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Frequency And Duration Of Rest And Intensity Of Lighting Effect On Computer Vision Syndrome In Medical Student Of Islamic University Of Malang

Muhammad Gusti Ramadhani Prasetyo[1*], Dewi Martha Indria[2], Ariani Ratri Dewi[3]
Universitas Islam Malang, Indonesia
Email : arianiratridewi@unisma.ac.id

ABSTRACT

In today's modern era, gadget use is integral to human activities, including higher education. Prolonged use of gadgets with inadequate breaks and unbalanced lighting intensity can lead to Computer Vision Syndrome (CVS), a range of eye, vision, and non-eye symptoms associated with gadget use. This research investigates the impact of rest frequency, duration of rest, and lighting intensity on CVS among medical students. This research was an analytical, quantitative, cross-sectional observational study, with second and third year medical students as respondents (total sampling). CVS was assessed using the Computer Vision Syndrome Questionnaire (CVS-Q), frequency and duration of rest were obtained through a questionnaire, and light intensity was measured using a lux-meter. Statistical analysis used the Chi-Square test for influence and binary logistic regression test for odds ratio. Among the 181 respondents, aged approximately 18-22 years, 48% (88 individuals) reported suffering from CVS (CVS-Q 9.65 ± 3.43). The study found that 56.35% of the respondents rested after more than 20 minutes, and 53% rested for less than 20 seconds each time. Additionally, unbalanced lighting intensity between the gadget screen and surrounding light was observed in 50.82% of the respondents (92 individuals). The Chi-square test revealed a pvalue of 0.000, indicating a significant effect of rest frequency, rest duration, and lighting intensity on the CVS-Q score. There is an influence of frequency and duration of rest and lighting intensity on increasing CVS scores.

Keywords: college students, break frequency, break duration, lighting intensity, CVS score

INTRODUCTION

Computer Vision Syndrome is a major occupational health threat in the 21st century [1] (Kahal et al., 2025). The American Optometric Association defines Computer Vision Syndrome as eye and vision problems that occur when a person uses gadgets for a long time to see at close quarters [2] (Kahal et al., 2025). Computer Vision Syndrome (CVS) is a public health problem with around 60 million people suffering from this disease globally [3] (Anbesu & Lema, 2023).

Logaraj et al. in their research found that the number of medical students who use laptops as learning media was found to be higher, with a percentage of 85% (171/201) than 46% (99/215) engineering students [3](Plch, 2020) . Research conducted in Nepal by Basnet et al showed that as many as 55% of medical students use cellphones, 25% use laptops and 25% use more than 1 type of gadget [4] (Jha et al., 2025). A meta-analysis study conducted by Fabricio Ccami-Bernala et al. in 2024 using a random-effects model with a 95% confidence interval calculated using the exact method found that the prevalence of CVS in women was higher than in men, namely with a ratio of 71.4% and 61.8% (Suman et al., 2023). As for the prevalence of CVS on each continent, it was found that Africa (71.2%) and Asia (69.9%) had a higher prevalence than the Americas (66.6%) and Europe (60.9%) (Carrillo-Larco et al., 2016). The type of population that is found to be high with CVS is college students with prevalence of 76.1% (Hassan et al., 2017). [5]

Research conducted on students by Shantakumari et al in Ajman found that CVS complaints were often found in students who did not take frequent breaks when using computers experienced eye fatigue (Alamri et al., 2022; Noreen et al., 2021). This is because the position of the eyes and the active eye accommodation when using a computer can cause accommodation fatigue [6(Kang et al., 2021). The study also found that visual complaints were more common in students who rarely took breaks while

using computers (Al Tawil et al., 2020). This can be explained by the fact that accommodation is an active process, and when the eyes are constantly in the same focused position, it can cause fatigue in the accommodation system. Reducing this strain can be done by shifting the focus of the eyes periodically, thereby reducing the continuous spasm of accommodation and reducing the effects of glare from the monitor (Coles-Brennan et al., 2019). Therefore, it is recommended that users turn their gaze to objects far from the screen at least once every 20 seconds every 20 minutes of gadget use [6] (Mellolo et al., 2024). The study also found that the light imbalance between the computer screen and the environment is also a factor that needs to be considered (Ekşioğlu, 2017; Green et al., 2017). Students who use computers in very bright or dark rooms are more prone to visual fatigue symptoms (Priya & Subramaniyam, 2020). Headache complaints are more pronounced when the computer screen is very bright and dry eye complaints are found in college students who use darker screens [6](Dandumahanti et al., 2025) .

