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RESEARCH ARTICLE

RELATIONSHIP BETWEEN VISUAL DISPLAY TERMINAL (VDT) USE DURATION AND DRY EYE SYNDROME AMONG MEDICAL STUDENTS AT MUHAMMADIYAH YOGYAKARTA UNIVERSITY

(HUBUNGAN ANTARA DURASI PENGGUNAAN VISUAL DISPLAY TERMINALS (VDT) DENGAN SINDROM MATA KERING PADA MAHASISWA KEDOKTERN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA)

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ABSTRACT

Dry eye syndrome is a multifactorial condition affecting the ocular surface and is characterized by disruption of tear film homeostasis, inflammation, ocular surface damage, discomfort, and visual disturbances. Its severity is classified as mild, moderate, or severe. One contributing factor is prolonged use of Visual Display Terminals (VDTs), which are electronic devices used to display information. VDT use is categorized as < 3 hours and ≥ 3 hours per day. This study aimed to examine the relationship between VDT use duration and dry eye syndrome among medical students at Muhammadiyah University of Yogyakarta. Primary data for this cross-sectional study were obtained from the Ocular Surface Disease Index (OSDI) questionnaire and a questionnaire assessing computer use. The sample consisted of 223 medical students who met the inclusion and exclusion criteria. Of the 223 respondents, 156 (70%) were female. Severe dry eye syndrome was identified in 112 respondents (50.2%), and blurred vision was the most frequently reported symptom, occurring in 49 respondents (21.9%). Most respondents (94.6%) used VDTs ≥ 3 hours per day. Data analysis demonstrated that VDT use duration was significantly associated with dry eye syndrome ($p = 0.009$ ($p < 0.05$)). Participants who used VDTs for ≥3 hours per day had a 1.53-fold higher risk of developing dry eye syndrome than those who used VDTs for <3 hours per day.

Keywords: dry eye syndrome, medical students, visual display terminal

ABSTRAK

Dry eye syndrome merupakan penyakit multifaktorial pada permukaan mata yang ditandai dengan gangguan homeostasis lapisan air mata, inflamasi, kerusakan permukaan mata, sensasi tidak nyaman, serta gangguan penglihatan. Keparahannya dibagi menjadi: ringan, sedang,

dan berat. Salah satu penyebabnya adalah durasi penggunaan Visual Display Terminal, yaitu perangkat yang menampilkan data elektronik. Durasi penggunaan Visual Display Terminal dibagi menjadi < 3 jam dan ≥ 3 jam per hari. Penelitian ini bertujuan untuk mengetahui hubungan durasi penggunaan Visual Display Terminal terhadap dry eye syndrome pada mahasiswa kedokteran Universitas Muhammadiyah Yogyakarta. Penelitian ini menggunakan desain cross-sectional dengan data primer dari kuesioner Ocular Surface Disease Index (OSDI) dan kuesioner penggunaan komputer. Sampel berjumlah 223 mahasiswa kedokteran yang memenuhi kriteria inklusi dan eksklusi. Didapatkan 223 responden, mayoritas adalah wanita 156 responden (70%). Sebanyak 112 responden (50,2%) mengalami dry eye syndrome berat, dengan gejala terbanyak adalah penglihatan kabur 49 kali (21,9%). Sebanyak 211 responden (94.6%) menggunakan VDT ≥ 3 jam per hari. Analisis statistik menunjukkan hubungan signifikan antara durasi penggunaan Visual Display Terminal terhadap dry eye syndrome p = 0,009 (p < 0,05). Pengguna VDT > 3 jam per hari berisiko 1,53 kali dibandingkan pengguna < 3 jam per hari. Terdapat hubungan yang signifikan antara durasi penggunaan Visual Display
Terminal terhadap dry eye syndrome pada mahasiswa kedokteran Universitas Muhammadiyah Yogyakarta.

Kata kunci: dry eye syndrome, mahasiswa kedokteran, visual display terminal

INTRODUCTION

Dry eye syndrome is a multifactorial condition affecting the ocular surface, characterized by disturbances in tear film stability and accompanied by ocular manifestations, including tear film instability and increased tear film osmolarity, inflammation with ocular surface damage, and neurosensory abnormalities.[1] Several factors may contribute to a heightened risk of developing dry eye syndrome, including age, autoimmune disorders, postmenopausal status, a history of refractive surgery, and the use of computers and visual display terminals (VDTs). Prolonged use of VDTs can reduce blink frequency, cause incomplete blinking, and increase tear evaporation, which may subsequently lead to dry eye disease.[2]

A Visual Display Terminal (VDT) is defined as a device that displays information from electronic data. Such devices typically consist of a screen for displaying data, a processing unit for preparing data for display, and a keyboard for data input and control.[3] In modern life, VDTs play an important role. Their existence provides convenience, especially in office work. Additionally, increased online activity during the COVID-19 pandemic resulted in more frequent VDT use among students.[4] Despite offering significant benefits, prolonged VDT use may also have adverse effects, including dry eye syndrome. This condition has become increasingly relevant in the digital era because of the high intensity of daily VDT use.[5] Devices classified as VDTs include

computer monitors, smartphones, tablets, laptops, and other electronic display devices.[6]

Excessive VDT use is one of the primary causes of significant eye health problems, particularly among medical students. A study conducted in Serbia reported a dry eye syndrome prevalence of 57.1%.[7] The prevalence of dry eye syndrome among medical students at Udayana University, Indonesia, was even higher, reaching 62.3%.[8] Based on this background, the researchers aimed to investigate the association between Visual Display Terminal (VDT) use duration and dry eye syndrome among medical students at Muhammadiyah University of Yogyakarta.

