vision syndrome among the studied population.

Predictors	p value	OR	95% CI
Gender Male (ref.) Female	**0.037***	1 2.055	1.046 – 4.038
Presence of refractive errors Yes NO (ref.)	**0.007***	2.288 1	1.259 – 4.160
Duration of daily computer use in hours [Q]	**<0.001***	1.627	1.353 – 1.958
Viewing reference material while working at the computer Yes NO (ref.)	0.467	1.308 1	0.635 – 2.693
The chair provide support for the lower back Yes (ref.) NO	**0.012***	1 2.327	1.206 – 4.488
The monitor and work surface are free from glare Yes (ref.) NO	0.575	1 1.231	0.596– 2.543
Use screen filter/antiglare screen Yes (ref.) NO	0.669	1 1.196	0.529 – 2.717

Have appropriate light for reading or writing documents Yes (ref.) NO	**0.003***	1 2.679	1.413 – 5.081
Take postural breaks every 30 minutes Yes (ref.) NO	0.960	1 0.982	0.477 – 2.109
Take regular eye breaks from looking at the monitor Yes (ref.) NO	0.115	1 1.843	0.862– 3.940
Constant	**<0.001***	0.017	

Q: Quantitative variable. *: Statistically significant p-value (<0.05). OR = Odds Ratio. CI = Confidence Interval.

As shown in table 4, being female (OR=2.055, p=0.037), having a refractive error (OR=2.228, p=0.007), and increasing working hours on the computer (OR=1.627, p<0.001) were significant predictors for the occurrence of CVS among the studied participants. The likelihood of developing CVS was 2.327 times higher among individuals who do not utilize chairs that offer lower back support in comparison to those who use chairs that provide such support. Additionally, individuals who worked in inadequate lighting faced a 2.679 times increased risk of developing CVS compared to those who worked in adequate lighting.

Discussion

Computer Vision Syndrome is a prevalent issue among academic staff in higher education institutions, affecting their well-being and productivity. In the current study, around two thirds of studied academic staff exhibited the criteria of the computer vision syndrome (63.4%) throughout the previous 12-month period (Figure 1). The high prevalence rate may be related to the nature of academic work, involving extended computer use for various tasks. Academic staff may also lack knowledge of ergonomic practices or access to suitable workstations. This finding aligned with a study from Indonesia which was carried out within the academic community of the University of Mulawarman, which revealed that the prevalence of CVS was 79.4% (Setyowati et al ,2021). Also, Tesfaye et al. (2022) in their study disclosed that the prevalence of CVS in Ethiopian academic members was 78.80%. Additionally, a survey was carried out on medical faculty members in Saudi Arabia, the prevalence of CVS was reported to be 81.2% (Zalat et al., 2022). Variations in the studied populations, computer usage, assessment tools, and workspace ergonomics contribute to differences in CVS prevalence rates among academic settings. Some studies during the COVID-19 pandemic observed increased computer use due to online lectures.

Among the various ocular symptoms associated with CVS, the most frequently reported symptoms among the studied academic staff were eye strain (57.5%), burning sensation (54.9%), and eye dryness (53.0%) Whereas, in terms of extraocular symptoms, neck and shoulder pain (70.5%),backpain(70.1%)andheadache (66.8%) were the most commonly noted symptoms among participants (Figure 1). These results matched those observed by previous studies where the commonest CVS symptoms among the enrolled academicians were neck pain, headache, burning sensation, dryness, and eye fatigue (Aldawsari et al., 2018; Qolami et al., 2021; Zenbaba et al., 2021).

Interestingly, we did not observe any notable relation between age, marital status, level of education, or duration of employment and the prevalence of CVS (Table 1). These findings were similar with the results of a study conducted by Zainuddin and

Muhammad (2014), which also found no significant association between prevalence of CVS and both age and work experience. On the other hand, females have a significant higher prevalence of CVS ($p = 0.032$) (Table 1). This result corroborates the findings of previous studies, indicating that the female gender was significantly linked to the susceptibility of developing CVS (Ranasinghe et al., 2016, Abudawood et al., 2020; Peiris et al., 2020; Zalat et al, 2022). Moreover, the prevalence of CVS was significantly higher among participants who have refractive error ($p<0.001$) and Myopia ($p = 0.008$) (Table 1). This finding was in contrary to those of Abudawood et al. (2020) that refractive errors showed no significant association with CVS.

The current study also revealed that participants who spent five hours or more on the computer per day have a significant higher prevalence of CVS compared to those who used the computer for less than five hours ($p = 0.012$) (Table 2). This finding supported the findings of a study conducted in Jordan, which showed that engaging in continuous computer work for a minimum of 5 hours among academic and administrative staff appears to raise the likelihood of experiencing visual symptoms (Shahwan et al., 2022). Also, it is worth mentioning that the use of reference material while using the computer was strongly linked to the occurrence of computer vision syndrome (Table 2). A possible explanation for this might be that constantly shifting focus between the computer screen and printed materials can increase eye fatigue and strain, contributing to CVS symptoms.

