

ASSOCIATION BETWEEN DIGITAL EYE STRAIN AND SLEEP QUALITY AMONG COLLEGE STUDENTS – A CROSS-SECTIONAL STUDY

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ABSTRACT

Digital Eye Strain (DES) refers to the onset or aggravation of recurring eye-related symptoms and signs resulting from the use of digital device screens. Preliminary definition of sleep quality is how the individual feels upon waking and throughout the day, feeling rested and restored after waking, and the number of awakenings experienced during the night. DES negatively affected sleep quality because Prolonged digital device use. Hence, we aimed to assess the association between Digital Eye Strain (DES) and sleep quality among college students. A cross-sectional study was conducted among 114 students aged 18–25 years at Pachamuthu College of Pharmacy. DES and sleep quality were assessed using CVS-Q and PSQI, and the data were analysed using SPSS to determine their relationship. Among 108 participants, the mean age was 20.6 years, with 71.3% females. The mean DES score was 19.01 ± 4.49 , and PSQI score was 3.61 ± 2.28 . Most participants (92.6%) had mild DES. DES and sleep quality showed a very weak, non-significant correlation ($p = 0.05$, $p > 0.05$). The study found a high prevalence of mild digital eye strain among participants, but no significant association was observed between digital eye strain and sleep quality. The weak correlation may be influenced by lifestyle, screen-use habits, and the predominance of mild DES symptoms. The study concluded that DES and sleep quality had a very weak and non-significant correlation ($p = 0.05$). Further large-scale studies were needed to examine the relationship between screen time, bedtime device use, sleep habits and sleep quality.

KEYWORDS: Digital Eye Strain (DES), Sleep Quality, Cross-Sectional study, PSQI, SPSS Software, non-significant correlation, p-value.

INTRODUCTION

The transition from traditional to cutting-edge digital technology is known as the "Digital Revolution." Communication, information access, education, and daily life have all changed as a result of the advancement of computers and the Internet. College students frequently use computers, tablets, and smartphones, but too much screen time can be detrimental to their social, mental, and physical well-being.^[1-3] The content, entertainment, information, and social interaction that smartphones offer are the primary causes of smartphone addiction. Lockdowns and social isolation, Difficulties with social interactions, FOMO (Fear of Missing Out), online work and learning, social challenges, and a lack of

interests or leisure activities can all factors contributing to excessive screen use time.^[4-7]

Overuse of screens can lead to headaches, neck, shoulder, and back pain, as well as eye strain. Additionally, it might be a factor in mental and social issues like depression, insomnia, loneliness.^[8] Digital Eye Strain (DES) refers to the onset or aggravation of recurring eye-related symptoms and signs resulting from the use of digital device screens.^[9] The history of DES is linked to the rapid growth of digital technology since the 1980s, with prolonged screen use increasingly causing eye-related problems. It is associated with some factors.^[10] Prolonged screen time, decreased blinking,

screen glare, frequency changes in pupil size, dim lighting, improper viewing distance, bad posture, and all contribute to DES.^[11-13] Ocular surface, accommodative, and extraocular mechanisms—such as decreased blinking, prolonged near focusing, screen distance—all contribute to digital eye strain.^[10] Prolonged digital device use can cause des, leading to headaches, eye dryness, burning, blurred vision, and neck or shoulder pain.^[14,15] A study of 387 students found a high prevalence of Digital Eye Strain (80.40%), mainly associated with prolonged screen time and inadequate breaks.^[16] Preliminary definition of sleep quality, how the individual feels upon waking and throughout the day, feeling rested and restored after waking, and the number of awakenings experienced during the night.^[17] Different scales are used to assess the Sleep Quality such as SQDF, PSQI, PROMIS Sleep, ESS, While we are using PSQI. The PSQI assesses self-reported sleep quality and disturbances over the last one-month time periods. The PSQI includes 19 items to measure seven domains of sleep quality: subjective sleep quality, sleep latency,

