

## ASSOCIATION OF DIGITAL EYE STRAIN WITH SLEEP DISTURBANCES AND PSYCHOLOGICAL STRESS IN YOUNG ADULTS

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### **ABSTRACT**

**Background:** Cases of Digital Eye Strain (DES) have been on the increase amongst young adults as a result of the excessive use of digital devices. Eye fatigue, dryness, blurred vision, and headaches are some of the symptoms that can have a negative impact on the quality of sleep and psychological health. The study of the correlation between DES and sleep disturbances and psychological stress is critical to the development of preventive measures for this group.

**Objectives:** to determine the dependence of digital eye strain on sleep disorders and psychological stress in young adults, as well as to determine the main risk factors that contribute to the results.

**Methodology:** It was cross-sectional study on a sample of 100 young adults (1830 years old). The participants were made to fill a structured questionnaire that contained the Computer Vision Syndrome Questionnaire (CVS-Q) on DES, the Pittsburgh Sleep Quality Index (PSQI) containing sleep disturbances, and the Perceived Stress Scale (PSS-10) on psychological stress. Demographic, daily screen time and ergonomic habits data were gathered. The statistical analysis was done with SPSS 26. The descriptive statistics were used to describe demographic and clinical aspects. Chi-square, Pearson and multivariate logistic regression were used to examine associations between DES, sleep quality, and stress. A p-value, which was less than 0.05, was significant.

**Results:** The mean age of participants was  $23.6 \pm 3.2$  years. DES was reported in 68%, with eye fatigue (55%), dryness (48%), and blurred vision (36%) as the most common symptoms. Poor sleep quality was observed in 62%, and high psychological stress in 58% of participants. High DES scores were significantly associated with poor sleep (mean PSQI:  $7.3 \pm 2.1$  vs  $4.5 \pm 1.8$ ;  $p < 0.001$ ) and elevated stress (mean PSS:  $21.4 \pm 4.6$  vs  $15.7 \pm 3.9$ ;  $p < 0.001$ ). Daily screen time  $> 6$  hours increased the risk of DES, poor sleep, and stress ( $p = 0.002$ ). Multivariate analysis confirmed DES as an independent predictor of sleep disturbances (OR=2.6; 95% CI 1.5–4.5;  $p < 0.001$ ) and stress (OR=2.3; 95% CI 1.3–4.1;  $p = 0.003$ ).

**Conclusion :** DES is common in adult youth and strongly linked with sleep disturbances and psychological stress. They can be alleviated by reducing the amount of screen time, engaging in ergonomics, and enhancing sleep hygiene. Education and lifestyle changes are presented as necessary in order to improve eye and general health.

**Keywords:** Digital Eye Strain, Sleep Disturbances, Psychological Stress, Young Adults

### **Introduction**

Computer vision syndrome is also known as Digital Eye Strain (DES), which is becoming a problem in the digital age. As more people continue to use computers, smartphones, tablets, and other digital gadgets, people, especially young adults, are spending longer durations in close activities, resulting in eye pain and visual exhaustion. The range of symptoms that are detected in DES includes eye fatigue and dryness, blurred vision, headaches and, in a few cases, neck or shoulder pains. These are some of the symptoms that tend to occur as a result of prolonged screen time, poor workstation arrangement, and lack of proper breaks when using a device [1,2]. It has

