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THE EFFECT OF EYE EXERCISES ON COMPUTER VISION SYNDROME (CVS)

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ABSTRACT

Introduction: The used of gadgets was increased greatly, gadgets have many benefits in the world of education, especially for students in the learned process. Excessive used of gadgets can cause complained of eye disorders called computer vision syndrome. The phenomenon found in female students at the Emaus Putri Dormitory in Surabaya, was that most of them experienced computer vision syndrome. One of the efforted to prevented and overcome computer vision syndrome was to did eye exercised. This studied aimed to determined the effected of eye exercised on computer vision syndrome.

Method: The method used was pre-experimental with a one-group-pre-post-test design researched design. The independent variable was eye exercised and the dependent variable was computer vision syndrome. The sample size was took used a total sampling technique with a sample of 44 female students at the Emaus Girls' Dormitory Surabaya. The instrument used was the CVS-Q questionnaire and used the Wilcoxon statistical test.

Result: Based on the results of the study before eye exercised, 38 (82%) respondents experienced computer vision syndrome, and after eye exercised, the number of respondents who experienced computer vision syndrome decreased to 17 (39%). The results of the Wilcoxon test showed a p value of (0.000) < α (0.05) which means that eye exercised have an effected in reduced the score of computer vision syndrome.

Conclusion: By to eye exercised regularly can reduced the symptoms of computer vision syndrome.

Keywords: *Computer Vision Syndrome; Eye Exercises*

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INTRODUCTION

The development of the world has brought rapid progress to human life in each generation. Generation Z refers to those born between 1995 and 2010, and is the generation that has been exposed to technology from an early age (Rachmawati, 2019). Generally, female students belong to Generation Z, often using electronic devices such as computers, laptops, mobile phones, the internet, and social media, which continue to grow (Firamadhina & Krisnani, 2021). The use of electronic devices has become widespread, not only among office workers and industries but also in the field of education, particularly among female students. The average duration of device usage is 5-7 hours per day, sometimes even longer. Devices are used to access information, communicate, and assist with tasks, making them more effective and efficient (Nurhikma et al., 2022). On the other hand, excessive use of these devices can lead to eye problems, one of which is computer vision syndrome.

Computer vision syndrome (CVS) refers to a set of eye and vision symptoms caused by prolonged use of computers, tablets, e-readers, mobile phones, and other electronic devices (American Academy of Ophthalmology, 2021). Common symptoms of computer vision syndrome include eye fatigue, eye pain, dry eyes, watery eyes, eye irritation, contact lens issues, reduced vision ability, slow focus adjustment, double vision, presbyopia, neck pain, lower back pain, and shoulder pain (Alemayehu, 2019). Based on a brief interview conducted by the researcher with several female students at the Emaus Women's Dormitory in Surabaya, it was found that many female students used electronic devices for more than 6 hours a day and complained of symptoms such as sore eyes, watery eyes, fatigue, dry and red eyes,

decreased vision, headaches, and pain in the shoulders and lower back.

In Indonesia, the incidence of vision disturbances due to eye fatigue is classified as severe low vision or a fatal eye disorder, with an incidence rate of 1.49% (Nurhikma et al., 2022). A study by Shadik (2023) on 250 students from the Faculty of Public Health at the University of Indonesia revealed that 79.2% of students experienced CVS. The most common symptoms reported by students were headaches (82%), blurred vision (72.4%), and watery eyes (69.6%), while the least common symptoms were seeing colored light halos around objects (21.2%). Based on a preliminary survey using the CVS-Q questionnaire conducted by the researcher on December 5, 2023, at the Emaus Women's Dormitory in Surabaya with 10 female students, 70% of them were found to experience computer vision syndrome. The most common symptoms reported by the students were watery eyes, itching, and headaches (90%), followed by blurred vision, worsening eyesight, and increased sensitivity to light (70%), red eyes and eyelid issues (60%), eye pain and difficulty focusing on near vision (50%), dry eyes (40%), excessive blinking and a burning sensation (30%), the sensation of foreign bodies in the eyes (20%), and double vision and colored light halos around objects (10%).

Computer vision syndrome is influenced by several factors, including personal factors such as age, gender, refractive errors, and duration of device use. Environmental factors include room lighting, humidity, and viewing angle. Device-related factors include viewing distance, screen resolution, and refresh rate. Of these factors, the most significant influences on CVS are the duration of device use, viewing distance while using devices, screen brightness, and body posture during device use. It is generally known that computer monitors can emit radiation that is undetectable by the human eye (Suci Febrianti, 2018).

