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Association between screen time and dry eye symptoms

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ABSTRACT

Background: Electronic media has become a necessity in everyday life because of its function to access information, communication, etc. These functions cause an increase in average screen time and risk of developing dry eye symptoms such as photophobia, grittiness, sore eyes, and blurred vision.

Objective: This study aims to determine whether there is a relationship between screen time and dry eye symptoms.

Methods: An observational-analytic study with a cross-sectional approach was conducted on 66 medical students. All students would download a screen time application on each electronic media they have for one week before data collection. Furthermore, data were collected using a questionnaire consisted of screen time and Ocular Surface Disease Index (OSDI) and were statistically analyzed.

Results: A total of 90.91% of the students use electronic media ≥8 hours/day. The proportion of students who experience dry eye symptoms is 46.97%. There was no statistically significant between screen time and dry eye symptoms (p = 0.676).

Conclusion: More than ninety percent of students spend more than 8 hours/day using electronic media but no statistically significant between screen time and dry eye (p>0.05).

Latar Belakang: *Media elektronik saat ini sudah menjadi sebuah kebutuhan dalam kehidupan sehari-hari karena fungsinya untuk mengakses informasi, komunikasi dan lain-lain. Semua fungsi ini meningkatkan rata-rata waktu penggunaan media elektronik dan risiko terjadinya gejala mata kering seperti fotofobia,* grittiness*, mata nyeri, dan penglihatan kabur.*

Tujuan: *Penelitian ini bertujuan untuk mengetahui apakah terdapat hubungan antara waktu penggunaan media elektronik dan gejala mata kering.*

Metode: *Studi observasional analitik dalam bentuk cross sectional terhadap 66 mahasiswa preklinik. Satu minggu sebelum pengambilan data, mahasiswa diminta mengunduh aplikasi screen time pada setiap media elektronik yang dimiliki. Selanjutnya pengambilan data dilakukan dengan kuesioner waktu penggunaan media elektronik dan* Ocular Surface Disease Index *(OSDI) kemudian dianalisis secara statistik.*

Hasil: *Sebanyak 90,91% mahasiswa menggunakan media elektronik ≥8 jam/hari. Proporsi mahasiswa yang mengalami gejala mata kering adalah 46,97%. Tidak ada hubungan bermakna antara waktu penggunaan media elektronik dengan gejala mata kering (p=0,676).*

Kesimpulan: *Lebih dari sembilan puluh persen mahasiswa menggunakan media elektronik lebih dari*

8 jam/hari namun, tidak terdapat hubungan yang signifikan secara statistik antara waktu penggunaan media elektronik dengan gejala mata kering (p>0,05).

INTRODUCTION

Electronic media is a mass media facility that uses modern electronic devices such as televisions, smartphones, laptops, computers, and tablets.[1] According to a survey conducted by We Are Social in January 2017, around 92% of Indonesians use television, 47% use smartphones, 21% use laptops or computers, and 5% use tablets.[2] Whereas in January 2019 in Indonesia, 95% of people use television, 60% use smartphones, 22% use laptops or computers, and 8% use tablets.[3] The screen time for social media has also increased. In January 2017, the time spent on social media around 3 hours 16 minutes per day.[2] In January 2019, the time spent increased to 3 hours 26 minutes per day. The average time for internet usage per day in Indonesia during the last two years is pretty high, namely more than 8 hours 36 per day.[3]

The increase in number of user and screen time of electronic media in the last two years are due to many benefits in meeting daily needs, including communicating via social media, accessing information via the internet, learning, online shopping, and other functions. However, electronic media also have several negative impacts on ocular health. One study conducted in Australia revealed that smartphone usage for one hour continuously increases incomplete blinks.[4] According to Dong Ju Kim et al, tablet usage for one hour can reduce the Tear film break-up time (TBUT).[5] TBUT time reduction indicates dry eye symptoms. Another study conducted by Jung Hyun Choi et al stated that the risk of developing dry eye symptoms was higher in people who used a computer for more than three hours per day.[6]

Excessive use of electronic media can increase the risk of dry eye symptoms. Symptoms of dry eye include photophobia, grittiness, sore eyes, and blurred vision.[7-10] Dry eye symptoms are often taken lightly. However, they can interfere in daily 36 activities. Therefore, research on the association between screen time and dry eye symptoms is needed.