been revealed that recent study has demonstrated the possibility of an association between DES and other health outcomes, such as sleep disorders and mental stress. The symptoms of sleep disturbances may include the problem of falling asleep, shortened sleep and low quality of sleep. Digital screens are associated with exposure to blue light, which can disrupt circadian rhythms, inhibit the secretion of melatonin in the evening, and worsen sleeping issues. At the same time, DES can be a factor that increases psychological stress because of constant discomfort, decreased productivity, and disruption of daily life. The psychological stress factor has been identified as a risk factor for various negative consequences, such as mood disorders, poor academic performance, and poor cognitive functioning [3,4]. Study has documented a high rate of prevalence of DES in university students and young professionals, with estimates showing a range of 60-90%; a testimony of the high dependence on digital devices. Recent studies indicate that more time in front of the screen, as well as insufficient visual ergonomics, worsen ocular symptoms and accompanying psychological anguish. Nevertheless, the majority of the present study is either small-sized or addresses either sleep or stress and its effects on them without assessing the combined effect of DES on both [5,6]. The correlation between DES, sleep disturbance, and psychological stress in young adults is a crucial matter to be studied as they become more dependent on digital devices both in school, the workplace, and social life. Constructive screening habits can be encouraged by preventing bad habits and diminishing the negative consequences through early detection of risk factors and putting preventive measures in place. Comprehensive study that will evaluate visual symptoms and psychosocial outcomes in one cohort is needed to make evidence-based recommendations to students and young professionals [7,8]. This study will seek to fill this gap by investigating the commonality of DES and its connection to the quality of sleep and psychological stress among young adults. Through the assessment of demographic, behavioural, and ergonomic variables, the study aims to provide some practical recommendations on the intervention strategies that can enhance ocular health, minimise stress, and maximise the quality of sleep among the high-demographic groups exposed to digital screens [9,10].

### **Study Objectives**

To determine the relationship between digital eye strain and sleep disorders and psychological stress among young adults, and demographic, behavioural, and ergonomic determinants of the results.

### **Materials and Methods**

#### **Study Design & Setting**

The was a cross-sectional study carried out at Department of Ophthalmology, Bacha khan Medical College, Mardan.kpk Pakistan from jan 2023 to dec 2023. The sample was obtained among undergraduate and postgraduate programs, and the measurement was carried out using a structured questionnaire and psychometric instruments.

#### **Participants**

A total of one hundred young adults were enrolled between the ages of 18 and 30 years. The criteria of inclusion were that participants had to use digital devices regularly ( $\geq 3$  hours a day). Limitations were: pre-existing ocular disease, psychiatric illness, or sleep disorders not associated with the use of digital devices. Informed consent was obtained, demographics, screen time/day, and ergonomics were recorded.

#### **Sample Size Calculation**

The number of 100 was derived based on a 95 per cent confidence interval, 80 per cent study power and a DES prevalence rate of 65 per cent in young adults. The cross-sectional study formula

was sufficient to provide enough power to identify meaningful results between DES, sleep disorders, and psychological stress.

### **Inclusion Criteria**

Young adults (18-30 years), daily use of digital devices for 3 hours or more, intention to take part.

### **Exclusion Criteria**

Known eye pathology, mental disorders, chronic sleeping disorders, recent eye surgery or use of drugs that alter sleep or stress.

### **Ethical Approval Statement**

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board (IRB)/Ethics Committee of the respective institution prior to the commencement of the study. Written informed consent was obtained from all participants (or their legal guardians, where applicable) before inclusion in the study. Confidentiality and anonymity of participant data were strictly maintained throughout the research process. Participants were assured of their right to withdraw from the study at any stage without any consequences.

### **Diagnostic and Management Strategy.**

The Evaluation of DES was based on the Computer Vision Syndrome Questionnaire (CVS-Q). The level of sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), whereas psychological stress was measured using the Perceived Stress Scale (PSS-10). Basic education on screen breaks and ergonomics, as well as preventive care, was administered to participants.

### **Statistical Analysis**

SPSS version 26 was used to analyse the data. Demographics, DES, sleep and stress were summarised using descriptive statistics. Measures of association between variables were done using Chi-square tests and Pearson correlation. The independent predictors were determined by multivariate logistic regression. The p-value was figured to be under 0.05 as statistically significant.

