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Original Article

IN DIGITAL ERA PREVALENCE AND RISK FACTORS OF COMPUTER VISION SYNDROME AMONG STUDENTS OF PUNJAB, PAKISTAN

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ABSTRACT

In modern era Computer Vision Syndrome (CVS) is abruptly increasing healthcare issue in the whole world, especially in educational environments due to extreme utilization of digital devices. This study was performed from January 2026 to February 2026 with total n-1,186 participants, in which females and male were n-673(56.7%) and n-513(43.3%) respectively. Chi-square test and Pearson Correlations were performed by using Jupyter Notebook. In Punjab overall high portion of participants that used digital devices in dark room's in which female participants were high percentage as compare to the male. Use of low screen brightness was prioritized by n-452(38.1%) of respondents, female students preferred to use low brightness as compare to male whose preferred medium or high. Female used digital devices for education and productive purposes with high portion of percentage as compare to male. Students suffer with headache issue after screen use was observed with aggregate prevalence of 68.3% in which females indicated headache incidents more common and high than males. Most risk factors that causing CVD in students of Punjab use of screen in dark rooms, low brightness, and high usage of screen with no any eye protector. These risk factors are mostly dominant in female as compared to male that are the major causes of weak eyesight's and headache in female participants.

I. INTRODUCTION

In modern era, the utilization of digital devices after the development of cutting-edge technologies has emerged as imperative across almost all domains of life (Singh, 2016). These digital devices are being used in workplaces, business entities, leisure environments, in addition by households to academic institutions (Artime-Ríos, 2022). Although this equipment's provide several advantages like social interactions, academic, entertainment and knowledge purposes but their overuse may result in variety of visual and eye-related symptoms that known as digital eye strain (DES) or computer vision syndrome (CVS) (Galindo-Romero, 2023). CVS or DES is a group of problems that affect the ocular organs**,** vision, muscle tissue, and even behavior, which arise due to inordinate utilization of digital screen devices (DSDs) (Pavel, 2023). Occurrence of CVS is progressively identified as substantial healthcare issue, especially in educational environments. The most general symptoms in CVS or DES are excessive lacrimation, dry eyes, fuzzy vision, excessive tearing and ocular irritation. Along with these ocular problems, some non-ophthalmic clinical features also involve such as cervical and lumbar pain, shoulder tightness, cranial pain and lethargy (Sheppard, 2018). Most common risk factors that because CVS are mostly digital screen related like **s**creen brightness, frame

rate, display or screen contrast levels, and some person to person factors like body postural alignment, eye-to-screen distance and spectacle uses (Uba-Obiano, 2022).

The most used term related to computers or related screens is known as video display terminal (VDT) that's includes laptops, tablets, cellular devices, office computers, E-book readers and other digital gadgets. About 45 million workers that operate digital computing systems by continuously viewing VDTs for prolonged time spans (Courtin,2016). Findings indicate that these indicators may arise subsequently after just two hours of constant screen exposure and SVS symptoms may influence 50% to 90% globally regularly end-users of electronic devices (Sheppard,2018; Council, 2016). In the US about 10,000 participants study revealed that a significant proportion of women self-identified with the clinical features of DES, with greater prevalence observed among participants using two or more screens devices concurrently had a higher likelihood of being affected from it (Council, 2016). Worldwide, millions of incident cases of this disease reported every year and around 60 million individuals are affected by CVS (**Sen, 2007)**. Greater than 143 million individuals in US utilize a computer on a daily basis (LPP-2006, 2011). At the start of 2020, the global population reached 7.75 billion, out of which 5.19 billion were distinct smartphone end-users, 3.8 billion were frequent social networking sites participants, 4.54 billion were internet user, accounting for 67%, 49%, 59% respectively. Normally, individuals with internet access use approximately 6 hours and 43 minutes per day for online activities, although it differs from country to country as the Philippines typically devotes 9 hours and 45 minutes each day in contrast to Japan, where individuals invest no more than 4 hours and 22 minutes daily (Kemp, 2020).

University students who engaged with screens exceeding 5 hours per day in an epidemiological descriptive study conducted in Peshawar Pakistan, revealed the three most prevalent health issues as eye fatigue (71.8%), cervical and spinal pain (70.1%), and headache (42.3%) (Hadi, 2021). Amid the (COVID-19) pandemic global health crisis intensified as people were compelled to work at home or engage in virtual education. During this outbreak, it was observed that 69.1% of medical and 77.1% of general undergraduate students experienced CVS, where headache was most common, along with ocular surface irritation and dryness (Kausar, 2018). The aim of this study is to find the updated comprehensive prevalence and risk factors of CVS or DES in the both male and female students of the different colleges and universities of the Punjab, Pakistan along with additional parameters.