sleep duration, habitual sleep efficiency, daytime dysfunction, sleep disturbance and use of sleeping medications.^[18] Getting enough quality sleep is essential for both mental and physical health.^[19,20] Seven components of sleep quality.^[21] High quality sleep is essential for optimal daily functioning, while poor sleep quality can leads to poor concentration, memory problems, mood changes, reduced performance, and increased risk of cardiovascular disorders.^[22,23] Excessive screen time before bedtime can reduce sleep quality by suppressing melatonin and disrupting the sleep–wake cycle and circadian rhythm because during screen time exposure to blue light.^[24-29] Assessment tools used in the study (Demographic questionnaire, PSQI, DESQ).^[18,30] The questionnaire collected basic demographic details. Sleep quality was assessed using the PSQI, with total scores ranging from 0–21 (that's indicates good and poor sleep quality).^[19] Digital Eye Syndrome was assessed using a 13-item symptom questionnaire. Among 100 participants, symptoms were classified as mild, moderate, or severe based on the scoring criteria.^[30]

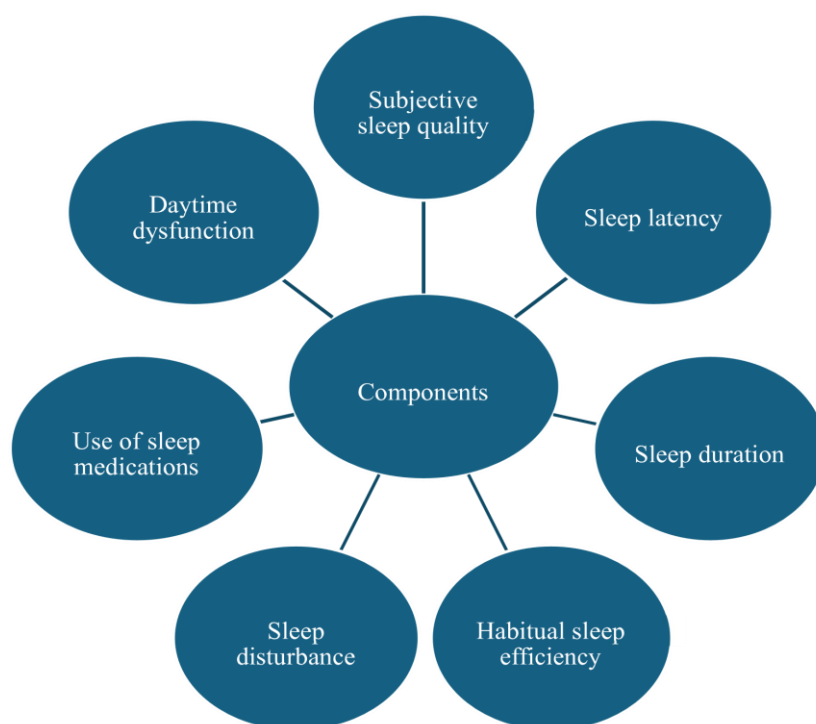


Fig 1: Components of Sleep Quality.^[21]

METHODOLOGY

The study was conducted as a cross-sectional study among 114 college students at Pachamuthu College of Pharmacy for a period of 6 months. Convenience sampling was used. Students aged 18–25 years who used digital devices such as smartphones, laptops, desktops, or tablets for at least 2 hours and were willing to participate were included, while students with ocular disorders, recent eye surgery, chronic migraine, neurological or psychological disorders, diagnosed sleep disorders, or incomplete responses were excluded. After obtaining written informed consent, demographic details, Digital

Eye Strain (DES) symptoms, and sleep quality were assessed using a validated DES/CVS-Q questionnaire and the Pittsburgh Sleep Quality Index (PSQI). DES symptoms such as eye strain, dryness, headache, blurred vision, redness, burning sensation, and neck pain were assessed. Data were analysed using IBM SPSS Statistics, with frequency, percentage, mean, standard deviation, Karl Pearson correlation, and independent t-test; $p < 0.05$ was considered statistically significant. The primary outcome was the association between DES score and sleep quality, while secondary outcomes include the prevalence and associated factors of DES and poor sleep

quality. Ethical approval, informed consent, voluntary participation, confidentiality, and anonymity were maintained throughout the study.