### **Results**

Among 100 participants, the mean age was  $23.6 \pm 3.2$  years, with 55% females and 45% males. DES was reported in 68% of participants. Eye fatigue (55%), dryness (48%), blurred vision (36%), and headache (28%) were the most commonly reported symptoms. The mean DES score was  $18.2 \pm 5.4$ . Poor sleep quality (PSQI  $>5$ ) was observed in 62% of participants, and high perceived stress (PSS-10  $\geq 20$ ) in 58%. Participants with high DES scores had significantly poorer sleep quality (mean PSQI:  $7.3 \pm 2.1$  vs  $4.5 \pm 1.8$ ;  $p < 0.001$ ) and elevated stress (mean PSS:  $21.4 \pm 4.6$  vs  $15.7 \pm 3.9$ ;  $p < 0.001$ ). Daily screen time exceeding 6 hours was associated with increased DES prevalence, poor sleep, and higher stress scores ( $p = 0.002$ ). Multivariate logistic regression confirmed DES as an independent predictor of sleep disturbances (OR=2.6; 95% CI 1.5–4.5;  $p < 0.001$ ) and psychological stress (OR=2.3; 95% CI 1.3–4.1;  $p = 0.003$ ). No significant differences were observed based on gender or study program.

### **Intervention Outcome**

Ergonomic instructions, 20-20-20 breaks and screen time reduction were given to the participants. Follow-up reported better awareness and self-reported decrease in DES symptoms, improved sleep hygiene, and perceived stress, which indicated that the effects of digital eye strain in young adults might be reduced by simple lifestyle changes.

**Table 1. Demographic Characteristics of Participants (n = 100)**

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	Mean ± SD	23.6 ± 3.2	-
Gender	Male	45	45%
	Female	55	55%
Daily Screen Time	<3 hours	20	20%
	3–6 hours	50	50%
	>6 hours	30	30%
Study Program	Undergraduate	60	60%
	Postgraduate	40	40%

Descriptive demographic characteristics of 100 young adult participants, including age, gender, daily screen time, and study program distribution.

**Table 2. Prevalence and Symptoms of Digital Eye Strain (DES) (n = 100)**

Symptom	Frequency (n)	Percentage (%)
Eye fatigue	55	55%
Dryness	48	48%
Blurred vision	36	36%
Headache	28	28%
Mean DES score	18.2 ± 5.4	-
Participants with DES	68	68%

Prevalence of Digital Eye Strain and its common ocular symptoms among the study participants, with mean DES score.

**Table 3. Sleep Disturbances and Psychological Stress (n = 100)**

Parameter	Mean ± SD	n (%)	p-value
PSQI Score (Sleep Quality)	6.5 ± 2.3	Poor sleep (PSQI >5): 62	<0.001*
PSS Score (Stress)	19.8 ± 4.8	High stress (PSS ≥20): 58	<0.001*
Mean PSQI by DES Status	7.3 ± 2.1 (High DES) vs 4.5 ± 1.8 (Low DES)	-	<0.001*
Mean PSS by DES Status	21.4 ± 4.6 (High DES) vs 15.7 ± 3.9 (Low DES)	-	<0.001*

Sleep quality (PSQI) and psychological stress (PSS) outcomes stratified by DES severity. Significant associations observed between high DES scores and poor sleep or elevated stress. \*p < 0.05 considered statistically significant.

**Table 4. Multivariate Logistic Regression: Predictors of Sleep Disturbances and Stress**

Predictor	Outcome	OR	95% CI	p-value
High DES	Poor Sleep	2.6	1.5–4.5	<0.001
High DES	High Stress	2.3	1.3–4.1	0.003
Screen Time >6h	Poor Sleep	1.9	1.1–3.3	0.02
Screen Time >6h	High Stress	2.0	1.1–3.5	0.01

Ergonomic Practices	Poor Sleep	0.7	0.4–1.2	0.15
Ergonomic Practices	High Stress	0.8	0.5–1.3	0.18

Multivariate logistic regression analysis showing the independent predictors of sleep disturbances and psychological stress. High DES and prolonged screen time were significant risk factors, while ergonomic practices showed no statistically significant protective effect.

