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Evaluation Of Sociodemographic Characteristics And Mobile Broadband Coverage On The Eye And Vision Symptoms In University Students Of Peshawar City

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ABSTRACT

Background: The widespread use of mobile and digital devices and screens has been associated with impacts on eye and vision issues. The students, being young adults and potential users of mobile phones and digital devices for academic purposes, are at higher risk of developing vision and eye-related issues. **Objective:** The aim of the current study was to evaluate the factors and determinants of eye and vision issues in university students of Peshawar city. **Methods:** The cross-sectional study, approved by Through ethical approval letter NO.***, was carried out from January to June 2024 in two public and two private universities. Data was analysed from 492 complete questionnaires shared with participants through Google Forms. **Results:** Respondents involved 83% male and 17% female, with female gender ($P=0.023$) significant for eye vision issues with screen utilisation. Age groups of 18-25 years ($P=0.021$) and 26-35 years (0.004), living in an urban area ($P=0.006$), broadband quality of poor ($P=0.026$), and Good ($P<0.001$) were significant factors of eye vision issues. Among the eye vision-related symptoms, headache ($P=0.010$) was found to be significant. Screen distance of $<50\text{cm}$ increased the risk of eye vision issues OR=2.08 (CI 1.10-3.40), $P=0.002$ times. Type of university, dry eyes, burning sensation, double vision, Halos around the screen and blurred vision were not significant. **Limitations:** Cross-sectional study design, male-dominant population and online data collection tool were the study limitations. **Recommendations:** Future studies should focus on more detailed and diverse populations and longitudinal studies. **Conclusion:** The impact of screens on vision and eye health has been significant in younger adults, people living in urban areas and in areas of good mobile broadband coverage. Headache is the most common and significant factor of eye strain.

Keywords: Screen Time, Eye Strain, Vision Issues, Broadband Coverage, Eye Health

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Introduction

Background:

In today's generation, using a computer has become essential for completing everyday official and academic tasks at home and work. Technological advancements in education have greatly transformed how information is presented, taught, and studied.^{1,2} However, despite this convenience, it has introduced numerous challenges related to time management and health. Computer use has increased globally since the early 20th century for both business and personal purposes. Given the widespread reliance on this technology for academic activities and teaching at colleges and universities, its impact on students requires attention. There has also been a rise in computer-related health issues in the current era of extensive and widespread computer use.^{3,4}

Computer vision syndrome (CVS), one of the top occupational dangers of the twenty-first century, can be brought on by continuous computer use for three hours or more each day. The most prevalent health issues linked to excessive computer usage are visual disorders.^{5,6} Long-term computer users experience severe accommodation problems, extra ocular muscle strains, and frequently demonstrate asthenopia.⁷ The growing incidence of asthenopia in young people is related to the increased use of mobile phones, tablets, etc.⁸ Users of computers and mobile devices frequently experience ocular problems. Eye strain, a feeling of a foreign body, redness, impaired vision, and double vision are some of the common symptoms.⁹

Digital eye strain is a symptom of evaporative dry eye, including insufficient or infrequent blinking, which compromises the ocular surface and develops asthenopic symptoms.¹⁰ Other environmental variables that contribute to the aggravation of these symptoms include poor ergonomics, bad lighting, glare, and reduced humidity in air-conditioned spaces. People with uncorrected refractive defects, contact lens users, those with a history of ocular disorders, diabetics, women, and those with autoimmune diseases are more likely than age-matched peers to experience greater and more severe symptoms.¹¹

During the covid19 pandemic, nearly 1.6 billion students throughout the world have been transformed from conventional and physical schooling to online and virtual education systems, although after the pandemic, most of the education activities resumed in the connectional, but the consistent use of online education systems has been adopted into the academic activities.¹²⁻¹⁴

Due to variations in viewing orientation (distance and angle), usage patterns, screen resolution and contrast, picture refresh rates, screen glare, colour spectra, and other digital properties, various display device types are linked to distinct profiles of visual impacts. Dryness and irritation, burning sensations, asthenopia, epiphora, hyperemia, blurred vision, diplopia, glare sensitivity, and momentary colour perception deceptions are some of the common visual symptoms of CVS.¹⁵