Using electronic devices like computers for more than 4 hours and using smartphones for more than 60 minutes causes the eyes to continuously focus on the screen, leading to eye fatigue. When eye fatigue occurs, the eye muscles must work harder, especially when looking at objects for extended periods. Continuous focusing over a long period leads to decreased eye accommodation, which is associated with the symptoms of computer vision syndrome (Yurika et al., 2022). If left untreated, the symptoms of computer vision syndrome can result in refractive eye disorders and glaucoma (optic nerve damage), which may ultimately lead to blindness (Nugroho et al., 2022).

According to a study by Arisandi et al. (2018), eye exercises have been proven effective in reducing the symptoms of computer vision syndrome. Eye exercises are one of the efforts to alleviate the complaints of computer vision syndrome, with the aim of improving eye function, sharpening vision, enhancing eye accommodation ability, and increasing the flexibility and strength of the eye muscles, making them more elastic and strong. Eye exercises are practical to perform, can be done independently, do not require a specific place, do not incur high costs, and do not take up much time, making them highly effective and efficient (Maisal et al., 2020). This study aims to identify the effect of eye exercises on computer vision syndrome among female students at the Emaus Women's Dormitory in Surabaya.

METHODS

This research is a quantitative study with a pre-experimental design, specifically a one-group pre-post-test design. Data collection was conducted at the Emaus Women's Dormitory in Surabaya from April to May 2024. The subjects of this study were female students from STIKES St. Vincentius A Paulo Surabaya who reside at the Emaus Women's Dormitory. The inclusion criteria for this study were: female students with or without refractive eye disorders, female students not undergoing any eye treatments or therapies, and female students who were willing to participate as respondents. The exclusion criteria for this study were: female students with eye diseases such as glaucoma, eye trauma or injuries, and female students undergoing specific eye treatments. The total sample population in this study consisted of 44 respondents. The sample size was determined using a total sampling technique, where all members of the population who met the inclusion criteria were used as study subjects.

This study was conducted over 2 weeks with 6 meetings. Each week, 3 meetings were held on Thursday, Friday, and Sunday at 8:00 PM WIB to accommodate the schedules of the female students in the dormitory. The eye exercises were conducted simultaneously and directly guided by the researcher. Each meeting consisted of 3 sets of exercises with ten different movements, each lasting 5-10 seconds, and a 10-minute break was provided between each set to allow the eyes to rest. The eye exercises used in this study were modifications of eye exercise movements from previous studies, namely: Maisal et al. (2020), Devara et al. (2019), Solikah & Hasnah (2022), Theodore Leng (2023). Data collection was conducted twice, once before and once after the eye exercises. The pre-test data was collected during the first meeting before the respondents performed the eye exercises, while the post-test data was collected during the sixth meeting after the respondents had completed the eye exercises. The researcher also provided a video of the eye exercises to help the respondents memorize the movements. The 10 eye exercises can be seen in Table 1.

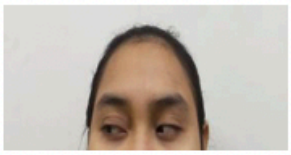
The severity of computer vision syndrome was measured using the CVS-Q questionnaire. The CVS-Q questionnaire was created by Seguí et al. (2015) and is available in English. This questionnaire has been adapted into an Indonesian version and has undergone re-validation and reliability testing by

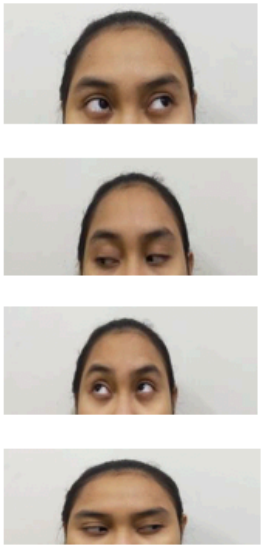
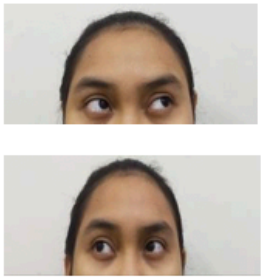
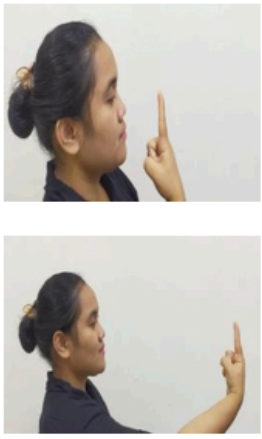
Shadik (2023) on 30 female students from the Faculty of Public Health, University of Indonesia, with a validity test result of r values between 0.436 and 0.631 and a Cronbach's Alpha value of 0.781 (Shadik, 2023). The CVS-Q questionnaire consists of 16 symptoms, along with the frequency and intensity of each symptom.

