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Factors Related to Eye Fatigue on Computer User Workers at PT. Krakatau Bandar Samudera in 2022

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Abstract

Eye fatigue is a strain on the eyes or visuals caused by the use of the sense of sight in jobs that require the ability to see for long periods, accompanied by uncomfortable viewing conditions. This study aimed to determine the factors associated with eye fatigue in computer user workers at PT. Krakatau Bandar Samudera in 2022. The design of this research is cross-sectional. The research population is all computer user workers totaling 168 respondents with a sample of 86 respondents taken by simple random sampling. Primary data collection using questionnaires, interviews, and observations, while secondary data was obtained from company profiles. Data analysis was carried out univariate and bivariate with the Chi-Square test. The results of the univariate analysis showed that from 86 respondents, 72 (83.7%) experienced complaints of eye fatigue, eye rest with risky time (<15 minutes) as many as 53 (61.6%), Eye Refractive Disorders 50 (58.1%) respondents, the lighting level does not meet the requirements as much as 16 (18.6%) respondents and the monitor height is not optimal as much as 3 (3.5%) respondents. The bivariate analysis results stated that there was a significant relationship between eye rest (P-value=0.000), eye refractive error (P-value=0.001), and eye fatigue. There is no significant relationship between lighting levels (P-value 0.295), monitor height (P-value = 0.415), and complaints of eye fatigue. Research advises, that the company implements lighting in the workspace according to the standard, namely a minimum of 300 lux, so it is necessary to take care of the lights that are out and gloomy.

Keywords: Eye, Fatigue, Rest, Refraction, Lighting, Height Monitor

Introduction

Continuous use of computers for a long time can cause effects on eye fatigue ranging from 40% to 90% (World Health Organization, 2003). The number of computer users in Indonesia is around 4% of the total population of Indonesia, but in 2009, the number of computer users in Indonesia had reached 10% of the total population (Novalina, 2010). It is estimated that globally, approximately 45 to 70 million people spend time looking at video displays, known as computer screens. Several studies have shown a relationship between computer use and visual indications related to

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health in children and adults (Akinbinu & Mashalla, 2014). Other studies have concluded that excessive computer use will interfere with visual function which causes ocular and physical fatigue (Kartini et al., 2021).

In Indonesia, complaints of eye fatigue in computer user workers are often found. The results of Fadhillah's research conducted on computer user workers at PT Bank X Jakarta showed that as many as 83.7% experienced complaints of eye fatigue. Based on the results of research in 2018 at PT. Arara Abadi, Sorek District, as many as 80% of computer workers experience eye fatigue (Asnel & Kurniawan, 2020). Other research by Nourmayanti on users.

Computer at Corporate Customer Care Center (C4) PT. Telekomunikasi Indonesia, Tbk, that 90.2% experience complaints of eye fatigue (Salote et al., 2020). Eye fatigue is a strain on the eyes that arises as a result of working with the senses of vision on close objects for a long time followed by an uncomfortable gaze. Eye fatigue occurs due to the adjustment of the pupils of the eyes to the light received by the eyes. The pupils of the eyes will shrink when receiving too much light and swell when receiving insufficient light (NISAK, 2018). Complaints of eye fatigue include: a throbbing or sore feeling near the eye and behind the eyeball, double vision, blurred vision, and difficulty focusing on vision, whether it's pain, redness, eye pain, watery, headache, sometimes accompanied by a feeling of nausea, aches, and easily emotional (Pheasant, 1991).

According to the National Institute for Occupational Safety and Health (NIOSH) taking a 15-minute eye break for using a computer for more than 2 hours can provide high work effectiveness to the eyes and reduce the risk of eye fatigue. Working for a long time using a computer without any rest for the eyes can result in a high risk of eye fatigue, because the lens loses its elasticity caused by the light emitted by the computer which focuses the view on an object that is close to the eye. This is in line with research conducted by Siagian (2017) which found that most respondents took eye breaks. From the results of bivariate analysis, it shows that p value = 0.003. This shows that there is a significant relationship between eye rest and eye fatigue. Workers who rarely rest their eyes while working tend to experience complaints of eye fatigue.

