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The Effect of Gadget Usage Duration on the Risk of Computer Vision Syndrome in Online Lecture Activities

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The duration of computer use for students during the COVID-19 pandemic is increasing because lecture activities that are usually carried out face-to-face must be done online. use of computers for 3 hours a day, can cause various health problems. One of them is Computer Vision Syndrome (CVS). CVS is a condition in which a person experiences one or more eye symptoms as a result of working long hours at a computer. The purpose of this study was to determine the relationship between the length of time using computers during online lectures with the occurrence of CVS of FK UKI students class of 2017. The method used in data collection was total sampling in this study, the number of samples obtained was 60 people. Data collection was carried out in this study by collecting primary data. Data on 2017 FK UKI students obtained from the Undergraduate Medical

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Education Program Section of FK UKI and willing to fill out the research questionnaire sent via Google Form. Fisher's test which was conducted showed that there was no significant relationship between the duration of working continuously in front of a gadget or electronic device with the CVS incidence with a significant value of 0.349 (p> 0.05). Fisher's test which was conducted showed that there was no significant relationship between the duration of working in front of a gadget or electronic device in one day and the incidence of CVS with a significant value of 0.737 (p> 0.05). There is no significant relationship between the length of working continuously in front of a gadget or electronic device with the CVS incident. There is no significant relationship between the length of working in front of a gadget or electronic device in one day and the CVS incident.

Keywords: Computer vision syndrome; gadget; duration of gadget use.

1. INTRODUCTION

The duration of computer use for students during the COVID-19 pandemic has increased because lecture activities that are usually carried out face-to-face must be carried out online. The National Disaster Management Agency (BNPB) issued a decree number 13 A regarding determining an emergency period due to the coronavirus. Based on this determination, the Ministry of Education and Culture (Kemendikbud) issued a Circular from the Minister of Education and Culture Number: 36962 / MPK.A / HK / 2020 dated March 17, 2020, concerning Online Learning and Working from Home in the Context of Preventing the Spread of Corona Virus Disease (COVID-19) (Argaheni, 2020). Using a computer for 3 hours a day can cause various health problems. One of them is Computer Vision Syndrome (CVS) (Logaraj, et al., 2014; Afandi E., 2025; Aoa.org., 2020). CVS is a condition where a person experiences one or more eye symptoms due to working for a long time in front of a computer (Reddy et al., 2013; Salmon, J.,2020). CVS symptoms are divided into 4 categories, namely asthenopic (strained eyes, tired eyes, sore eyes), ocular surface (dry eyes, irritation), visual (blurred vision, prolonged change in focus, double vision), extraocular (neck pain, back pain, shoulder pain) (Reddy, et al., 2013; Hane, et al., 2014; Fugate, L., 2011). CVS can be caused by poor lighting, glare on the computer screen, improper computer use distance, poor sitting posture, uncorrected vision problems, and a combination of these factors. It is estimated that almost 60 million people in the world suffer from CVS, and there are 1 million new cases of CVS each year. In previous research, Thompson stated that more than 90% of computer users experience visual disturbances such as eye strain, headaches, dry eyes, and blurred vision both at close and far distances (Sari, 2018; Valentina, 2018). Rossignol stated that visual disturbances increase significantly in individuals who spend their time in front of a video display terminal (VDT) or computer screen for 4 hours a day. 6 In a study conducted by the National Institute of Occupational Safety and Health (NIOSH), 61.4% of workers in Malaysia who use computers at work experience complaints of lower back pain, shoulders, and neck, while 70.6% experience complaints of eye strain (K.Y.L, 2020; Insani Y.,2018).

In a study conducted on 400 computer operators in India in 2008, 46.3% showed asthenopic symptoms. In a study in Australia on 1000 computer workers, it was found that 63.4% experienced uncontrolled CVS symptoms, this figure decreased by 25.2% after being provided with ergonomic work desks and frequent work breaks (Rosenfield, 2011). Research on CVS in Indonesia conducted by Hendra et al on students of the Faculty of Public Health, University of Indonesia, found that 65.9% of respondents experienced severe health complaints, then research conducted by Kusumawati in 2012 on computer user employees of PT. Bank Negara Indonesia (BNI) in Makassar, found that 28.6% of subjects experienced asthenopia symptoms before using computers and increased to 90.6% of subjects after using computers (Muchtar, et al., 2016). Almost all students use computers to do assignments or do daily activities at the Faculty of Medicine, Christian University of Indonesia. Given that computer use can cause health problems, researchers are interested in examining the relationship between the length of computer use and the emergence of CVS complaints in students Faculty of Medicine, Indonesian Christian University, class of 2017.