Based on the description that has been explained, research is needed to find out whether there is an effect of less frequency and duration of rest and less or excessive lighting intensity on computer vision syndrome in medical students at UNISMA.

METHOD

Design, place, and time of the study

This study uses a quantitative method with an analytical observational study with *a cross-sectional approach*. This research is located on the Campus of the Faculty of Medicine, Islamic University of Malang, with the time of implementation of the research in June-July 2024. The Research Ethics Commission of RSI UNISMA gave ethical approval with the number 013/KEPK/RSI-U/II/2024.

Sample and population of the study

The respondents in this study were 2nd and 3rd level students of the Medical Education Study Program, Faculty of Medicine, Islamic University of Malang. This study uses *a non-probability sampling method*, namely *total sampling*. The inclusion criteria in this study were students of the Medical Education Study Program, Faculty of Medicine, UNISMA levels 2 and 3 who attended the questionnaire filling activity, namely 181 respondents with details of 102 level 2 students and 79 level 3 students. Respondents who do not participate in this research activity will be completely excluded.

Research Instruments

This study used the *Computer Vision Syndrome – Questionnaire* (CVS-Q) questionnaire instrument to analyze whether respondents experienced CVS. This questionnaire includes 16 symptoms whose frequency and intensity will be assessed in the form of scores. If the CVS score is ≥ 6, the respondent is declared to have CVS. This CVS-Q questionnaire is valid and reliable after a validity and feasibility test with the results of the validity test obtaining a value of r calculated ≥ r table (0.320) and the results of the reality test obtaining *a Cronbach alpha* value of 0.923.

The measurement of the frequency and duration of rest in this study used a questionnaire instrument. The frequency and duration of rest questionnaire is a questionnaire containing 4 questions in the form of multiple-choice answers about the frequency of respondents taking breaks from using gadgets and the length of time respondents take breaks from using *gadgets*. This questionnaire was made by the researcher himself by not adopting the existing questionnaire, then the content of this questionnaire was validated by the supervisor who is also an ophthalmologist. This questionnaire has been valid and reliable after a validity and reliability test with the results of the validity test obtaining an r value of ≥ r of the table (0.320) and the results of the reliability test obtaining *a Cronbach alpha* value of 0.856.

The measurement of lighting intensity in this study used a *Lux Meter* with the brand GM1010 BENETECH. This tool is a standard tool used to measure the level of lighting of both *gadgets* and rooms. The measurement results for the lighting intensity of the gadget are said to be low when <50 lux, medium

50-80 lux, and high when >80 lux. The intensity of room lighting is said to be low when <120 lux, medium 120-250 lux, and high when > 250 lux.

Research Stages

Research preparation begins with determining the research schedule by consulting the Medical Education Study Program of FK UNISMA so that the research can be carried out properly and the creation of a CVS-Q questionnaire, as well as a questionnaire on the frequency and duration of rest.
The next stage is the implementation of research. The initial step of this study is to measure the intensity of the lighting of each respondent's room for 1 week which will be recorded on the researcher's observation sheet before filling out the questionnaire. Furthermore, all respondents will fill out the CVS-Q questionnaire, as well as the frequency and duration of rest questionnaire together with the assistance of the researcher. Finally, the intensity of lighting in the rooms on the FK UNISMA campus where students commonly use gadgets is carried out including classrooms or tutorials, laboratories, libraries, and canteens.

Data Analysis Methods

The data obtained was then analyzed using *the Chi-Square Test* because the data measurement scale in this study was nominal for CVS score and ordinal for frequency and duration of rest as well as lighting intensity. The data analysis of this research was carried out using *IBM SPSS software for Windows version* 27.

RESULTS AND DISCUSSION

Characteristics of Research Respondents

This study involved 181 students of the Medical Education Study Program, Faculty of Medicine, Islamic University of Malang as respondents with details of 102 2nd level students and 79 3rd level students.

