Prevalence and Associated Factors of Computer Vision Syndrome Among Academic Staff in the University of Gondar, Northwest Ethiopia: An Institution-Based Cross-Sectional Study

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ABSTRACT

INTRODUCTION: Computer vision syndrome (CVS) is the leading occupational hazard of the 21st century, which causes the critical public health issues in the present era. In developing countries, including Ethiopia, data on the proportion and the causes of CVS are scarce among academic staff for policy conclusions. Accordingly, this study was conducted to determine the prevalence and factors associated with CVS among academic staff at the University of Gondar.

METHODS: Institution-based cross-sectional study design was conducted from March to April, 2021. A simple random sampling technique was used to select 525 study participants. Data were collected using a pre-tested self-administered structured questionnaire. The collected data were then entered into EpiData version 4.6 and analyzed using STATA version 14 software. The association between dependent and independent variables was computed with a binary logistic regression.

RESULTS: The prevalence of CVS was found to be 78.8% out of a total of 500 participants [95% CI (74.95, 82.30)], of which the majority (71.60%) of them were males. Using a computer for more than 9 years [AOR = 1.65, 95% CI (1.01, 2.71)], using visual display terminals [AOR = 2.63, 95% CI (1.60, 4.32)], and working in improper illumination levels (300 and >500 lux) [AOR = 2.47, 95% CI (1.47, 4.33)] increased the risk of CVS, whereas, Using eye droplets [AOR = 0.30, 95% CI (0.15, 0.58)] and taking rest breaks [AOR = 0.55, 95% CI (0.34-0.92)] were protective factors.

CONCLUSION: This study disclosed that CVS was common among academicians. In the current study, the manifestation of CVS was affected by years of computer use, visual display terminals use, workplace illumination level, rest breaks, and eye droplets. Taking rest breaks in between the work, reducing exposure to display screens, use of eye drops, and optimizing workplace illumination levels are recommended to reduce the problem.

KEYWORDS: Computer vision syndrome, prevalence, associate factors, academician, Ethiopia

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Introduction

The American Optometric Association defines computer vision syndrome (CVS) as a group of eye and vision-related problems resulting from prolonged usage of digital screens.[1] Headaches, eye irritation, blurred vision, double vision, eye strain, and eye fatigue are common symptoms of CVS.[2] Nowadays, in both private and government institutions, working without computers is challenging.[3] Meanwhile, investigations proved that the use of computers for more than 3 hours per day intensifies the incidences of CVS[3-5] and it is a major occupational epidemic of the 21st century.[6,7] The effects of CVS on users' health can be expressed in terms of musculoskeletal,[8] psychological,[9] physiological,[10] occupational productivity,[11] and quality of life (QoL) as well as visual comfort.[5] This leads to lower employee work efficiency, loss of productivity, a higher rate of errors, worse job satisfaction, and a lower quality of life.[1,12] As revealed by research, it can reduce productivity by up to 40%.[11]

The epidemiology of CVS differs based on definitions and populations under investigation. Literature suggests, about 90% of computer users experience visual and ocular symptoms such as headaches, eye strain, ocular discomfort, dry eye, and blurred vision.[13,14] According to literature,[15] over 60 million people worldwide suffer from CVS, with 1 million new cases occurring per year. Similarly, the problem of CVS is extremely high in developing countries compared to developed nations because of lack of access to and use of personal protective equipment, high workload, and limited break time when using a computer.[16] Plausible studies reported the prevalence of CVS was 54.6% in Brazil,[17] 63% in Malaysia,[18] 67.4% in Sri Lanka,[19] 67.8% in Lebanon,[20] and 69.3% in Chennai.[21] In Africa, studies reported that the prevalence of CVS was 65% in Nigeria,[22] and 51.5% in

Ghana.[3] Also, a study conducted in Egypt showed that 92% of eye tiredness was reported among computer operators.[23] In Ethiopia, the prevalence of CVS ranges from 68.8%[24] to 81.3%[25] among different population groups.

A range of risk factors has been associated with the occurrence of computer vision syndrome (CVS).[17,19] Age,[12] sex,[19] monthly income, occupational status,[26] and years of computer use[12] are among the sociodemographic factors associated with CVS. Working hours on computers per day, knowledge of CVS, use of electronic materials outside work, monitor distance, and adjustment of screen brightness are among personal factors that contribute to CVS development.[3,9,18,19,24,26-28] While, alcohol drinking, cigarette smoking, and khat chewing are among behavioral factors.[13,29,30] In addition, scholars have explored that CVS is associated with work and environmental-related characteristics including workplace illumination level, glare, antiglare filter, use of eye drops, window curtains, and brightness of computer screen.[3,19,25,27,31-33]

Academicians not only teach students, but they are also involved in a wide range of activities characterized by prolonged and repetitive computer use during writing, reading, preparing notes, and writing manuscripts for publication, as well as in administrative activities and community service programs, all of which have the potential to exacerbate CVS symptoms.[18,34-37] However, there have been few studies on the magnitude and risk factors of CVS among academicians, with an emphasis on western nations. However, in developing nations including Ethiopia, the proportion of CVS among academics and the causes that lead to CVS remain uncertain to conclude. In addition, due to the lack of up-to-date and reliable data on computer vision syndrome (CVS), it is challenging to design policies and programs for the prevention and control of such problems. Therefore, determining the prevalence and associated factors of CVS is needed to ensure a sufficient allocation of healthcare resources to address this growing public health problem. So, the purpose of this study was to explore the prevalence and risk factors of computer vision syndrome among academic staff at the University of Gondar, Northwest Ethiopia.