The purpose of this study was to determine the relationship between the length of use of gadgets or electronic devices during online lectures and the occurrence of CVS in UKI Medical Faculty students in the 2017 intake.

2. MATERIALS AND METHODS

This type of research is observational analytic with a cross-sectional approach the location in collecting research data was carried out by sending a Google form to each FK UKI student in 2017 who met the inclusion criteria. The time for processing, collecting, and implementing the research was carried out from November 1, 2020 - December 31, 2020. The population studied was 169 FK UKI students in the 2017 batch. The sampling method used was purposive sampling on FK UKI students in the 2017 batch. Research Criteria include: 1) Inclusion Criteria (Preclinical students of the 2017 batch of the UKI Faculty of Medicine who are willing to be research subjects, age 18-23 years, using computers, mobile phones, and tablets for at least 6 months and using computers, mobile phones, and tablets for at least 1 hour a day; 2) Exclusion Criteria (Having refractive disorders such as hypermetropia, myopia, astigmatism, inappropriate lens prescriptions, presbyopia or other focus disorders. using contact lenses, using glasses (minus glasses, plus glasses, cylinder glasses, reading glasses), suffering from certain diseases that cause visual impairment such as diabetes mellitus, hypertension, Sjogren's syndrome, meibomian gland dysfunction, allergic conjunctivitis, vitamin A deficiency, thyroid disease, arthritis, and trigeminal nerve or facial nerve injury, using certain medications such as diuretics, antihistamines, psychotropics (stimulants), antihypertensives, antidepressants, antibiotics, hormone replacement therapy, and steroids). The method of data collection carried out in this study was by collecting primary data. Data from FK UKI students of the 2017 intake were obtained from the Undergraduate Medical Education Program Section of FK UKI and were willing to fill out the research questionnaire sent via Google Form by the researcher. SPSS will be used for data processing and data analysis using univariate and bivariate analysis tests using SPSS software.

3. RESULTS AND DISCUSSION

3.1 Research Results

This study uses primary data, namely data from FK UKI students of the 2017 intake obtained from the Undergraduate Medical Education Program Section of FK UKI who are willing to fill out a research questionnaire sent via Google Form by the researcher. Data collection was carried out on January 15, 2021-February 9, 2021. The method used in data collection is total sampling, meaning that each subject who meets the inclusion criteria is taken as a sample until a certain time. In this study, the number of samples obtained was 60 people. The data that has been collected was then analyzed to determine the relationship between the length of computer use and the occurrence of computer vision syndrome during online lectures in FK UKI students of the 2017 intake.

Table 1 shows the characteristics of the sample based on the gender and age of the respondents, where for gender there is almost the same number between men and women. the number of female respondents is only slightly more, namely 32 out of 60 respondents or 53.3 percent, while men with 28 respondents or 46.7 percent. For age, it is dominated by respondents aged 21 years with a total of 33 out of 60 respondents or 55 percent.

Table 1. Characteristics of The Sample Based on The Gender And Age

Characteristic	Frequency (n)	Percentage (%)
Gender		
Laki-Laki	28	46.7
Perempuan	32	53.3
Age		
20 year	12	20
21 year	33	55
22 year	10	16.7
23 year	5	8.3
Total	**60**	**100**

Table 2 is the data on the use of Gadgets (computers/laptops, mobile phones, tablets/ipads), where from the data it can be seen that almost all respondents use gadgets, including the use of computers/laptops with a total of 56 out of 60 respondents or 93.3 percent of respondents using. Likewise with the use of mobile phones a total of 50 respondents or 83.3 percent use; meanwhile as many as 48 out of 60 respondents or 80 percent do not use tablets/iPads.

Table 3 shows the data on the duration of gadget use, where almost all respondents have used gadgets for more than 1 year, namely 56 out of 60 respondents or 93.3 percent. Furthermore, based on the duration of working using gadgets continuously, 47 respondents work for more than 2 hours continuously. Based on the duration of gadget use in one day, as many as 48 respondents use gadgets for more than 4 hours a day.