METHODS

This research was an observational analytic study with a cross-sectional approach conducted online from July to August 2020. The subjects of this research were the first, second, and third-year medical students from School of Medicine and Health Sciences - Atma Jaya Catholic University of Indonesia. The sample size required in this study was 66 students with 95% confidence interval. The number of students from each batch was determined using a proportional stratified sampling technique. Then the student was selected by simple random sampling. The inclusion criteria for this study were medical students who use electronic media. Exclusion criteria included students who suffered from Sjögren syndrome and or anterior eye disease, students who had done LASIK surgery procedures, contact lens users, and smokers.

Data collection and measurements

Data collection uses screen time applications and questionnaires. Smartphones and tablets with the Android system use Screen Time - Restrain yourself & parental control® application version 1.3.3 (Ez Life Inc.). The Time Sense® application on laptops and computers with Windows systems. Smartphones, tablets, laptops, and computers with the iOS system use the available screen time applications. The screen time for television was recorded every day for one week by students through Google Sheets.

One week after students download the screen time application on each electronic media they have, they would fill out a questionnaire consisting of demographics, risk factors, screen time, also the Ocular Surface Disease Index (OSDI). OSDI Questionnaire contains 12 questions about the frequency of dry eye symptoms, the environment, and activities

carried out during the past week. Questions answered use score 0 = none of the time, score 1 = some of the time, score 2 = half of the time, score 3 = most of the time, and score 4 = all of the time. The score then calculated with:

$$\frac{(sum\ of\ scores\ for\ all\ questions\ answered)\ x\ 25}{(total\ numbuer\ of\ questions\ answered)}$$

Results of OSDI calculated score then matched on a scale of 0 to 100. Scale 0- 12 = normal, scale 13-22 = mild, scale 23-32 = moderate, and scale 33-100 = severe.[11-13]

OSDI questionnaire has good reliability because of its high and stable internal consistency. This visible from Cronbach's alpha value >0.7. Construct validity was tested by factor analysis and proved to be good because each factor was independent.[12-14] This questionnaire had good sensitivity and specificity. In distinguishing between normal and dry eyes, the sensitivity and specificity values were 0.80 and 0.79, respectively.[12]

Statistical analysis

The collected data were analyzed using Fisher's exact test in the Stata Statistical Software: Release 12.[15]

Ethical clearance

Ethical clearance was acquired from the Ethical Review Committee of School of Medicine and Health Sciences – Atma Jaya Catholic University of Indonesia (No: 18/06/KEP-FKUAJ/2020).

RESULTS

Respondent characteristics

The number of respondents who entered the inclusion and exclusion criteria was 105 students. About 39 out of 105 students were excluded because of incomplete data and unavailable or damaged screen time application so that the total correspondence was 66 students.

Table 1. Respondent characteristics

Characteristics	Value
Age	
Median (range)	20 (18-22)
Mean±SD	19.60±0.96
Sex	
Male, N (%)	19 (28.79%)
Female, N (%)	47 (71.21%)
The number of electronic media used by respondents	
One, N (%)	11 (16.67%)
Two, N (%)	34 (51.52%)
Three, N (%)	18 (27.27%)
Four, N (%)	3 (4.55%)
The number of users of each electronic media	
Smartphone	66 (100.00%)
Laptop	41 (62.12%)
Tablet	22 (33.33%)
Television	14 (21.21%)
Computer	2 (3.03%)

Univariate analysis

Screen time

Screen time of each respondent was accumulated and categorized into two categories based on the highest number of users of electronic media (Table 1) and its screen time average (Table 2). These categories are <8 hours/day category and ≥8 hours/day category (Table 3).

Dry eye symptoms

The results of the OSDI questionnaire were divided into two groups. These groups are the normal eye group with a scale of 0-12 and the dry eye group with a scale >12. The OSDI questionnaire can also assess the severity of dry eye symptoms in dry eye group.

Table 2. Screen time distribution of each electronic media

Electronic media	Mean±SD
Smartphone	8.20±2.77
Laptop	3.94±4.05
Tablet	2.10±3.49
Television	0.32±0.85
Computer	0.17±1.00

Table 3. Screen time

Electronic Media	Frequency, N (%)	Mean±SD
<8 hours/day	6 (9.09%)	14.75±6.02
≥8 hours/day	60 (90.91%)	

Table 4. Dry eye symptoms

Dry eye symptoms	Frequency, N(%)	Mean±SD
Normal Eye	35 (53.03%)	15.05±14.98
Dry Eye		
Mild	16 (24.24%)	
Moderate	7 (10.61%)	
Severe	8 (12.12%)	

Bivariate analysis

Age and dry eye symptoms

More students have dry eyes in the 19-years-old group compared to the 20-years-old group.