II. METHOD

Participant

This survey analysis was done from January 2026 to February 2026 in Sialkot. Students from 30 different institutions of Punjab, a province of Pakistan were participated in it, in which 9 were colleges (medical, Pharmacy and Intermediate colleges) and 21 were universities. From 14 years to 27 years of age students participated in this survey analysis. Those students who provided complete information and attempt a >90% questionnaire were included in this study and those who did not provide complete information and attempt <90% equations were excluded from this cross-sectional analysis. A total n-1,837 student participated in it. Out of this, n-1,186 participants were included, in which n-673(56.7%) were female respondents and n-513(43.3%) were male.

Measures

First, the margin error (sampling error) then sample size (n-1,068) was found out by using the following formulas, 3% margin error was obtained (Rashid, 2026).

Margin error (e) = z x $\sigma/\sqrt{n}$ Sample size = $\frac{\frac{z^2 \, X \, p(1-p)}{e^2}}{1+(\frac{z^2 \, X \, p(1-p)}{e^2 N})}$

z is z-score (95% C.L. z-score is 1.96), σ is standard deviation of population, n is number of samples, p is population proportion, e is margin error, N is population size. A total of 27 questions along with their options were created into Google form (supplementary file 1) and forwarded to students after taking their consents. This study was approved by the departmental ethical review committee of GAUS (GAUS-2026-001).

Procedure

After completion of sample size data was extracted and pre-analyzed on Microsoft Excel 2010 installed in Windows 10 pro. We perform chi-square test for significant gender differences and Pearson Correlations in our analysis. The coding of these statistical analyses was created by using Jupyter Notebook of Anaconda Navigator 1.9.12. To run this model, this graphical user interface (GUI) was installed in Microsoft Windows 7 (32-bit). For coding optimization and troubleshooting support was taken from Deep-seek an online free available (supplementary file 2).

III. RESULTS

In this study, a total n-1,186 students participated, out of which n-673(56.7%) were female and n-513(43.3%) were male respondents (Female: Male ratio: 1.31:1). From the 14 to 27 years of age group, students participated, and the average age group was 21.3+2.8 along with standard deviation. In Punjab, the overall high portion of participants are often involved in digital device-related practices in dark environments, n-489(41.2%) whereas n-365(30.8%) rarely engaged in this activity and n-332(28.0%) did not use it in a dark environment. Female participants significantly often use high dark room n-301(44.7%) as compared to the male n-188(36.6%) ($p=0.005$). In the preference of screen brightness level, using screens at a low level was prioritized by n-452(38.1%) of respondents, moderate brightness level at n-445(37.5%), and high brightness by a little bit lower percentage as n-289(24.4%). In this survey analysis, it was concluded that females preferred to use low brightness settings n-286(42.5%) as compared to males who preferred medium or high with an equal percentage as n-192(37.4%), n-155(37.4%) respectively ($p<0.001$). Mostly students use these devices for educational and productive purposes, then social media/entertainment and gaming purposes as n-522(44.3%), n-443(37.6%) and n-214(18.2%) respectively. A statistically significant gender difference was observed in which females were used for this purpose, a little bit higher with portion as compared to males [n-296(44.4%), n-226(44.1%) $p<0.0022$]. Now a day's trend of study on mobiles or digital devices is going to be increasing. A high percentage of participants used their mobiles for study n-365(30.8%) and a gender-based statistically significant difference was found that males mostly used devices for study n-151(29.4%), whereas females with a high percentage that use it for some-time study on mobile then mostly [n-216(32.1%), n-214(31.8%), $p<0.0001$] as shown in figure 1.

