MAGNA MEDIKA
Berkala Ilmiah Kedokteran dan Kesehatan
e-ISSN 2774-2318
p-ISSN 2407-0505

Research Article
MAGNA MEDIKA
Berkala Ilmiah Kedokteran dan Kesehatan
Journal Page: https://jurnal.unimus.ac.id/index.php/APKKM

The Correlation between Light Intensity, Age, and Working Period with Eye Fatigue in Computer Users

Raden Ayu Tanzila[1], Dinda Arista[2]

[1]) Department of Physiology, Faculty of Medicine, Universitas Muhammadiyah Palembang

[2]) Bachelor's degree in Medicine, Faculty of Medicine, Universitas Muhammadiyah Palembang

Article Info

Article history:
Received 17 August 2022
Revised 24 October 2022
Accepted 27 October 2022
Available online 01 February 2023

Keywords:
Computer users; eye fatigue; light Intensity

Correspondence:
ratanzila247@gmail.com

How to cite this article:

1. Tanzila RA, Arista D. The Correlation between Light Intensity, Age, and Working Period with Eye Fatigue in Computer Users. MAGNA MEDIKA Berk Ilm Kedokt dan Kesehat. 2023; 10(1): 1-8

Abstract

Background: In the 21st century, many jobs involve using computers, estimated at around 75%, and there are 90 million adults who use computers daily. The use of technology often results in harmful effects, mainly if it is not appropriately managed. Factors affecting eye fatigue are work equipment, work environment (light intensity), work design, work duration, individual characteristics (age), or refraction.

Objective: This study aims to determine the correlation between light intensity, age, and work duration with eye fatigue complaints in computer users at PT Bank X Palembang.

Methods: This research is analytically observational. The population was all computer users at PT Bank X Palembang. Sampling was conducted in 40 samples that met the inclusion and exclusion criteria. Data were obtained by questionnaires and measuring lux meters. Data were analyzed bivariate using the chi-square test.

Results: showed that 24 respondents (60%) worked with poor light Intensity and 27 respondents (67.5%) complained of eye fatigue. Based on statistical tests, there was a significant correlation between light Intensity (p = 0.027), there was no significant correlation between age (p = 1.000) and years of services (p = 1.000), and complaints of eye fatigue in user's computers at PT Bank X Palembang.

Conclusion: poor light intensity can cause eye fatigue in computer users.

e-ISSN 2774-2318
p-ISSN 2407-0505

INTRODUCTION

Computers have played a significant role in changing the way people live in recent times. Many office workers use the computer as one main facility supporting work.[1] The role of computers is extensive today, and the increasingly widespread use of the internet has resulted in workers spending at least 3 hours a day in front of the computer.[2] The use of technology, besides having a positive impact, often results in harmful effects, mainly if it is not appropriately managed.[3]

It is estimated that globally, between 45 and 70 million people spend time staring at a display *video* or a computer screen. Several studies have shown an association between computer use and health-related visual symptoms (Computer Vision Syndrome, CVS) in children and adults, especially in developed countries.[4] Globally, nearly 60 million people suffer from CVS, which is expected to increase by millions of cases yearly.[5]

According to *the Occupational Safety and Health Administration* (OSHA), factors that can affect eye fatigue are work equipment factors (object size, position, and screen display), work environment (room lighting), work design (monitor distance, work duration), individual characteristics (eye or refractive error), or a combination of all factors.[6] The results of Irma, Lestari, and Kurniawan's research (2019) on computer users at PT PLN (Persero) Rayon Soppeng and Rayon Pajalesang Soppeng Regency, it was found that there was a correlation between monitor distance, age, and duration of computer use with subjective complaints of eye fatigue in computer users.[7] Rathore (2017) also states that workers who work with computers for more than 3 hours per day are more at risk of eye fatigue complaints.[8]

In addition to prolonged computer use, lighting conditions that are too dark or too bright cause a decrease in contrast so that in dark conditions, accommodation of the eyes occurs more often and can trigger eye fatigue.[9]

The level of illumination is measured by the local lighting method, where a measuring instrument or *lux* meter is placed on each worker's desk. The recommended lighting level of SNI in offices in the workspace and computer room is 350 lux, and in meeting rooms and active archive rooms, 300 lux.[10]

Besides that, the computer monitor screen has a level of high radiation. The longer you interact with the monitor screen at work, the physiological abilities of the muscles and the muscles around the eyes will decrease. As a result, the eyes will experience fatigue. Age can also cause the eye muscles' physiological ability to decrease, making it easy to cause eye fatigue.

