Fatigue and Its Relationship with Age: A Study of Indonesian Computer-Using Employees in Higher Institution

by Syamsul Gultom

Submission date: 25-Jun-2020 02:07PM (UTC+0700)
Submission ID: 1349416787
File name: ARTIKEL_REKTOR_DI_JURNAL_PSYCHOSOCIAL.pdf (449.5K)
Word count: 6112
Character count: 33204

International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 08, 2020
ISSN: 1475-7192
DOI: 10.37200/IJPR/V24I8/PR281404

Fatigue and Its Relationship with Age: A Study of Indonesian Computer-Using Employees in Higher Institution

Syamsul Gultom[1], Dewi Endriani[2], Agustin Sastrawan Harahap[3]

***Abstract*---**Nowadays, more and more people are using computers for work, particularly among office workers. There is a high risk of fatigue during working time or after that. This fatigue condition might be experienced physically and mentally by the workers. Numerous studies have examined fatigue in employees working physically, but the purpose of this research is to recognize mental and physical fatigue for employees working with age-related computers. This study is a quantitative study with forty-one employees as the participants. The study took place in one of the government universities in Indonesia. Physical fatigue was assessed using the Whole Body Reaction Tester (WBRT) and emotional fatigue (EF) was assessed using the Bourdon Wiersman Test. The data were tested by normality, homogeneity, and T-tests. The results showed that the elderly group experienced visual physical fatigue while the younger group experienced audio physical fatigue. Some of the participants felt secure with mental fatigue at work speed and had issues with mental fatigue at work accuracy and consistency. Further research needs to be carried out in order to determine the causes of these problems.

***Keywords*---**Computer users, physical fatigue, mental fatigue, age, whole body reaction test, bourdon wiersman test

1 Introduction

Fatigue may be described as a diminished capacity to conduct tasks at the optimal degree due to lassitude or fatigue of mental or physical strength (Hallowell, 2010; Gander et al., 2011). Those are signs of neurological degradation attributable to the symptoms of exhaustion. For example, exhaustion inhibits the role of the prefrontal cortex, thereby influencing simple and complicated

[1] *The Lecturer in Sport Sciences Faculty, Universitas Negeri Medan, Medan, Indonesia.*
[2] *The Lecturer in Sport Sciences Faculty, Universitas Negeri Medan, Medan, Indonesia.*
[3] *The Lecturer in Sport Sciences Faculty, Universitas Negeri Medan, Medan, Indonesia.*

***Corresponding author**: Gultom, S. Email: syamsulgultom@unimed.ac.id*
Manuscript submitted: 09 Feb 2020, Manuscript revised: 18 March 2020, Accepted for publication: 27 April 2020

cognitive functions such as the capacity to focus and assimilate new knowledge, schedule, interpret and react to new stimulus (Angus & Heslegrave, 1985; Harrison & Horne, 1999; Lorist et al., 2000; Van Dongen & Dinges, 2005). Due to physiological deterioration, exhaustion can seriously impair the individual's capacity to function comfortably and efficiently.

Fatigue is often commonly characterized as a physiological condition of diminished mental or physical capacity arising from sleep deprivation, circadian period, and workload (Walker, 2006; Poolton et al., 2007; Purvis et al., 2010). Potential health implications arising from extensive computer associated study have been of substantial apprehension ended the past period, through tiredness and musculoskeletal topics (e.g. Sillanpää et al., 2003; Buckle, 2005; Jens Wahlstrom, 2005; Woods, 2005; Kimura et al., 2007) and idea concerns (e.g. Blehm et al., 2005; Woods, 2005) as prime instances.

Throughout the meantime, numerous experiments have been performed to assess specific risk factors for job-related upper extremity disorders (WRUEDs) across separate occupational groups for computer-related research with WRUED (e.g. Faucett & Rempel, 1996; Lassen et al., 2004; Andersen et al., 2008; Janwantanakul et al., 2008).