The iris or the pupil may absorb light with a wavelength of between 300 and 400 nm after it passes through the cornea. The most dangerous short-wave blue light is between 415 and 455 nm in energy. Direct crystal penetration into the retina results in photochemical retinal damage that cannot be repaired.¹⁶⁻¹⁹

Online ISSN

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Retinal ganglion cells that produce the photopigment melanopsin are the ones responsible for non-image-forming reactions. In the adult mammalian retina, melanopsin-expressing cells make about 1-2 per cent of retinal ganglion cells, are inherently photosensitive, and integrate photic data from rods and cones to regulate non-image-forming adaptation. Melanopsin photopigment and (ipRGCs') Intrinsically photosensitive retinal ganglion cell action spectra peak at 480 nm blue light.²⁰ Eye discomfort connected to blue light is a growing worry as the public progressively becomes aware of its negative consequences. Blue light's short wavelength causes the focus to be in the front of the retina rather than the centre, making it such that prolonged exposure to blue light worsens nearsightedness and visual fatigue. People's capacity to study and work efficiently might be impacted by symptoms like diplopia and difficulty focusing²¹.

The purpose of this study was to identify the prevalence, symptom frequency, and risk factors associated with screen utilisation on vision in University students of District Peshawar using digital devices for social media and learning activities.

RESEARCH METHODOLOGY

This cross-sectional study was conducted in 2 public and two private universities of Peshawar, Khyber Pakhtunkhwa, from January 2024 to June 2024. The study was approved by the Institutional Ethics Review Board (IERB) with ethical approval letter No..... The population of the current study were the undergraduate and graduate university students, and data were collected through a non-probability convenience sampling technique. All the students in the four selected study settings were informed about the study, its objectives and the questionnaires through participants' information. Participants who agreed for voluntarily participation were enrolled in the study following the signing of the participation consent form. Data were collected through a modified questionnaire, which was tested for consistency and reliability using Cronbach's Alpha and exploratory factor analysis. A pilot study was conducted with thirty participants, yielding a Cronbach's Alpha value of 0.87. Sample size for the current study was calculated with the formula $n = p (1-p) z^2/d^2$ using p (prevalence) =14% (0.14), d (margins of error) =5% (0.05), z ; confidence level=95% (1.96), which will provide a sample size of (n=491).

Questionnaires were sent via email to students enrolled in the selected universities, and access to the forms was revoked once completed. Sociodemographic characteristics and symptoms of CVS included headache, blurred vision, halos around the screen, double vision, and burning sensation in the eyes. Completed questionnaires were recorded in the Statistical Package for Social Sciences (SPSS) version 27. Descriptive and inferential statistics were carried out for the study variables. The level of significance was $P < 0.05$.

CHAPTER 4: RESULTS

The results of the study reported 492 filled questionnaires, including 410 males (83.33%) and 82 (16.67%) of the respondents. As illustrated in Figure 1. Table 1 below Table1 has reported detailed sociodemographic characteristics of the study participants:

Table 1: Sociodemographic characteristics and vision symptoms in studied participants

Variables	Frequency	Percentage	Significance
Gender			
Male	410	83.33	
Female	82	16.66	0.023
Age groups			
18-25 years	182	37%	0.021
26-35 years	198	40%	0.004
36 years and above	112	23%	
University			0.072
Public sector	302	62%	
Private	190	38%	
Residential living status:			0.006
Living in rural	264	54%	
Living in Urban	228	46%	
Mobile broadband coverage in a residential area:			
Very poor	134	27.23%	0.081
Poor	76	15.44%	0.026
Fair	87	17.68%	0.003
Good	90	18.29%	<0.001
Excellent	56	11.38%	0.061
Eye vision symptoms in participants			0.010
Headache	90	18.29%	0.221
Dry eyes	68	13.82%	0.081
Burning sensation	64	13%	0.111
Double vision	63	12.80%	0.107
Halos around the screen	77	15.65%	0.620
Blurred vision			

Table has reported gender of the studied participants and the age group of the participants, the type of participants from the university, and the residential living status as rural or urban. The mobile broadband coverage, as a predictor of continuous and intermittent use in the participants, was reported as very poor in 27.33% and excellent by 11.38% of the participants.