Based on the description above, the researcher feels it is necessary to conduct a study to determine the correlation between light intensity, age, and working period with eye fatigue in computer users at PT Bank X Palembang.

METHODS

The design of this study used an observational analytic study with a *cross-sectional approach* carried out at PT Bank X Palembang from December 2021 – January 2022. The data used in this study is primary data with filling *Visual Fatigue Index* (VFI) questionnaire to find out complaints of fatigue eye, a questionnaire for

e-ISSN 2774-2318
p-ISSN 2407-0505

knowing age and years of service, and measurements intensity light use *lux meter*. The respondent has eye fatigue if their VFI score is ≥ 0,4 and not fatigue if their VFI score is <0,4. The respondent has good light if the lux meter score is 300-350 lux and bad light if <300 or >350 lux. The sample in the study is all user worker computers at PT Bank X Palembang, totaling 40 respondents who were taken by *total sampling*. All respondent is guaranteed confidentiality. The inclusion criteria in the study were respondents who were still actively using computers at PT Bank X Palembang in the last six months and respondents who were not suffering from diseases related to visual disturbances such as myopia, hypermetropia, and astigmatism. The exclusion criteria in this study are respondents who are not willing to become research respondents and do not fill out *informed consent,* respondents who have a history of systemic disease, a history of chronic hypertension, and a history of operation eye—data analysis using univariate analysis and bivariate analysis using the Chi-square test.

RESULTS

Based on Table 1, the majority of respondents were 31-40 years old, with as many as 19 respondents (47.5%), and by gender majority of respondents manifold sex men, as many as 27 respondents (67.5%). Based on the latest education, as many as 36 respondents (90.0%) have the latest education in Bachelor's degree. Based on years of service, most respondents have a working period of 3-10 years, and as many as 28 respondents (70.0%).

Table 2 shows light Intensity on computer users. It was found that 24 points (60.0%) had poor light intensity as measured using a lux meter, and 16 points (40.0%) had good light Intensity. Table 3 shows the light intensity distribution in each room with complaints of eye fatigue. The study results found that on the first floor in the banking's hall room, there were three respondents with a light intensity of 304.0 lux, and the three respondents did not experience eye fatigue. The measurement results on the second floor in the Account officer room were 15 respondents with an intensity measurement of 163 lux 15 respondents, seven respondents did not experience eye fatigue, and eight respondents experienced eye fatigue. On the third floor, it was found that only three respondents did not complain of eye fatigue even though the results of the measurement of light Intensity were 170 lux. From table 4, it is known that as many as 27 respondents (67.5%) experienced eye fatigue, and 13 respondents (32.5%) did not experience eye fatigue.

The chi-Square test results (Table 5) obtained a p-value of 0.027 which means a significant correlation between the Intensity of light and eye fatigue on the user computer at Bank X Palembang. *Kolmogorov-Smirnov* alternative test results (Table 6) obtained a *p-value* of 1.000 (p > 0.05) which means that there is no correlation between age and eye fatigue on user computers at Bank X Palembang.

e-ISSN 2774-2318
p-ISSN 2407-0505

Table 1. Respondents' Characteristics

Characteristics of Respondents		Respondent	
		N=40	%
Age	21-30 years old	13	32.5
	31-40 years old	19	47.5
	41-50 years old	7	17.5
	Over 50 years old	1	2.5
Gender	Man	27	67.5
	Woman	13	32.5
Last education	Bachelor's degree (S1)	36	90.0
	Vocational Degree (D3)	4	10.0
Years of service	< 3 years	3	7.5
	3-10 years	28	70.0
	11-20 years old	4	10.0
	> 20 years	5	12.5

Table 2. Distribution of Light Intensity on Worker's Computer

No.	Light Intensity	Respondent	
		N= 40	%
1	Bad (<300 or >350 lux)	24	60.0
2	Good (300-350 lux)	16	40.0
3	Total	40	100%