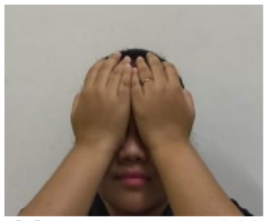
Data analysis in this study used univariate analysis to describe the characteristics of the respondents, which included. Bivariate analysis was conducted using the Wilcoxon test to determine whether there was an effect of eye exercises on computer vision syndrome and to observe differences in the computer vision syndrome scores before and after the eye exercises. The statistical test results are considered significant if the p-value is less than α (0.05).

Table 1 Eye Gymnastics Procedures for Female Emaus Surabaya Dormitory Students

No.	Movement Procedure	Motion Picture	Movement Rationale
1)	Provide a safe and quiet environment	 (Personal documentation, 2024)	A safe and quiet environment can create comfort and improve concentration.
2)	Positioning the body sitting upright and looking straight ahead in a comfortable position with eyes open.	 (Personal documentation, 2024)	The upright body position and forward gaze aims to improve the client's posture after working on the computer, provide comfort and minimize the risk of injury to the client.
3)	Rubbing your palms together until they are warm, then close your eyes and place your palms over your eyes slowly without pressure for 15 seconds, and repeat twice while taking a deep breath and exhaling slowly.	  (Personal documentation, 2024)	This movement will help reduce eye stimulation and relax the eyes.

4)	Closing both eyes, use the index fingers to lightly massage the eyelids in a slow circular motion for 10 seconds, then massage both eyeballs using both index fingers with very light pressure for 10 seconds and repeat 10 times.	  (Personal documentation, 2024)	Massaging can improve blood circulation around the eyes and prepare the eyes for exercise, while light pressure can stimulate the eyes.
5)	Positioning the head upright then direct the eyes to look up (ceiling) and then look down (floor), do this movement 5-10 times.	  (Personal documentation, 2024)	Exercises eye muscle flexibility
6)	Move the eyeballs to the right and left like a glance in rotation with, do this movement 5-10 times	  (Personal documentation,	Exercises eye muscle flexibility
7)	Move the eyeballs upwards then hold for 2 seconds then move both eyeballs towards the top left and top right alternately and repeat 5-10 times.	  (Personal documentation, 2024)	Exercises eye muscle flexibility

8)	Move the eyeballs to the upper left corner to the lower right corner and then alternate from the upper right corner to the lower left corner, do this movement 5-10 times.	 (Personal documentation,	Exercises eye muscle flexibility
9)	Rotate the eyeballs clockwise 5-10 times, then close the eyes for 5 seconds and then rotate the eyeballs counterclockwise 5-10 times, then close the eyes again for 5 seconds.	 (Personal documentation, 2024)	Exercises eye muscle flexibility
10)	Focusing the eyes, hold up the index finger in front of the eyes then focus on the index finger then bring it closer to the nose then move the index finger away from the front of the nose slowly and slowly while keeping the eyes focused, repeating the same movement 5 times.	 (Personal documentation, 2024)	Focusing movement exercises can keep the eyes focused when looking at objects from a certain distance.
11)	Blink your eyes 10 times.	 (Personal documentation, 2024)	Blinking can help the vascularization process as well as maintain eye moisture and prevent dry eyes

12)	Close the eyes and place the palms of both hands on the eyes, without pressing and hold for 5 minutes, while inhaling and exhaling slowly 3 times.	 (Personal documentation, 2024)	Ending the eye exercise with *eye palming* can relax the eyes after doing intense eye exercise movements.

Source: Modified Maisal et al., (2020), Devara et al., (2019), Solikah & Hasnah, (2022), Theodore Leng,

RESULTS

Based on Table 2, of the 44 respondents, the average age of all respondents is 20.82 years. Looking at the factors of gadget usage duration and viewing distance, all respondents often use gadgets (smartphones, laptops, computers) for more than 4 hours per day, and with a viewing distance of less than 50 cm (shorter than arm length). When using gadgets, all respondents always adjust the screen brightness according to the room lighting. None of the respondents have had diseases such as diabetes mellitus, cataracts, or glaucoma. Eight (18%) respondents have refractive eye disorders, with seven (16%) respondents experiencing myopia, and one (2%) respondent having astigmatism. Twenty-nine (66%) respondents have ever carried out interventions to address computer vision syndrome complaints, such as resting their eyes, with 26 (89%) respondents resting their eyes, and 3 (10.3%) respondents using cold compresses on their eyes.

