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Prevalence and Associated Factors of Computer Vision Syndrome among Undergraduate Students of Kathmandu Valley, Nepal: A Web-Based Cross-Sectional Study

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ABSTRACT

Background: Computer Vision Syndrome is a collection of vision and eye-related problems like headache, blurred or double vision, eye strain, fatigue, and teary eyes, which can occur when using digital devices. It is one of the most significant public health concerns of the twenty first century. The objective of this study is to determine the prevalence of computer vision syndrome, common symptoms experienced, and preferred preventive measures while identifying socio-demographic, knowledge, and practice-associated risk factors among undergraduate students of Kathmandu Valley, Nepal.

Methods: A web-based cross-sectional study was conducted from December 2020 to March 2021. A non-probability convenience sampling method was used to collect data from 320 participants via an electronic survey. The factors associated with computer vision syndrome were analysed using bivariate and multivariate logistic regression models. The adjusted odds ratio was calculated at a 95% confidence interval, and $p < 0.05$ was considered statistically significant.

Results: The prevalence of computer vision syndrome was found to be 65% (95% CI: 59.5%-70.2%). The most frequently reported symptoms were tired eyes, headache, and eye itchiness. Participants living in a nuclear family (p=0.033) showed significant association with the prevalence of computer vision syndrome.

Conclusion: Computer Vision Syndrome is a common health issue among undergraduate students. Therefore, it is important to make university students aware of the health implications and preventive measures.

Keywords: Computer vision syndrome; Kathmandu; prevalence; students

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BACKGROUND

Over the past years, advancements in computer technology and innovations have remarkably impacted education, health, development, and more. Every other person uses computers in the form of laptops, tablets, personal computers, and cell phones.(1) There has been a significant rise in health issues related to prolonged computer usage.(2) Prolonged computer use can cause a vision problem called Computer Vision Syndrome (CVS), a collection of vision and eye-related problems resulting from the use of digital devices.(3) These can include headache, blurred/double vision, eye strain, fatigue, teary eyes, light sensitivity, burning sensations, and dryness on the ocular surface.(4) Prolonged use of computers for three or more hours per day, poor lighting, screen glare, improper viewing distances, poor seating posture, uncorrected vision problems can cause CVS.(5)

Computer Vision Syndrome (CVS) is one of the most significant global public health concerns of the 21st century, with almost 70% of computer users experiencing symptoms.(6) It is also a rapidly growing public health concern in developing countries.(7) The COVID-19 pandemic has forced

us to rely heavily on digital devices and virtual learning platforms for work, education, and entertainment.

The integration of Information and Communication Technology (ICT) has significantly transformed the educational landscape in Nepal, replacing traditional teaching methods.(8) While there have been some studies on CVS among medical students, no research includes students of other discipline as per the researcher's knowledge.(8,9) Despite the digital revolution in education and the global pandemic, a comprehensive study has yet to be conducted in Nepal to assess the association of prolonged digital device usage with the eye health of students of different discipline. Therefore, this study aimed to fill this gap by investigating the prevalence of CVS and exploring associated factors among undergraduate students in the Kathmandu Valley.

METHODS

Study type and participant description

This web-based descriptive cross-sectional study was conducted among the undergraduate students of Kathmandu Valley. The duration of the study was four months from December 2020 to March 2021. The study population included undergraduate students of all academic years and faculties from Tribhuvan University, Pokhara University, Purbanchal University, and Kathmandu University in Kathmandu Valley between the ages of 18 and 30.

Sample size and sampling

The sample size was determined using the formula $n=z^2 * p * (1-p) / e^2$. The confidence interval was set at 95%, the margin of error at 5%, and the non-response rate at 10%. The estimate was based on the prevalence of digital eye strain, which was 69.5%.(10) The calculated sample size was 359. A non-probability convenience sampling method was used to select the participants who were approachable through social media.