Refractive error is a condition in which a firm image is not formed on the retina. In refractive errors, there is an imbalance in the optical system in the eye, resulting in blurred images. Someone who has refractive errors without being corrected can cause eye fatigue, whereas someone who uses a computer for more than 4 hours a day tends to experience refraction. The results of other studies showed that there was a relationship between eye refraction disorders and eye fatigue disorders. It was known that of the 21 workers who had refractive errors, there were 20 workers who experienced eye fatigue complaints and of the 15 workers who did not have refractive errors, 9 workers experienced eye fatigue complaints. From the statistical test results, a p-value = 0.013 was obtained, which means that there is a significant relationship between refractive errors and complaints of eye fatigue (Berliana, 2017).

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Eyestrain can occur in poor quality lighting, for example when the lighting in the visual task area is much brighter than the surroundings. This results in the eye having to frequently make adjustments (adaptation and accommodation) when the view moves from the bright part to the dark part. Repeatedly from the dark to the bright parts, the results of research from Sari (2021) using the Chi square test obtained P Values of 0.001 (Pv<α), meaning that statistically at α 5% there is a significant relationship between eye fatigue and the level of computer lighting.

Monitor height is one of the factors that can affect eye fatigue. Evaporation of tears often occurs in computer users with the height of the monitor at or higher than the horizontal line of the eye. This is because the eye will look straight ahead so that the ocular surface of the eye is wider. The wider the ocular surface of the eye, the more evaporation of tears which can make the eyes dry. Based on the results of the study, there were 14 respondents who complained that their eyes felt dry, or 31.1%. Meanwhile, 29 people or 64.4% of the respondents who complained that their eyes felt sore could obtain P Values of 0.004 (Pv < α), so it can be concluded that there is a relationship between the height of the monitor and eye fatigue (Sari, 2021).

PT. Krakatau Bandar Samudera is a company engaged in port services. Computer user workers at PT. Krakatau Bandar Samudera, every day is required to work using a computer for quite a long time and continuously so that it can have consequences for eye health. Based on the results of a preliminary study conducted on 10 respondents, it can be obtained that as many as 9 respondents (90%) experienced eyestrain.

Methods

This study used a quantitative method with a cross sectional approach. The independent variables in this study were eye distance on the computer, length of work, computer lighting levels and monitor height, while the dependent variable studied was eye fatigue in computer user workers at PT. Krakatau Bandar Samudera in 2022. The research was conducted in April-June 2022, the population in this study, namely all computer users, totaled 168 computer users. The sample in this study, namely as many as 86 samples were taken using simple random sampling method. The instruments used in this study were questionnaires and interviews which produced data on eye fatigue, eye refraction and eye rest in computer users. In addition, direct measurements were also made to measure the level of lighting and the height of the monitor using a Lux meter, tape measure and ruler. The collected data was analyzed using the chi-square test, with a significance limit of α (alpha) = 5% with a 95% confidence level.

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Result and Discussion

A. Univariate Analysis Results

Table 1. Frequency Distribution of Factors Associated with Eyestrain in Computer Users

Variables	Frequency	Persentation (%)
Eye Fatigue		
Yes	72	83,3%
No	14	16,3%
Eye Rest		
Risk	53	61,6%
No Risk	33	38,4%

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Eye Refractive Abnormalities		
Risk	50	58,1%
No Risk	36	41,9%
Lighting Level		
No Qualify	16	18,6%
Qualify	70	81,4%
Monitor Height		
No Optimal	3	3,5%
Optimal	83	96,5%

Based on Table 1, it can be seen that of the 86 respondents, 72 (83.7%) respondents experienced eye fatigue and 14 (16.3%) respondents did not experience eye fatigue. there were 53 (61.6%) respondents at risk because they took an eye break for less than 15 minutes within 2 hours of using a computer and there were 33 (38.4%) respondents who were not at risk because they took a minimum of 15 minutes of rest within 2 hours of using a computer. as many as 50 (58.1%) were at risk with eye refractive errors and there were 36 (41.9%) not at risk with no eye refractive errors. 70 respondents (81.4%) respondents whose lighting level met the requirements and 16 (18.6%) respondents had a lighting level that did not meet the requirements. and as many as 83 (96.5%) respondents have optimal monitor height and as many as 3 (5.3%) respondents have monitor height that is not optimal.