RESULT

The study comprised 108 participants in total. The participants' average age was 20.6 years. Table 1 displayed the participants demographic characteristics. Figure 1 illustrates that of the study participants, 77 were female and 31 were male.

Table 1: Demographic Characteristics of the Participants (N = 108).

Demographic variable	Frequency (n)	Percentage (%)
Female	77	71.3
Male	31	28.7
Total	108	100.0
Mean age	20.6 years	—

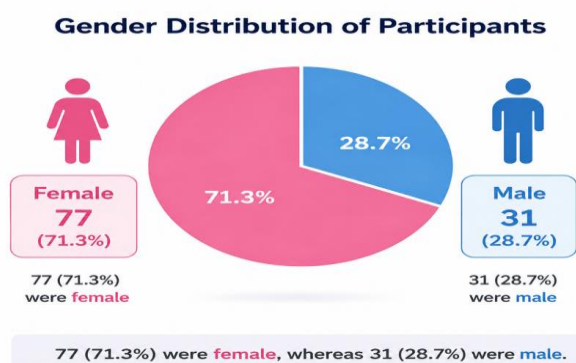


Figure 2: Gender Distribution of Participants.

About 71% of the participants in the study were female, compared to about 29% who were male.

SLEEP QUALITY

The participants' sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI). All 108 participants were included in the analysis. Table 2 provided the PSQI data's descriptive statistics.

Table 2: Descriptive Statistics of PSQI Scores (N = 108).

Statistical parameter	PSQI score
N	108
Mean	3.61
Standard deviation (SD)	2.28
Standard error of mean	0.22
Minimum	0
Maximum	11
Mode	3.00
Sample variance	5.21
High outliers	9

The participants' PSQI scores ranged from 0 to 11, with an average of 3.61 ± 2.28 . The first and third quartiles

were 2.00 and 4.25, respectively, and the median PSQI score was 3.00. 50% of participants had PSQI scores between 2.00 and 4.25, according to the IQR of 2.25. The PSQI score of 3.00 was the most observed. High scores of 11 were classified as outliers. A small percentage of participants had significantly higher PSQI scores than the majority, as evidenced by the identification of nine high outliers. The distribution of PSQI scores among the participants is displayed in Figures 2 and 3. The histogram shows the positively skewed, non-normal distribution of PSQI scores, while the box-and-whisker plot shows the median, interquartile range (IQR), and high outliers.

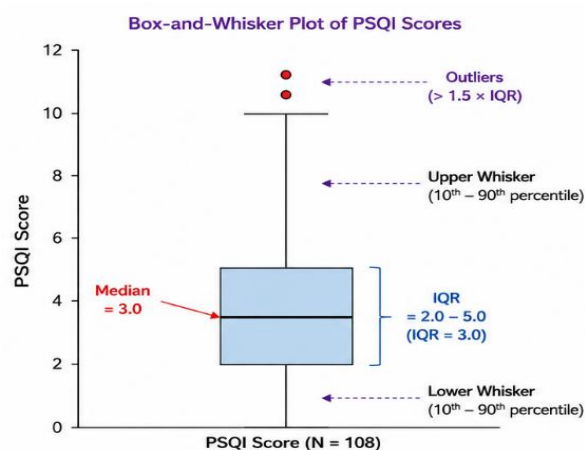


Figure 3: Box plot of PSQI score.

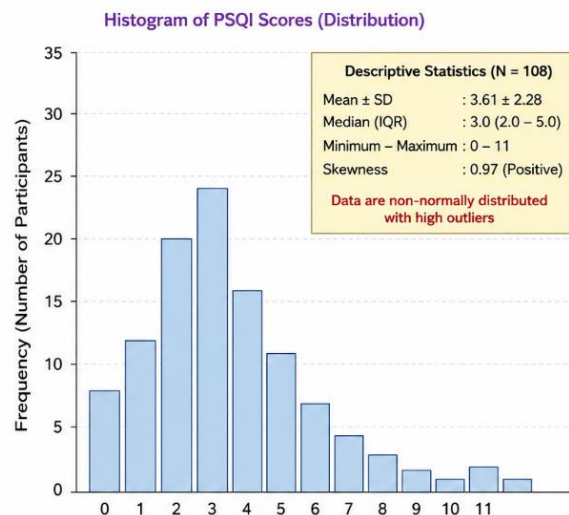


Figure 4: Histogramical representation of PSQI score.

