COMPUTER VISION SYNDROME AMONG ACADEMIC COMMUNITY IN MULAWARMAN UNIVERSITY, INDONESIA DURING WORK FROM HOME IN COVID-19 PANDEMIC

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Abstract

Background: The new normal era in the midst of the Covid-19 pandemic has changed various aspects of life, including teaching and learning activities in the education system. The increasing use of gadgets such as laptops, cell phones while studying or working at home has an impact on increasing health problems. Many people who work on laptops report high levels of complaints and work-related symptoms, including eyestrain or computer vision syndrome (CVS).**Aims:** The objective of researchto determine the risk factors of CVS in the Mulawarman University academic community while working from home. **Settings and Design:** This research is analytic observational with cross sectional study of 746 theUniversity of Mulawarman academic community consisting of lecturers, education staff, and students.**Methods and Material:** Data collection using an online questionnaire by google form. This study was conducted among 746 respondents in Mulawarman University. All the respondents were asked to confirm informed consent to participate in the study.**Statistical analysis used:** Data were analyzed using statistic program. The binar logistic registration test was used to study the significance of influences. **Results:** The risk factors for the incidence of CVS in the Mulawarman University academic community are influenced by monitor distance, illumination level, eye disorders and sex, while the use of air conditioner is a protective factor for CVS incidence. **Conclusions:** The Mulawarman University academic community has a risk of CVS incidence.

Keywords: Computer Vision Syndrome, Covid-19, University academic community, Workplace

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Introduction

At the end of 2019 until now, the Coronavirus Disease-19 (COVID-19) is still spread out in almost all parts of the world, including Indonesia. Thus, referring to the data from the World Health Organization (WHO) on August 24, 2020, the confirmed cases of 23,311,719 were found with 806,410 deaths of COVID-19 (1).In Indonesia, the number of confirmed cases based on data from the Task Force Commission for COVID-19 on the website page on August 25, 2020, was 157,859 cases with the death of 6,858 (2).East Kalimantan also contributed to the number of confirmed COVID-19 cases on the same date were 3,145 with the death of 125 cases (3).As the capital city of East Kalimantan Province, Samarinda City is in second place after Balikpapan City as the highest contributor to COVID-19 conformation cases, and on August 25, 2020, that were 672 cases with 26 deaths (4).

The Indonesian government through the Ministry of Education and Culture of the Republic of Indonesia has taken the stance in a policy to restrict the activities in education including the activities in universities during the COVID-19 pandemic based on a letter of the Minister of Education and Culture Number 36962 / MPK. A / HK / 2020 on March 17, 2020, concerning Online Learning and Working from Home in the Context of Preventing the Spread of Corona Virus Disease (COVID-19). Therefore, the Circular of the Directorate General of Higher Education Number 302 / E.E2 / KR / 2020 on March 31, 2020, concerning the Learning Period for the Implementation of the Education Program, which states the higher education leaders can monitor and assist students in learning from home (5). The Rector of the University of Mulawarman responded immediately to this policy by deciding to restrict the campus activities. The policy restricted to the academic services and other activities by implementing the online learning process from home both Work From Home and Study From Home.

Changes of the working habit in the learning process in the Covid-19 pandemic require the academic community to leave the conventional method of working and maximize the use of modern devices/more advanced technology with the smartphones and laptops, however, the use of computers and modern cellular computing devices such as smartphones as a prominent instrument in daily activities is greatly increased. Referring to Herrington, the use of mobile technology in universities has increased (6).The current devices have connectivity to support access to the materials available on the web so that many students use it as a support tool to take part in online learning, especially in developing countries (7).Gikas posited that by using mobile technology both smartphones and tablet computers, students can access lecture material and communicate with lecturers and their friends everywhere(8).A survey conducted by Eden Dahlstrom ECAR in 2012 revealed that 67% of students

believed that mobile computing devices have an important role to play in academic activities and academic success(9).