The main digital electronic device utilized by study participants was the handheld mobile device, indicated by n-643(54.2%) respondents, followed by notebook computers (laptop) as the second most used device n-412(34.7%), then televisions n-362(30.5%), and digital tablets n-345(29.1%). Overall, participants, both females and males, mostly used their mobiles at night, at 344(29%), 202(30%), and 142(27.7%) respectively. It was also observed in our analysis that overall participants and both female and male average daily screen time (smart phone) is 4-6 hours, with a high percentage of n-333(28.1%), n-193(28.7%) and n-140(27.3%) respectively with no statistically significant gender difference in distribution of screen time ($p=0.417$) as explain into table 1. Students sometimes suffer with headache issues after screen uses were observed with n-506(42.7%) and the frequently suffering from headaches was n-304 (25.6%), resulting in an aggregate prevalence of 68.3% for screen-induced headaches. Females indicated headache episodes more commonly than males with n-484(72.0%) and n-326(63.5%), and the gender-based variation was highly significant ($p=0.003$). Analysis of ocular acuity showed n-319(26.9%) individuals with positive weak eyesight whereas n-361(30.4%) individuals had negative weak eyesight. Minus/Negative weak eyesight percentage was high in female n-218(32.4%) and Plus/Positive weak eyesight was high in male n-160(31.2%) with statistically significant ($p=0.0073$). After usage of a long-time phone, the majority of females and males suffer eye symptoms with n-319(47.5%) and n-245(47.8%) respectively, and overall, students reported this problem with n-564(47.6%). A higher proportion of females reported no family history of weak eyesight n-317(47.2%) compared with males 177(34.5%). The association between gender and family history was statistically significant ($p <0.001$).

Evaluation of ophthalmic (vision-related) clinical features showed that no eye-related signs were observed by n-292(24.6%) of respondents, closely followed by Blurry Focus n-289(24.4%), eye strain-related pain n-231(19.5%), erythema (redness) n-179(15.1%) and ocular dryness n-195(16.4%). There was no notable disparity in the distribution of eye-related manifestations between both genders ($p=0.247$). Lacrimal fluid secretion patterns post-screen exposure demonstrated that n-357(30.1%) reported no tears, n-350(29.5%) indicated episodic tearing, n-247(20.8%) showed reduced lacrimal secretion while n-232(19.6%) experienced hyper-lacrimation, showing no

significant difference between male and female (p=0.233). Ocular dryness during the study throughout the research was found often by n-369(31.1%) of participants, rare by n-355(29.9%), whereas n-462(39%) documented not once undergoing this condition with no considerable sex-based distinction (p=0.366) as shown in table 2 and figure 1. After and during screen based exposure caused mostly Neck pain n-324(28.1%) followed by the Shoulder, Back and Muscles Pain, 289(25%), 279(24.2%) and 263(22.8%) respectively.

Figure I: Statistically Significant Gender Differences Prevalence in University Students of Punjab Pakistan