Data collection method

The study utilized self-administered questionnaire to gather sociodemographic data, information on CVS symptoms, knowledge of CVS, and details on computer usage. The tool was developed based on the similar studies conducted among university students in Malaysia and Nepal.(8,11) The initial draft tool was revised based on consultation of the experts and the supervisor. The first part of the tool includes socio-demographic information which consists of age (18-21 years, 22-29 years), sex (male/female), ethnicity (Brahmin/Chhetri, Janajati, Madhesi), marital status (single/married), family type (nuclear/joint), university attendance (Kathmandu, Tribhuvan, Pokhara, Purbanchal), current academic year (1st, 2nd, 3rd, 4th, 5th), and faculty of study (Engineering and technology; medical and health science; commerce, humanities and others; natural and agricultural sciences). To assess knowledge, 16 questions were asked about the causes, symptoms, and preventive measures for CVS, with each correct response yielding one point. The sum of correct answers was used to determine the overall knowledge scores of the participants on a scale of 0-16. Scores were classified as 'below median' and 'median and above'. The questionnaire also included questions related to computer use practices, such as the duration of computer use (>2 years, 1-2 years, <2 years), number of hours per day (>10, 6-10, 2-5), device type (big, small, or both), frequency of posture changes (no posture change, after 2 hours, every 1-2 hours, every 30 minutes), and frequency of breaks taken (no breaks, after 2 hours, 30 minutes-2 hours, before 30 minutes). The data collection tool was prepared with reference to other similar studies.

The prevalence of CVS was determined based on the symptoms experienced intermittently or continuously for at least one week during the past twelve months, with tiredness, redness, watering, itchiness, and headache being assessed as symptoms. Students who reported experiencing at least two symptoms were considered as having presence of CVS and the remaining were categorized as absence of CVS.(11,12)

The data was collected on Google Forms. The first page of the survey included information about the study and its purpose. The survey link was shared with the participants through social media platforms such as WhatsApp and Facebook.

Statistical analysis

Google Forms data were automatically recorded in Google Sheets. Before exporting to Statistical Package for the Social Sciences (SPSS) version 26 (IBM) for analysis, all collected data were systematically compiled, coded, checked, and edited in MS Excel 2016. Data analysis was done using descriptive and inferential statistics. Descriptive analysis was reported in mean, standard deviation, frequency, percentage, and its 95% CI where applicable. The factors associated with CVS were analysed using bivariate binary logistic regression. The variables with p-value less than 0.1 in bivariate logistic regression were further entered into the multivariate logistic regression model. The adjusted odds ratio was calculated at a 95% confidence interval, and $p < 0.05$ was considered statistically significant.

Ethical Approval

All participants were required to sign a form indicating their consent to participate in the study. The Institutional Review Committee at Tribhuvan University's Institute of Medicine (IOM) granted ethical approval for conducting the study with IRC number 371(6-11)E2077/078. The consent form was included in

the questionnaire. Confidentiality was maintained at all stages to protect the participants' personal information.

RESULTS

Characteristics of the study participants

A total of 320 responses were received during the study period. There were no missing data. More than half of the participants (54.7%) were between 18 and 21 years, with the mean age of 21.5 (±1.9) years. Males made up more than half of the participants (51.6%), and most of them (96.9%) were unmarried. Majority belonged to Brahmin/Chhetri ethnic group (63.7%) and nuclear family (80.3%). Half of them (47.8%) were from Kathmandu university, where majority (34.1%) were in their fourth year and were from engineering and technology backgrounds (45.3%) (Table 1).

Table 1: Socio-demographic characteristics of the participants.