Table 2. Data on the use of Gadgets (computers/laptops, mobile phones, tablets/iPads)

Using Gadgets	Frequency (n)	Percentage (%)
Using Computer or Laptop		
Use	56	93.3
Not use	4	6.7
Using Mobile Phone		
Use	50	83.3
Not use	10	16.7
Using a Tablet/IPad		
Use	12	20
Not use	48	80

Table 3. Data on The Duration of Gadget Use

Duration of Gadget Use	Frequency (n)	Percentage (%)
Length of time using the gadget		
≥ 1 year	56	93.3
< 1 year	4	6.7
Working hours using gadgets continuously		
≥ 2 hour	47	78.3
< 2 hour	13	21.7
Length of time working using gadgets in one day		
≥ 4 hour	48	80
< 4 hour	12	20

Table 4. Data On The Length Of Breaks when Using Gadgets

Duration Breaks of Gadget Use	Frequency (n)	Percentage (%)
Take a break after how many hours of using gadgets		
Rest	55	91.7
No rest	5	8.3
Take a break after how many hours of using gadgets		
≥ 2 hour	32	53.3
< 2 hour	23	38.3
No rest	5	8.3
Length of time working using gadgets in one day		
≥ 10 minutes	43	71.7
< 10 minutes	12	20
No rest	5	8.3

Table 4 shows data on the length of breaks when using gadgets, where 55 respondents, or 91.7 percent took breaks between working hours using gadgets, then only 32 respondents, or 53.3 percent took breaks after several hours of using gadgets with a break length of more than 10 minutes, amounting to 43 respondents or 71.7 percent.

Table 5 shows data that 35 samples (58.3%) complained of tired eyes, 33 samples (55%) complained of shoulder pain, 31 samples (51.7%) complained of neck pain, 29 samples (48.3%) complained of headaches and back pain, 23 samples (38.3%) complained of sore eyes, 20 samples (33.3%) complained of dry eyes, 18 samples (30%) complained of strained eyes, 7 samples (11.7%) complained of difficulty focusing vision, 6 samples (10%) complained of eyes feeling like there was a foreign object, 5 samples (8.3%) complained of blurred vision, 0 samples (0%) complained of double vision. The

Table 5. Sample characteristics based on CVS complain

Complaints	Yes		No	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Tired eyes	35	58.3	25	41.7
Strained eyes	18	30	42	70
Sore eyes	23	38.3	37	61.7
Dry eyes	20	33,3	40	66.7
Feeling like there is a foreign object in the eye	6	10	54	90
Headache	29	48.3	31	51.7
Blurred vision	5	8.3	55	91.7
Double vision	0	0	60	100
Difficulty focusing vision	7	11.7	53	88.3
Neck pain	31	51.7	29	48.3
Shoulder pain	33	55	27	45
Back pain	29	48.3	31	51.7

most common complaint experienced by all samples was tired eyes with 35 samples (58.3%). The most common symptom of asthenopia was tired eyes with 35 samples (58.3%), the most common symptom related to the ocular surface was dry eyes with 23 samples (33.3%), the most common visual symptom was difficulty focusing vision. as many as 7 samples (11.7%), the most common extra-ocular symptom was shoulder pain as many as 33 samples (55%).

Bivariate Analysis: From the research that has been conducted on 60 research samples, the results of the bivariate analysis include the relationship between the length of continuous work in front of gadgets or electronic devices in one day with the occurrence of CVS and the relationship between the length of work in front of gadgets or electronic devices in one day with the occurrence of CVS. The analysis used in the test of two categorical variables is the Chi-Square test, by looking at the Pearson Chi-Square value. The results of the test of the relationship between the length of continuous work in front of gadgets or electronic devices with the occurrence of CVS using the Fisher's test by looking at the Fisher's Exact Test because it does not meet the requirements of the Chi-Square test, namely having 1 cell (25%) that has an expected count value <5 (4.6). The results of the test and the relationship between the length of use of gadgets or electronic devices in one day with the occurrence of CVS using the Fisher's test by looking at the Fisher's Exact Test because it does not meet the requirements of the Chi-Square test, namely having 1 cell (25%) that has an expected count value <5 (4.2).

Based on Table 6, it was found that the significance value was 0.349 (p>0.05), this shows that the length of time working continuously in front of gadgets or electronic devices is not significantly related to the occurrence of CVS.

Based on Table 7, it was found that the significance value was 0.737 (p>0.05). This shows that the length of use of gadgets or electronic devices in one day is not significantly related to the occurrence of CVS.