Long-term use of those mobile technologies can cause health problems, while it uses for more than thirty hours per week and more than ten years can increase the risk of depression, obsessions, and somatic disorders (10). Many studies have shown that computer use for more than three hours a day causes the health risks namely a clinical syndrome called the Computer Vision Syndrome (CVS), low back pain, tension headaches, and psychosocial stress (11).The CVS is defined as a combination of eye and vision problems associated with computer use (12). Akinbinu and Mashalla's research (2013) states that 62% of people who work using computers for more than six hours per day and CVS symptoms appear by using computers six hours per day by 48.9% and eight hours by 23.7% (13).Smita et al (2013) stated that eye health problems appear in people who use computers for more than six hours (14).

Therefore, this happens because the risk factors for using mobile technology are in the form of the insufficient duration of use or recovery time, unreliable posture, repetitive movements, uncomfortable environments, static work positions, so that health problems arise include the carpal tunnel syndrome, back complaints, neck, and shoulders, work stress and frequently happens is well-known eye complaints as the computer vision syndrome (CVS) (10).Yan, et al categorized the CVS symptoms into three groups, such as factors related to eye symptoms (dry eyes, watery eyes, irritated eyes, burning eyes), vision-related symptoms (eye fatigue, headaches, blurred vision, double vision), and symptoms related to posture (neck pain, shoulder pain, back pain)(15).

The previous studies have explained that CVS's risk factors for female workers, the duration of computer use, the distance from the eye to the computer screen, the light intensity of the computer screen, and the surrounding environment (16). Temperature and humidity can adhere to the tear film on the surface of the eye and cause discomfort and increase the CVS symptoms (17).

The research by Reddy et al (2013) posits that knowledge and practice in students showed that 89.9% of 795 students obtained symptoms of CVS and headaches (18).The results of the same study by Chu et al (2011) 90% of respondents experienced symptoms of CVS (19).Although most of the symptoms of CVS are temporary and there is no permanent visual damage, some workers still obtain visual difficulties after work, for instance, eye and musculoskeletal discomfort which can decrease the productivity of up to 40%. The results of research conducted by Purwanto stated that one of the impacts of work from home (WFH) on the performance of teaching staff during the COVID-19 pandemic could reduce the work motivation (20). Sofiana's research states that teaching staff workload affects work stress (21).Likewise, Fatin's research results show that mental workload, technical difficulties, work anxiety, and work fatigue were highly faced by students when learning online during COVID-19(22).

The implementation of WFH and/or SFH is still implementing for the University of Mulawarman by the academic community with unpredictable time. Therefore, to improve the learning performance and work productivity of the University academic staff and avoid symptoms of discomfort while using computers for work or learning activities from home online during COVID-19, further research is needed. The purpose of the study was to determine the prevalence of CVS in the University of Mulawarman's academic community, and the risk factors for CVS incidence. The research can identify problems and increase awareness in daily practice to implement preventive measures related to CVS symptoms.

Subjects and Methods

The study used a cross-sectional research design with a sample of 746 the University of Mulawarman academic community consisting of lecturers, education staff, and students from the entire population who filled out an electronic survey questionnaire (google form) which was distributed via the contact and social media. The data collection by using a simple random sampling technique on academics who are interested in participating in this research. Data collection was conducted online in July 2020. Respondents filled in the concentration information as a form of agreement to become respondents. The respondents were informed about the objectives and participated voluntarily. The study received ethical approval from the Health Research Ethics Commission (KEPK) Faculty of Medicine, the University of Mulawarman with No. 18 / KEPK-FK / VI / 2020.

The questionnaire consisted of the CVS symptoms taken from Reddy et al, 2013 (18)such as headaches, blurred vision, double vision, difficulty focusing, sore eyes, and dizziness accompanied by nausea, and watery eyes. The questionnaire also contained the characteristics of the respondent, the use of air conditioner (AC), the length of time to use the computer in a day, the distance between the eyes and monitor screen, the level of environmental lighting, taking breaks, the length of rest, the length of work continuously, and the visual impairment.