B. Results of Bivariate Analysis

Table 2. Factors Associated with Eyestrain in Computer Users

Variables	**Eye Fatigue**						***P Value***
	Yes		**No**		**Total**		
	N	**(%)**	**N**	**(%)**	**N**	**(%)**	
Eye Rest							
Risk	51	96,2	2	3,8	53	100	0,000
No Risk	21	63,6	12	36,4	33	100	
Eye Refractive Abnormalities							
Risk	48	96,0	2	4,0	50	100	0,001
No Risk	24	63,6	12	33,3	36	100	
Lighting Level							
No Qualify	12	75,0	4	25,0	16	100	0,295
Qualify	60	85,7	10	14,3	70	100	
Monitor Height							
No Optimal	2	66,7	1	33,3	3	100	0,415
Optimal	70	84,3	13	15,7	83	100	

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1. **Relationship Between Eye Rest and Eyestrain in Computer User Workers at PT. Krakatau Bandar Samudera in 2022**

According to Pheasant (1991) eye fatigue means eye strain and is caused by the use of the sense of sight in work which requires the ability to see for a long time which is usually accompanied by uncomfortable viewing conditions. According to the America Optometric Association (AOA) it is recommended to do eye rest when using a computer for a long time. The average length of time used for eye rest is 15 minutes.

Based on the results of bivariate analysis, it can be seen from 53 respondents who are at risk because they do not rest their eyes or take eye breaks for less than 15 minutes in 2 hours of computer use, there are 51 (96.2%) respondents experiencing eye fatigue and 2 (3.8%)) did not experience eye fatigue. Whereas of the 33 respondents who were not at risk because they took a minimum eye rest of 15 minutes in 2 hours of computer use, 21 (63.6%) experienced eye fatigue and 12 (36.4%) respondents did not experience eye fatigue. The results of bivariate analysis using the Chi square test obtained P values of 0.000 (Pv < α), meaning that statistically at α 5% there is a significant relationship between eye rest and eye fatigue. And the results of OR = 14,571 computer user workers who are at risk of not resting their eyes for at least 15 minutes in 2 hours of computer use have a 14 times greater risk of experiencing eyestrain than computer workers who do eye rest for at least 15 minutes in 2 hours of computer use.
This research is in line with research conducted by Hasyim (2011) with Pvalue = 0.042 which states that there is a significant relationship between eye rest and complaints of eye fatigue in workers who use computers at the Palembang Samsat Office, and Fatima's research (2018) with Pvalue = 0.000 which states there is a significant relationship between eye rest and complaints of eye fatigue in computer workers at PT. Antam Tbk, Bogor Regency.

Efforts that can be made to prevent eye fatigue can be done by looking at an object (object or other thing) with a different focus and it is recommended that it is farther away than the distance between the monitor and the eye. According to the Ministry of Health of the Republic of Indonesia concerning the Prevention and Control of Non-Communicable Diseases (P2PTM) how to rest good eyes with the 20-20-20 rule, namely taking a break after 20 minutes of working on a computer, looking at objects 20 feet (6 meters) away for 20 seconds , then blinked eyes, then close the eyes, and slowly open the eyes. The frequency of regular eye rest is useful for breaking the chain of fatigue so that it will add comfort to computer users (Suma'mur, 2014).

2. **Relationship Between Eye Refractive Disorders and Eye Fatigue in Computer User Workers at PT. Krakatau Bandar Samudera in 2022**

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Refractive error is an eye disorder that has been previously diagnosed. Abnormalities in the form of firm shadows are not formed on the retina. In refractive errors, there is an imbalance in the optical system in the eye, resulting in blurred images (Ilyas, 2018).