Table 1. Characteristics of Responden

Characteristics	Quantity	CVS	Non-CVS	CVS Score	Chi Square	P-Value
Gender						
Women	110	57 (57,4%)	53 (56,3%)	6.55 ± 4,652	1,581	0,209
Male	71	30 (42,6%)	41 (43,7%)	4.93 ± 4.166		
Age (years)						
18	1	0 (0%)	1 (2,6%)	2.00	5,955	0,311
19	22	11 (12,7%)	11 (11,3%)	5.95 ± 5.009		
20	68	39 (44,9%)	29 (29,9%)	6.96 ± 4,433		
21	65	28 (32,1%)	37 (38,1%)	5.51 ± 4,497		
22 24		9 (10,3%)	15 (15,5%)	4.33 ± 4.029		
23 1		0 (0%)	1 (2,6%)	2.00		
The use of glasses / lensa contact						
Yes	90	58 (66,6%)	32 (34%)	7.26 ± 4,491	19,236	0,000
No	91	29 (33,4%)	62 (66%)	4.58 ± 4.174		
Number of gadgets						
1 *Gadget*	4	0 (0%)	4 (4,2%)	1.50 ± 1.915	6,403	0,041
2 *Gadgets*	78	33 (37,9%)	45 (47,9%)	5.49 ± 4,407		
> 2 *Gadgets*	99	54 (62,1%)	45 (47,9%)	6.42 ± 4,587		

Screen time (24 hours/24 hours)	**hours)** 22 The Gospel of Jesus Christ				
< 3		0 (0%)	22 (23,4%)	0.36 ± 0.727	141,687	0,000
3 – 6	65	2 (2,3%)	63 (67%)	13.91 ± 3,365		
6 – 12	72	63 (72,4%)	9 (9,6%)	2.98 ± 1.691		
> 12	22	22 (25,3%)	0 (0%)	7.81 ± 2,237		

Table 1 shows that the majority of respondents in this study were women (61%). The CVS score showed that female respondents in the study tended to experience a higher severity than men, although statistical analysis did not find a significant difference. Respondents aged 20 were the age group with the highest percentage (37%) and highest average CVS scores (44.9%). Statistical analysis found that there was a significant difference in CVS scores between age groups. In terms of respondents' characteristics related to the use of glasses or contact lenses, respondents who wore glasses or contact lenses (49%) had a higher average CVS score than respondents who did not wear glasses or contact lenses (51%). Statistical analysis found a significant difference in CVS scores between the two groups. Table 1 also shows that the majority of respondents use more than 2 devices (54%) with a higher average CVS score where statistical analysis found a significant difference in CVS score between groups. In addition, the majority of respondents to this study used gadgets for 6 to 12 hours per day (49%) with the highest average CVS score, where statistical analysis found a significant difference in CVS scores between groups.

Overview of the Effect of Frequency and Duration of Rest on CVS Score

All research respondents who were present when filling out the questionnaire filled out a questionnaire to assess CVS scores as well as the frequency and duration of breaks given simultaneously in the lecture room of the Faculty of Medicine, Islamic University of Malang. The results of the questionnaire on the effect of frequency and duration of rest during the use of the gadget on the CVS score are shown in Table

Table 2. Overview of the Effect of Frequency and Duration of Breaks on CVS Score

Parameter	CVS	Non-CVS	Skor CVS	Chi-Square	P-Value	Lambda
Frekuensi Istirahat						
< 20 menit	79 (90,8%)	0 (0%)	10.00 ± 3.416	151,466	0,000	0,904
≥ 20 menit	8 (9,2%)	94 (100%)	2.75 ± 2.071			
Durasi Istirahat						
< 20 detik	86 (98,9%)	10 (10,7%)	9.19 ± 3.573	141,154	0,000	0,872
≥ 20 detik	1 (1,1%)	84 (89,3%)	2.21 ± 1.826			
Selama 20 detik setiap 20 menit						
Ya	-	-	-	-	-	-
Tidak	87 (48%)	94 (52%)	5.91 ± 4.526			

Table 2 shows that all respondents who had CVS (100%) did not take a break every 20 minutes had a significantly higher average CVS score (p= 0.000, Chi Square Test and Lambda Correlation = 0.904) than respondents who took a break every 20 minutes. This explains the p-value of p-value<0.05, so there is a relationship between the frequency of rest and the incidence of CVS. In addition, the Lambda Correlation value gets a value of 0.904. This means that the relationship between resting frequency and CVS incidence is 90.4%. Table 2 also shows that the number of respondents who rested for less than

20 seconds was higher who had CVS (98.9%) while those who rested for 20 seconds or more each time were more likely not to have CVS (89.3%). Statistical analysis found that respondents who rested longer had significantly lower CVS scores (p= 0.000, Chi Square Test, Lambda Correlation= 0.872). This shows that there is a relationship between rest duration and the incidence of CVS. Lambda Values The correlation of 0.872 explained that the relationship between rest duration and CVS incidence rate was 87.2%. In this study, there were no respondents who rested at least 20 seconds every 20 minutes.