The collected data were analyzed using computer program statistics. The magnitude of the bivariate association of CVS prevalence in the different categories of explanatory variables was calculated using odds ratios (ORs) with 95% confidence intervals (95% CI). The multivariate analysis using a binary logistic regression model to identify the factors associated with the incidence of Computer Vision Syndrome (CVS).

Results

The respondents involved in this study were 746 academic community at the University of Mulawarman. The characteristics of respondents can be seen in table 1. The results indicated that respondents experienced symptoms of eye fatigue or computer vision syndrome (CVS) of 79.4% of respondents. It showed that the majority of respondents (43.7%) were 20-24 years old with an average age of 26 years, 67.3% were female, and 68.4% were students. The average length of time using the Visual Display Terminal (VDT) was 7.34 hours/day and 51.1% of respondents used VDT for≤ 6 hours/day. The average eye distance and VDT of respondents were 32.86 cm and 79.9% of respondents had a distance of <50 cm. The respondents worked with 47.9% sufficient lighting and 4.8% low lighting levels. Thus, it was 31.4% of work and learn by using an Air Conditioner (AC).

Table 1: Respondent Characteristics

No	Variable	n (746)	%	Mean
1	**Age (Year)**			
	15 - 19	180	24.1	
	20 - 24	326	43.7	
	25 - 29	34	4.6	
	30 - 34	48	6.4	
	35 -39	46	6.2	26.35 Yr
	40 - 44	48	6.4	
	45 - 49	32	4.3	
	50 - 54	16	2.1	
	55 - 59	11	1.5	
	60 - 64	5	0.7	
2	**Sex**			
	Male	244	32.7	
	Female	502	67.3	
3	**Occupation**			
	Lecturer	150	20.1	
	Student	510	68.4	
	Educational Staff	86	11.5	
4	**Length of Use VDT (hour/day)**			
	≤ 6	381	51.1	7.34
	> 6	365	48.9	
5	**Distance from VDT (cm)**			
	≥ 50	150	20.1	32.86
	< 50	596	79.9	
6	**Computer Vision Syndrome**			
	Yes	592	79.4	
	No	154	20.6	
7	**Illumination Level**			

No	Variable	n (746)	%	Mean
	Good	353	47.3	
	Middle	357	47.9	
	Low	36	4.8	
10	**Vision abnormalities**			
	Yes	386	51.7	
	No	360	48.3	
12	**Use of AC**			
	Yes	234	31.4	
	No	512	68.6	

The distribution of complaints concerning the eye fatigue or computer vision syndrome (CVS) obtained by respondents, namely 44.10% sore/dry eye complaints, 40.21% headache, 33.51% blurred vision, 31.23% difficulty focusing, 28.82 watery eyes, and 27.48% pain throbbing around the eye. The distribution can be seen in Table 2 as follows:

Table 2: Distribution of Computer Vision Syndrome

No	Syndrome	n	%
1	Pain around the eye	205	27.48
2	Blurred vision	250	33.51
3	Double vision	67	8.98
4	Hard to focus	233	31.23
5	Dry eye	329	44.10
6	Headache	300	40.21
7	Dizziness accompanied by nausea	66	8.85
8	Eye Watering	215	28.82

The results of the bivariate analysis showed that the use of air conditioning, length of use, distance, level of light, sex, and vision disorders were related to the incidence of eye fatigue complaints. (CVS), while the length of work is not related to CVS, the results of the analysis can be seen in table 3.

Table 3: Result of Bivariat Anaysis

No	Variable	p-value
1	Sex	0,000
2	Vision abnormalities	0,000
3	Illumination Level	0,004
4	Usage Distance	0,007
5	Length of Use	0,009
6	Use of AC	0,013
7	Length of working	0,168*

∗P value no statistically significant.