Chi-square statistics showed a significant difference in screen utilisation and eye vision issues among males and females, with $P=0.023$. Thus, Analysis of variance (ANOVA) showed a significant association of age groups 18-24 years with $P=0.021$ and 26-35 years with $P=0.004$ as significant groups of eye vision issues among the studied participants. For the residential status living in the urban areas,

Online ISSN

3007-3197

Print ISSN

3007-3189

<http://amresearchreview.com/index.php/Journal/about>

$P=0.006$ was found to be associated with increased prevalence of eye vision issues. The mobile broadband coverage was further evaluated in subgroups in terms of the quality of the services. The ANOVA reported a significant difference in eye vision issues reported with $P=0.026$ for poor quality of the broadband services, $P=0.003$ for fair quality, and highly significance was reported with $P<0.001$ for Good quality broadband services. Thus, among the significant factors related to eye vision symptoms, the headache, $P=0.010$, was the only significant factor related to increased mobile usage and screen time.

There was no significant difference reported with $P=0.072$ for public and private university students, mobile broadband coverage as very poor, $P=0.081$, and broadband coverage as excellent, $P=0.061$. In the eye vision-related factors, the dry eyes $P=0.0221$, burning sensation $P=0.081$, double vision $P=0.111$, halos around the screen $P=0.107$ and blurred vision $P=0.620$ were reported as not significant, as reported in Table 1. Descriptive statistics, including the frequency and gender of the participants, with eye and vision symptoms has been illustrated in Figure 2.

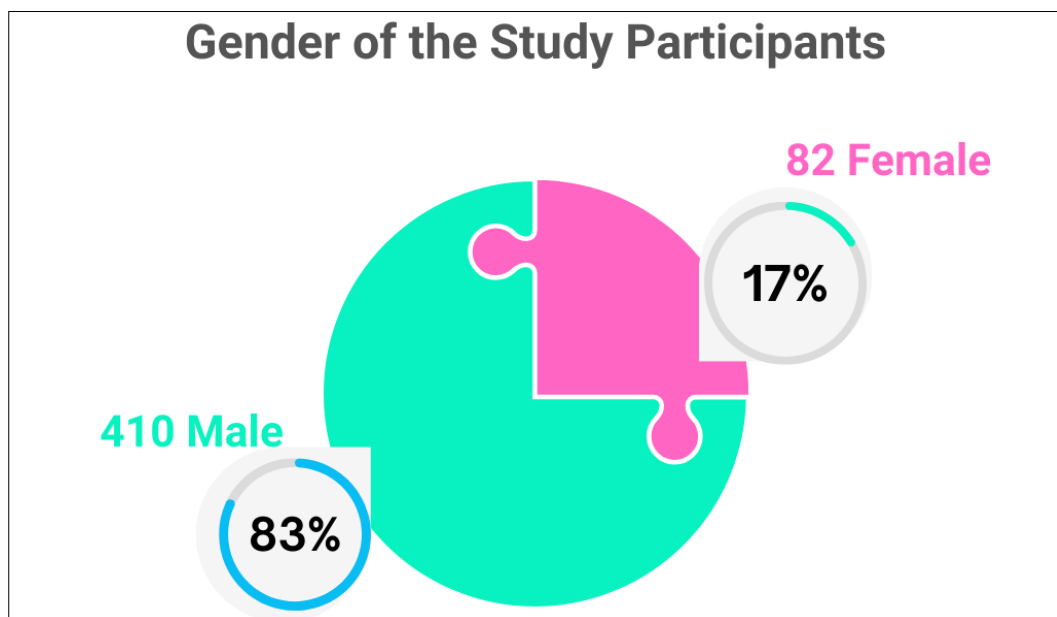


Figure 1: Number and percentage of participants' gender categorised as Male and Female