Characteristics	Number (n=320)	Percentage (%)
Age (years)		
18-21	175	54.7
22-29	145	45.3
Sex		
Male	165	51.6
Female	155	48.4
Ethnicity		
Brahmin/Chhetri	204	63.8
Janajati	99	30.9
Madhesi	17	5.3
Marital Status		
Single	310	96.9
Married	10	3.1
Family Type		
Nuclear	257	80.3
Joint	63	19.7
University		
Kathmandu University	153	47.8
Tribhuvan University	119	37.2
Pokhara University	36	11.2
Purbanchal University	12	3.8
Academic Year		
1st Year	41	12.8
2nd Year	95	29.7
3rd Year	42	13.1
4th Year	109	34.1
5th Year	33	10.3
Faculty		
Engineering and Technology	145	45.4
Medical and Health Science	83	25.9
Commerce, Humanities, and Other	67	20.9
Natural and Agricultural Sciences	25	7.8

About half (50.6%) of the participants had below median level of knowledge on CVS . Majority (89.0%) had been using computers for more than 2 years where relatively few participants (8.8%) used it for less than 2 hours. Regarding preventive measures, 18.1% and 29.1% of the participants did not take break and change posture respectively (Table 2).

Table 2: CVS awareness, computer use and ergonomics practices.

Characteristics	Number (n=320)	Percentage (%)
Level of Knowledge		
Below Median	162	50.6
Median and Above Median	158	49.4
Commonest type of devices used		
Using of both devices (big screen and small screen)	204	63.7
Using one of the two devices (big screen or small screen)	116	36.3
Duration of computer use (years)		
More than 2	285	89.0
1– 2	22	6.9
Less than 1	13	4.1
Average duration of computer use per day (hours)		
More than 10	39	12.1
6 – 10	111	34.7
2 – 5	142	44.4
Less than 2	28	8.8
Frequency of posture change while working on the computer		
Doesn't change posture	93	29.1
After 2 hours	28	8.7
Every 1-2 hours	83	25.9
Every 30 minutes	116	36.3
Frequency of breaks while working on the computer		
Doesn't take break	58	18.1
After 2 hours	43	13.4
30 minutes – 2 hours	127	39.7
Before 30 minutes	92	28.8

Prevalence of Computer Vision Syndrome (CVS)

The prevalence of CVS among the undergraduates reporting two or more symptoms was 65.0% (CI: 59.5%-70.2%). The tiredness of the eyes (76.6%), headache (57.2%), and itchiness of the eyes (27.2%) were the most common symptoms (Figure 1).

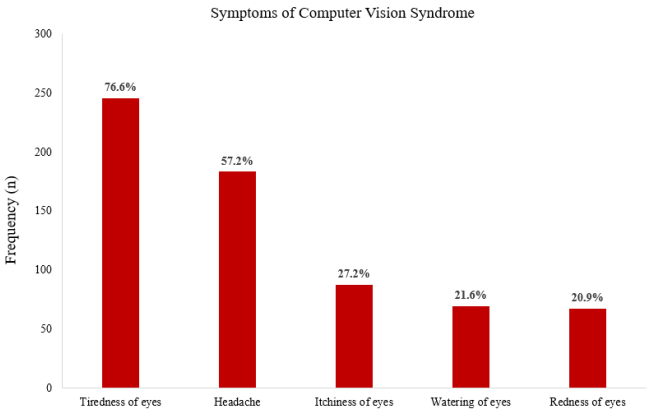

Figure 1. Symptoms of Computer Vision Syndrome

Preventive Measures for CVS

More than half of the participants (55.3%) practised measures for CVS prevention. They mostly took a break while remaining seated (32.5%) followed by closing their eyes (26.6%) and looking at far objects in between (19.7%) (Table 3).

Table 3: Type of measures taken to prevent CVS

Type of measures taken to prevent CVS	Number (n=320)	Percentage (%)
Take a break but remain seated	104	32.5
Close your eyes	85	26.6
Blink more frequently	51	15.9
Massage the eyes	53	16.6
Use eye drops	53	16.6
Looking at far objects in between computer uses	63	19.7

Factors associated with Computer Vision Syndrome

The unadjusted models indicated significant associations of the prevalence of CVS with sex (COR: 1.58, CI: [0.99-2.51]), marital status (COR: 0.22, CI: [0.06-0.86]), family type (COR: 0.52, CI: [0.27-0.97]), knowledge level (COR: 0.50, CI: [0.32-0.81]), devices used (COR: 1.95, CI: [1.21-3.13]), duration of devices used (COR: 6.88, CI: [1.85-25.60]), average use of devices per day (COR: 5.58, CI: [2.33–13.37]), changes in posture (COR: 2.02, CI: [1.129-3.62]) and in-between breaks (COR: 3.17, CI: [1.36-7.36]). However, after adjusting for potential confounders, only family type remained significantly associated with the prevalence of CVS (AOR: 0.47, CI: [0.24-0.95]).