Digital Eye Strain (DES)

Digital Eye Strain (DES) with scores ranging from 13 to 35, the 108 participants had a mean DES score of 19.01 ± 4.49 . The first and third quartiles were 16.00 and 21.00, respectively, and the median DES score was 18.00. The IQR was 5.00. The most commonly recorded DES score was 18.00. Some participants reported significantly higher levels of digital eye strain, and the DES scores showed positive skewness (1.22), indicating

a right-skewed distribution. Five high outliers were found. Table 3 displayed the DES Score's comprehensive descriptive statistics. The study population's DES scores

showed moderate relative variability, as indicated by the coefficient of variation of 23.61%.

Table 3: Descriptive Statistics of DES Scores (N = 108).

Statistical parameter	DES score
N	108
Mean	19.01
Standard deviation (SD)	4.49
Standard error of mean	0.43
Minimum	13
Maximum	35
Range	22
Q1 (25th percentile)	16.00
Median	18.00
Q3 (75th percentile)	21.00
Interquartile range (IQR)	5.00
Mode	18.00
Sample variance	20.14
Skewness	1.22
Kurtosis	2.06
Coefficient of variation	23.61%
High outliers	5

The distribution of DES scores among the participants is displayed in Figures 4 and 5. The distribution's upper non-outlier value was 27, while its lower end reached a score of 13. At 29, 29, 33, 34, and 35, five high outliers were found. A small percentage of participants had significantly higher levels of digital eye strain, as

indicated by these abnormally high scores. Higher scores in the upper tail are consistent with the median (18) being lower than the mean (19.01). Consequently, a positively/right-skewed distribution is suggested by the box plot.

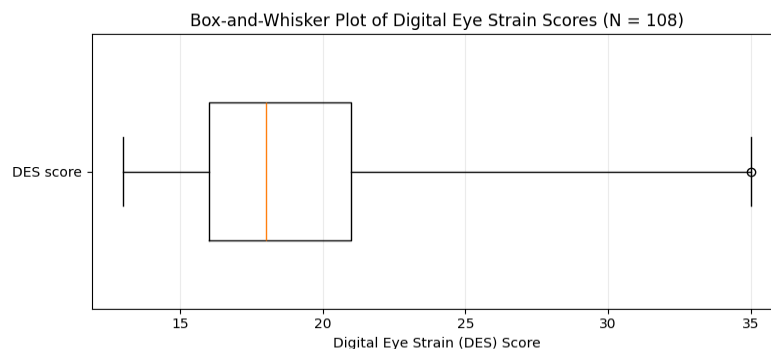


Figure 5: Box plot of DES score.

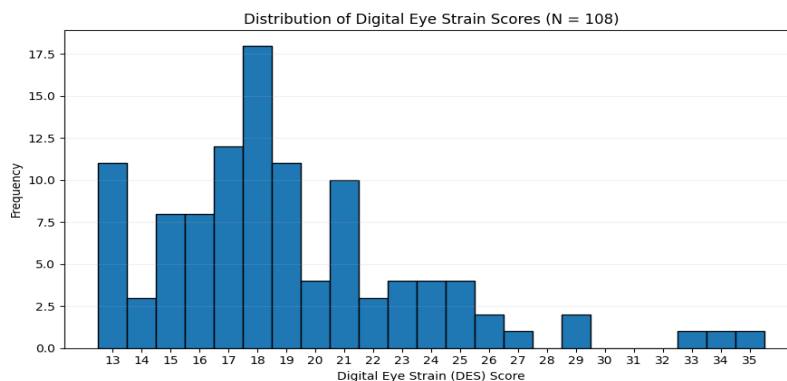


Figure 6: Histogramical representation of DES score.