With digital devices and screen utilisation, headache was reported in 36% of men and 51.2% of women reported headaches (p -Value = 0.10). After utilising a screen, 41.5 per cent of men and 48.8 per cent of women reported having dry, fatigued, or hurting eyes (p -Value=.221). Burning sensations have been reported by 29.3% of men and 39.02% of women after utilising screens (p -Value =.081). Double vision after utilising a screen has been reported by 27.8% of men and 36.6 % of women (p -value =.111). After utilising a screen, 36.1% of men and 26.8% of women reported seeing halos around screen objects (p -Value =.107). After utilising a screen, 39.5 per cent of men and 36.6 per cent of women reported having blurry vision (p -Value=.620). As illustrated in Figure 2.

Online ISSN

3007-3197

Print ISSN

3007-3189

<http://amresearchreview.com/index.php/Journal/about>

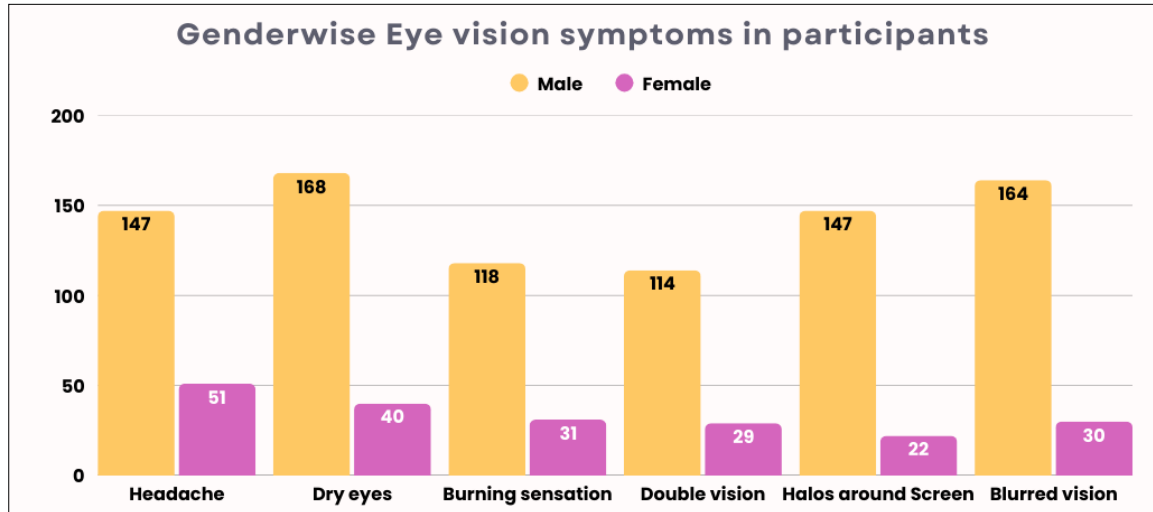


Figure 2: Gender wise prevalence of eye vision issues in the study participants
Types of devices and digital gadgets used by the study participants have been reported in Figure 3. Descriptive statistics reported that 490 of the participants were using smartphones, and 349 were using a laptop as well. Likewise, 50% of the participants, approximately n=250, were using the TV screens as well. While the use of digital tablets and gadgets was reported among 180 participants.