Table 3 Lighting Intensity Characteristics

Location of Gadget Use	Intensity Lighting
Respondent Room	197.92 ± 56,987
Classroom	283 ± 5,656
Tutorial Room	242 ± 35,655
FK Library	359
FK Canteen	136

Table 3 shows that the average lighting intensity of the respondent's room is still within the recommended range for the room, which is 120-250 lux. The considerable variation, shown by the magnitude of the standard deviation value, reflects that there are differences in lighting habits in different respondents' rooms. In the classroom, the average lighting intensity is higher than recommended (more than 250 lux). The small standard deviation indicates that the intensity of classroom lighting is more consistent across the room with very small variation. Meanwhile, in the tutorial room, the lighting intensity still meets the standard even though there is considerable variation.

The lighting intensity in the FK UNISMA library is more than 100 lux brighter than recommended. The standard deviation that was not recorded showed that the lighting intensity was consistent across the library area. The FK UNISMA canteen has a lighting intensity within the recommended limits and is consistent throughout the canteen area.

Overview Influence Lighting Intensity to CVS Score

Table 4 shows that out of 181 respondents, 92 non-CVS respondents (97.9%) had moderate/compliant lighting in their room (120-250 lux). It appears that the CVS score in the group of respondents with moderate lighting intensity tends to be the lowest, where the statistical analysis found significant differences (p=0.000, Chi Square Test, Lambda Correlation=0.453). This result can be concluded that there is a relationship between lighting intensity and CVS occurrence, where the Lambda Correlation value was found to be 0.453 indicating that the relationship between room lighting intensity and CVS incidence is 45.3%.

Table 4 also shows that most non-CVS respondents (91.5%) use moderate/compliant lighting on their gadgets (50-80 lux). The average CVS score of the group was significantly lower than the group of respondents with high intensity of gadget lighting (p=0.000, Chi Square Test, Lambda Correlation=0.791). This result can be concluded that there is a relationship between lighting intensity and CVS occurrence, where a Lambda Correlation value of 0.791 means that the relationship between gadget lighting intensity and CVS incidence is 79.1%.

Lighting of gadgets and rooms is said to be appropriate when both are within the recommended standard range. This study found that 49% of respondents had balanced lighting in their daily lives, where the average CVS score of the group was significantly lower than the group of respondents with unbalanced lighting (p=0.000, Chi Square Test, Lambda Correlation=0.852).

Table 4 Overview of the Effect of Lighting Intensity on CVS Score

Intensity Lighting	CVS	Non-CVS	CVS Score	Chi-Square	P-Value	Lambda
Respondent Room						
Low	(0%)	(2,1%)	5.00	75,292	0,000	0,453
Medium	(42,5%)	(97,9%)	4.22 ± 3,646			
Height	(57,5%)	(0%)	10.32 ± 3,617			
Gadgets						
Low	-	-	-			
Medium	(11,4%)	(91,5%)	92 ± 2.396	116,081	0,000	0,791
Height	(88,6%)	(8,5%)	9.29 ± 3,946			
Room Suitability with Gadgets						
Balanced	4 (4,5%)	85 (95,5%)	2.56 ± 2,056	133,169	0,000	0,852
No	83 (90.2%)	9 (9,8%)	9.15 ± 3,851			

DISCUSSION

Effect of Rest Frequency on *Computer Vision Syndrome*

This study found a significant influence of the frequency of breaks on CVS scores. This is in line with a study conducted by Natnael et al in Ethiopia with bank workers who worked in front of a computer for more than 20 minutes without a break almost twice as likely to suffer from it

CVS (AOR=1.93, 95% CI=1,11,3,35) was compared to those who rested every 20 minutes [7]. A similar study was found in a study conducted by Logaraj et al. in Chennai, where college students who took less breaks or worked in front of a computer for more than 20 minutes without a break were more prone to CVS symptoms compared to those who took more frequent breaks [3].

Staring at the screen continuously requires the eyes to focus closely over a long period of time. Near vision requires an accommodation process in which there is a contraction of the ciliary muscles, relaxation of the lenciary suspensorium ligament, and lens clotting. In this process, the iris sphincter musculus is also involved which makes the pupil miosis and the extraocular muscles that position the eyes more convergent. A series of mechanisms for close vision that occur continuously over a long period of time will result in fatigue in the components of the eyeball involved. As a through an increase in the intensity and frequency of complaints such as double vision and difficulty focusing on near vision [8].