The results of cross-tabulation between the variables of eye refraction and complaints of eye fatigue were found in respondents who had more eye refractive errors, namely 48 respondents (96.0%). Meanwhile, there were fewer respondents who did not experience eye refraction disorders and experienced complaints of eye fatigue, namely 24 respondents (66.7%). The results of bivariate analysis using the Chi square test obtained P values of 0.001 (Pv < α), meaning that statistically at α 5% there is a significant relationship between eye refractive errors and eye fatigue in computer user workers at PT. Krakatau Bandar Samudera In 2022 with an OR = 12,000, computer user workers with eye refractive errors have a 12 times greater risk of experiencing eye fatigue compared to workers who do not experience eye refractive errors. This research is in line with research conducted by Yanti (2020) with Pvalue = 0.017 which states that there is a significant relationship between eye refraction disorders and complaints of eye fatigue in computer user workers at PT. Gunanusa Utama Fabricators Serang-Banten 2020.

The results of this study are in line with the theory which suggests that eye refractive errors can cause eye fatigue due to the constant accommodation to be able to see the subject clearly. In nearsightedness (myopia) refractive errors are caused by too strong eye refraction, the eye axis is too long or the lens is too convex. Symptoms of myopia are vision that appears blurry when far away, and only clear at relatively close distances. Apart from that, sufferers of hypermetropia or nearsightedness, these sufferers cannot or are blurry when they see close objects. Whereas patients with asigmatism (cylinder) usually see shaded objects, the symptoms of this condition are tired eyes, dizziness, blurred vision when looking at a distance, while seeing up close is better, and views that are not focused (Ilyas, 2018).

Efforts that can be made to minimize the occurrence of complaints of eye fatigue for computer workers by applying more good rest patterns, conducting periodic eye examinations or when experiencing complaints of eye fatigue, so that if there are abnormalities in the eye can be carried out immediately Treatment or therapy for the eye , as well as wearing glasses specifically designed for using computers, namely the top of the lens to see the computer and the bottom to read.

3. The Relationship Between Computer Lighting Levels and Eyestrain in Computer User Workers at PT. Krakatau Bandar Samudera in 2022

According to the Minister of Manpower Regulation No. 50 of 2018, regarding the safety and health of the work environment, lighting is something that provides light (light) or that illuminates which includes natural lighting and moon lighting.

The results of cross-tabulation between computer lighting level variables

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and eye fatigue complaints were obtained from 16 respondents with lighting levels that did not meet the requirements, 12 (75.0%) respondents experienced eye fatigue and 4 (25.0%) respondents did not experience eye fatigue. While of the 70 respondents with lighting levels that met the requirements, there were 60 (85.7) who experienced eye fatigue and 10 (14.3%) did not experience eye fatigue. The results of bivariate analysis using the Chi square test obtained P values of 0.295 (Pv>α), meaning that statistically at α 5% there was no significant relationship between computer lighting levels and eye fatigue at PT. Krakatau Bandar Samudera in 2022.

The research results show that the average computer radiation level is 298.6 lux. The results of the analysis show that there is no significant relationship between eye fatigue and the level of computer radiation lighting on computers at PT. Krakatau Bandar Samudera in 2022 with a Pvalue = 0.295. The results of this study are not in line with Indah's research (2021) which states that there is a significant relationship between computer radiation levels and eye fatigue with Pvalue = 0.001.

Adequate and well-regulated lighting is one of the factors to get a comfortable and safe working environment. How to set up good lighting according to standards, namely: the management is responsible for controlling in providing lighting in the workplace, the size of the spacious room is more efficient, the placement of light bulbs can produce irradiation, avoiding the use of shiny paint, natural and artificial lighting does not cause glare and using lamps with a lot of small power rather than lamps with a small amount of power (PT Safety Sign Indonesia, 2017).