MATERIALS AND METHODS

This study employed a descriptive cross-sectional design and was conducted from September 2024 to May 2025 at Muhammadiyah University of Yogyakarta. The data used were primary data obtained from the study participants, namely medical students at Muhammadiyah University of Yogyakarta. The sampling method used in this study was convenience sampling. A total of 223 students who met the inclusion and exclusion criteria participated in the study. Data were collected using the Ocular Surface Disease Index (OSDI) questionnaire to assess symptoms of dry eye syndrome and a computer use questionnaire to measure the duration of Visual Display Terminal (VDT) exposure. The collected data were analyzed using SPSS. Ethical clearance for this study was granted by the Research Ethics Committee, Faculty of Medicine and Health Sciences, Muhammadiyah University of Yogyakarta (KEP FKIK UMY) No. 002/EC-KEPK FKIK UMY/I/2025.

RESULTS AND DISCUSSION

Based on the study findings, a total of 245 respondents were initially recruited. Of these, 22 respondents met the exclusion criteria, resulting in a final sample of 223 respondents who met the inclusion criteria.

Respondent characteristics

Based on Table 1, the youngest respondent in the 16-19-year age group was 18 years old, while the oldest respondent in the 20-24-year age group was 23 years old. There were 58 respondents from the class of 2022 and 187 respondents from the class of 2024.

Table 1 Respondent characteristics

Age	Gender			
	Male		Female	
	Frequency	Percentage	Frequency	Percentage
16-19 years	21	9.4%	61	27.4%
20-24 years	46	20.6%	95	42.6%

Based on Table 1, females accounted for the majority of respondents (70%), whereas males accounted for 30%. The higher prevalence of dry eye syndrome among females may be attributed to the effects of 17ß-estradiol, which stimulates genes involved in the breakdown of fats and fatty acids, while suppressing genes involved in fat synthesis.[9]

The distribution of respondent characteristics according to age showed that 63.2% were aged ≥ 20 years. At this age, students spend a significant amount of time using VDTs. Medical education increasingly relies on digital devices and screen-based activities. [10]

Duration of VDT Use

Table 2 Duration of VDT Use

Category	Frequency	Percentage
< 3 hours	12	5.4%
≥ 3 hours	211	94.6%
Total	223	100%

According to Table 2, most respondents used VDTs for more than 3 hours, accounting for 211 respondents (94.6%). Several studies have reported that users of digital devices may be exposed to screens for up to 12 hours per day. The American Optometric Association has noted that Americans spend an average of approximately 7 hours per day using digital devices in both occupational and home settings. Although this technology offers substantial benefits, it may also pose risks to ocular health.[11] This is evidenced by the occurrence of dry eye disease among office employees and VDT users, ranging from 26% to 70% with exposure to 1-2 hours of VDTs per day.[12] In 2010, approximately 70% of computer users worldwide experienced eye-related health problems. Furthermore, in 2011, around 90% of long-

term computer users reported vision complaints, including dry eyes, after prolonged computer use.[13]

Severity of Dry Eye Syndrom

Based on Table 3, severe dry eye syndrome was most prevalent, affecting 112 respondents (50.2%), whereas the normal category was the least prevalent, comprising 28 respondents (12.6%).

Table 3 Severity of dry eye syndrome

Category	Frequency	Percentage
Normal	28	12.6%
Mild	44	19.7%
Moderate	39	17.5%
Severe	112	50.2%
Total	223	100.0%

Based on the study findings, severe dry eye syndrome was the common category, affecting 112 respondents (50.2%). These findings are consistent with those reported by Jadeja et al. (2024), who found that respondents with moderate-to-severe OSDI (n = 88.19%) had longer daily digital device use durations and lower Schirmer test and tear break-up time (TBUT) values than respondents with mild OSDI scores (p = 0.001). Digital device use exceeding 3–3.5 hours per day has been associated with a significant increased risk of dry eye disease.[14]

Symptoms of Dry Eye Syndrome

Based on Table 4, the most frequently reported symptom of dry eye syndrome was blurred vision, occurring 49 times (21.9%), followed by poor vision (42 times, 18.8%), eye sensitivity to light (37 times, 16.6%), and eye pain (13 times, 5.82%). A gritty sensation in the eyes was the least frequently reported symptom, occurring 5 times (2.2%).