Materials and Methods

Study design and period

An institution-based cross-sectional study was employed to assess computer vision syndrome and associated factors among academic staff at the University of Gondar from 17 March to 17 April, 2021.

Study setting and area

The study was conducted at the University of Gondar. The University of Gondar is found in the oldest and most historical city of Gondar, Northwestern Ethiopia, and it is located 737 km from Addis Ababa, the capital of Ethiopia.[12] The establishment of the University dates back to 1954. Currently, the University has 5 campuses: the College of Medicine and Health Sciences and Comprehensive Specialized Hospital (CMHS), Maraki, Atse Tewdros, Atse Fasil, and Teda.[38] During the study period, there were a total of 2858 academic staff on all campuses.

Source and study populations

All academic staff at the University of Gondar were the source population. Besides, the randomly selected academic staff on each campus were the study population.

Inclusion and exclusion criteria

Academic staff who had at least 1 year of working experience and who were available during data collection time were included while those who had a history of ocular diseases like acute, chronic, infective conjunctivitis, eyelid disorders, chronic migraine, uncorrected refractive error, and other binocular vision problems were excluded.[39]

Sample size determination and sampling procedure

The sample size was calculated by using single population proportion formula,[40] with the following assumptions: prevalence (p) of CVS among users 73% from previous study,[41] 4% margin of error (d), and 95% confidence interval (CI). Accordingly, based on a single population proportion formula:- $n = (Z\alpha/_2)^2 \frac{[p(1-p)]}{d^2}$; where n = initial sample size, $Z = 1.96$, the corresponding Z-score for the 95% CI, P = Proportion = 73%, d = Margin of error = 4%; $n = (1.96)^2 \frac{[0.73(1-0.73)]}{0.04^2} = 473$. The total sample size (N = 520) was obtained by addition of 10% contingency for non-response rate on a calculated sample size for the first objective.

Whereas, EPI INFO version 7 software was applied to calculate the sample size for the factors associated with CVS (for the second objective) so as to ensure the adequacy of the sample. To do so, 3 associated factors from the previous study,[41] inappropriate seating position (83.96% of the participants were exposed and 2.55 crude odds ratio (COR) with 95% CI), taking breaks for >20 minutes (77.31% of the participants were exposed and 2.04 crude odds ratio (COR) with 95% CI), and using eyeglasses (88.57% of the participants were exposed and 3.16 crude odds ratio (COR) with 95% CI) were taken to attain 255, 389 and 477 samples, respectively. Finally, we took the largest sample size (477) to ensure the adequacy of the sample for statistical power. We added 10% for non-response rate which gave us the ultimate sample of 525 respondents. So, the adequate sample size for this study was 525 academicians, using the second objective sample size calculation.

The simple random sampling technique was employed to enumerate the study subjects based on data obtained from the

human resources department of all campuses. OpenEpi Random Program version 3 was used to randomize academic staff registered in the staff list of the human resource management office of each campus and the selected academic staff were invited for the study.

Operational definitions

Computer vision syndrome (CVS): the presence of at least one symptom in one or 2 eyes at any time during the last 12 months.[12] The symptoms include blurred vision, eye strain, eye fatigue, redness of the eyes, watery eyes, eye dryness, double vision, eye irritation, burning sensation, and headache.

Good knowledge of CVS: knowledge of participants who correctly answered greater than or equal to 7 (⩾70%) questions out of 10 knowledge-related questions about CVS.[19,26]

Poor knowledge of CVS: knowledge of participants who correctly answered less than 7 questions out of 10 knowledge-related questions about CVS.[19,26]

Presence of glare on the computer screen: existence of direct light sources on the computer screen because of unshaded windows with curtains/blinds.[42]

Appropriate seating position: the face of the user is just at level with the computer screen.[41,43]

Viewing distance: the distance from the eye of the user to the computer screen in centimeters

Workplace illumination level: the average amount of light falling on task position, 300 to 500 lux is optimum illumination level, and <300 lux (low) or >500 lux (high) is improper illumination level[44,45]; when measured 76 cm above the floor.[46]

Cigarette smoker: smoking at least one stick of cigarette per day.[47]

Alcohol drinker: the consumption of any kind of alcohol by academic staff at least 2 times per week.[47]

Khat chewer: chewing khat 3 times per week for at least 12 months.[47,48]

A habit of taking rest breaks: a brief rest break taken every 60 to 120 minutes. During this break, a respondent may stand up, move around, or do something else, get a beverage, take coffee or tea, chat up a coworker, or take a lap around the office.[49]