Table 3. Distribution of Light Intensity with Eye Fatigue in Computer Users

No.	Floor	Room	Light Intensity (lux meter)	Number of respondents	Eye Fatigue	
					Yes	No
1.	1	Banking hall	304.0	3	-	3
2.		Back office	312	3	3	-
3.		Manager	229.6	1	1	-
4.	2	Account officer	163	15	8	7
5.		Credit	150	1	1	-
6.		IT room	192.5	1	1	-
7.	3	Credit support	170	10	7	3
8.		HR	133.5	1	1	-
9.		Facility room	112	2	2	-
10.		Quality control	115	2	2	-

Table 4. Distribution of Eye Fatigue in Computer Users

No.	Visual Fatigue Index	Respondents	
		N= 40	%
1.	Fatigue eye	27	67.5
2.	Not fatigue eye	13	32.5
3.	Total	40	100%

e-ISSN 2774-2318
p-ISSN 2407-0505

Table 5. The Correlation Between Light Intensity and Eye Fatigue

No.	Light Intensity	Complaints of Eye Fatigue				*p Value*
		Yes		No		
		(N)	(%)	(N)	(%)	
1.	Bad	13	54.2%	11	45.8%	0.027
2.	Good	14	87.5%	2	12.5%	
3.	Total	27	67.5%	13	32.5%	

Table 6. The Correlation Between Worker Age and Complaints of Eye Fatigue

No.	Age (years old, y.o)	Complaints of Eye Fatigue				*p-value*
		Yes		No		
		(N)	(%)	(N)	(%)	
1.	21-30 y.o	8	61.5%	5	38.5%	
2.	31-40 y.o	13	68.4%	6	31.6%	1.000
3.	41-50 y.o + > 50 y.o	6	75.0%	1	25.0%	
4.	Total	27	67.5%	13	32.5%	

Table 7. Correlation Between Work Period of Workers and Eye Fatigue

No.	Years of service	Complaints of Eye Fatigue				*p-value*
		Yes		No		
		(N)	(%)	(N)	(%)	
1.	< 3 years + 3-10 years	20	64.5%	11	35.5%	
2.	11-20 years old	3	75.0%	1	25.0%	1.000
3.	> 20 years	4	80.0%	1	20.0%	
4.	Total	27	67.5%	13	32.5%	

Kolmogorov-Smirnov alternative test results (Table 7) obtained a *p-value* of 1.000 ($p > 0.05$) which means that there is no correlation between a work period and eye fatigue on user computers at Bank X Palembang.

DISCUSSION

The study results found that most of the respondents were in a room with poor lighting intensity. This follows the results of Sya'ban's (2014) research based on the measurement of lighting intensity at PT. Grapari Telkomsel Kendari, with a total of 33 measurement points, obtained 26 points at a lighting level of < 300 lux (92.3%) with poor lighting.[11]

Eye fatigue was calculated using the *Visual Fatigue Index* (VFI); it is known that as many as 27 respondents (67.5%) with lighting levels experienced eye fatigue. This result is in line with the research conducted by the *National Occupational Safety and Health* (NIOSH), which shows that almost 88% of all computer users experience eye fatigue due to focusing their eyes on the computer screen for more than 4 hours a day.[12] Then, the results of research conducted

e-ISSN 2774-2318
p-ISSN 2407-0505

by Suryatman on workers at PT. UJT found that 29 respondents (72.5%) experienced eye fatigue, and 11 people (27.5%) did not experience eye fatigue.[13]

The power of accommodation of the eye is the ability of the eye lens to thicken (convex) or thin out (flat) according to the distance of the object being viewed so that the image falls on the retina. The older a person gets, the more the lens loses its elasticity so that the power of accommodation decreases, and it becomes more difficult for the muscles to thicken and thin the eye. This is because the lens becomes less flexible each year and loses its ability to adjust.[14]

Work using a computer is one of the jobs that have a tendency to use excessive eye accommodation abilities. Excessive eye accommodation, if it occurs for a long time, will result in eye fatigue that continues in permanent visual disturbances such as eye refraction.[15]

Based on Wiyanti's, on average, there are complaints of eye disorders that are felt after workers have worked for 3-4 years for jobs requiring accuracy. Workers who have worked for more than three years will have a faster risk of experiencing eye fatigue.[16]