Table 4: Association between independent variables and computer vision syndrome.

Characteristics	CVS		COR (95% CI)	AOR (95% CI)
	Present n (%)	Absent n (%)		
Sex				
Female	109 (70.3)	46 (29.7)	1.58 (0.99–2.51)	1.66 (0.96–2.85)
Male	99 (60)	66 (40)	Ref	
Marital Status				
Married	3 (30)	7 (70)	0.22 (0.06–0.86)	0.23 (0.05–1.05)
Unmarried	205 (66.1)	105 (33.9)	Ref	
Family Type				
Nuclear	160 (62.3)	97 (37.7)	0.52 (0.27–0.97)	0.47 (0.24–0.95)*
Joint	48 (76.2)	15 (23.8)	Ref	
Level of Knowledge				
Below Median	69 (42.6)	93 (57.4)	0.50 (0.32–0.81)	0.62 (0.36–1.07)
Median and Above	43 (27.2)	115 (72.8)	Ref	
Commonest type of devices used				
Both devices (big screen and small screen)	144 (70.6)	60 (29.4)	1.95 (1.21–3.13)	1.71 (0.99–2.95)
One of the two devices	64 (55.2)	52 (44.8)	Ref	
Duration of computer use (years)				
More than 2	192 (67.4)	93 (32.6)	6.88 (1.85–25.60)	2.30 (0.46–11.42)
1– 2	13 (59.1)	9 (40.9)	4.82 (1.03–22.57)	1.46 (0.22–9.58)
Less than 1	3 (23.1)	10 (76.9)	Ref	
Average duration of computer use per day (hours)				
More than 10	27 (69.2)	12 (30.8)	4.75 (1.67–13.50)	1.49 (0.41–5.39)
6 – 10	69 (62.2)	42 (37.8)	3.47 (1.44–8.37)	1.75 (0.58–5.30)

2 – 5	103 (72.5)	39 (27.5)	5.58 (2.33–13.37)	2.74 (0.94–7.97)
Less than 2	9 (32.1)	19 (69.9)	Ref	
Frequency of posture change				
Doesn't change posture	67 (72)	26 (28)	2.02 (1.13–3.62)	1.74 (0.82–3.67)
After 2 hours	24 (85.7)	4 (14.3)	4.71 (1.54–14.43)	3.20 (0.83–12.36)
Every 1 – 2 hours	52 (62.7)	31 (37.3)	1.32 (0.74–2.34)	1.06 (0.49–2.26)
Every 30 minutes	65 (56)	51 (44)	Ref	
Frequency of breaks				
Doesn't take break	38 (65.5)	20 (34.5)	1.60 (0.81–3.15)	1.10 (0.46–2.63)
After 2 hours	34 (79.1)	9 (20.9)	3.17 (1.36–7.36)	1.98 (0.68–5.75)
30 minutes – 2 hours	86 (67.7)	41 (32.3)	1.76 (1.01–3.07)	1.46 (0.71–3.01)
Before 30 minutes	50 (54.3)	42 (45.7)	Ref	

DISCUSSION

This study investigated the prevalence rate and factors associated with computer vision syndrome among undergraduate students. The prevalence of two or more symptoms of CVS among the students was 65.0%. This finding aligns to that of studies conducted in Ghana and Saudi Arabia.(11,12) This consistency might be attributable to the comparable characteristics of respondents in terms of computer usage and the timing of the conduction of these studies amid the early stages of the COVID-19 pandemic — when virtual education was more prevalent as a method of teaching and learning, fostering increased screen time among students. However, in our study, the prevalence rate was found lower than that reported in studies from India (80.3%) and Malaysia (89.9%).(13,14) This variance could be attributed to methodological differences, as those studies defined CVS prevalence based on the presence of at least one symptom, whereas in our study it was defined as the presence of two or more symptoms among students. According to our results, the top five debilitating symptoms of CVS were tiredness of eyes, headache, itchiness, watering and redness of eyes. This is consistent with reports from similar studies.(7,5,11)