Furthermore, the present study demonstrated that the existence of glare on the computer monitor, the failure to utilize an antiglare screen, and presence of appropriate light for reading or writing documents were significantly associated with the occurrence of CVS (Table 3). This result was in accordance with the findings of Ranasinghe et al. (2016), who detected a notably higher prevalence of CVS among individuals who did not use screen filters. Similarly, there have been other studies that have also indicated that the presence of bright lighting and glare in the work environment can result in eye strain and difficulties in perceiving objects on computer screens, with a significant correlation being reported between the observed visual symptoms

and the presence of glare on the screen (Sheppard and Wolffsohn, 2018; Sánchez-Brau et al., 2020; Shahwan et al., 2022).

Not having a chair with a lower back support, not taking regular breaks to adjust posture every 30 minutes and neglecting to take regular eye breaks from looking at the monitor were strongly associated with experiencing CVS among the studied participants (Table 3). This could be because taking regular breaks during continuous computer work helps to reduce eye strain. Changing the focus from the computer screen relaxes the eye muscles and accommodative system, thereby increasing work efficiency. Additionally, maintaining the same posture for a prolonged period can lead to muscle fatigue and increase the risk of CVS (Shantakumari et al., 2014; Tesfaye et al., 2022). This was in harmony with the results of other researches, which similarly found that individuals who took regular breaks faced a reduced likelihood of experiencing symptoms associated with CVS compared to those who did not engage in such breaks (Dessie et al., 2018; Noreen et al., 2020; Derbew et al., 2021).

According to the results of the multivariate analysis, the likelihood of acquiring CVS was 2.055 times greater in females compared to males (Table 4). Variations in eye structure, hormonal factors, or visual behavior differences may explain this finding. Also, female hormones such as estrogen can affect tear production and stability, leading to increased dryness and discomfort during computer use (Guillon and Maïssa, 2010; Nuzzi and Caselgrandi, 2022). This finding was similar to the findings in Ethiopia, indicating that females have a greater likelihood of experiencing CVS when compared to males (OR = 2.69) (Zenbaba et al., 2021). Another important finding was that daily computer usage for several hours was a significant predictor of CVS. Participants who spent long time on the computer per day were more prone to develop CVS (OR = 1.627) (Table 4). This could be explained by that extended use of computer screens can reduce blinking, leading to dry eyes. Staring at a fixed distance for long periods can result in accommodation fatigue, causing eye strain, blurred vision, and headache. This finding aligned with previous studies of the same nature, which indicated that a long time was spent on the computer substantially raises the risk of CVS

(Abudawood et al., 2020; Peiris et al., 2020; Qolami et al., 2021; Rochmayani and Cahyaningsih, 2021). Additionally, having a refractive error was another statistically significant predictor for CVS among the studied participants (OR=2.228) (Table 4). A possible explanation for this might be that when refractive errors are present, the eyes may have difficulty focusing on digital screens, leading to eye strain and discomfort. Also, in the current study the participants who opted not to utilize chairs that offered lower back support had a 2.327 times higher likelihood of developing CVS in comparison to individuals who did make use of such chairs (Table 4). This may be due to that extended sitting without proper lumbar support can lead to poor posture, causing strain on the neck, shoulders, and eyes. Moreover, participants in poorly lit environments were 2.679 times more likely to develop CVS compared to those in well-lit settings (Table 4). This aligns with findings from other studies (Tesfaye et al., 2022; Zalat et al., 2022). Insufficient lighting can create challenges in focusing on the computer screen, resulting in eye exhaustion and discomfort. The existence of glare on the computer monitor and the failure to utilize an antiglare screen were factors that had the potential to predict the occurrence of computer vision syndrome among the studied group (Table 4). This was in agreement with the studies done by Sánchez-Brau et al., 2020; Shahwan et al., 2022; who also reported that the presence of bright lighting and glare in the work environment can result in eye strain and difficulties in perceiving objects on computer screens.

Conclusion

Computer vision syndrome is prevalent among academic staff members, where eye strain, burning sensation, eye dryness, neck and shoulder pain, and back pain are committed as the most common symptoms. The present study identified predictors for this high prevalence, such as being female, longer daily use of computers, having refractive error, not having a chair with lower back support, and inadequate lighting.

Recommendations

The research has the potential to assist all the parties involved in implementing preventive measures in order to mitigate this occupational health problem among academicians. Additionally, it could contribute to raising awareness among teaching staff

about the health risks associated with VDTS. Proactive measures are needed due to high CVS prevalence among academic staff. Initiatives should promote proper ergonomics, breaks, and eye care. Institutions must create guidelines for ergonomic workstations and encourage healthy computer habits. Regular eye exams are crucial, especially for high-risk individuals. Additional support is necessary for female staff at risk. Future research is needed to understand contributing factors and intervention effectiveness.

Study limitations

The current study provides valuable insights, but it is important to recognize its limitations, specifically the potential for recall bias with self-reported data. The use of a single university setting may restrict the generalization of the findings. Additionally, the cross-sectional design does not determine causality; a longitudinal study would offer a more thorough understanding of CVS prevalence and progression among academic staff.

Conflict of Interest

The author stated that there was no conflict of interest.

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