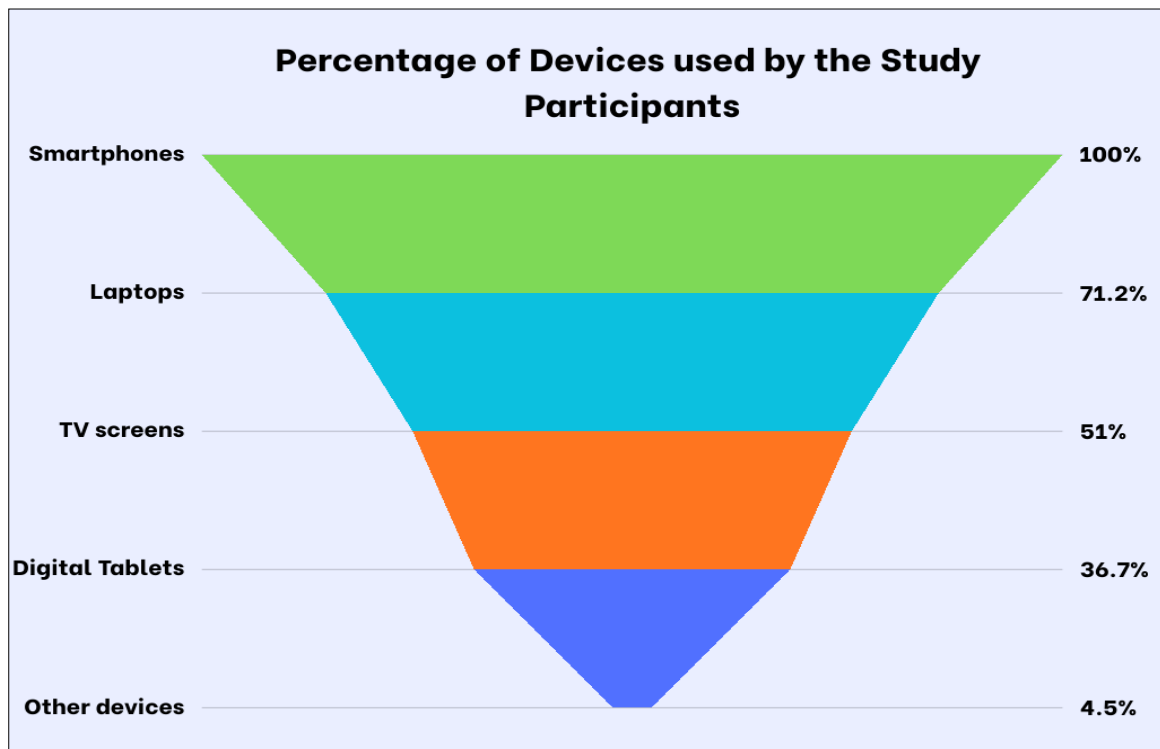


Figure 3: Percentage of Digital devices used by Study Participants

Online ISSN

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Print ISSN

3007-3189

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Pearson correlation showed a significant association between smartphone use of smartphones usage and eye vision issues, with a correlation value of 0.8 and $P=0.021$ as the level of significance. Thus, the use of laptops was also reported with a correlation value of 0.5 and a level of significance of $P=0.041$, showing a mild positive association and borderline significance.

Furthermore, the risk of eye vision issues was evaluated in participants' utilisation of digital devices and their distance from the face. It was categorised as <50 cm, 50-100 cm and more than 100 Cm. Distance from the screen and its descriptive statistics have been illustrated in Figure 4.