The variables of using air conditioning, duration, distance, level of lighting, sex, and eye abnormalities were included in the logistic regression model. The results of the multivariate analysis found that the logistic regression analysis showed that the gender had an Exp value (B) of 3.242, meaning that female respondents had a chance of obtaining the eye fatigue or CVS complaints of 3.242 compared to male respondents. Eye disorders have an Exp (B) value of 2.424, which means that respondents who have eye disorders of 2.424 times more likely to have the eye fatigue (CVS) problem than respondents who do not have eye disorders. The level of illumination, the value of Exp (B), was 1.728, which means that respondents with low lighting levels have a chance of obtaining 1.728 times complaints of eye fatigue (CVS) compared to respondents with good lighting levels. The distance to use VDT has an Exp (B) value of 1.654, which means that respondents with a distance of> 50 cm when WFH and VDT have a chance of 1,654 times experiencing the eye fatigue (CVS) complaints. In the AC use variable, the Exp value (B) of 0.504, which means that respondents who used AC during WFH have a 0.504 chance not to attain the eye fatigue complaints compared to respondents who do not use AC during WFH.

The Nagelkerke R Square value described in table 4 showed a value of 0.157 which means that the regression model obtained can explain the independent variables affect 15.7% of the incidence of the eye fatigue complaints and 84.3% were explained by the variables outside the study. Subsequently, the value of the Hosmer and Lemeshow test (0.842> 0.05), which means that the model has adequately explained the goodness of fit data. The results of multivariate logistic regression analysis can be seen in table 4.

Table 4. Results of MultivariatAnalysis

Variable	p	β	Exp(B)	95% CI
Sex	0.000	1.176	3.242	2.202 – 4.773
Use of AC	0.001	-0.685	0.504	0.336 – 0.757
Usage Distance	0.024	0.503	1.654	1.069 - 2.560
Illumination Level	0.002	0.547	1.728	1.223 - 2.442
Eyedisorders	0.000	0.886	2.424	1.642 - 3.579
Nagelekrke R Square			0,157	
Hosmer and Lemeshow Test			0,842	

Discussion

The study was conducted at the University of Mulawarman academic community and the incidence of CVS was 79.4% during the WFH and SFH. Thus, consistent with the study of Abudawood et al, who reported a high prevalence of CVS of 95% among medical students of King Abdul Aziz University, Saudi Arabia (23). Noreen's research found that 67.2% of undergraduate medical students

from Bahria University Medical and Dental, Karachi, Pakistan obtained at least (headaches, eye fatigue, burning sensation, eye irritation, and neck-shoulder pain) associated with computer vision syndrome (CVS) (24).A study conducted on university students in Malaysia found a high prevalence of CVS at 89.9% (18), while a study in Nigeria found a prevalence of 74% (13).The CVS incidence was attained by the employees, based on the results of a study by Sanches et al. However, it revealed that 74.3% of workers with VDT at the University of Alicante, Spain have CVS (25). The prevalence was not very high among the administrative staff of universities in Ghana at 51.5% (26).

After multivariate analysis, five factors associated with CVS, for instance, gender, eye abnormalities, lighting levels in the workplace, distance, and air conditioner. Gender in several studies shows the incidence of CVS was more common in women than men. Based on the results of the study, however, the female respondents were at risk of having the eye fatigue complaints (CVS) of 3.242 compared to male respondents. This was based on the results of a study by Sanchez, 2020 which states that women have a risk of having the CVS by 3.40 times than men (25).Abudawood's research found that female students had a high risk (P = 0.003) for having CVS (23). Ranasinghe in his study stated that a significant relationship between gender and eye fatigue ($p < 0.05$) with a higher prevalence of CVS in women (69.5%) than male rice (65.4%)(27).