With DES scores ranging from 25% to 49%, 100 (92.6%) of the 108 participants had mild symptoms of digital eye strain. Eight people (7.4%) had moderate symptoms, with scores ranging from 50% to 74%. None of the individuals were categorized as having severe symptoms (>75%) or minimal symptoms (<25%). As seen in Figure 6, the majority of the study population had mild symptoms of digital eye strain, with about 7% of participants exhibiting moderate symptoms. The distribution of participants based on the severity of digital eye strain symptoms is shown in Figure 6 & Table 3.

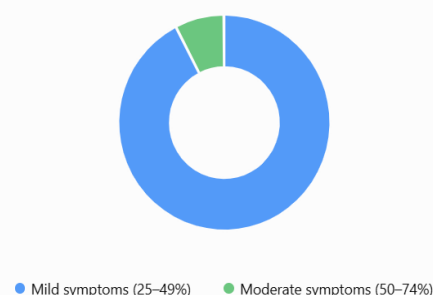


Figure 7: Severity of DES symptoms.

Table 3: DES severity classification.

DES symptom category	Frequency (n)	Percentage (%)
Minimal symptoms (<25%)	0	0.0
Mild symptoms (25–49%)	100	92.6
Moderate symptoms (50–74%)	8	7.4
Severe symptoms (≥75%)	0	0.0
Total	108	100.0

Spearman's rank correlation coefficient was employed to evaluate the relationship between DES and PSQI scores because neither the PSQI nor the DES scores had a normal distribution. Digital eye strain and PSQI scores showed a very weak positive correlation ($\rho = 0.05$, $n = 108$) according to Spearman's rank correlation analysis, which was not statistically significant at the 5% significance level ($p > 0.05$).

DISCUSSION

The current study evaluated sleep quality and digital eye strain (DES) in 108 participants, whose mean age was 20.6 years. Males made up 28.7% of the study population, while females made up 71.3%. When interpreting the results, it's important to consider the predominance of female participants because the distribution of DES and sleep-related outcomes may differ depending on behavioural and demographic factors. DES scores ranged from 13 to 35, with a mean of 19.01 ± 4.49 . The interquartile range was 5.00, and the median score was 18.00. The majority had scores concentrated toward the lower-to-moderate range, while a smaller percentage had significantly higher scores, as indicated by the positive skewness (1.22). There were five high outliers found. Participants with higher DES scores may indicate variations in screen time, duration of digital device use, viewing preferences, the surroundings, or other personal factors.^[31,32] The IQR was 2.25, the median was 3.00, and the mean PSQI score was 3.61 ± 2.28 . Scores ranged from 0 to 11.^[18, 33] The PSQI scores were not normally distributed, according to the statistical significance of the normality goodness-of-fit test ($\chi^2 = 73.19$, $df = 5$, $p < 0.001$). There were nine high outliers found. Although the presence of participants with higher scores suggests that a subset of the study population had poorer sleep quality, the relatively low mean PSQI score suggests that a significant portion had relatively low PSQI scores.

The results are especially pertinent since young adults' use of digital devices and sleep are closely linked behavioural factors.^[34,35] Long-term screen time can exacerbate visual symptoms like headaches, dry eyes, blurred vision, and trouble concentrating.^[31,36] Additionally, prolonged bedtimes, increased cognitive stimulation, and screen light exposure may be linked to altered sleep patterns when using digital devices, especially in the evening or before bed.^[34,35,37] On the other hand, fatigue, eye strain perception, and visual comfort during the day can all be impacted by insufficient or poor-quality sleep.^[38] 7.4% of participants in this study had moderate symptoms of digital eye strain, compared to 92.6% who had mild symptoms. There were no individuals who were categorized as having minimal or severe symptoms. Although severe symptoms were not seen, the predominance of mild symptoms indicates that digital eye strain was prevalent in the study population.^[39,40] Additionally, the analysis showed that neither the PSQI nor DES scores had a normal distribution. To ascertain the relationship between the two variables, a non-parametric Spearman's rank correlation test was chosen. DES and PSQI scores showed a very weak positive correlation ($\rho = 0.05$, $n = 108$) according to Spearman's correlation. Nevertheless, at the 5% significance level ($p > 0.05$), this association was not statistically significant. As a result, the null hypothesis was not rejected, suggesting that the current study did not find any statistically significant correlation between digital eye strain and sleep quality. Although the magnitude of the association was very small, the positive direction of the correlation suggests that participants with higher DES scores tended to have slightly higher PSQI scores. Consequently, there was insufficient evidence to conclude that higher levels of digital eye strain were linked to lower sleep quality in this study population.