Based on Table 3, it shows that before the eye exercises were conducted, there were 36 respondents who experienced computer vision syndrome and 8 respondents who did not experience computer vision syndrome.

Based on Table 4, it shows that after the eye exercises were conducted at Asrama Putri Emaus Surabaya, 27 respondents no longer experienced computer vision syndrome, while 17 respondents still experienced computer vision syndrome.

Based on Table 5, the pretest mean score was 9.70, and the posttest mean score was 5.18. This difference in mean scores indicates that the eye exercises can reduce the computer vision syndrome score among the female students at Asrama Emaus Surabaya.

Based on Table 6, the statistical test results using the Wilcoxon test with a significance level of $\alpha = 0.05$ show that the p-value = 0.000 or $p < \alpha$, meaning that Ho is rejected and H1 is accepted. This indicates that eye exercises have an effect on computer vision syndrome.

Table 2. Respondent Characteristics

No	Variable	Frequency (n)	Percentage (%)	Mean ± SD
1.	Age			20,82 ± 2,423
	19 years	15	34	
	20 years	8	18	
	21 years	8	18	
	22 years	9	20	
	Older than 22 years	4	9	
2.	Refractive eye disorders			
	Myopia / nearsightedness	7	16	
	Astigmatism/cylindrical eye	1	2	
	No refractive eye Disorder	36	82	
3.	Interventions to reduce eye fatigue			
	Yes	29	66	
	No	15	34	
4.	Interventions to reduce eye fatigue			
	Resting the eyes	26	89	
	Compressing the eyes with cold water	3	10,3	

Table 3. Knowledge Level Categories of Female Students Before Eye Exercises

Category	Frequency (n)	Percentage (%)
Experiencing CVS	36	82
Not experiencing CVS	8	18

Table 4. Knowledge Level Categories of Female Students After Eye Exercises

Category	Frequency(n)	Percentage (%)
Experiencing CVS	17	39
Not Experiencing CVS	27	61

Table 5. Difference in Mean Scores Before and After the Eye Exercises

	N	M
Before eye exercises	44	9.70
After eye exercises	44	5.18

Table 6. The Effect of Eye Exercises on Computer Vision Syndrome

Test Statistics[a]	
Z	-5.657[b]
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test
b. Based on positive ranpks.

DISCUSSION

Computer Vision Syndrome Scores Before Eye Exercises

Based on the research results before the eye exercises were conducted, 36 (82%) respondents experienced computer vision syndrome, while 8 (18%) did not. When examining the duration of gadget use, all respondents (100%) used gadgets for more than 4 hours per day. According to Setiono's theory (2010) as cited in Permana et al. (2015), it is stated that computer use should not exceed 4 hours per day. Prolonged viewing of objects on a device screen can lead to muscle strain, causing eye fatigue, and may result in refractive issues.

According to the researcher's assumption, using gadgets for more than 4 hours per day is a common practice among university students. Nowadays, gadgets are an indispensable part of students' lives. Using gadgets for long durations can cause eye fatigue and other symptoms of computer vision syndrome, such as dry eyes, eye irritation, and headaches. This is supported by a study conducted by Muchtar & Sahara (2016), which states that individuals who use gadgets for more than 4 hours per day continuously are 26 times more likely to suffer from computer vision syndrome. This happens because prolonged screen time leads to excessive tear evaporation, which causes dry eyes and fatigue, resulting in discomfort in vision. This is also supported by a study by Permana et al. (2015), which states that if a person uses a computer for more than 4 hours per day, they must take more frequent breaks for their eyes.

Regarding the viewing distance when using gadgets, all respondents (100%) use gadgets with a viewing distance of less than 50 cm. According to Denis Ankrum's theory (2010), as cited in Permana et al. (2015), when viewing objects at close range, the eye lens thickens to focus on nearby targets, and there is no exact limit for this distance, but at least a 50-70 cm distance should be maintained between the eyes and the screen. The researcher believes that using gadgets at too close a distance is a common habit, especially among students. Using gadgets at such a close range reduces the eye's accommodation ability, and the lens continues to work to focus on a particular object on the screen, causing eye fatigue, irritation, and even blurred vision. This aligns with the research by Akinbinu & Mashalla (2015), which states that using gadgets too close to the eyes increases accommodation, making the eye lens and eye muscles work more frequently and leading to symptoms of eye strain and headaches.