Table 4 Symptoms of dry eye syndrome

Complaints	Total	Percentage
Eyes feel dazzled/sensitive to light	37	16.6%
Eyes feel gritty	5	2.2%
Pain or soreness in the eyes	13	5.82%
Blurred vision	49	21.9%
Poor vision	42	18.8%

The most frequently reported symptom of dry eye syndrome among medical students at Muhammadiyah University of Yogyakarta was blurred vision, reported by 49 respondents (21.9%). These findings differ from those of Allwihan (2024), who reported that the most common severe eye symptoms were a burning sensation (6.7%) and dryness (8.6%).[15] The eye surface is protected by a special epithelial layer containing numerous goblet cells that produce mucus and various immune cells whose primary function is to defend against microbes. Eyes that are constantly open are susceptible to dehydration stress, either due to tear evaporation or unfavorable environmental factors, including prolonged VDT use, low humidity, and/or excess wind exposure or air conditioning.[16] However, the eyes have natural protection against dryness and damage through the homeostasis mechanism. If this mechanism is disrupted, it can lead to the manifestation of dry eye syndrome, such as a gritty sensation, eye pain, eye irritation, and sensitivity to light.

Relationship Between VDT Use Duration and Dry Eye Syndrome

Table 5 shows that there is a relationship between the duration of VDTs use and the occurence of dry eye syndrome, with a significance value of p = 0.009 (p < 0.05). Severe dry eye syndrome was most common category among respondents who used VDTs use ≥ 3 hours per day, affecting 110 respondents (49.3%) .

Table 5. Relationship Between VDT Use Duration and Dry Eye Syndrome

Duration	Dry Eye Syndrome										*P*
	Normal		Mild		Moderate		Severe		Total		
	F	%	F	%	F	%	F	%	F	%	
< 3 hours	5	2.2%	3	1.3%	2	0.9%	2	0.9%	12	5.4%	0,009
≥ 3 hours	23	10.3%	41	18.4%	37	16.6%	110	49.3%	211	94.6%	
Total	28	12.6%	44	19.7%	39	17.5%	112	50.2%	223	100%	

The chi-square analysis indicated a significant association between the VDT use duration and dry eye syndrome among medical students at Muhammadiyah University of Yogyakarta. The analysis yielded a p-value of 0.009, which met the significance criterion (p < 0.05), thereby supporting the study hypothesis. The findings of this study are consistent with those reported by Utlu (2024), who found significant differences in OSDI scores between students who used smartphones and tablets for 1–5 hours and those who did not use these devices. The duration of

smartphone and tablet use significantly affected OSDI scores, with p-values of 0.023 ($p < 0.05$) for smartphone use and 0.001 ($p < 0.05$) for tablet use, indicating a significant association between the device use duration and dry eye syndrome.[17] The present findings are also in agreement with those reported by Kim Dong Ju (2017), who found that one hour of tablet use resulted in a significant increase in the scores of five specific eye symptoms (eye fatigue, eye pain, eye irritation, watery eyes, and hot/burning eyes). Additionally, the mean total asthenopia score increased significantly with a p-value < 0.001.[18] A consistent decrease in blink rate occurs during the use of Visual Display Terminals (VDTs) devices. This occurs because users tend to focus intensely on the screen, which decreases the frequency of blinking.

The primary function of blinking is to maintain a uniform distribution of tears across the ocular surfaces. Disruptions in the blinking process impair the balance between tear production and tear evaporation. As a result, tear structure and ocular surface homeostasis are disrupted, leading to ocular discomfort.[19]

Based on the data obtained, the risk of dry eye syndrome associated with Visual Display Terminal (VDT) use was assessed by calculating the Relative Risk (RR) value:

$$RR = \frac{\text{Risk in exposed group}}{\text{Risk in unexposed group}}$$

$$RR = \frac{\frac{188}{188+23}}{\frac{7}{7+5}}$$

$$RR = \frac{0{,}890}{0{,}583} \approx 1{,}53$$

The results showed that individuals who used VDTs for ≥ 3 hours per day had a 1.53-fold higher risk of developing dry eye syndrome than those who used laptops for < 3 hours per day. These findings align with a study conducted by Al Tawil et al. (2020), which reported that 66.6% of business students and 33.9% of medical students experienced dry eye syndrome, with VDT use exceeding 5 hours per day associated with a higher incidence of eye symptoms (OR 1.52; CI: 1.07–2.16).[20] Tsubota and Nakamori, as cited by Romeo et al. (2024), reported that the average blink rate decreased by 5 times after 10 minutes of VDT use. Blink rate varies according to the cognitive demands of a task; as task difficulty increases, blink frequency

decreases. Studies have also shown that the proportion of incomplete blinks increases during screen use compared with reading printed materials. The combination of reduced blink frequency and an increased proportion of incomplete blinks disrupts tear film stability and increases tear evaporation from the eye surface. This occurs because the tear film is not optimally replenished over a longer period, leading to poor lipid layer integrity.[21]

CONCLUSION

This study demonstrated a significant association between VDT use duration and dry eye syndrome among medical students at Muhammadiyah University of Yogyakarta ($p = 0.009$). Severe dry eye syndrome was the most prevalent category (50.2%). The most dominant symptom resulting from prolonged VDT use was blurred vision, reported by 49 respondents (21,9%).

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest related to this study.

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