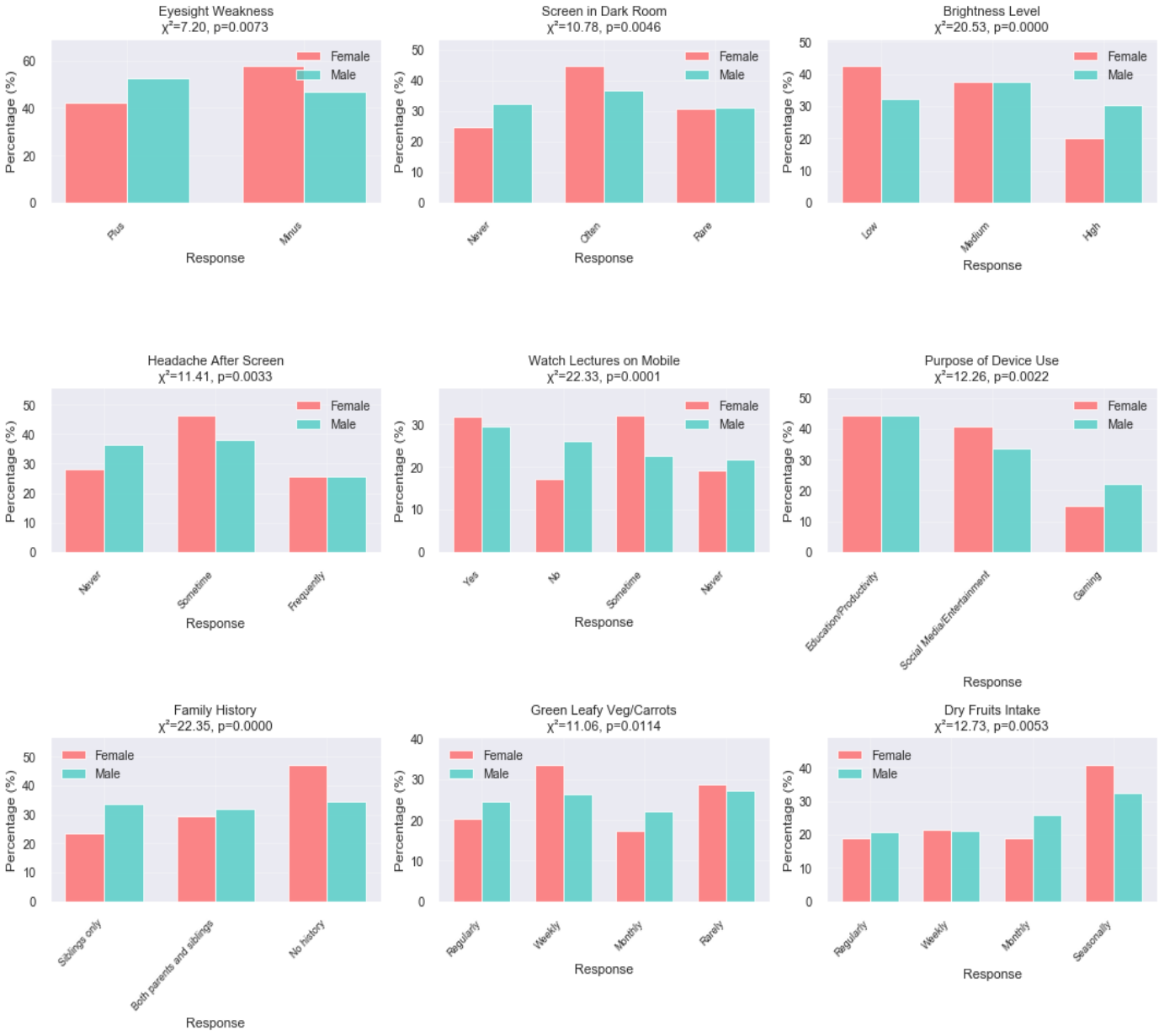
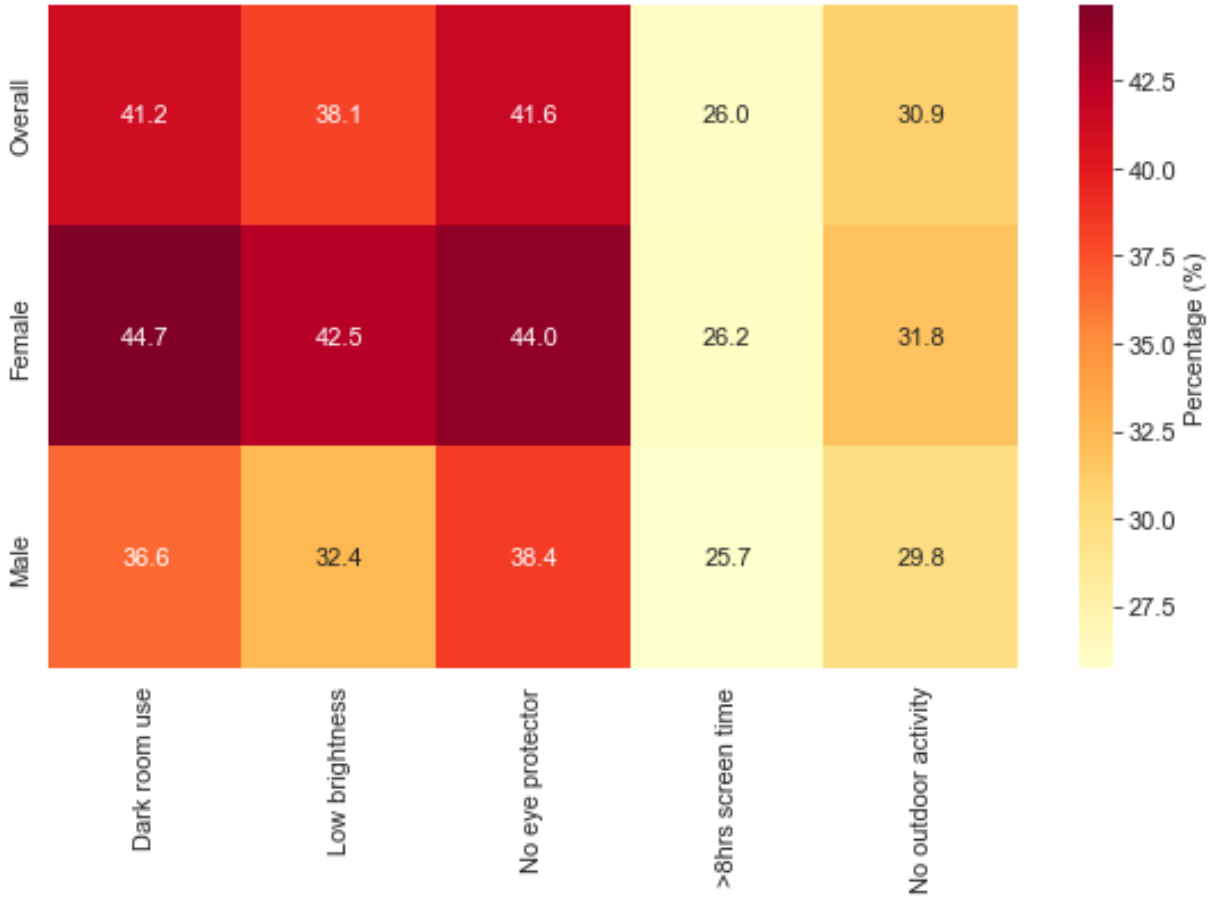