3.2 Discussion

In this study, there were 32 female samples and 28 male samples. Many studies have stated that the incidence of CVS in women is greater than in men, although not significantly different. This occurs because physiologically, the tear film layer in women tends to thin faster with increasing age. Thinning of the tear film causes dry eyes, which is one of the symptoms of CVS (Paramita, 2014). In this study, there were 5 samples aged 23 years (8.3%), 10 samples aged 22 years (16.7%), 33 samples aged 21 years (55%), 12 samples aged 20 years (20%). Age factors can also affect the occurrence of CVS. This occurs because of the aging process which causes decreased visual function. As age increases, lamellar fibers will continuously form which causes the lens to enlarge and decrease its elasticity. Thickening of the lens reduces the ability of the ciliary muscle to change the curvature of the lens during accommodation so that the lens's accommodation ability also decreases, causing a condition called presbyopia. Presbyopia generally appears at 40 years and gets worse when the light is dim and in

Table 6. Relationship between Length of Continuous Working in Front of Gadgets or Electronic Devices with CVS Incidents

Working Continuously in Front of Gadgets or Electronic Devices	CVS				Total	P
	CVS (+)		CVS (-)			
	Frequency (n))	Percentage (%)	Frequency (n)	Percentage (%)		
≥ 2 hour	32	53.3	15	25	47	0.349
< 2 hour	7	11.7	6	10	13	
Total	**39**	**65**	**21**	**35**	**60**	

Table 7. Relationship between length of use of gadgets or electronic devices in one day and incidence of CVS

Working Continuously in Front of Gadgets or Electronic Devices	CVS				Total	P
	CVS (+)		CVS (-)			
	Frequency (n))	Percentage (%)	Frequency (n)	Percentage (%)		
≥ 2 hour	32	53.3	16	26.7	48	0.737
< 2 hour	7	11.7	5	8.3	12	
Total	**39**	**65**	**21**	**35**	**60**	

the morning or when the presbyopic sufferer is tired. Symptoms of presbyopia increase until around the age of 55 years. Presbyopia can appear at a younger age because of changes in accommodation ability that tries to adjust to the need to see the monitor at close range (Azkadina, 2012; Riordian, 2016).

In this study, students who use computers or laptops were 56 samples (93.3%), mobile phones were 50 samples (83.3%), and Ipads or tablets were 12 samples (20%). Nakazawa's study showed a significant increase in CVS complaints in computer workers more than 5 hours per day. This is because the eyes cannot stare at the monitor screen for long. The eyes cannot focus on pixels or small dots that form shadows on the monitor screen for long. Computers are often set up in such a way that the computer font used may be too small, the reflection of nearby light sources may be too bright, and the monitor may be placed too high for normal eye vision, causing the eyes to work too hard, which can trigger CVS (Baqir, 2017). Research conducted by Muchtar on students of the Faculty of General Medicine, Malahayati University showed that the majority of those living in dormitories who used laptops felt that they had experienced CVS, namely 226 people (73.9%) (Muchtar, et al., 2016). Research conducted by Kasim on students of the Faculty of Medicine, Hasanudin University, class of 2014-2016 in 2017 showed that the majority of students experienced CVS when using smartphones, as many as 81.1% and the majority of them were smartphone users ≥ 8 hours (48.9%) (Kasim, 2017).

Research conducted by Pangemanan on students of SMP Kr. Eben Heazae 2 Manado showed a significant relationship between the length of tablet computer use and vision complaints. In this study, it was found that students of SMP Kr. Eben Haezer 2 Manado used tablet computers the most, namely more than 2 years (60.7%) with an average of 2-3 hours a day (50%) and experienced more complaints of eye strain or fatigue (Pangemanan, 2014). In this study, the research sample used gadgets ≥ 1 year as many as 56 samples (93.3%), those who used gadgets < 1 year as many as 4 samples (6.7%). Research conducted by Bhanderi et al found that the incidence of CVS was higher in VDT users who worked with computers for less than five years, while research conducted by Wang found that CVS incidence was higher in computer users who had worked for more than 10 years (Rianil, 2018).

The results of the analysis of the length of continuous work in front of gadgets or electronic devices with the incidence of CVS are known that of the 47 samples who worked ≥ 2 hours continuously in front of gadgets or electronic devices, 32 samples (53.3%) experienced CVS and 15 samples (25%) did not experience CVS. And 13 samples who worked <2 hours continuously in front of gadgets or electronic devices, 7 samples (11.7%) experienced CVS and 6 samples (10%) did not experience CVS.