According to the Decree of the Minister of Health of the Republic of Indonesia number 1405/MENKES/SK/XII/2002 concerning the health requirements of the office and industrial work environment, the minimum light intensity in the computer workspace is 300-350 lux. [17]The Intensity of the room lighting that does not meet the standards, whether the Intensity is too high, low, or dazzling, can affect the tension of the visual nervous system, which eventually causes eye fatigue.[18]

Many factors affect eye fatigue, one of which is in workers who work in an environment that lacks lighting, which causes the eyes to need to work harder. Old age also physiologically makes the eyes get tired quickly. Eye fatigue is caused by eye strain due to using the sense of sight in uncomfortable conditions for a long time. This eye fatigue can result in decreased work efficiency, mental fatigue, complaints of soreness in the eye area, pain around the eyes, headaches, damage to the visual apparatus, and increased accidents.[18]

The research results show that several rooms in table 3 at Bank X Palembang have poor lighting with an average of <300 lux. In that table, many respondents experience eye fatigue. In a room that has a light intensity >300 lux, some respondents do not experience eye fatigue complaints.

From the results of the study, it was also found that there were still some respondents who had light intensity >300 lux but still had complaints of eye fatigue. This may be due to other factors that can affect a person's eye fatigue, such as age, work duration, and working period. These results can be seen in table 6 that the age group that experienced the most eye fatigue was the age range of 31-40 years.

Table 6 also shows that people in the age range of 41-50 experience complaints of eye fatigue (85.7%). According to the results of the researcher's observations, respondents with an age range of 41-50 years are more likely to experience eye fatigue because, from the results of the questionnaire, most of the respondents answered that they often feel tired when working in front of the computer, most of the respondents also answered that sometimes they felt worse vision in the afternoon and evening.

e-ISSN 2774-2318
p-ISSN 2407-0505

At night, all respondents also answered that they often felt tired and tired eyes when they came home from work and had experienced pain in the neck, shoulders, and waist, and most of the respondents often forgot to rest their eyes after an hour of working in front of the computer.

Statistical test results obtained no significant existence correlation. Among age with complaint fatigue eyes (*p-value* 1.000). These results align with Sya'ban's research, with statistical test results showing no correlation between age and complaints of eye fatigue. This study also found that many people aged <45 experienced eye fatigue complaints; there was no risk at that age, but the lighting level was influenced.[14]

From Table 7, it can be seen that respondents with a working period of more than three years who experienced eye fatigue were 24 respondents and those who did not experience eye fatigue 13 respondents. In contrast, three respondents with a working period of fewer than three years experienced eye fatigue. This may be due to the fact that computer users who are in front of the computer every day will get bigger to increase the occurrence of eye fatigue complaints. *Kolmogorov-Smirnov* alterna-tive test results obtained a *p-value* of 1.000 (p >0.05) which means no correlation exists between years of service and complaints of eye fatigue. According to Pheasant (2013) also affects eye fatigue as working with a near vision for a long time is also a significant source of eye fatigue.[12] However, from the study results, it is known that respondents with a working period of 11-20 years and 1 with a working period of >20 years did not experience eye fatigue complaints. This may be due to the influence of good light intensity.

The computer monitor screen has a level of high radiation. The amount of radiation absorbed by the eye is directly proportional to the length of the interaction with the monitor screen.[19] The longer user interacts with the monitor screen, the physiological abilities of the muscles and the muscles around the eyes will decrease; as a result, the eyes will experience fatigue.[20]

CONCLUSION

Research results found a correlation between light Intensity and eye fatigue and no correlation between age and working period with complaint fatigue eye on the user's computer at PT Bank X Palembang.

REFERENCES

1. Situmorang CK, Widjasena B, Wahyuni, I. (2020). Hubungan antara durasi dan postur tubuh penggunaan komputer terhadap keluhan *neck pain* pada tenaga kependidikan Fakultas Kesehatan Masyarakat Universitas Diponegoro. *Jurnal Kesehatan Masyarakat, 8(5), 672-678.*
2. Victoria G, Rary LY, Talarima, B. (2019). Eye Fatigue on Employees of Computer Users at PT. Bank X in Ambon City Maluku Indonesia. *Jurnal Aisyah: Jurnal Ilmu Kesehatan, 4(1), 35-44.*
3. Firdani F. (2020). Faktor yang Berhubungan dengan Kelelahan Mata pada pekerja Operator Komputer. *Jurnal Endurance: Kajian Ilmiah Problema Kesehatan*, *5(1), 64-70.*
4. Akinbinu TR, Mashalla YJ, (2014). Medical Practice and Review Impact of Computer Technology on Health: Computer Vision Syndrome (CVS). *Acad Journals*, *5(3), 20–30.*