Score of Computer Vision Syndrome After Eye Exercises

Based on the results of the study, after conducting eye exercises, 27 respondents (61%) no longer experienced computer vision syndrome. According to Devara et al. (2019), eye exercises help train the eye muscles, which can maintain the elasticity of the eye muscles and reduce eye fatigue. The eye exercises were performed in sitting, standing, or lying positions. Taking breaks for the eyes during screen time can help reduce the frequency of the eye accommodation mechanism, preventing the eyes from becoming easily fatigued. Besides resting the eyes, performing eye exercises is one of the interventions that can be done to relieve eye fatigue (American Academy of Ophthalmology, 2021).

In the researcher's view, doing eye exercises for 5-10 minutes can reduce eye strain, helping the eyes relax. Eye exercises can also moisturize the surface of the eyes, preventing dryness. When performing eye exercises, the eye muscles are stretched, maintaining their elasticity and reducing intraocular pressure. By doing eye exercises regularly, complaints of computer vision syndrome can be minimized.

This is in line with the study by Solika & Hasnah (2022), which states that eye exercises have been proven to be effective in addressing eye fatigue and reducing symptoms of computer vision syndrome. This is also supported by the research conducted by Maisal et al. (2020), which indicates

that performing eye exercises for 5-10 minutes, 6 days a week, can relieve eye fatigue and reduce the computer vision syndrome score.

The Effect of Eye Exercises on Computer Vision Syndrome

Based on the results of the study with 44 respondents, it was found that 36 (82%) respondents experienced computer vision syndrome. After performing eye exercises, the number of respondents experiencing computer vision syndrome decreased to 17 (39%). Before the eye exercises, 8 (18%) respondents did not experience computer vision syndrome, and after the eye exercises, the number of respondents without computer vision syndrome increased to 27 (69%). Data analysis was performed using the Wilcoxon signed-rank test with a significance level of $\alpha = 0.05$. The statistical test results of this study showed a p-value of 0.000 or $p < \alpha$, which means the null hypothesis (Ho) is rejected and the alternative hypothesis (H1) is accepted. This indicates that eye exercises have an effect on computer vision syndrome, and there is a significant difference in the mean pretest and posttest scores. The pretest mean value was 9.70, and the posttest

mean value was 5.18. The negative ranks mean value from 42 respondents was 21.50, and there were 2 respondents with ties. This shows that eye exercises had an impact on reducing the computer vision syndrome score among the female students at the Emaus Dormitory in Surabaya.

According to Khotimah et al. (2022), eye exercises consist of movements performed by the eyes to stimulate the eye muscles, thereby increasing blood circulation and improving visual sharpness. These exercises provide visual comfort and help train the eye's convergent lens focus, which influences the eye's accommodation ability. The researcher believes that eye exercises contribute to the reduction of computer vision syndrome scores. There were 2 respondents who did not experience any changes in their computer vision syndrome scores, both of whom had refractive eye disorders, specifically myopia (nearsightedness). This is closely related to factors that influence the condition, one of which is refractive errors such as myopia. Eye exercises are an effort to prevent the onset of computer vision syndrome symptoms, which, if left unaddressed, may lead to eye health issues, including refractive eye disorders.

This is in line with the study conducted by Tang et al. (2023), which states that eye exercises are a simple method to prevent refractive eye disorders. The effectiveness of eye exercises is closely related to the technique or movements performed during the exercises. Eye exercises are less effective in preventing myopia progression if performed using incorrect techniques or movements and only for a short period of time. The effectiveness of eye exercises is more noticeable when done regularly for a longer duration and accompanied by the correct techniques and movements.

This is also supported by previous research conducted by Arisandi et al. (2018), which showed that eye exercises help reduce the computer vision syndrome score. Human eyes need rest and exercises to stretch the eye muscles. Computer vision syndrome occurs due to prolonged use of gadgets, causing the eye muscles to become stiff, which can reduce visual sharpness. Therefore, performing eye exercises can retrain the eye muscles to prevent stiffness and improve visual sharpness.

CONCLUSION

The majority (82%) of female students experienced computer vision syndrome before performing eye exercises at the Emaus Female Dormitory in Surabaya. After the eye exercises, more than 61% of the female students no longer experienced computer vision syndrome. There is an effect of eye exercises on computer vision syndrome, and eye exercises can reduce the computer vision syndrome score among female students at the Emaus Female Dormitory in Surabaya.

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