Fatigue is common issue in universal community as well as in prime and behavioral health treatment environments (e.g. Zafran et al., 2011; Günther et al., 2017; Manikanta et al., 2020; Bramastyo & Syarifah, 2020). The high levels of fatigue-related incidence are especially disconcerting because exhaustion adversely impacts everyday functioning and quality of life (Mäurer et al., 2016) and results in substantial economic costs (Fann et al., 2018). Given the individual and financial meaning of this disorder, it leftovers little recognized then under-treated.

Fragment of the explanation for our inadequate comprehension is exhaustion a dynamic, multidimensional structure is completely individual. For case, tiredness may be categorized into peripheral or central fatigue (e.g. Davis, 1995; Schillings et al., 2003; To et al., 2019) while peripheral fatigue is directly linked to the pathophysiological nature of the disease, central fatigue is characterized by symptoms that transcend some observable physical disability.

Tiredness can often take separate psychological or bodily aspects, such as elements have been found through the variety of illnesses (e.g. Westbrook et al., 2016; Rizou et al., 2016; De Gucht et al., 2017). Physical exhaustion is defined by somatic symptoms of weakness (i.e. loss of stamina or influence forte), while intellectual or behavioral exhaustion is described by difficulties in focusing and loss of alertness and capacity to perform cognitive activities involving self-motivation (e.g. Shokri et al., 2005; Simpson & Zambuko, 2011; Binnie, 2015)

Numerous experiments have been performed to deal with exhaustion and jobs. But most of the research studied exhaustion in employees whose jobs require more physical activity. Some of them are a report by Sneddon et al. (2013) “Stress, fatigue, situation awareness and safety in offshore drilling crews”, the essay by Techera (2017) “Measuring and Managing Construction Worker Fatigue”, and a book by Shinar (2017) “Fatigue and Driving”. Sørengaard et al. (2019) conducted Longitudinal and cross-sectional analysis of the connection among character and tiredness between alteration hands of the connection among character and tiredness between change workforces. In the meantime, this study focused on fatigue felt by computer-based

workers. Boolani et al. (2020) manierre performed an exploratory multivariate analysis investigating associated characteristics of mental and physical exhaustion and strength. Thus Lou et al. (2001) studied Exacerbated physical fatigue and mental fatigue in Parkinson's disease. These two researches looked at mental and physical exhaustion related to energy, depression, and insomnia.

This current study explored the mental and physical fatigue correlated with age of computers users. As we know, computers use has become an integral part of many professions over the last decades. The complexity of the office job has changed with the advent of computer data processing. Extended device usage subjects staff to a heavy visual and sensory load and the use of a mouse and keyboard means repetitive movements of the upper extremity.

Any scholars have also conducted studies on the use of machines. Blagojević et al. (2012) studied the Risk Factors for Health Disorders of System Operators in Telecom Serbia. Thus Hwang et al. (2010) studied the impact of inactive computer period and non-computer period on the production of electronic operation tracking. Most sof the previous computer usage experiments have still struggled with physical activity.

The analysis was therefore designed to determine the degree of fatigue felt by the staff working with the computers. Measurement of mental fatigue was conducted using the Bourdon wiersman (BWT) method, whereas physical fatigue was assessed by the Whole Body Reaction Test (WBRT).

The participants in this research were staff members of one Indonesian higher institution in Sumatra Utara. Employees operate on a machine for a total of 6 hours a day and 5 full working days. It ensures that the staffs operate 30 hours a week in front of the machine. Most of them use a device to format papers.

The research also established the extent of exhaustion related to the age of employees. The findings define exhaustion dependent on age. Participants were divided into three age classes. The first group composed of workers under 20 and 30 years of age, the second category of workers under 30 and 40 years of age and the third group of employees above 40 years of age.

Many people claim that working in an educational facility is more comfortable than in any other environment, because workers are not harassed. This research explored the mental and physical exhaustion felt by the staff. There are two forms of physical exhaustion; audio physical fatigue and visual physical fatigue. There are three forms of mental exhaustion assessed in this analysis. These are mental fatigue on working speed, mental fatigue on working accuracy, and mental fatigue on working consistency.