Data collection tools and procedure

Data were collected through a pretested self-administered structured questionnaire. The questionnaire was adopted after an extensive review of existing literature and consisted of 5 sections containing different items. The first section, socio-demographic characteristics, assesses information on age, sex, educational status, and working experience. The second section included questions related to knowledge of CVS. In this section, the academician knowledge of CVS using 10-items questions was assessed. The list of the questions incorporated knowledge of the problem caused by computer use and knowledge of safety measures taken during use of a computer (adjustment of computer brightness, use of an anti-glare filter, use of eyeglasses, and taking a regular break). Responses to the questions were coded as "True" when the score is one, and "False" when the score is zero. Knowledge score was then computed and dichotomized into poor knowledge for <70% and good knowledge for ⩾70% correct responses out of the total scores. The tool was used in an earlier study performed in the country's context.[24] The third category encompasses questions that assess information on CVS. A structured self-administered questionnaire adopted from the American Optometric Association tool (Standardized) was used to evaluate symptoms of CVS.[50] The tool addresses 10 symptoms including blurred vision, eye strain, eye fatigue, redness of eyes, watery eyes, eye dryness, double vision, eye irritation, burning sensation, and headache during the last 12 months. The CVS was calculated by summing up the 10 symptom scores. Scoring of the answers is based on 0 (no) and 1 (yes), whereby a 0 score indicates the absence of symptom and a 1 score reflects the presence of symptom. Individuals scoring of at least one symptom during the last 12 months were ascertained as the presence of CVS. The instrument has been employed in previous studies conducted in Ethiopia.[24,26,39,41]

The fourth and fifth sections provided detailed information on personal and environmental factors including cigarette smoking (yes/no), khat chewing (yes/no), alcohol consumption (yes/no), physical activity (yes/no), working hours (hours/day), a habit of taking a break (yes/no), eyeglass use (yes/no), eye droplet use (yes/no), history of systemic illness (yes/no), etc. affecting the computer vision syndrome. Additionally, the fifth section comprises standardized checklist used to evaluate workplace hazards and observe employees' onsite safety practices.[19] The checklist assesses computer and environmental-related factors such as seating position, source and direction of light, the position of the window, and presence of glare and window curtain. Furthermore, workplace illumination level was measured to evaluate the average illuminance in the working area. It was measured by using a lux meter (LX-103 ISO-9001, CE, IEC1010) in 2 positions: one at the keyboard position (20 cm apart) and 2 others on the top of the computer screen (10 cm apart). The average of these measurements was calculated and taken as the average illuminance level of the task position (Figure 1).

Before disseminating the questionnaire, data collectors asked each study participant about the history of his/her eyes to assess their visual acuity, ocular disease, eye health, refractive error, and chronic migraine. Participants who had been confirmed with such eye problems were excluded from the study. Finally, the self-administered questionnaire was distributed to all eligible participants at their workplaces.

Data quality control

The questionnaire was first developed in English and translated into the local language, Amharic, and back to English by language experts and professionals to ensure consistency. Two

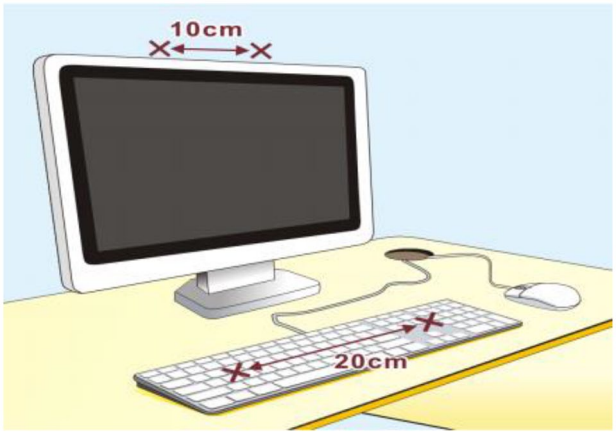

Figure 1. The method of illumination level measurement for a computer workstation.

BSc ophthalmic nurses working in the University of Gondar Comprehensive Specialized Hospital were involved in data collection after they took adequate training and orientation. Likewise, 2 MSc ophthalmic nurse supervisors working in the College of Medicine and Health Sciences at the University of Gondar were recruited. The data collectors and supervisor had taken orientation on issues relating to the clarity of the questions, objectives of the study, confidentiality of information, voluntary involvement (consent) in the study, and time of data collection as study participants' regular duties should not be compromised. The principal investigator supervised both data collectors and supervisors. To test the validity and reliability of the questionnaire, a pre-test was conducted 1 week before the actual data collection on 5% (27) of the sample size at *Teda Health Sciences College* in Gondar city, and the College was excluded in the final survey. Based on the finding from the pre-test analysis, a few modifications were made to avoid misinterpretations and ambiguities, and the time taken for the data collection was estimated. When there was a problem during the data collection, the feedback was given by discussing it with the principal investigator, supervisors, and, data collectors.

Data processing and analysis

Data were checked for completeness and entered into Epi-data version 4.6 and then exported to STATA Version 14 for further analysis. Besides, we performed descriptive statistics and presented the results with narration, tabulation, and graphical presentation. Normality, outliers. Multicollinearity of the variables were checked before running bivariable and multivariable binary logistic regression analysis where the multicollinearity assumption was checked by a variance inflation factor (VIF), and all variables showed values of <5. Thus, we found no evidence of multicollinearity. The reliability of the standardized American Optometric Association Questionnaire which was used to evaluate symptoms of CVS was tested using Cronbach's alpha and a reliable Cronbach's alpha = .7974 was found. The 10- items knowledge questionnaire of the CVS was also examined for reliability and Cronbach's alpha was found to be .8184. The instruments were, therefore, tolerable for their consistencies in repeating what have previously been measured using the tools.