e-ISSN 2774-2318
p-ISSN 2407-0505

5. Ranasinghe P, dkk. (2016). Computer Vision Syndrome Among Computer Office Workers in A Developing Country: An Evaluation of Prevalence and Risk Factors. *BMC Res Notes; 9(1), 1-9.*
6. Anggraini, Y. (2013). Faktor-faktor yang berhubungan dengan terjadinya keluhan Computer Vision Syndrome (CVS) pada operator komputer PT. Bank Kalbar kantor pusat tahun 2012. *Jurnal Mahasiswa PSPD FK Universitas Tanjungpura*, *3(1), 4-15.*
7. Irma, I., Lestari, I., Kurniawan, AR. (2019). Faktor yang berhubungan dengan keluhan subjektif kelelahan mata pada pengguna komputer. *Jurnal Ilmiah Kesehatan Pencerah*, *8(1).*
8. Rathore, Indu. (2017). Computer Vision Syndrome – An Emerging Occupational Hazard. *Research Journal of Science and Technology, 9(2), 293-297.*
9. Gowrisankaran S, Sheedy JE. (2015). Computer vision syndrome: A review. Albin TJ, editor. *Work; 52(2), 303–14.*
10. Rohadi, R S. dan Yulianti I. (2017). Uji efektifitas pencahayaan ruang kuliah menggunakan software calculux index 4.12. *Unnes Physics Journal, 6(1), 50-53.*
11. Salote A, Jusuf H, Amalia, L. (2020). Hubungan lama paparan dan jarak monitor dengan gangguan kelelahan mata pada pengguna computer. *Gorontalo Journal Health and Sciences Community, 4(2), 104-121*
12. Pheasant S. (2013). Ergonomic, Works, and Health. USA: Aspen Publisher Inc.
13. Wiyanti, Nina dan Martiana, T. (2015). Hubungan Intensitas Penerangan dengan Kelelahan Mata. Jakarta: *The Indonesian Journal of Occupational Safety Health*, *4(1), 144-154.*
14. Sya'ban, A.R., Riski, M.R. (2014). Faktor-Faktor yang Berhubungan dengan Gejala Kelelahan Mata (Astenopia) pada Karyawan Pengguna Komputer PT. Grapari Telkomsel Kota Kendari. *Proseding Seminar Bisnis & Teknologi*, *754-768.*
15. Keputusan Menteri Kesehatan Nomor 1405/MENKES/SK/XI/2002 Tentang Persyaratan Kesehatan Lingkungan Kerja Perkantoran dan Industri.
16. Sunyanti, S. (2019). Keluhan kelelahan mata pada pekerja pengguna computer di perusahaan travel di Kolaka Raya. *Jurnal Ilmiah Keselamatan, Kesehatan Kerja dan Lingkungan*, *5(2), 168-177*
17. Permana, M. A., Herry K. & Mardiana. (2015). Faktor yang berhubungan dengan keluhan Computer Vision Syndrome (CVS) pada pekerja rental komputer di wilayah UNNES. *Unnes Journal Of Public Health*, *3(3), 55-56.*
18. Suryatmam, TH., Hermawan, O. (2021). Perbaikan Intensitas Cahaya Pengguna Komputer dengan Pendekatan Ergonomi di PT. UJT Indonesia. *Jurnal Teknik FT UMT, 10(1), 59-73.*
19. Naota, SK., Afni N, Moonti S. (2019). Faktor-faktor yang berhubungan dengan gejala kelelahan mata pada operator computer di Dinas Tenaga Kerja dan Transmigrasi Provinsi Sulawesi Tengah. *Jurnal Kolaboratif Sains, 2(1), 268-281.*
20. Berliana N, Rahmayanti F. (2017). Faktor-faktor yang Berhubungan dengan Keluhan Kelelahan Mata pada Pekerja Pengguna Komputer di Bank X Kota Bangko. *Jurnal Kesehatan Terpadu, 1(2), 68-72.*