These results might not be consistent with research showing a link between extended use of digital devices

and sleep disorders.^[34,35,41] The lack of a significant association in the current study could be explained by a number of factors. The length of time spent in front of a screen, the viewing distance, the brightness of the screen, the frequency of breaks, the lighting, the use of corrective lenses, and the type of digital device all have an impact on digital eye strain.^[31,32,36] Similarly, a variety of factors, such as academic workload, stress, sleep schedule, caffeine intake, physical activity, and lifestyle choices, can affect sleep quality.^[42-44] These variables might have affected the observed relationship and were not always taken into consideration in the correlation analysis. Additionally, the majority of study participants only had mild DES symptoms; only a small percentage had moderate symptoms, and none had severe symptoms. It's possible that the limited range of symptom severity made it harder to find a significant relationship with PSQI scores. The fact that the current study employed a cross-sectional observational design is also noteworthy. Consequently, even if a strong correlation had been found, it would not prove that digital eye strain and sleep quality are causally related.^[45] Additionally, since no statistically significant correlation was found in this specific sample, the non-significant correlation found here should not be taken as evidence that digital eye strain has no effect on sleep.

CONCLUSION

Overall, our study identified a very weak, non-significant positive correlation ($p = 0.05$) between PSQI scores and digital eye strain. The relationship between digital eye strain and sleep quality may be better understood in future studies with larger and more varied populations, as well as assessment of screen time, bedtime device use, duration of exposure, sleep habits, and other potential confounding factors.

REFERENCES

- Sharma AK, Shanmugaboopathi. PS. Digital Revolution and Its Nature and Extent in the Contemporary World. *Technoarete Transactions on Advances in Social Sciences and Humanities*, 2022; 2(4): 27-32.
- Firdaus L, Pagua JA, et al. Digital revolution: the history of the Internet. *Internet Reference Services Quarterly*, 2025; 29(3): 415-418.
- Chhasatia AH. Association between screen time and anxiety among college students. *Ann Med Sci*, 2025; 4: 324-328.
- Emanuel R, Bell R, Cotton C, Craig J, Drummond D, Gibson S, et al. The truth about smartphone addiction. *College Student Journal*, 2015; 49(2): 291-299.
- MedecinDirect. Addictions aux écrans: comprendre, prévenir et traiter la dépendance numérique. Paris: MedecinDirect; [cited 2026 Aug 14]. Available from: <https://www.medecindirect.fr/maladies/addictions-ecrans>
- RNfinity. Technology addiction. London: RNfinity; 2024 Oct 6 [updated 2025 Jun 8; cited 2026 Aug 14]. Available from: <https://www.rnfinity.com/news/Techno-addicts>
- Department d'Educació i Formació Professional. Factors de risc per desenvolupar una addicció. Barcelona: Generalitat de Catalunya; 2022 [cited 2026 Aug 14]. Available from: <https://educacio.gencat.cat/ca/arees-actuacio/families/benestar-digital/addiccio-pantalles/factors-risc>
- Devi KA, Singh SK. The hazards of excessive screen time: Impacts on physical health, mental health, and overall well-being. *J Educ Health Promot*, 2023 Nov 27; 12: 413. doi: 10.4103/jehp.jehp_447_23. PMID: 38333167; PMCID: PMC10852174
- Andrew D Pucker, Aaron M Kerr, et al. Digital eye strain: updated perspectives. *Clin Optom*, 2024; 16: 233-246. doi:10.2147/OPTO.S412382.
- Kirandeep Kaur, Bharat Gurnani, et al. Digital eye strain- A comprehensive review. *Ophthalmic Ther*, 2022; 11: 1655-1680. doi:10.1007/s40123-022-00540-9
- Nethradhama Medical Staff. Digital eye strain: symptoms, causes and treatment. Bengaluru: Nethradhama Super Speciality Eye Hospital; 2025 Jun 6 [cited 2026 Aug 14]. Available from: <https://nethradhama.org/blog/eyes-on-screens-navigating-the-digital-eye-strain-dilemma-for-optimal-eye-health>
- Cedars-Sinai. Computer vision syndrome. Los Angeles (CA): Cedars-Sinai; [cited 2026 Aug 14]. Available from: <https://www.cedars-sinai.org/health-library/diseases-and-conditions/c/computer-vision-syndrome.html>
- Chen LW. Digital eye strain: targets eyes wellness market. *Wel-Bloom*; 2025 Feb 21 [cited 2026 Aug 14]. Available from: Wel-Bloom website
- Miao E. Digital eye strain: what it is, causes, signs and symptoms, treatment, and more. *Osmosis*; 2025 Mar 4 [cited 2026 Aug 14]. Available from: <https://www.osmosis.org/answers/digital-eye-strain>
- Bynocs. Digital eye strain: causes, symptoms and treatment. *Bynocs*; 2025 [cited 2026 Aug 14]. Available from: <https://bynocs.com/blogs/digital-eye-strain/>
- Almudhaiyan TM, Aldebasi T, Alakel R, et al. The prevalence and knowledge of digital eye strain among the undergraduates in Riyadh, Saudi Arabia. *Cureus*, 2023; 15(4): e37081. doi:10.7759/cureus.37081
- Nelson KL, Davis JE, Corbett CF. Sleep quality: an evolutionary concept analysis. *Nurs Forum*, 2022; 57(1): 144-51. doi:10.1111/nuf.12659. PMID: 34610163.
- Jaya vera Summer. Health benefits of sleep. Sleep Foundation; 2025 Jul 22 [cited 2026 Aug 14]. Available from:

- <https://www.sleepfoundation.org/how-sleep-works/benefits-of-sleep>
19. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*, 1989; 28(2): 193-213.
 20. Sabelskaya. Benefits of healthy sleep infographics, flat vector illustration. iStock; [cited 2026 Aug 14]. Available from: iStock – Benefits of Sleep Illustrations
 21. Joao KAD, de Jesus SN, Carmo C, Pinto P. Sleep quality components and mental health: study with a non-clinical population. *Psychiatry Res*, 2018; 269: 244-250. doi: 10.1016/j.psychres.2018.08.020.
 22. Tesfaye W, Getu AA, et al. Poor sleep quality and associated factors among healthcare professionals at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia. *Front Psychiatry*, 2024; 15: 1225518. doi:10.3389/fpsy.2024.1225518
 23. Sim & Hooi Dental Clinic. Are you sabotaging your success with poor sleep? Here's what you need to know. Kuala Lumpur: Sim & Hooi Dental Clinic, 2023 Dec 6 [updated 2023 Dec 15; cited 2026 Aug 14]. Available from: <https://www.shdc.com.my/post/signs-of-poor-sleep-quality-here-s-what-you-need-to-know>
 24. Lopez JV, et al. Screen use and sleep duration and quality at 15 years old: A cohort study. *Sleep Epidemiol*, 2023; 10:100013. doi: 10.1016/j.sleep.2023.100013
 25. Silvani MI, Werder R and Perret C. The influence of blue light on sleep, performance and wellbeing in young adults: A systematic review. *Front. Physiol*, 2022. 13:943108. doi: 10.3389/fphys.2022.943108
 26. LMC Optometry & Eye Care. Blue light exposure and how it affects your eye health. Toronto: LMC Optometry & Eye Care; 2022 Feb 18 [cited 2026 Aug 17]. Available from: <https://lmcoptometry.ca/blue-light-exposure-and-how-it-affects-your-eye-health/>
 27. Doctor Anywhere Thailand. What is melatonin? Does it really improve sleep? 2024 Nov 20 [cited 2026 Aug 17]. Available from: <https://www.doctoranywhere.co.th/post/what-is-melatonin-does-it-really-improve-sleep>
 28. iStock. Sleep stages infographic, flat vector illustration isolated [Internet]. iStock; [cited 2026 Aug 18]. Available from: iStock sleep stages illustrations.
 29. Bryan L. Circadian rhythm. Sleep Foundation; 2025 Jul 23 [cited 2026 Aug 17]. Available from: <https://www.sleepfoundation.org/circadian-rhythm>
 30. Mylona I, Glynatsis MN, Dermenoudi M, Glynatsis NM, Floros GD. Validation of the Digital Eye Strain Questionnaire and pilot application to online gaming addicts. *Eur J Ophthalmol*, 2022; 1-7. doi:10.1177/11206721211073262.
 31. Singh S, McGuinness MB, Anderson AJ, Downie LE, Vingrys AJ. Digital eye strain in young screen users: a systematic review. *J Clin Med*, 2023; 12(20): 6588.