The association between dependent and independent variables was computed with a binary logistic regression. Variables with *P*-values of <.2 in the bivariable logistic regression analysis were exported to a multivariable logistic regression to control the potential effects of confounders. Lastly, statistically significant variables were established at *P*-value < .05 in a multivariable binary logistic regression model, and an adjusted odds ratio (AOR) with a confidence interval of 95% was reported to measure the strength of the association. The final model was checked for goodness-of-fit using the Hosmer–Lemeshow test, and the result explained a good fit (*P* = .741).

Results

Socio-demographic characteristics of study participants

A total of 500 questionnaires were completed correctly which gave a response rate of 95.24%. More than two-thirds (71.60%) of the participants were male. The median (interquartile range (IQR)) age of the participants was 30 (28-34) years. The majority of the respondents, 284 (56.80%), were married. Regarding educational status, 345 (69%) of the participants were master's degree holders. The participants' mean years of computer use was 9 (SD ± 4) years (Table 1).

Personal characteristics of study participants

Of the study participants, 273 (54.60%) of them reported they were taking a regular break during working time, and their mean (±SD) estimated length of break time was found to be 22.49 (±10.16) minutes. The median (interquartile range (IQR)) viewing distance between the participants' eyes to their computer screens was 50 cm (45-60 cm). More than half (55.20%) of participants' seating position was found to be inappropriate. The majority of the respondents, 388 (77.60%), did not wear eyeglasses. Moreover, only 1 in 10 (10.40%) of the participants used eye droplets while using a computer. On the other hand, one-fifth (20.60%) of the participants consulted an eye specialist for their eye problems and 4.60% of them had a previous eye disorder. Furthermore, 5.40% of them had systemic disease (Table 2). Nearly half (51.8%) of the respondents used visual display terminals (VDTs) outside work and 149 (57.53%) of them spent more than 3 hours on them (Figure 2).

Behavioral characteristics of study participants

Of all the study participants, only 11 (2.20%) of them reported they were cigarette smokers and 17 (3.40%) of them described they were chewing khat. Whereas a quarter (23.8%) of the respondents had alcohol drinking habits (Table 3).

Table 1. Socio-demographic characteristics of academic staff, University of Gondar, Ethiopia, 2021 (N = 500).

VARIABLES	FREQUENCY	PERCENT (%)
Sex		
Male	358	71.60
Female	142	28.40
Age (years)		
21-29	190	38.00
30-39	244	48.80
>40	66	13.20
Marital status		
Single	207	41.40
Married	284	56.80
Divorced	9	1.80
Educational status		
Degree	76	15.20
Master	345	69.00
PhD	79	15.80
Year of computer use (in years)		
<9	263	52.60
>9	237	47.60

Table 2. Personal characteristics of academic staff, University of Gondar, Ethiopia, 2021 (N = 500).

VARIABLES	FREQUENCY	PERCENT (%)
Working hours with computer/day		
<8	324	64.80
>8	176	35.20
The habit of taking a regular break		
Yes	273	54.60
No	227	45.40
Length of break		
<20 min	75	27.47
⩾20 min	198	72.53
Seating position		
Appropriate	224	44.80
Inappropriate	276	55.20
Distance of the user from the computer screen		
⩽50 cm	317	63.40
>50 cm	183	36.60
The reported reason for using computer		
Checking email	408	81.60
Social media	317	63.40
For research work	345	69.00
Reading and writing teaching material	454	90.80
Eyeglasses/spectacle use		
Yes	112	22.40
No	388	77.60
Eyeglasses/spectacle purpose		
For computer	98	87.50
For other*	14	12.50
Use of eye droplets		
Yes	52	10.40
No	448	89.60
Consulted eye specialist		
Yes	104	20.60
No	396	79.40
Previous history of eye problem		
Yes	23	4.60
No	477	95.40
Systemic disease		
Yes	27	5.40
No	473	94.60
Systemic disease reported		
Hypertension	7	25.93
Kidney stone	6	22.22
Diabetes mellitus	7	25.93
Asthma	5	18.52
Stroke	2	7.40
Knowledge about CVS		
Good	438	87.60
Poor	62	12.40

*Eyeglasses/spectacles for sunlight, for boost up, for safety, cosmetics.