The Fisher test conducted showed that there was no significant relationship between the length of continuous work in front of gadgets or electronic devices and the occurrence of CVS with a significance value of 0.349 ($p>0.05$). This is due to several factors such as length of rest, room lighting, temperature, visibility, type of gadget or electronic device and air humidity. The results of this study differ from the study conducted by Hane with the results of the study as many as 40 out of 62 students who used computers outside campus for 2-6 hours were at significantly higher risk of experiencing CVS.4 Parwati stated that ophthalmic symptoms appeared after 2 hours of continuous computer use (Kumasela, 2013).

This is because visual work on computers requires rapid eye movement and alignment, all of which involve continuous muscle activity, causing repeated stress on the eye muscles and reduced blinking frequency so that the eyes become dry and sore. Computer users are in the same position for a long time, with repeated small movements of the eyes, head, arms, and fingers, causing body movements to be less than optimal and causing tonic stress in the muscles, resulting in CVS complaints (Baqir, 2017).

The results of the analysis of the duration of use of gadgets or electronic devices in one day with the occurrence of CVS are known that of the 48 samples who worked ≥ 4 hours in front of gadgets or electronic devices in one day, there were 32 samples (53.3%) experiencing CVS and 16 samples (26.7%) did not experience CVS. And 12 samples who worked <4 hours in front of gadgets or electronic devices in one day, there were 7 samples (11.7%) experiencing CVS and 5 samples (8.3%) not experiencing CVS. The Fisher test conducted showed that there was no significant relationship between the duration of use of gadgets or electronic devices in one day

with the occurrence of CVS with a significance value of 0.737 (p>0.05).

The results of this study do not correspond to the research theory by Logaraj, Madhupriya, and Hedge which shows that students who are at risk of using computers for 4-6 hours per day are at significantly higher risk of experiencing redness, burning sensation, and dry eyes compared to students who use computers for less than 4 hours (Sari, 2018). Muhdahani's research on 57 computer operators who operate computers for at least 4 hours a day, found that 88.5% of subjects experienced accommodative asthenopia or fatigue (Murtopo, 2015).

This is because the eyes cannot stare at the monitor for long. The eyes cannot focus on the pixels or small dots that form shadows on the computer screen to keep the image sharp. This process causes repeated stress on the eye muscles. Moreover, after using the computer for a long time, the blinking frequency decreases so that the eyes become dry and sore. The ability of convergence and accommodation of the eyes that focus excessively when working in front of a computer occurs because the eyes need to adjust to the distance between the eyes and the monitor and the characters, letters, and images on the computer, causing the ability to focus vision to decrease. This adjustment will change the body position to accommodate any deficiencies in the way of seeing. Computer users are in the same position for a long time, with small, repeated movements of the eyes, head, arms, and fingers, causing body movements to be less than optimal and causing tonic stress in the muscles (Baqir, 2017).

There are several limitations in this study that may affect the results of this study. This study did not examine other factors such as age, gender, length of rest, room lighting, type of gadget or electronic device, room lighting, temperature and humidity. This study was conducted only based on anamnesis not with a physical examination that can determine the diagnosis of CVS accurately such as visual acuity examination, refraction examination, and Schirmer test which is an indicator to measure water production which is one of the symptoms of CVS, namely dry eyes.

4. CONCLUSION

Based on the results of the study on the relationship between the length of computer use and the incidence of CVS, the following conclusions can be drawn: 1. The characteristics of UKI Medical Faculty students in the 2017 intake are mostly female (53.3%), 21 years old (55%), using computers or laptops (93.3%), using mobile phones (83.3%), not using tablets or iPads (80%), using gadgets for more than ≥ 1 year (93.3%), working using gadgets continuously for ≥ 2 hours (78.3%), the average number of times working using gadgets for ≥ 4 hours (80%), taking time to rest between working hours using gadgets (91.7%), taking time to rest after ≥ 2 hours using gadgets (53.3%), taking time to rest for ≥ 10 minutes (71.7%), experiencing CVS (39%), and the most common CVS complaint is tired eyes (39%). 58.3%; 2) There is no significant relationship between the length of time working continuously in front of gadgets or electronic devices and the incidence of CVS, 3) There is no significant relationship between the length of use of gadgets or electronic devices in one day and the incidence of CVS.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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