Figure II: Risk Factor Prevalence: Overall and by Gender



Morning physical activity revealed that n-517(43.7%) respondents engaged in weekly exercise, n-370(31.3%) did not perform any morning physical activity, and n-296(25%) performed daily exercises. A substantial gender-based difference was noticed for habitual morning exercise on a weekly basis, with the male showing n-233(45.5%) than the female n-284(42.3%) (p=0.049). Nutritional assessment indicated that green leafy vegetables and carrots were included in the diet on a weekly basis by n-360(30.4%) of respondents. A high percentage of females also use it weekly, at 225(33.6%) based whereas in males, rare-based use of eating habits was higher than weekly, with n-139(27.1%) and n-135(26.3%) respectively. Usages of dry-fruits were mostly on a seasonal basis, by the majority of participants, n-441(37.2%) and also by both females and males, with statistically significant gender differences with percentage of n-275(40.9%) and n-166(32.4%) respectively (p=0.0053) as shown in figure 1. Foods rich in vitamin C content were also intake seasonally or occasionally by n-386(32.6%), once per week by n-295(24.9%), on a regular basis by n-277(23.4%), while month-to-month by n-225(19%) of study participants. A high percentage of females also use vitamin C-rich fruits rarely/seasonally with n-248(37%) whereas in males, regular use of it is high then rarely/seasonally with n-141(27.5%) and n-138(26.9%) respectively.

Throughout the research relating to eye care behaviors, n-493(41.6%) participants found that they had never adopted eye safety measures during study. The adaptation of protective eyewear did not show marked variation among females and males (p=0.117). Evaluation of sleep period showed that n-392(33.1%) of individuals had night sleep duration of 6-7 hours and no significant relationship was observed between sleep period and gender (p=0.113). Outdoor environmental activities were very rarely based on n-367(30.9%) of study participants and never did these by n-304(25.6%), whereas on a weekly and daily basis, they participated with n-275(23.2%) and n-240(20.2%) respectively with no distinct gender differences (p=0.598) as shown in table 3. In this analysis, the most risk factors were observed that cause CVD in college and university students who use screens in dark rooms, low brightness levels, and no use of eye protector, as shown in Figure 2. Moreover, all these risk factors are mostly dominant in females as compared to males, which are the major causes of weak eyesight's and headache in female participants.