In terms of preventive measures, the most common practice was taking breaks while remaining seated during computer use, followed by closing eyes, blinking frequently, massaging the eyes, using eye drops and looking at distant objects between computer use sessions. Ideally, limiting digital device use would be the best preventive measure. However, given the necessity of online activities for work and education, particularly for students, this is not feasible. Therefore, while it is important to adopt preventive measures during digital screen use, individuals should also focus on reducing other screen-related activities, such as watching TV and browsing social media, to compensate for essential commitments that require screen use.

Typically, students in nuclear families are more likely to engage in problematic/ excessive use of screen and internet because of fewer family members and reduced social interaction, leading to more time spent on digital devices.(15,16) However, our results indicated the opposite findings showing higher odds of developing CVS among the students from joint or extended families compared to those from nuclear families. This might be because joint families might have limited living space, which can result in suboptimal ergonomic setups for computer use. Especially during the COVID-19 lockdown, all the family members might have had to share finite space all day for a long period of time due to restricted external movement, which might have led to poor ergo-ophthalmic practices such as poor posture, improper viewing distances, and inadequate lighting conditions, exacerbating CVS symptoms in students.17 Additionally, it is quite possible that in a joint family setting, the presence of more adults and older siblings using screen media extensively could influence the younger adults in the family to also increase their screen time.(18) Our study found no significant association between taking breaks, changing posture, and the prevalence of CVS, similar to the findings of Tawil et al. and Abudawood et al.(19,20) respectively. Additionally, we did not observe a significant association between the prevalence of CVS and the number of daily hours spent using digital devices. This contradicts several studies that report an increased odds of having CVS with increased time of daily computer use.(14,21) Although only about half of the participants practised preventive behavioural measures and around one fourth of the students took regular breaks of the recommended duration while using digital devices; still the hours spent per day using digital devices were not seen to be associated with CVS occurrence. Further research with well-defined variables is needed to confirm these findings.

Knowledge regarding the prevention, causes and symptoms of CVS showed no significant association with CVS prevalence in this study group. This finding contradicts a study conducted in Mozambique, where having good knowledge of safe use of computer and preventive measures were found to be protective for

the occurrence of CVS.(22) Conversely, a study in Saudi Arabia reported that those students who were aware of the 20/20/20 rule had higher odds of having CVS.(19) This suggests that merely having knowledge about ergonomics is insufficient; the application of this knowledge is crucial for preventing CVS. However, in our study, only half of the participants had knowledge score above median reference, and, only half practiced preventive measures, despite the study population being undergraduate students who are expected to understand and apply such knowledge. Therefore, it is essential to incorporate ergonomic use of digital devices into curricular lectures and foster an environment that encourages the application of this knowledge.

This study includes students at different universities of Kathmandu Valley; thus, the findings can be generalized to all the students of the valley. It has still a few limitations. Since it was an online study, only participants who had access to the internet and could access the survey requests posted on various platforms could participate. There was a chance of information bias since we used online self-administered questionnaire. Additionally, many factors that may have an association with CVS like distance of screen when used, digital device brightness/contrast adjustment, glare experience and antiglare device use could not be considered in this study. Future studies should include these factors to ensure more comprehensive analysis.

CONCLUSION

The study concluded that majority of the undergraduate students experienced two or more symptoms of computer vision syndrome, the most common of which was tiredness of the eyes. Type of family, that is, joint family was the most determinant factor for CVS. As digital integration is growing in the education sector, it is important to make university students aware of the health implications and preventive measures.

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Conflicts of interest

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

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