There are four degrees of audio-visual physical exhaustion encountered by the assessment workers. The rates are regular, mild, serious, and extreme. Some of the workers felt a modest degree of audio-visual physical fatigue. There are also four degrees of emotional fatigue felt by workers. They are fine, decent, adequate and questionable.

2 Method

Data

The participants in this study were the workers using computers in one university in Sumatera Utara, Indonesia. Forty one participants were chosen randomly. The participants consist of 31 male workers and 10 female workers. The data then were divided into three groups based on the age. The groups of participants can be seen from the Table 1.

Table 1

Group of the participants

Gender	Group 1 (20-29 years old)	Group 2 (30-39 years old)	Group 3 (>40 years old)
Male	10	10	11
Female	3	6	1
Total	13	16	12

The first group consists of the participants whose ages are around 20-29 years old. There are 13 participants in this group with 10 male participants and 3 female participants. The second group consists of 16 participants whose ages are around 30-39 years old. This group has the largest numbers of participants among other groups with 10 male participants and 6 female participants. The last or the third group consists of participants whose ages are more than 40 years old. There are 12 participants with 11 male participants and only one female participant.

Instrument

Normality test

Normality Test is one of the evaluation criteria for study and is used to determine whether or not the research data carried out has a normal distribution. The normality test used for this analysis is the Kolmogorov-Smirnov normality test. The basic concept of the Kolmogorov Smirnov normality test is to equate the data distribution (which will be checked for normality) with the standard normal distribution (e.g. Lilliefors, 1967; Razali & Wah, 2011; Marwa Ahmed Fadl, 2019). So it can be said that the Kolmogorov Smirnov test is a measure of the difference between the normality test data and the standard normal data. The test method is, as in the usual difference test, if the significance is below 0.05, it means that there are significant differences or abnormal data, and if the significance is above 0.05, there is no significant difference and it means that the data is normal, not different from normal standards. The benefit of this method is that it is clear and does not cause variations in interpretation between one observer and another observer.

Table 2

Normality test on physical and mental fatigue

Physical and mental fatigue	Mean	Kolmogorov-Smirnov	Sig.	Status
WBR audio - Pretest	0.448	0.2	p>0.05	Normal
WBR visual- Pretest	0.542	0.2	p>0.05	Normal
Speed - Pretest	7.667	0.2	p>0.05	Normal
Accuracy - Pretest	11.268	0.071	p>0.05	Normal
Consistency- Pretest	6.491	0.2	p>0.05	Normal

The final results of the normality test above indicate that the samples tested were normally distributed, with a significance value greater than 0.05.

Homogenity and T-Test

Homogeneity test is done as a prerequisite for analysis of variance that will be used in this report. Homogeneity test is performed by Levene test on every component. The method of testing is as in the normal homogeneous test, if the significance is below 0.05, the data are not homogeneous, and if the significance is above 0.05 then the data is homogeneous. As for the t-test, the value of the t-test must be less than 0.05 such that the result is accepted.

Table 3

Homogenity and T-Test on Physical and Mental fatigue

Physical and mental fatigue	Levene's Test	Sig.		T-test	Status
WBR audio	0.373			<0.001	
WBR visual	0.224			<0.001	Ha
Speed	0.134	p>0.05	Homogen	<0.001	
Accuracy	0.343			<0.001	Accepted
Consistency	0.175			<0.001	

The final result of the homogeneous test above shows that the sample tested is homogeneous, with a significance value greater than 0.05. The result of these homogeneous tests above showed that the sample tested is homogeneous, with a significance value greater than 0.05. The fatigue levels of the participants were measured by the Whole Body Reaction Tester (WBRT) and Bourdon Wiersman test.

This study used two instruments in measuring the physical and mental fatigue. Whole Body Reaction (WBR) test was applied to measure the physical fatigue of the participants. From this test, the audio-visual physical fatigue measurement of the participants was achieved.

The second instrument was Bourdon Wiersma test. This tool test was applied to measure the mental fatigue of the participants. Mental fatigue on working speed, mental fatigue on working accuracy, and mental fatigue on working consistency was achieved from this measurement. These two instruments were used to get the data from the participants.