One of the most important environmental factors when using a computer is lighting. In this study, it was found that respondents with low light levels had a risk of 1.728 times obtaining eye fatigue complaints (CVS) compared to respondents with good lighting levels. The results were consistent with some studies which found that working with low light levels can cause eye fatigue complaints (28)(12)(29).The level of light required by a person varies concerning the task being performed. For administrative work such as the academic community requiring an illumination intensity of 300 lux, it is considered the most comfortable for entering numbers, while 500 lux was convenient for objects in the form of text because it requires larger visuals(30).The amount of light required for computer work and other office tasks such as reading and writing varies. Workers over the age of 50 need twice the light level of young adults to work comfortably on computers (31). Smita et al's research found that high lighting conditions and sensitivity to glare due to computer use were shown to increase reading time and decrease attention on assignments. The brightness should be adjusted so that it closely matches the surrounding environment and the contrast should be adjusted as high as possible to eliminate any discomfort. The eye fatigue, headache, and wateriness were found to be significantly more in subjects working with computers without adjusting screen brightness (14).

The results exposed that 79.9% of respondents used VDT less than 50 cm, and a distance of using VDT less than 50 cm increased the risk factors for CVS symptoms by 1.654. The American Optometric Association recommends a viewing distance of 20-28 inches (32). The distance of VDT to

the eye will affect the accommodation capacity so that if the eye's accommodation power works to an extreme it can cause the eye muscles to tire quickly and cause headaches, thus, increasing the risk of CVS due to symptoms of CVS including the eye fatigue and headaches. The results of this study were consistent with Abudawood's research where the majority of students (64.9%) viewed the computer at a distance less than the arm and arm length, which resulted in significantly more for the CVS symptoms. Likewise, Hassan et al. found that students viewing from a distance of less than 50 cm were prone to a higher risk of CVS (23). Shantakumari et al. added that the prevalence of headache decreased in students who viewed the screen from a distance greater than 50 cm (33).In contrast, distance from the monitor was not associated with CVS in a study conducted in Sri Lanka among computer workers (27).

Many environmental factors can cause dry eyes such as a warm workplace, the use of air conditioner (AC), and biological contaminants, dust, and chemicals in the air (34).Low relative humidity (below 40%) with high temperature increases the evaporation of the tear film, resulting in hyperosmolarity and eye dryness(35). It was 44.10% of respondents that their eyes became dry when working with an air conditioner. The use of AC was related to the incidence of CVS, but after conducting a multivariate analysis, it was a protective factor so that respondents who use AC during WFH have a 0.504 chance of not obtaining the CVS complaints compared to respondents without using AC during WFH. The results revealed that inversely related to the existing theory in terms of air conditioning causes the dry eyes, thus, increasing the risk of CVS complaints, it can happen because the use of air conditioning and lighting were not measured directly, the data was taken subjectively where respondents provided the subjective opinion regarding the thermal comfort and lighting.

Uchino et al found that 10.1% of male and 21.5% female office workers in Japan who used VDT complained of dry eyes, which is the main cause of CVS(35).The prevalence of dry eye increases with age. The prevalence of women over 50 years of age is 7.8% higher than men, namely 4.3%, this is related to prolonged computer use (25).

The results showed that people who had a history of eye disorders had a risk of experiencing CVS of 2,424.Eye disorders experienced by respondents were minus, cylinder, plus, glaucoma and ocular hypertension. The results of this study are in accordance with the results of the studyShahid's research found that the most eye disorders are myopia(30.7%) patients, followed by hypermetropia (20%) patients(36). Students and employees using VDT for long periods without rest will cause extra accommodation power to work. Myopia is closely relateduse of electronic gadgets such as smart phones and computers.One of the causeseye strain is a refractive disorder(37).

One of the study's limitations is that several variables such as lighting level, use of air conditioning (thermal comfort), eye disorders are measured subjectively, so it is advisable to conduct further

research to determine the level of lighting and thermal comfortwhether it affects the incidence of CVS in the academic community of Mulawarman University.

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