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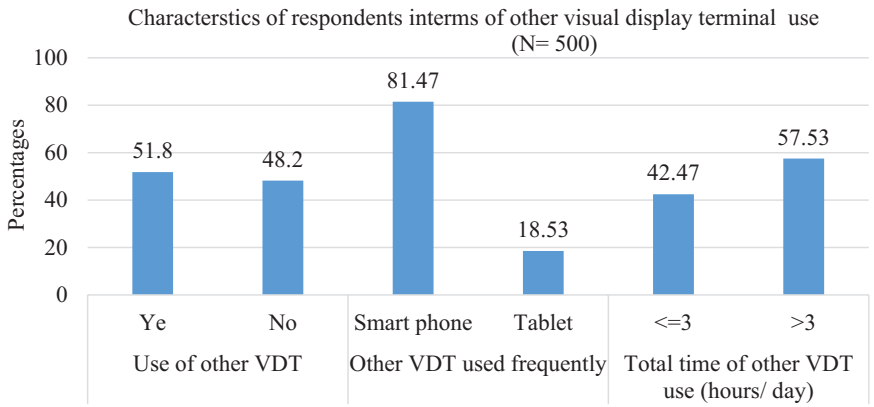

Figure 2. Characteristics of academic staff in terms of other visual display terminal use, University of Gondar, Ethiopia, 2021 (N = 500).

Table 3. Behavioral characteristics of academic staff, University of Gondar, Ethiopia, 2021 (N = 500).

VARIABLES	FREQUENCY	PERCENT (%)
Smoking cigarette		
Yes	11	2.20
No	489	97.80
The number of stick/s smoking per day?		
1-2	9	81.82
>2	2	18.18
Chewing Khat		
Yes	17	3.40
No	483	96.60
Frequency of chewing khat		
Daily	4	23.53
Once during 2 or 3 day	11	64.71
Once a week.	2	11.76
Alcohol drinking (at least twice per week)		
Yes	119	23.80
No	381	76.20

Computer and environmental-related characteristics of study participants

Above one-third (34.80%) of participants' computer screens was adjusted below the eye level. Only 31% (n = 157) of the participants reported that they used ergonomically comfortable setting chairs. Regarding workplace illumination levels, 4 in 5 (79.60%) of the employees worked in improper illumination levels (<300 and >500 lux). Moreover, 238 (47.60%) of the respondents claimed that there was a glare on their computer screen and 40% (n = 205) of respondents' workplace window/s was/were not covered with curtains/blinds. Of the participants, only 170 (34%) of them used an antiglare filter on their computer screen and nearly half (52%) of the respondents reported that they have adjusted their computer brightness (Table 4). Concerning workplace light sources, 274 (54.80%) of the respondents used natural light sources, and above half (55.36%) of the light source was found in the side (right or left) direction of the respondents (Figure 3).

Prevalence of computer vision syndrome (CVS)

The prevalence of computer vision syndrome among academic staff of University of Gondar during the last 12 months was 78.80% [95% CI (74.95, 82.30)]. The commonest CVS symptoms reported were headache (47%), eye redness (46.80%), blurred vision (45.80%), burning sensation (43.80%), eye irritation (42.80%), and eye fatigue (40.80%). Whereas, the least commonly reported symptom was a double vision (16.40%). There is no significant difference in the prevalence between male and female respondents (57% vs 21.8%), respectively ($X^2 = 0.49$; $P = .482$) (Figure 4).

Factors associated with computer vision syndrome

In the bivariable logistic regression analysis, years of computer use, a habit of taking breaks, use of visual display terminals (VDTs), use of eye droplets, sitting chair, the brightness of computer screen, use of an anti-glare filter, and workplace illumination level were factors associated with CVS. However, after controlling for confounding variables in the multivariable binary logistic regression analysis, only years of computer use, a habit of taking breaks, use of visual display terminals, use of eye droplets, and workplace illumination level were factors that remained to have a significant association with a computer vision syndrome.

Employees who used a computer for greater than 9 years were 1.65 times more likely to develop CVS compared to those who used it for 9 years or less [AOR = 1.65, 95% CI (1.01, 2.71)]. Participants who took rest breaks in between work were 45% less likely to develop CVS compared to their counterparts

Table 4. Computer and environmental-related characteristics of academic staff, University of Gondar, Ethiopia, 2021 (N = 500).

VARIABLES	FREQUENCY	PERCENT (%)
Types of a computer used		
Desktop only	85	17.00
Both desktop and laptop	195	39.00
Laptop only	220	44.00
Level of a computer screen		
Above eye level	63	12.60
At eye level	263	52.60
Blow eye level	174	34.80
Ergonomically comfortable sitting chair		
Yes	157	31.40
No	343	68.60
Position of window/s		
Window/s at the side of a computer	300	60.00
Window/s at the front of a computer	93	18.60
Window/s at the back	107	21.40
Window/s covered with curtains/blinds		
Yes	295	59.00
No	205	41.00
Glare on the computer		
Yes	262	52.40
No	238	47.60
Use antiglare filter		
Yes	170	34.00
No	330	66.00
Adjust computer brightness		
Yes	260	52.00
No	240	48.00
Illumination level		
300-500 lux (optimum)	102	20.40
<300 and >500 lux (improper)	398	79.60

who did not take rest breaks [AOR = 0.55, 95% CI (0.34, 0.92)]. Moreover, workers who used eye drops were 70% less likely to develop CVS compared to those who did not use eye drops [AOR = 0.30, 95% CI (0.15, 0.58)]. The probability of developing CVS was 2.63 times greater among employees who used visual display terminals (tablets, and smartphones) compared to their counterparts who did not use visual display terminals [AOR = 2.63, 95% CI (1.60, 4.32)]. Furthermore, the amount of workplace illumination was significantly associated with CVS. Participants who worked in improper (<300 and >500 lux) illumination levels were 2.47 times higher at risk of developing CVS compared to their counterparts who worked in illumination levels of 300 to 500 lux [AOR = 2.47, 95% CI (1.47, 4.33)] (Table 5).