 32. Rosenfield M. Computer vision syndrome: a review of ocular causes and potential treatments. *Ophthalmic Physiol Opt*, 2011; 31(5): 502-515.
 33. Mollayeva T, Thurairajah P, Burton K, Mollayeva S, Shapiro CM, Colantonio A. The Pittsburgh Sleep Quality Index as a screening tool for sleep dysfunction in clinical and non-clinical samples: a systematic review and meta-analysis. *Sleep Med Rev*, 2016; 25: 52-73.
 34. Carter B, Rees P, Hale L, Bhattacharjee D, Paradkar MS. Association between portable screen-based media device access or use and sleep outcomes: a systematic review and meta-analysis. *JAMA Pediatr*, 2016; 170(12): 1202-1208.
 35. Brautsch LAS, Lundgren J, Lallukka T, et al. Digital media use and sleep in late adolescence and young adulthood: a systematic review. *Sleep Med Rev*, 2023; 68: 101742.
 36. Rosenfield M, Jahan S, Nunez K, Chan K. Cognitive demand, digital devices and eye strain. *Ophthalmic Physiol Opt*, 2015; 35(5): 563-571.
 37. Chang AM, Aeschbach D, Duffy JF, Czeisler CA. Evening use of light-emitting eReaders negatively affects sleep, circadian timing, and next-morning alertness. *Proc Natl Acad Sci U S A.*, 2015; 112(4): 1232-1237.
 38. Rana M, Gupta PC, Grover S, Furr A, Bhargava N. Prevalence and association of digital eye strain with the quality of sleep and feeling of loneliness among female college students in Northern India. *Indian J Public Health*, 2023; 67(4): 618-625. doi: 10.4103/ijph.ijph_1761_22.
 39. Logaraj M, Madhupriya V, Hegde SK. Computer vision syndrome and associated factors among medical and engineering students in Chennai. *Ann Med Health Sci Res*, 2014; 4(2): 179-185.
 40. Al Tawil L, Aldokhayel S, Zeitouni L, Qadoumi T, Hussein S, Ahamed SS. Prevalence of self-reported computer vision syndrome symptoms and its associated factors among university students. *Eur J Ophthalmol*, 2020; 30(1): 189-195.
 41. Hale L, Guan S. Screen time and sleep among school-aged children and adolescents: a systematic literature review. *Sleep Med Rev*, 2015; 21: 50-58.
 42. Hershner SD, Chervin RD. Causes and consequences of sleepiness among college students. *Nat Sci Sleep*, 2014; 6: 73-84.
 43. Lund HG, Reider BD, Whiting AB, Prichard JR. Sleep patterns and predictors of disturbed sleep in a large population of college students. *J Adolesc Health*, 2010; 46(2): 124-132.
 44. Irish LA, Kline CE, Gunn HE, Buysse DJ, Hall MH. The role of sleep hygiene in promoting public health: a review of empirical evidence. *Sleep Med Rev*, 2015; 22: 23-36.
 45. Setia MS. Methodology series module 3: cross-sectional studies. *Indian J Dermatol*, 2016; 61(3): 261-264.