Table I: Screen Use Habits of Universities Students in Punjab, Pakistan

Question	Category	Overall total participants	Overall count and Percentage	Female total participants	Female count and Percentage	Male total participants	Male count and Percentage	χ^2	df	p-value	Significant
Use of screen in dark room	Never	1186	332 (28%)	673	166(24.7%)	513	166(32.4%)	10.78	2	0.0046	Yes
	Often		489(41.2%)		301(44.7%)		188(36.6%)				
	Rare		365(30.8%)		206(30.6%)		159(31%)				
Brightness level on screen?	Low	1186	452(38.1%)	673	286(42.5%)	513	166(32.4%)	20.53	2	0	Yes
	Medium		445(37.5%)		253(37.6%)		192(37.4%)				
	High		289(24.4%)		134(19.9%)		155(37.4%)				
Purpose of using devices	Education/ Productivity	1179	522(44.3%)	667	296(44.4%)	512	226(44.1%)	12.26	2	0.0022	Yes
	Social Media / Entertainment		443(37.6%)		271(40.6%)		172(33.6%)				
	Gaming		214(18.2%)		100(15%)		114(22.3%)				
Watch lectures on mobile	Yes	1186	365(30.8%)	673	214(31.8%)	513	151(29.4%)	22.33	3	0.0001	Yes
	No		249(21%)		115(17.1%)		134(26.1%)				
	Sometime		332(28%)		216(32.1%)		116(22.6%)				
	Never		240(20.2%)		128(19%)		112(21.8%)				
Screen use time	Day	1186	259(21.8%)	673	146(21.7%)	513	113(22%)	2.48	3	0.4786	No
	Afternoon		265(22.3%)		140(20.8%)		125(24.4%)				
	Night		344(29%)		202(30%)		142(27.7%)				
Average daily screen time (smart phone)	All time	1186	318(26.8%)	673	185(27.5%)	513	133(25.9%)	2.84	3	0.4167	No
	< 2 hours		222(18.7%)		115(17.1%)		107(20.9%)				
	2-4 hours		323(27.2%)		189(28.1%)		134(26.1%)				
	4-6 hours		333(28.1%)		193(28.7%)		140(27.3%)				
	> 8 hours		308(26%)		176(26.2%)		132(25.7%)				
How many years using electronic devices	<5 years	1186	219(18.5%)	673	136(20.2%)	513	83(16.2%)	6.76	4	0.1491	No
	5-10 years		247(20.8%)		145(21.5%)		102(19.9%)				
	10-15 years		247(20.8%)		138(20.5%)		109(21.2%)				
	16-20 years		288(24.3%)		162(24.1%)		126(24.6%)				
	> 20 years		185(15.6%)		92(13.7%)		93(18.1%)				

Table II: Symptoms and Health Complaints from CVD

Question	Category	Overall total participants	Overall count and Percentage	Female total participants	Female count and Percentage	Male total participants	Male count and Percentage	χ^2	df	p-value	Significant
Headache after screen use	Never	1186	376(31.7%)	673	189(28.1%)	513	187(36.5%)	11.41	2	0.0033	Yes
	Sometime		506(42.7%)		312(46.4%)		194(37.8%)				
	Frequently		304(25.6%)		172(25.6%)		132(25.7%)				
Weak eyesight	+ (Plus/Positive)	1186	319(26.9%)	673	159(23.6%)	513	160(31.2%)	7.2	1	0.0073	Yes
	- (Minus/Negative)		361(30.4%)		218(32.4%)		143(27.9%)				
Family history of eyesight problems	Siblings only	1185	330(27.8%)	672	158(23.5%)	513	172(33.5%)	22.35	2	0.001	Yes
	Both parents and siblings		361(30.5%)		197(29.3%)		164(32%)				
	No history		494(41.7%)		317(47.2%)		177(34.5%)				
Any symptoms after long phone usage	Yes	1185	323(27.3%)	672	203(30.2%)	513	120(23.4%)	9.89	2	0.0071	Yes
	No		298(25.1%)		150(22.3%)		148(28.8%)				
	Sometime/ Rarely		564(47.6%)		319(47.5%)		245(47.8%)				
Most common eye symptom	Blurry Focus	1186	289(24.4%)	673	173(25.7%)	513	116(22.6%)	5.41	4	0.2476	No
	Redness		179(15.1%)		104(15.5%)		75(14.6%)				
	Dryness		195(16.4%)		103(15.3%)		92(17.9%)				
	Pain		231(19.5%)		120(17.8%)		111(21.6%)				
Dry eyes during study	Never	1186	462(39%)	673	253(37.6%)	513	209(40.7%)	2.014.28	23	0.3665 0.2329	No No
	Often		369(31.1%)		220(32.7%)						
Tear secretion after screen use	Rare		355(29.9%)		200(29.7%)		149(29%)				
Dry eyes during study	Less	1186	247(20.8%)	673	253(37.6%)	513	155(30.2%)	4.28	3	0.2329	No
	More		232(19.6%)		130(19.3%)		117(22.8%)				
	Sometimes		350(29.5%)		142(21.1%)		90(17.5%)				
	No tears		357(30.1%)		204(30.3%)		146(28.5%)				
	Never				197(29.3%)		160(31.2%)				
	Often										