Discussion

Without a doubt, the advent of computer screens and modern technology such as computers, tablets, smartphones, and other electronic devices have revolutionized the world and benefited society as these devices are easily accessible and available as an indispensable source of information.[11] However, the rapid increase in the use of these devices incurs substantial health, economic and societal costs among users.[51] CVS has been reported as one of the most common complaints among computer users.[52] In Ethiopia, employees of public sectors including universities are usually neglected in health and safety programs despite the prevailing poor workplace ergonomic and safety arrangements in a developing country. Furthermore, academicians in Ethiopia usually handle extracurricular tasks including conducting and preparing research for publication, providing community services, and managing administrative positions beside the regular teaching activities on their computers which may exacerbate the experience of CVS. Understanding the magnitude and investigating etiologies of the condition play a paramount role in establishing effective prevention and control strategies. The current study aimed to examine the prevalence and factors affecting CVS among academic staff at the University of Gondar, Ethiopia. The prevalence of CVS at the University in the past 12 months was found to be 78.80% [95% CI (74.95, 82.30)]. Years of computer use, habit of taking breaks, the use of visual display terminals, the use of eye drops, and the amount of workplace illumination had an impact on CVS in the current study.

The prevalence of CVS in the current study is consistent with findings from studies conducted in Saudi Arabia (81.2%),[34] and Indonesia (79.4%).[37] This agreement could be due to the nature of tasks in the academic environment in every higher academic institution where roles related to teaching and research activities are common. Participants in those nations might be obliged to work in a substandard workplace in an unhealthy manner for prolonged periods on their computers. Moreover, this concordance might be a result of similarity in data collection methods (all studies used self-administered questionnaires). Furthermore, this concordance could be due to similarity in the data collection period (all studies used 12 months of time frame to ascertain the symptoms). The other possible explanation for the consensus might be due to study participants belonging to a similar age group as compared to those countries.

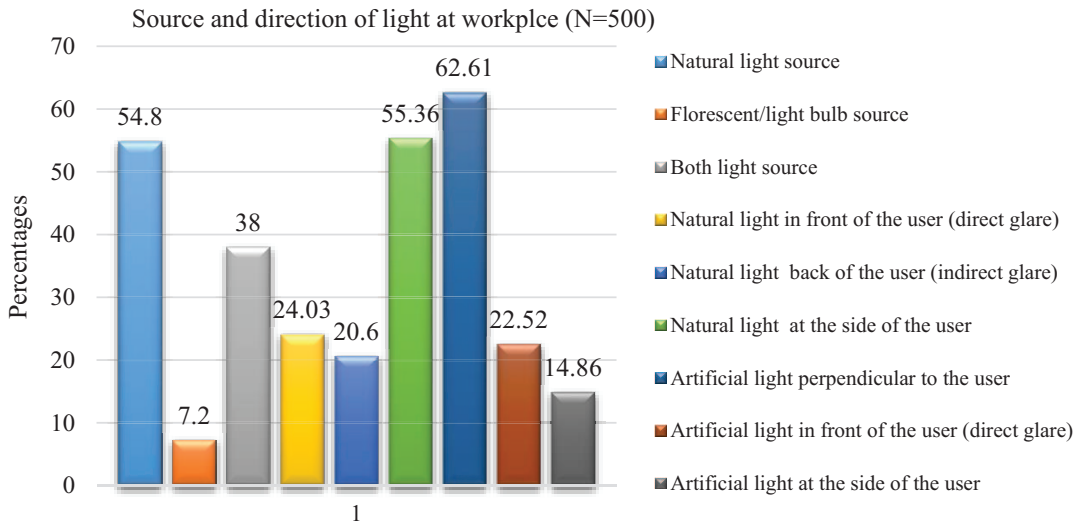

Figure 3. Workplace illumination source and its direction among academic staff in the University of Gondar, Ethiopia, 2021 (N = 500).

