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Prevalence of Asthenopia and Its Relationship with Digital Device Usage and Academic Performance Among Medical Students

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Abstract

Background: Asthenopia, referred to as visual fatigue, was a collection of symptoms that occurred due to prolonged eye use, during activities like reading, using digital screens, or performing close-up tasks. However, the relationship between asthenopia and digital device use remained unexplored.

Objective: Study aimed to determine the prevalence of asthenopia and its association with digital device used and to assess academic performance using CGPA among medical students.

Methods: A cross-sectional study was conducted in Karachi involving 336 participants aged 18–30 years. Participants completed a validated Dry Eye Questionnaire (DEQ-5) to assess asthenopia severity and a structured Questionnaire. Convenience sampling was used to recruit participants, and the data were analyzed using SPSS version 22 by applying Cohen's kappa statistic and correlation analysis to identify the relationship between asthenopia and digital device use.

Results: The prevalence of asthenopia in the sample was 15.7% with headache and eyestrain, 15.4% with headache and itchy eyes, 16.0% with headache and blurred vision, 7.1% with headache and dry eyes, 11.2% with headache and red eyes, 12.1% with headache and aching eyes, and 10.4% with headache and eye burning. Cohen's kappa analysis revealed no significant correlation between asthenopia and academic performance (p-value = 0.888).

Conclusion: There was no statistically significant relationship between asthenopia severity and academic performance. The findings suggested that there was a high prevalence of asthenopia among desktop computer users, with no significant impact on academic performance. These results emphasized the need for visual health measures regardless of academic productivity.

Keywords: Asthenopia, Computer Vision Syndrome, Digital Device Use, DEQ-5 Questionnaire, Digital Screens

Introduction

Digital Eye Strain DES affects about 60 million people worldwide, which lowers computer workers' quality of life and reduces their efficiency at work (1). There is significant variation in the prevalence of Computer vision syndrome CVS data from around the world indicate that it ranges from 12.1% to 94.8% in the juvenile population and from 35.2% to 97.3% in the adult population (2). In spring semester 2019, the American University of Beirut reported that the prevalence of asthenopia was 67.8%, with hazy vision being the most commonly reported

symptom (27.0%). Students completed an anonymous, self-administered questionnaire regarding themselves, their usage of digital devices, their symptoms of asthenopia, potential risk factors, and preventative methods (3). According to a research on 168 madrassa students, 81.1% of them had myopic, 7.6% had hyperopic, and 11.3% had astigmatic refractive defects. This finding emphasized the importance of screening madrassa students for future blindness (4). Asthenopia, commonly referred to as visual weariness, is a collection of disorders brought on by overuse of the eyes for a variety of reasons. The purpose of this review is to present an overview of the large body of research on digital eye strain, with a focus on clinical symptom management (5). One might categorized asthenopia as internal or external. Internal asthenopia is characterized by strained and aching sensations within the eye. External forms of asthenopia are mostly related to settings in the viewing area and are frequently linked to lighting glare (6).

With the advent of digital technology, students now frequently used digital devices for social, recreational, and academic reasons, including phones, tablets, and laptops. As a result, asthenopia accompanied by other symptoms like headache, dizziness, itchy or red eyes, and difficulty concentrating, is common among students (7). Research conducted both in vitro and in vivo has demonstrated that exposure to blue light, depending on its wavelength and intensity, can harm specific eye tissues, most notably the retina, either permanently or temporarily (8). Examine the impact of student's use of mobile phones on their variety-seeking (VS) intention and academic performance (AP) (9). Digital technology makes it possible for formal education to be highly customized, allowing individuals to develop unique study routines and approaches. However, it also increases the risk of psychosocial isolation. The constantly shifting web context is another important consideration (10).

Methods

This study employed a cross-sectional design to assess the prevalence of asthenopia and dry eye symptoms among young adults who frequently used digital devices. The study was conducted in different medical colleges in Karachi over duration of one year. The target population comprised male and female young adults aged 18–30 years who frequently used digital devices such as computers, tablets, smartphones, and e-readers. A sample size of 336 participants was calculated using OpenEpi software based on a reference study conducted in 2020 by Sawaya R.I.T. et al., titled "Asthenopia among university students: The eye of digital generation" at Beirut University (3). Participants were selected through a non-probability convenience sampling technique. Participants with pre-existing eye disorders or visual impairments, other than asthenopia, as well as individuals who did not frequently use digital devices, were excluded from the study.

The questionnaire included information regarding digital devices used, reasons for digital device usage, symptoms of asthenopia, and preventive measures. In addition, the 5-Item Dry Eye Questionnaire (DEQ-5) a validated and reliable tool, was used to assessed the frequency and intensity of dry eye symptoms and ocular discomfort. Data were collected through face-to-face interviews. Descriptive statistics, including frequency, mean, and standard deviation, were used. Inferential statistics were applied to assess relationships between variables using correlational analysis. The chi-square test was used for discrete data, while Spearman's correlation coefficient was applied for continuous and non-normally distributed data. Data was analyzed using SPSS version 22. Ethical considerations included obtaining informed consent from all participants, maintaining confidentiality of personal information, minimizing potential risks or discomfort, adhering to ethical guidelines and regulations, and informing participants of their right to withdraw from the study at any stage without penalty.