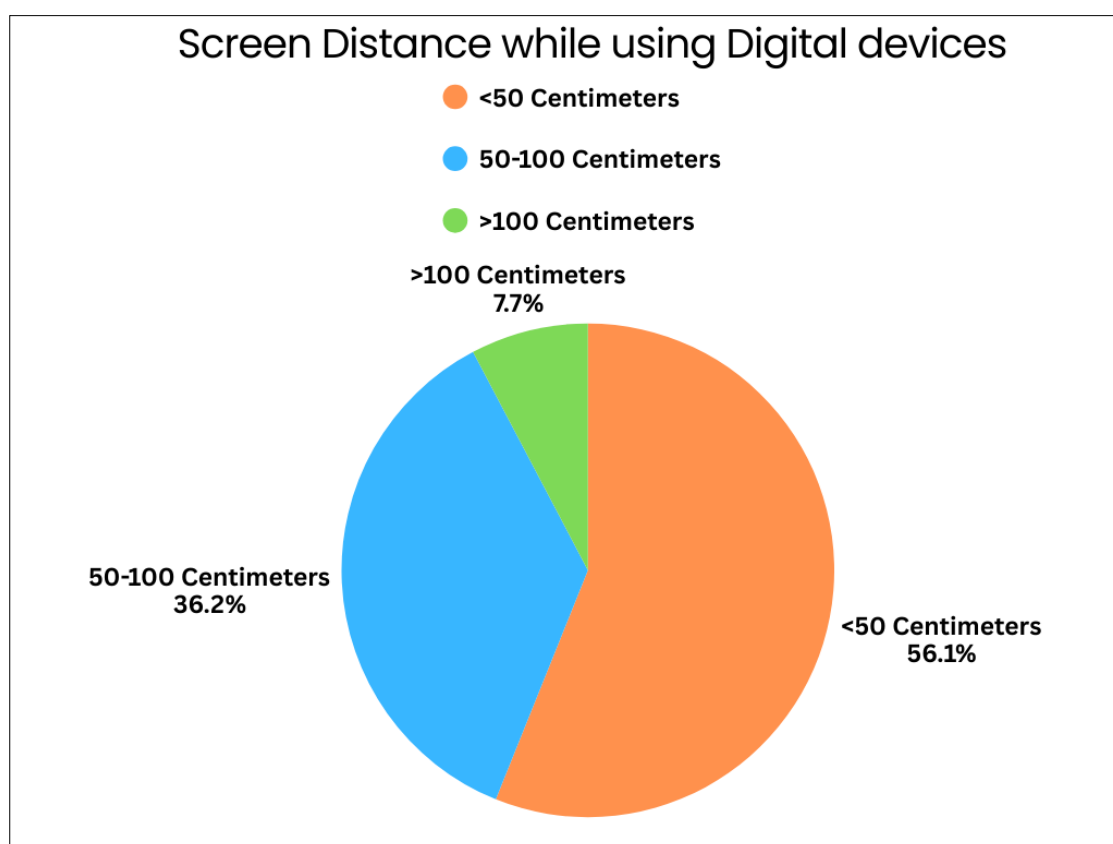


Figure 4: Participants' distance from the screen during utilisation of mobiles, laptops and televisions

Descriptive statistics showed that only 38 participants out of the studied 492 were using digital devices at a very safe distance. While 178 participants were using it at a distance, which may be safe for some devices but not for others. While 276 participants were using the digital devices at an eye distance dangerous for eye health.

Table 2: Odds of Eye vision issues in participants with screen distance.

Screen Distance	Odds ratio	Confidence Interval		Level of significance
		Lower	Upper	
<50 cm	2.08	1.10	3.40	0.002

Online ISSN

3007-3197

Print ISSN

3007-3189

<http://amresearchreview.com/index.php/Journal/about>

50-100 Cm	3.21	0.93	7.89	0.051
>100 Cm	1.45	0.81	3.14	0.071

Based on the screen distance, only the distance of less than <50 com was found significant with $P=0.002$ for causing eye strain and vision issues, and such users had the risk of developing such issues two times higher when compared to other users of screen distance with 50-100 cm and >100 cm.

CHAPTER 5: DISCUSSION

The current study aimed to find out the impact of screen use on university-level students and its impact on eye vision issues in the city of Peshawar. The descriptive cross-sectional study found that there was a significant difference between male and female students ($P=0.0123$) in mobile and screen utilisation. Thus age group was also found to be significant with age of 18-25 years ($P=0.021$) and 26-35 years ($P=0.004$) reporting a highly significant difference and utilisation of mobile and digital devices. Among the residential statuses, the urban residence ($P=0.006$) was found with higher difference for screen utilisation. Thus, the broadband quality of the internet was also evaluated, which is an important factor in internet services accessibility and utilisation. In the broadband quality the poor quality ($P=0.026$), fair quality ($P=0.003$) and good quality of broadband coverage ($P<0.001$) were found to be significant factors for screen time utilisation and eye vision issues. Among the associated factors for eye visions the only significant factor was found to be headache ($P=0.010$).