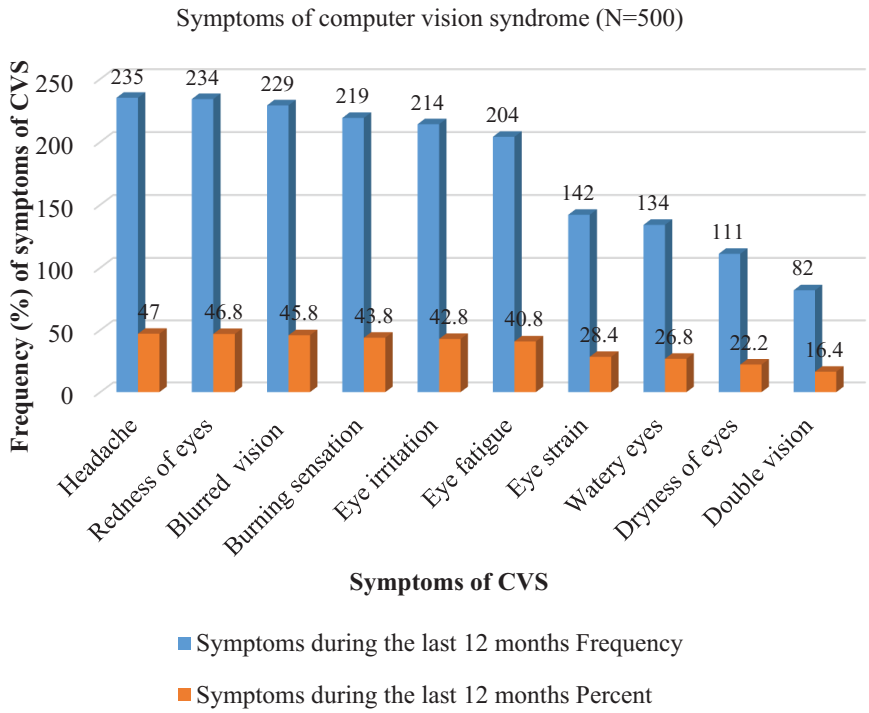

Figure 4. Percent of computer vision syndrome symptoms reported among academic staff, University of Gondar, Ethiopia, 2021 (N = 500).

Our finding was, however, higher compared to the studies in Malaysia (68.1),[53] and Iran (48.7%).[54] The variation could be due to differences in a study period. Our study was conducted during the COVID-19 pandemic. Since the end of 2019, the Covid-19 pandemic has disrupted campus life. Hence, lecture activities that were previously held face-to-face have shifted to online meetings. Accordingly, the consequence of online lectures has been an increased frequency and duration of computer utilization. Exposure to computer screens with a higher frequency and duration is a risk factor for CVS. Research findings complement this explanation.[36,55] Moreover, this disparity may also be due to methodological variability such as sample size (154 samples in Iran). The difference could also be due to inconsistency in definitions/measurements of CVS. A study in Iran diagnosed CVS if subjects were with more than 6 symptoms but this study solely considered one symptom. Moreover, the difference may also be due to data collection methods. The previous study in Malaysia used the face-to-face interview method which is better for clarification of the symptoms but this study employed a self-administered questionnaire to elicit eye symptoms.[53] Furthermore, heterogeneity in individuals' pain perceptions, reporting, and coping strategies could be another reason for the discrepancy.

Our study sample comprised a large number (71.6%) of males and about half (48.80%) of them were from younger age groups (30-39 years old). Commonly, most University academic

Table 5. Bivariate and multivariable logistic regression analysis of factors associated with computer vision syndrome (CVS), University of Gondar, Ethiopia, 2021 (N = 500).

VARIABLES	CVS		COR WITH 95% CI	AOR WITH 95% CI	*P*-VALUE
	YES	NO			
Years of computer use					
<9	201	62	1	1	
>9	193	44	1.35 (0.87 -2.09)	1.65 (1.01-2.71)	.045*
The habit of taking a break					
Yes	199	74	0.44 (0.28-0.69)	0.55 (0.34-0.92)	.023*
No	195	32	1	1	
Use of other visual display terminals					
Yes	224	35	2.67 (1.70-4.20)	2.63 (1.60-4.32)	<.001**
No	170	71	1	1	
Use of ergonomically comfortable setting chair					
Yes	114	43	1	1	
No	280	63	1.68 (1.07-2.62)	1.48 (0.88-2.48)	.139
The brightness of the computer screen					
Bright	224	74	1	1	
Dull	170	32	1.76 (1.11-2.78)	1.51 (0.90-2.55)	.121
Use eye droplets					
Yes	28	24	0.26 (0.14-0.47)	0.30 (0.15-0.58)	<.001**
No	366	82	1	1	
Distance from monitor screen (cm)					
⩽50	242	75	0.66 (0.41-1.05)	0.71 (0.42-1.18)	.183
>50 cm	152	31	1	1	
Workplace illumination level					
300-500 lx	66	36	1	1	
<300 and >500 lx	328	70	2.56 (1.58-4.14)	2.47 (1.47-4.33)	⩽.001**

Abbreviations:1, reference category; AOR, adjusted odds ratio; CI, confidence interval; COR, crudes odds ratio; CVS, computer vision syndrome.
*Significant at $P < .05$. **Significant at $P < .001$ in multivariable logistic regression analysis, Hosmer and Lemeshow test $P = .741$.

setting is dominated by males and the younger generation. Studies done in Malawi,[56] Indonesia,[36] and Saudi Arabia[34] had similar age and gender distribution, except for the studies in Malaysia,[53] and Iran,[54] which had more females than males. Even though there is no association between gender and CVS, the prevalence of computer vision syndrome was higher among male staff when compared with female staff (57% vs 21.8%) respectively. This could be due to men academicians being more likely than women to engage in extracurricular activities such as administrative positions and community service activities in addition to their normal teaching duties. As a result of their extra work activities, working men may be exposed to a variety of workplace risk factors because they spend a lot of time in front of computers. Another reason for the increased prevalence of CVS among men in this study could be due to a large number of male participants (71.6%) than females (28.4%).