Table III: Life Style, Protective and Nutritional Factors

Question	Category	Overall total participants	Overall count and Percentage	Female total participants	Female count and Percentage	Male total participants	Male count and Percentage	χ^2	df	p-value	Significant
Morning Exercise routine	Daily	1183	296(25%)	671	158(23.6%)	512	138(27%)	6.05	2	0.0485	Yes
	Weekly		517(43.7%)		284(42.3%)		233(45.5%)				
	Never		370(31.3%)		229(34.1%)		141(27.5%)				
Use of green leafy vegetables /carrots	Regularly	1183	262(22.1%)	670	136(20.3%)	513	126(24.6%)	11.06	3	0.0114	Yes
	Weekly		360(30.4%)		225(33.6%)		135(26.3%)				
	Monthly		229(19.4%)		116(17.3%)		113(22%)				
Usage of dry fruits	Rarely	1184	332(28.1%)	672	193(28.8%)	512	139(27.1%)	12.73	3	0.0053	Yes
	Regularly		233(19.7%)		127(18.9%)		106(20.7%)				
	Weekly		252(21.3%)		144(21.4%)		108(21.1%)				
	Monthly		258(21.8%)		126(18.8%)		132(25.8%)				
	Seasonally		441(37.2%)		275(40.9%)		166(32.4%)				
Usage of Vitamin C (citrus fruits)	Regularly	1183	277(23.4%)	670	136(20.3%)	513	141(27.5%)	17.54	3	0.0005	Yes
	Weekly		295(24.9%)		169(25.2%)		126(24.6%)				
	Monthly		225(19%)		117(17.5%)		108(21.1%)				
	Rarely/Seasonally		386(32.6%)		248(37%)		138(26.9%)				
Use of eye protector while studying	Never	1186	493(41.6%)	673	296(44%)	513	197(38.4%)	4.29	2	0.117	No
	Sometime		338(28.5%)		179(26.6%)		159(31%)				
	Frequently		355(29.9%)		198(29.4%)		157(30.6%)				
Sleep duration at night	4-5 hours		299(25.2%)		166(24.7%)		133(25.9%)	5.95	3	0.1139	No
	6-7 hours		392(33.1%)		237(35.2%)		155(30.2%)				
Engage in outdoor activities	8-10 hours	1186	292(24.6%)	673	168(25%)	513	124(24.2%)	1.87	3	0.5989	No
	>10 hours		203(17.1%)		102(15.2%)		101(19.7%)				
Morning Exercise routine	Daily	1183	240(20.2%)	671	135(20.1%)	512	105(20.5%)	6.05	2	0.0485	Yes
	Weekly		275(23.2%)		147(21.8%)		128(25%)				
	Rarely		367(30.9%)		214(31.8%)		153(29.8%)				
	Almost never		304(25.6%)		177(26.30%)		127(24.8%)				
			296(25%)		158(23.6%)		138(27%)				

IV.DISCUSSION

The findings of this study demonstrated a high prevalence of Computer Vision Syndrome (CVS) or Digital Eye Strain (DES) among college and university students of Punjab, with significant relationships observed among CVS, prolonged computer use, gender differences, daily physical activities and nutritional assessments. In this analysis, the aggregate prevalence of headache was (68.3%) after prolonged use of the screen, followed by neck pain (28.1%), shoulder (25%), back (24.2%) muscle pain (22.8%), ocular dryness (31.1%) and 19.6% reported watery eyes. Relating to the health consequences of smart technology device use, a research study performed in Lebanon reported that participating respondents complained about cervical pain (neck pain), 69% stated shoulder discomfort and 61% of participants reported lumbar pain (Fares, 2017). Studies conducted in Iran reported that eye pain was the major eye issue (41%) in students, followed by excessive watering (18%), burning sensation and itchy eyes (15%). Moreover, 38% of students experienced headaches and 19% reported shoulder pain in ocular manifestations (Zhang, 2022).