Focusing your eyes to see objects at close range, such as on a gadget screen, will also reduce the frequency of flickering from about 15-20 times per minute to about 10 times per minute. Blinking is necessary for the secretion of tears from the tear glands, the lipid components of the Meibom glands as well as distributing tears throughout the surface of the eyeball, especially the avascular cornea. A decrease in the frequency of blinking due to eyes focusing too long on gadgets will increase CVS scores through an increase in the intensity and frequency of complaints that the eyes feel dry, the eyes feel hot like burning, the eyes feel like there is a foreign object and itch, the eyes are watery, painful and red, and the eyelids feel heavy [9].

However, the study found that the group of respondents who rested their eyes for less than 20 minutes actually had a significantly higher CVS score than the group of respondents who did not rest their eyes for a longer time. This is likely to happen because the respondents are in rooms and gadget screens whose lighting intensity is not in accordance with the specified standards.

Effect of Rest Duration on *Computer Vision Syndrome*

This study found a significant effect of the duration of rest on the increase in CVS score. According to the *American Optometric Association,* taking a break every 20 minutes of *gadget* use by looking at objects 20 feet away for 20 seconds can reduce CVS symptoms [2]. Research conducted by Al Tawil et al in Saudi Arabia found that the majority of students in his study (77.3%) were not aware of the importance of *the rule of twenty,* so students felt symptoms of CVS such as muscle pain in the shoulders, neck, and waist [10].

Pausing from looking closely to see an object 20 feet away will turn the process of accommodation in the eyeball into a distant view. To be able to focus far away the ciliary muscles will relax, so the suspensory ligament is stiffened and the lens is drawn to the equator and its anteriorposterior diameter becomes thinner. Thinner lenses will lower the strength of the refraction so that the shadows of distant objects fall right on the fovea. The position of the eyeball to see far away is in the primary position and does not require contraction towards convergence. If this process is done for a long time, for example for 20 seconds, intra and extraocular muscle relaxation will reduce CVS complaints related to eye fatigue [11] [12].

The Effect of Lighting Intensity on
Computer Vision Syndrome

This study found that there was a significant influence of lighting intensity on the increase in CVS scores. This is in accordance with the results of a study by Shantakumari et al. in Ajman which found that too high the brightness of *gadget* screens was significantly related to the increase in CVS symptoms among college students in Ajman [6]. The results of this study are also in line with a study by Aseefa et al on bank workers (73%) who found that poor room lighting had an effect on the incidence of CVS [13]. Sheedy et al. also found that poor lighting conditions can cause discomfort when doing activities using *gadgets*[14]. However, this study is not in line with the research conducted by Chairani et al. Chairani et al. Research found that as many as 54 workers with a score of ($p = 0.366$, POR= 1.962;

95%CI = 0.455 − 8.463) which means that there is no relationship between lighting intensity and *Computer Vision Syndrome* [15].

The characters on the gadget screen are pixels. Pixels are lighter in the center and darker at the edges. Objects or letters formed from a collection of pixels have less definite borders than objects/letters on print media. This requires the eyes to constantly refocus in order to form sharp vision.

The lighting of the gadget's screen that is too high or too dim, as well as the lighting of the room that is too bright or too dim and unbalanced with the screen lighting will make it more difficult to form a focused vision of the object that consists of this collection of pixels. Research by Zulaiha et al conducted in Jambi found that lighting intensity that is not in accordance with the standards set by the National Standardization Agency can result in a glare effect so that the characters of letters and images produced by *gadgets* result in blurring of the eyes [2], [16]. The eye effort to focus and refocus continuously will strain the eyes and increase CVS complaints.

CONCLUSION

Based on the results of the research, it can be concluded that the frequency and quality of rest, as well as environmental lighting conditions, have a significant influence on the increase in Computer Vision Syndrome (CVS) scores. The findings indicate that taking rests at intervals longer than every 20 minutes is associated with higher CVS scores, suggesting that infrequent breaks contribute to greater visual strain. In addition, rest durations of less than 20 seconds at a time were found to be insufficient for eye recovery and were linked to an increase in CVS scores. Furthermore, inappropriate lighting intensity—whether too dim or excessively bright, both from digital devices and room lighting—was shown to exacerbate CVS symptoms. These results emphasize the importance of adopting adequate rest intervals, sufficient break durations, and optimal lighting conditions to reduce the risk of Computer Vision Syndrome.

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