**Discussion**

We concluded that Digital Eye Strain (DES) was very common among young adults and is strongly linked with poor sleep quality as well as high levels of psychological stress. Such results are in line with the increasing evidence in the world that long-term screen viewing has adverse impacts on visual comfort as well as general well-being, especially for students and young professionals, who over-rely on digital devices [11]. In line with prior descriptive and analytical analyses, the prevalence of DES symptoms in our cohort (68%) was comparable to the recent studies in adolescent and young adults. High prevalence of DES (63.7%) in a large cross-sectional study of adolescents and a great impact on low sleep quality, especially with excessive screen time and exposure to bedtime devices [12]. This solidifies the fact that prolonged use of digital media is a major contributor towards visual strain and sleeping disturbances. On the same note, general population surveys reported high sources of ocular discomfort associated with hours of daily screen time, and the indicators like dryness, fatigue, and blurred vision were very common among the daily screen time users [13,14]. These results highlight the fact that DES is not a single ocular problem but tends to be a multi-system problem in combination with lifestyle and behavioral trends [15]. The fact that we found a correlation between high scores in DES and worse sleep is reflected in the results of observational studies that indicate that the use of digital screens is correlated with the deterioration of sleep quality. In one of the recent studies, the female college students in Northern India showed that there was a high level of association between the severity of DES and poor sleep quality, which indicates that visual strain and sleep outcomes are interrelated in the youthful age samples of the population [16]. Mechanism, although believed to be multifactorial, too much evening screen time may delay the onset of melatonin and disturb circadian rhythms, which culminates in the cause of sleep latency and fragmentation as demonstrated in many sleep study studies [17]. The correspondence of the relationship between DES and psychological stress to that of wider psychosocial study in our study is also echoed in statistics. Even though all the study on DES does not directly gauge stress, the findings of the mental health study suggest that perceived stress greatly influences the quality of sleep and overall well-being among student groups [18]. High levels of stress could further promote screen time by using coping strategies, which can exacerbate discomfort in the eyes and sleep disorders, and form a two-way relationship, which is worth a more extensive longitudinal study [19]. Conversely, other studies indicate that relatively easier ergonomics and Internet behavioural changes can help streamline the symptoms of DES and its overall effects. The systematic reviews allow justifying the advantages of screen habits optimisation, periodic breaks, and environmental lighting and display configuration aimed at minimizing the symptoms [20]. Although we did not directly test interventions in our study, these results support the hypothesis that the lifestyle changes may reduce the impact of DES. It is important to note that blue light blocking strategies are not a new concept to be study, but the evidence has been conflicting, and ergonomic practices tend to be more reliable [21]. The effect of demographic and behavioural factors on DES outcomes has been studied by other study. As an example, longer screen time, which exceeds 4-5 hours a day and poor ergonomic position, has been found over and over again to correlate with more significant symptoms, just as we saw that

daily screen time over 6 hours increased the risk of DES [22]. Nevertheless, certain study suggests that personal factors (e.g., academic workload, mental health condition, and even such demographic differences as gender) can moderate the DES - sleep connection and therefore larger, more heterogeneous study is essential to investigate the moderators in question in greater detail.

### **Limitations**

The study was cross-sectional in nature, which did not allow the studyer to make any causal conclusions. The sample was very small and was not limited to one population in one university, which can have an impact on the generalizability. DES, sleep, and stress self-reported questionnaires could be subject to reporting bias. Objective measures of longitudinal studies are justified to be validated.

### **Conclusion**

Digital Eye Strain is very common in young adults and is strongly linked to low-quality sleep and high levels of psychological stress. The prevention measures, such as screen-time regulation, ergonomic changes, and sleep hygiene education, should be encouraged. Interventions implemented early in life can enhance the ocular health, mental state and quality of life among this population.

**Disclaimer:** Nil

**Conflict of Interest:** Nil

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### **Authors Contributions**

Concept & Design of Study: Muhammad Bilal, Shafqat Ali Shah

Drafting: Hidayatullah Mahsud

Data Collection & Data Analysis: Muhammad Tariq

Critical Review: Manzoor ali

Final Approval of version: All Mentioned Authors Approved.

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