In this study, we found a significant association between CVS development and year of computer use. This finding is consistent with the results of other studies.[19,20,57,58] A possible suggestion for this finding could be the cumulative exposure nature of CVS symptoms rather than being an acute condition that could prime to severe eye problems. As a result, long years

of using a device equals more accumulated stress on the eyes, which might intensify the risk of developing CVS.

This study revealed habit of taking rest breaks in between work as a protective factor for CVS. Similarly, previous investigations support this result.[9,24,26,27,53,59,60] The possible reason for this report could be that taking rest breaks during continuous computer work lets the muscles inside the eye relax which can then decrease eye muscle fatigue and headache.[4,61] It has been suggested to do this at every 1 to 2 hours interval and refresh the eyes every 20 minutes while computer use.[19,62] The results of other investigations indicated that prevention efforts through the 20/20/20 method avert occurrences of CVS. With this method, someone who works with a computer is advised that he/she looks away from 20 feet or 6 m every 20 minutes for a total of 20 seconds.[63,64] The 20/20/20 rule usually is given as an advice by eye care professionals to induce significant changes in dry eye symptoms and tear film and some limited changes for ocular surface integrity.[65]

Our finding replicated reports of other investigations in that the use of VDTs outside work is an important factor of CVS.[9] A possible justification for this supposition may be the use of VDTs in poor illumination levels with long exposure times for instructional, recreational, and other purposes. Another possible reason might be that VDTs like smartphones and tablets have smaller screens and are used closer to the user's face. Therefore, using such VDTs aggravates the risk of experiencing CVS and is significantly most risky than using a computer.[66]

Some studies show that the use of eye droplets is a protective factor against the development of CVS symptoms.[20,62,67-69] The current analysis also detected a concordant report. The possible explanation could be that eye drops are used to keep the eye from drying, rewet the ocular surface, and foster tear volume[70] then possibly reduce the development of visual complaints (CVS).

The significant relation between workplace illumination and the manifestation of CVS has been well documented in this study. This result is in agreement with the report of other studies.[3,13,37,71] We also found a reliable result that goes along the results of the aforementioned studies. A possible suggestion for this finding could be that extreme illumination, whether too much or too low, is a contributing factor to CVS symptoms. Low light can gradually tire the eyes while excessive illumination can cause contrasts on a computer screen, making it difficult to see or read during working hours. Research findings complement this explanation.[13,72] The recommended illumination levels vary depending on the tasks to be completed, the type of lighting, and the location of the computer seat. A study report suggests that illumination settings of 300 to 500 lux are recommended for typical computer desk work.[49]

This study measured workplace illumination levels to support the hypothesis that workplace environmental factors predispose the occurrences of CVS. Moreover, we employed Ophthalmic nursing professionals to ascertain whether the participants had a history of vision-related complaints which could potentially confound our study. Some limitations, however, cannot be ignored in the present study. First, we did not conduct an ophthalmic examination due to the large sample size of study participants. Second, the study results relied on self-reported symptoms, which may have exposed the study results to a recall bias. Also, the cross-sectional nature of the study makes it difficult to conclude the temporal relationships between CVS and associated factors. Thus, we recommend researchers conducting studies in the future to account for diverse sectors and to conduct the ophthalmic examination.

Conclusion

This study revealed that the prevalence of computer vision syndrome was common among university academic staff, with more than three-quarters of the academicians suffering from the condition. It also indicated that male academicians experienced higher proportions of the syndrome than their female counterparts. Use of computers for more than 9 years, use of visual display terminals (VDTs), and working in improper illumination levels (<300 and >500 lux) significantly increased the development of CVS, whereas taking rest breaks and using eye droplets were found to be protective factors of CVS in the current study. Therefore, it is recommended to take rest breaks in between the work, reduce exposure to display screens, use eye drops, and optimize workplace illumination levels to minimize the condition.

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Author Contributions

AHT initiated the concept of the research, wrote up the research proposal, analyzed the data involved in the presentation and interpretation process of results and discussions, and drafted the manuscript document and is the corresponding author. MA and GA involved in data analysis, presentation, and interpretation of the findings and discussion. THM involved in data analysis, presentation, and interpretation of the results and discussion. All authors read and approved the final manuscript.

Availability of Data and Materials

The datasets generated and/or analyzed during the current study are not publicly available due to the fact that the data contain indirect identifying characteristics (eg, age and sex) but are available from the corresponding author upon reasonable request.

Ethical Approval and Consent to Participate

Ethical approval was obtained from the Institutional Ethical Review Board (IRB) of the University of Gondar, College of Medicine and Health Sciences, Institute of Public Health (Reference #: IPH/1425/2021). Written informed consent was

obtained from each respondent before commencing data collection and after an explaining the nature and possible consequences of the study. The information sheet that clearly shows the research topic, the objectives of the study, confidentiality of each participant's responses, the study benefits, and associated risks was prepared and presented. Any personal identifiers were eliminated to ascertain confidentiality and only anonymous data were used for interpretations. Furthermore, since the data were collected during the COVID-19 pandemic, we implemented infection prevention protocols including social distancing and wearing of face masks. Data collectors provided health education regarding the prevention and control methods of CVS, and professional recommendations were given for those people with CVS. Individuals who had severe CVS problems were referred to the Hospital.

Supplemental Material

Supplemental material for this article is available online.

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