Results

This cross-sectional study included 338 participants from several medical colleges in Karachi, of whom 53.3% were female and 31.1% were male, suggesting that female students were more likely to have participated. The participants ranged in age from 18 to 30 years. The Doctor of Physical Therapy (DPT) program accounted for the largest percentage of enrolled students (40.8%), followed by BS Medical Laboratory Technology (13.9%), Bachelor of Dental Surgery (13.3%), MBBS (9%), Nursing (9%), D-Pharmacy (7%), Biotechnology (3.6%), BS Radiology (2.1%), and Psychology (0.3%). Desktop computers accounted for 80% of all digital device usage, with tablets, iPads, and iPhones following at 62.1%, laptops at 54.45%, and Android phones at 18.3%. The majority of participants reported using digital devices for educational purposes for two to four hours daily, whereas most participants reported using them for work, entertainment, and communication for less than four hours per day. Asthenopia symptoms were reported by 7.1%–16% of respondents, whereas 21%–25% reported no symptoms. Although 43.5% of participants reported taking regular breaks, only 36.1% used adjustable screens, 13.6% used adjustable chairs, 15.7% used eye drops, and 6.8% used anti-glare glasses. The prevalence of dry eye symptoms revealed that 29.3% of participants reported no symptoms, 47.6% reported mild symptoms, 18.9% reported moderate to severe symptoms, and 4.1% reported severe symptoms. These findings demonstrated that digital eye strain and dry eye symptoms were highly prevalent among young adults who had used digital devices for prolonged periods of time.

Table 1: Demographic Characteristics of Participants

Gender	Frequency	Percent
Male	120	35.5%
Female	218	64.5%
Total	338	100.0%
Age Group	Freuquency	Percentage
18-20	105	31.1%
21-23	180	53.3%
24-26	52	15.4%
27-30	1	3%
TOTAL	338	100.0%
Field Of Study	Frequency	Percentage
MBBS	31	9.2%
BDS	45	13.3%
DPT	138	40.8%
NURSING	33	9.8%
BSMLT	47	13.9%

BIO-TECNOLOGY	12	3.6%
D-PHARMACY	24	7.1%
BS RADIOLOGY	7	2.1%
PSYCHOLOGY	1	.3%
TOTAL	338	100.0%

Table 2: Use of Digital Devices and Associated Purposes

Digital Devices		**1**	**2**	**3**	**4**	**5**
Desktop	Frequency	284				
	Percentage	80%				
Laptop	Frequency	184				
	Percentage	54.45%				
Android Phone	Frequency	62				
	Percentage	18.3%				
Table/IPad/iPhone	Frequency	210				
	Percentage	62.1%				

What are the reasons you use the digital devices for?	**Frequency**	**Percentage**
STUDING	211	62.4%
WORK	43	12.7%
ENTERTAINMENT	62	18.3%
COMUNICATION	22	6.5%
TOTAL	338	100.0%

Table 3 Table: Daily Screen Time, Dark Room Usage, and Years of Screen Exposure

How many hours per day in total do you spend using a digital screen?	**Frequency**	**Percentage**
>2hours	20	5.9%
2-4hours	73	21.6%
4-6hours	151	44.7%
>6hours	94	27.8%
Total	338	100.0%

Around how many hours are spent using the screen in a dark room?	Frequency	Percentage
<2hours	151	44.7%
2-4hours	89	26.3%
4-6hours	72	21.3%
>6hours	26	7.7%
TOTAL	338	100.0%
How many years did you spend with this frequency on the screen?	**Frequency**	**Percentage**
1Year	40	11.8%
2Year	59	17.5%
3Year	80	23.7%
4Year and more	159	47.0%
Total	338	100.0%

Table 4: Hours Spent on Digital Devices for Different Activities

How many hours do you spend on the digital devices for the purpose of studying?	Frequency	Percentage
< 2hours	92	27.2%
2-4hours	124	36.7%
4-6hours	89	26.3%
>6hours	33	9.8%
TOTAL	338	100.0%
How many hours do you spend on the digital devices for the purpose of working?	**Frequency**	**Percentage**
<2hours	150	44.4%
2-4hours	100	29.6%
4-6hours	69	20.4%
>6hours	19	5.6%
Total	338	100.0%

How many hours do you spend on the digital devices for entertainment?	Frequency	Percentage
<2hours	96	28.4%
2-4hours	95	28.1%
4-6hours	92	27.2%
>6hours	55	16.35%
Total	338	100.0%
How many hours do you spend on the digital devices for communication?	**frequency**	**percentage**
<2hours	153	45.3%
2-4hours	98	29.0%
4-6hours	61	18.0%
>6hours	26	7.7%
Total	338	100.0%