Gender and dry eye symptoms

More than half of the male students have dry eye, whereas more than half of the female students have normal eye.

Table 5. Age and dry eye symptoms

Age	Dry eye symptoms		Total, N(%)
	Normal eye, N(%)	Dry eye, N(%)	
18	4 (50.00%)	4 (50.00%)	8 (100.00%)
19	10 (43.48%)	13 (56.52%)	23 (100.00%)
20	15 (65.22%)	8 (34.78%)	23 (100.00%)
21	6 (54.55%)	5 (45.45%)	11 (100.00%)
22	0 (0.00%)	1 (100.00%)	1 (100.00%)
Total	35 (53.03%)	31 (46.97%)	66 (100.00%)

Table 6. Gender and dry eye symptoms

Gender	Dry eye symptoms		Total, N(%)
	Normal eye, N(%)	Dry eye, N(%)	
Male	9 (47.37%)	10 (52.63%)	19 (100.00%)
Female	26 (55.32%)	21 (44.68%)	47 (100.00%)
Total	35 (53.03%)	31 (46.97%)	66 (100.00%)

Screen time and dry eye symptoms

Fisher's exact test showed no statistically significant between screen time and dry eye symptoms (p = 0.676).

Table 7. Association between Screen Time and Dry Eye Symptoms

Screen time	Dry eye symptoms		Total, N(%)	P value
	Normal eye, N(%)	Dry eye, N(%)		
<8 hours/day	4 (66.67%)	2 (33.33%)	6 (100.00%)	0,676
≥8 hours/day	31 (51.67%)	29 (48.33%)	60 (100.00%)	
Total	35 (53.03%)	31 (46.97%)	66 (100.00%)	

DISCUSSION

Dry eye is an anterior eye disease caused by many factors. One of these factors is electronic media usage. Previous studies have provided an overview of the effects of using electronic media in the form of an increase in the number of incomplete blinks, a decrease in the tear film Break-Up Time (TBUT), and an increase in ROS due to blue light exposure.[4,5,16,17] All of these effects can affect the incidence of dry eye.

In this study, there was no statistically significant between screen time and dry eye symptoms. These results are similar to research by Mowatt L et al in 2017 that showed an insignificant relationship between CVS symptoms and computer screen time with dry eye symptoms in sixth place. The absence of regulating the students' computer usage patterns can be the cause of these results. In his research, around 60% of students who experienced severe dry eye had less frequent computer usage breaks.[18]

Research by Garza-Leon et al in 2016 also stated that increasing computer screen time causes a decrease in the average OSDI score. In his study, there was no assessment of the computer screen position. Lowering the computer screen position can reduce tear evaporation.[19]

Electronic media usage in a dark room, low room temperature, and low humidity also influence dry eye symptoms.[20,21] Low room temperature decreases TBUT score and increases tear film osmolarity. Low humidity environments affect the eye by increasing the evaporation rate and tear film instability along with degradation of lipid layer thickness and tear production.[22] But these factors were ruled out in this study.

According to Li Shan Shan et al study in 2018 to 901 Shanghai University students aged 18-22 years, students who watch using mobile phones and/or computers for more than 8 hours per day are more susceptible to dry eye disease. Nevertheless, Li Shan Shan et al did not limit the room lighting of respondents when using electronic media.[23]

Similar results were also found in a case-control study by Doguizi S et al in 2019 comparing the case group, namely workers who used computers for more than 6 hours/day, and the control group containing workers who used computers less than 1 hour/day. This study showed that 37.7% of respondents in the case group (> 6 hours/day) experienced dry eyes, while in the control group (<1 hour/day) there were 10.2% of respondents experienced dry eyes.[24] These results can be influenced by

screen time grouping with the same electronic media types, temperature, and environmental conditions.

This study did not determine the respondents' usage pattern, electronic media types, and environmental conditions of respondents. In the future study, the researcher can specify these factors, so all respondents would receive quite the same treatment and the research can focus on the association between screen time and dry eye symptoms.

CONCLUSION

There is no statistically significant between screen time and dry eye symptoms in medical students ($p > 0.05$).

CONFLICT OF INTEREST

No relevant disclosures.

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