Several studies showed headache as the most common symptom, which is in line with our findings (Altalhi, 2020; Ranasinghe, 2016; Reddy, 2013). For instance, 53.3% of students at Emirates University and 43.2% among students from medical and engineering universities in Chennai document headache as the most prevalent symptom, but in both of these studies, the prevalence related to headache is lower than students of Punjab in our analysis (Logaraj, 2014; Shantakumari, 2014). Headaches are frequently linked to other CVS signs, although several individuals may not perceive these symptoms as direct visual-related problems. Prolonged exposure to a screen leads to headaches because visual organs constantly fixate on the digital display, eye blinking reduces, resulting in ocular dryness, and neck and shoulder muscles become stressed due to improper posture. Collectively these variables lead to visual fatigue and tension headaches (Ranasinghe, 2016).

According to our studies, females are at higher risk of CVS due to multiple factors, like females preferring to use low luminance settings of n-286(42.5%) as compared to males who preferred medium or high with equal percentage as n-192(37.4%), n-155(37.4%) respectively. Females showed a higher frequency of physical inactivity than males (34.1% vs. 27.5%). Studies carried out among Saudi students also demonstrated that the eye symptoms were markedly elevated in female students (Altalhi, 2020). Research carried out in Shanghai indicated a marked increase in the occurrence of cervical/ shoulder and lumbar pain within the secondary school population who utilize smart phone devices for over 2 hours per day (Shan, 2013). In our current study, 18.7% of respondents used screen devices for less than 2 hours per day, screen exposure was observed ranging from 2 to 4 hours by 27.2%, within the 4-6-hour range by 28.1% whereas over 8 hours by 26.0%. People who maintain continued exposure to these electronic devices are more likely to have CVS symptoms than those who use these gadgets for short periods with breaks. The length of digital device utilization was an important variable linked with the occurrence of CVC, individuals who on a daily basis utilize computers for greater than 3 hours are considerably at greater risk of exhibiting CVC symptoms (Arshed, 2023).

In spite of prolonged periods of digital device use, the greater proportion of participants stated pauses and taking short breaks during the usage of digital devices(DD) (nearly a 20-second break every 20 mintues while viewing an object located roughly 20 feets away), which is a common routine adopted by students in Egypt and Saudi Arabia (Fares, 2017; Shan Z, 2013). This outcome supports the assumption that excessive screen exposure elevates the probability of CVC and DES, as validated by scientific literature which demonstrates that substantial digital screen exposure is a leading cause of digital eye strain (DES) (Shan Z, 2013). It is also shown that scheduled breaks, especially every 30 minutes, were linked to the reduced occurrence of CVS symptoms. This positive influence of frequent pauses is widely reported in occupational health studies and is suggested as a simple but useful approach to minimize the influence of excessive screen exposure (Arshed, 2024). The American Optometric Association recommends taking regular breaks at 20-minute intervals of digital device usage and directing the gaze toward a point 20 feet away for 20 seconds as an easy and effective technique of reducing digital eye strain (i.e., CVD, 2018).

These digital and smart devices can also affect sleep quality and night sleep cycle. Quality nighttime sleep is vital for pediatric and teenagers' physical and psychological development as it influences focus, behavioral functioning and general mental and physical well-being (Jiang, 2015). The blue light of smartphone screens lowers the melatonin synthesis, a hormone involved in regulating circadian rhythms (sleep-wake cycle). In China, research on high school learners reported that engaging with mobile phones is negatively correlated with total sleep time and bedtime, along with being linked to challenges in daytime drowsiness and sustaining sleep continuity at night (Acharya, 2013). A comprehensive literature analysis demonstrated a modest relationship between sleep and maladaptive mobile phone use, while additional intervention studies should be conducted to better understand the consequences of mobile use on sleep quality (Cárthaigh, 2020). People who intake healthy nutritionally rich food, engage in daily physical activities, frequently blink eyes to prevent ocular dryness and irritation, take short interval breaks during screen usage, adjust screen brightness and maintain proper posture can prevent themselves from eye diseases. Public awareness should be enhanced through social media, seminars, educational programs and campaigns so people can adopt preventive strategies and promote healthy and safe digital device usage. In the case of limitation, the sample size was low and in future this type of analysis should be done from all district level to province level.

V. CONCLUSION

In this analysis, most risk factors were observed causing CVD in students of Punjab who use screens in dark rooms, low brightness, high usage of screens with no eye protector. Moreover, all these risk factors are mostly dominant in females as compared to males, which are the major causes of weak eyesight and headache in female participants. Public awareness should be enhanced through social media, seminars, educational programs and campaigns so students can adopt preventive strategies and promote healthy and safe digital device usage.

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