Table 05: Prevalence Of Asthenopia With Symptoms

Prevalence of asthenopia	Frequency	Percentage
Headache and Eye Strain		
No Symptoms	74	21.9%
Only Headache	211	62.4%
Asthenopia	53	15.7%
Headache and Itchy Eyes		
No symptoms	72	21.3%
Only Headache	214	63.3%
Asthenopia	52	15.4%
Headache and Blurred vision.		
No symptoms	71	21.0%
Only Headache	213	63.0%
Asthenopia	54	16.0%
Headache and dry eyes		
No symptoms	85	25.1%

Only headache Asthenopia	229 24	67.8% 7.1%
Headache and red eyes		
No symptoms Only headache Asthenopia	78 222 38	23.1% 65.7% 11.2%
Headache and Aching eyes		
No symptoms Only headache Asthenopia	87 210 41	25.7% 62.1% 12.1%
Headache and eye burn		
No symptoms Only headache Asthenopia	83 220 35	24.6% 65.1% 10.4%

Table 6: Dry Eye Scoring

DRY EYE SCORING	FREQUENCY	PERCENTAGE
No dry eyes	99	29.3%
Mild dry eyes	161	47.6%
Moderate dry eyes	64	18.9%
Sever dry eyes	14	4.1%
Total	338	100.0%

Discussion

Analysis of 103 studies finds the prevalence of Computer Vision Syndrome (CVS), 69% higher prevalence among. Women (71.4%) vs. men (61.8%) University students (76.1%) Africa (71.2%) and Asia (69.9%) contact lens wearers (73.1%). This is related to the earlier study of 53.3% of 4,786 students reported asthenopia (2). Hazy vision (98.1%) Headache (86.1%) Discomfort (73.1%) Pain (70.4%) Eye strain (66.7%) Myopia (54.6%) Hypermetropia (23.2%) Astigmatism (22.2%) (4). Young adults between the ages of 18 and 30 made up the study's participants, who were drawn from both the general and student populations. The mean ages of the participants, who were mostly female, ranged from 21 to 22. It was discovered that Computer Vision Syndrome symptoms were very common, especially in women. While myopia, hyperopia, and vision correction were not significantly linked to CVS (11). A study of 1,462 students (mean age 22.8) found 73% were women 71% reported eye strain. (12). Previous study conducted on 2,491 children found that 9.4% (235) had refractive errors. The most common refractive errors were myopia (42.2% overall, 46.6% in the 10+ age group) and simple astigmatism (40.5% in children under 10). This study highlights the prevalence and types of refractive errors in children, emphasizing the importance of vision screening, especially for those aged 10 and above (13). In another study on asthenopia (eye strain), before the intervention, 100% of the respondents

experienced asthenopia, with an average Visual Function Index (VFI) score of 0.4819. After the intervention, 91.7% of participants still experienced asthenopia, representing an 8.3% reduction (14). Asthenopia prevalence is 12.1% overall (ranging from 5.4-18.2% across subgroups. Protective factors include maintaining a 34-65 cm distance between the eyes and the screen, regular rest between classes, and performing eye exercises. In a previous study, 97.1% (n=367) experienced eye strain (15)

This study conducted a Digital Device Usage Survey where respondents rated their device usage from 1 (least) to 5 (most). Desktop computers were the most frequently used devices (80%), followed by laptops (54.4%), tablets/iPads/iPhones (62.1% with moderate usage), and Android phones (18.3%) (16). A study of 2,009 individuals (median age 20) found that 68.4% used digital devices for more than 6 hours per day for work and 61% for social purposes. Only 9.4% were aware of Computer Vision Syndrome (CVS). Common symptoms included headaches, eye burning, itching, tearing, and redness. Daily usage of more than 6 hours was linked to increased eye strain severity (17). This is a previous study's finding Initial Questionnaire Refinement original 52 symptoms and 2 self-evaluation questions. Reduced to 19-item questionnaire through item reduction and assessment reliability and validity (18). Another study of Development and Validation of ASQ-17 Phases 1-4 Refinement of original 19-item questionnaire Resulted in 17-item questionnaire (ASQ-17) ASQ-17. Distinct curve peaks in each dimension Significant score differences between asthenopia and non-asthenopia groups (19). The study findings compare two groups, (Group A) and (Group B). Statistically significant differences were observed in Group B. In the one-month follow-up, Group A showed no significant changes, while Group B demonstrated significant decreases in the Schirmer test ($p = 0.005$), lacrimal film quality ($p = 0.022$), keratitis ($p < 0.001$), conjunctival lesions ($p = 0.005$), and fatigue score ($p < 0.001$) (20).

Conclusion

The study concluded that there is no significant relationship found between asthenopia and academic performance and severity of asthenopia. The study results further revealed that there is a high prevalence of asthenopia among desktop computer users, with no significant impact on academic performance. These results emphasize the need for visual health measures, regardless of academic productivity. To prove the lack of a relationship between asthenopia and academic achievement, future research should increase the sample size and include a wider range of device users.

Author Contribution

Author	Contribution
Prof.Dr. Erum Tanveer*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Dr. Hamza Ahmed	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Israr Ali Haider	Substantial Contribution to acquisition and interpretation of Data

	Has given Final Approval of the version to be published
Aisha Bano	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Nisaullah	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Savera	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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