Efforts that can be made by the company to improve lighting levels that are below standard are to turn on all the lights according to the standards, namely a minimum of 300 Lux and a maximum of 700 Lux in each room that is used for work, increase the wattage of the lamps or replace them with energy-efficient lamps that have more optimal lighting levels and adjusting the position of the workplace or the position of the lamp in order to produce optimum and standard lighting.

4. The Relationship Between Monitor Height and Eyestrain in Computer User Workers at PT. Krakatau Bandar Samudera in 2022

The height of the monitor is the height of the center of the monitor as measured from the horizontal line of the eye. The computer should be placed parallel to the horizontal line of the eye with the center of the monitor screen. when looking at objects at close range, the eye lens will thicken to focus on a close object. Each eye brings the vision axis closer so that it can see the target. This mechanism involves accommodation and convergence processes. If the eye looks at a close object for a long time, it will cause ciliary muscle tension, causing eye fatigue. The farther the object is viewed, the less eye fatigue due to accommodation and convergence. The optimal height is

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usually 20 cm to 29 cm below the horizontal line of the eye (Candra Dewi, 2009).

Based on the results of research conducted from 3 respondents with monitor height that was not optimal, there were 2 (66.7%) who experienced eye fatigue and 1 (33.3%) did not experience eye fatigue. Meanwhile, from 83 respondents with optimal monitor height, 70 (84.3%) respondents experienced eye fatigue and 13 (15.7%) respondents did not experience eye fatigue. The results of bivariate analysis using the Chi square test obtained P values of 0.415 (Pv>α), meaning that statistically at α 5% there was no significant relationship between Monitor Height and Eyestrain at PT. Krakatau Bandar Samudera in 2022. This is not in line with research conducted by Candra Dewi (2009), namely that among 22 respondents who worked with a monitor height that was not optimal, 20 people (90.9%) experienced eye fatigue and 2 others (9 .1 %) did not experience eye fatigue. Meanwhile, among the 23 respondents who worked at optimal monitor height, there were 12 people (52.2%) who experienced eye fatigue and 11 people (47.8%) did not experience eye fatigue.

Based on the results of measurements carried out by Candra Dewi (2009) on respondents who work with monitor heights that are not optimal, there are as many as 22 people or 48.9%. Monitor height is one of the factors that can affect eye fatigue. Evaporation of tears often occurs in computer users with monitor heights that are not parallel or higher than the horizontal line of the eyes. This causes the ocular surface of the eye to be wider. The wider the ocular surface of the eye, the more evaporation of tears which can make the eyes dry.

The factor suspected to be the cause of the height of the monitor is related to eye fatigue, namely the mismatch between the height of the table and the height of the respondent's sitting elbow. A table that is higher than your elbows sits on causes the monitor to be higher than your eyes. In this condition the respondent's eyes will look straight up so that the ocular surface of the eye becomes wider and more evaporation of tears occurs. In addition, tear evaporation can also be caused by an air-conditioned workplace. While the respondent was working, the Air Conditioner (AC) was always turned on so that the humidity in the room was low. Low humidity will increase tear evaporation so that this can cause workers to complain of eye fatigue.

Conclusion

1. Based on the results of the research and analysis carried out, there is a relationship between eye rest and eye refraction disorders on complaints of eye fatigue in computer user workers at PT. Krakatau Bandar Samudera in 2022
2. There is no relationship between lighting levels and monitor height on eye fatigue in workers who use computers at PT. Krakatau Bandar Samudera in 2022
3. Based on the results of direct measurements and observations, lighting and monitor height, most of them are in good condition and meet the established standards.

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Suggestion

1. After working for 1.5-2 hours using a computer, workers are expected to be able to stretch (stretching), stretching can be done for 5 minutes after using a computer, this stretching serves to relax the muscles in the worker's body.
2. Workers who use gadgets > 4 hours are expected to reduce the use of gadgets when outside the office (at home) because this can affect eye health.
3. It is hoped that workers can maintain healthy eyes by eating nutritious foods that contain lots of Vitamin A, for example carrots, tubers, nuts, and vegetables such as broccoli and spinach.

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