Screen time is associated with several sociodemographic characteristics in the literature. In the children and adolescents population, screen utilisation has been found excessively increased during and after the pandemic.²² Literature has reported the strongest association of mobile and other digital screens utilisation associated with gender and depressive symptoms in the studied population.²³, thus in the studied population, mobile screen usage and time spent have been reported with influence on academic performance and sleep quality as well.²⁴ as female gender was found associated with a significant difference in mobile screen utilisation, parallel findings have reported 166% increased level of depression in girls when compared to boys, with 75% of depressive symptoms.²⁵

The current study reported the significance of age groups (18-25 years and 26-35 years) with increased use of screens and eye vision issues. Screen time has been found to have long-lasting impacts, and the impacts of screen time at the age have been found to be influential at the age of twelve years.²⁶

The current study reported headache ($P=0.010$) as a significant factor among the eye vision issues, although another study from Pakistan did not find such a significant association.²⁷ However, empirical evidence has reported screen time duration and difficulty in focusing on tasks, as well as being a significant predictor of eye redness.²⁷ Furthermore, it has been found that children with increased mobile usage have been found to have $OR=1.53$ times higher risk of developing vision issues. Furthermore, the female gender $OR=1.73$ was found to be higher risk of developing eye vision issues with screen time utilisation,²⁸ which was also found

Online ISSN

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significant with $P=0.023$ in the current study. Thus, another parallel study from India reported reduced visual acuity ($P<0.05$) in students with increased mobile utilisation.²⁹

In the steadied participants, a lower distance from the screen $<50\text{cm}$ was found to be a significant factor ($P=0.02$) for vision issues in the studied participants. While there is evidence from the literature that digital eye strain is caused by increased time spent on the screen, as well as the use of screens with unsafe distance.³⁰, thus the viewing distance of mobile screens and digital screens, including laptops and TV screens, has been reported to be habitual in participants. People who viewed the mobile screen at a closer distance ($P<0.001$) were also found to use the laptop screens at a closer distance.³¹ likewise, one hour of increased mobile usage has been reported with an $\text{OR}=1.21$ increase in risk of developing myopia.³²

The current study adopted a sectional design, which may not be able to identify the causative factors of increased mobile utilisation and screen time and their causative impacts on eye vision issues in users. The current study had the methodological limitation of the adopted questionnaire through Google Forms; such a type of data collection can be biased, and responses may come from participants who may not be the true population of the study. The study was conducted in public and private Universities and the participants were students with a minimum age of 18 years and a maximum of 40 years. The study's focus was on a specific age group, which may have limited the generalizability of the findings. The current study had a selection bias as well, as 83% of the study participants were male, which affects the generalizability of the research findings. The online questionnaire circulated in a social square of male participants only, with minimal accessibility to females; only 17% of the responses came from female participants.

Future research studies may focus on more robust research designs, which will be able to identify the causative factors of eye vision issues related with increase mobile utilisation and screen time. As well as the focus of the future research studies should be on more detailed populations, and the use of digital screens and devices in teenage students and older adults will help in identifying the factors and determinants, which can lead to eye vision issues in the general population.

Conclusion

The current study aimed to find out the impact of screen utilisation, including mobile phones and digital device is, on digital eye strain, and eye vision issues in university students of Peshawar City findings of the current study reported that age groups of 18 to 25 years and 26 to 35 years were the significant age Groups for Digital eye strain. Living in the urban areas, poor and good quality of the broadband coverage, and headaches were the most common symptoms of digital eye strain, and were significant factors. Studying in a public are private security and excellent quality of the broadband coverage, and dry eyes, burning sensation in the eyes, double vision, halos surround screen and blurred vision factors. The cross-sectional study design included more than 80% of participants who were male and use up and line questionnaire for data collection, for the methodological limitation. Future studies should focus on longitudinal study designs and diverse population groups and genders.

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