Data Analysis

The data in this study were 41 participants which consisted of 31 male workers and 10 female workers. More participants or about 16 workers were in group 2 which means their ages were 30-39 years. Most of the participants or about 18 workers have been working for over than ten years. The working period of the participants can be seen from the Table 4.

Table 4

Working period of the participants

Working period	Group 1 (20-29 years old)	Group 2 (30-39 years old)	Group 3 (>40 years old)
< 5 years	8	3	0
< 10 years	5	6	1
> 5 years	-	7	11

The participants whose working period was less than 5 years were about 11 workers. Most of the participants or about 8 workers were in the group 1 whose ages were 20-29 years. While the participants whose working period was less than 5 years included in group 2 whose ages 30-39 years were about 3 workers.

The participants who had less than 10 years working period were about 12 workers. Five participants in group 1, six participants in group 2, and only one participant was in group 3. On the other hand, the workers whose working period was more than 10 years were about 18 participants. There was no participant whose working period is more than 10 years in group 1. It is because the participants in this group were still young so it was impossible for them working more than 10 years. There were 7 participants in group 2 whose working period was more than 10 years. And there were 11 participants in group 3 whose working period was more than 10 years. There were more participants in group 3 whose working period was more than 10 years than other groups because the older participants should have worked longer than others.

Physical Fatigue Measurement

After grouping the participants into 3 groups then the participants were given Whole Body Reaction Test (WBRT) to measure the physical fatigue. There were two kinds of physical fatigue which were measured in this test; they were audio physical fatigue and visual physical fatigue.

The results of the measurement were ranged from the normal, mild, medium, and severe. The Figure 1 explained the audio and visual physical fatigue.

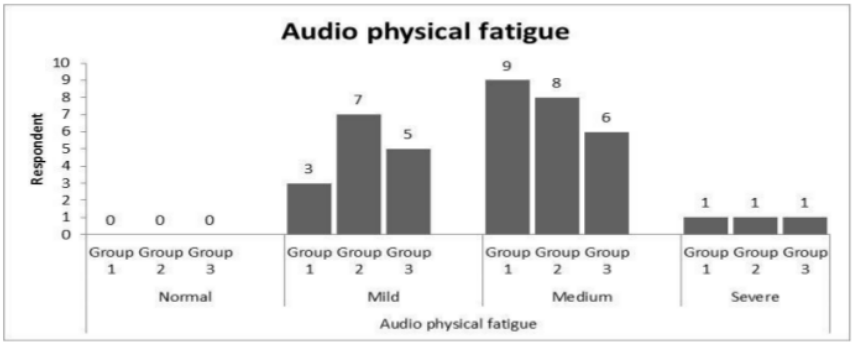

Figure 1. Audio Physical Fatigue measurement

After measuring the physical fatigue using Whole Body Reaction Test (WBRT), the results of audio-visual physical fatigue then classified into four levels. The levels are normal, mild, medium, and severe. There is no participant experienced the normal audio-visual physical fatigue. There were 7 participants in group 2 experienced the mild level of audio physical fatigue. Then it was followed by the participants in group 3 with 5 participants experiencing the mild level. There were 3 participants in group 1 experiencing the mild level of audio physical fatigue. Altogether there were 15 participants experiencing the mild level of audio physical fatigue.

There were 9 participants in group 1 experienced the medium level of audio physical fatigue. Then, there are 8 participants in group 2 experienced the medium level. Meanwhile, there were 6 participants in group 3 experienced the medium level of audio physical fatigue. The total number of participants experiencing the medium level of audio physical fatigue was 23 participants.

There was only one participant of each age group experiencing the severe level of audio physical fatigue. It means that there were 3 participants experiencing this level.

After measuring the physical fatigue using Whole Body Reaction Test (WBRT), the results of audio-visual physical fatigue then classified into four levels. The levels are normal, mild, medium, and severe. There is no participant experienced the normal audio-visual physical fatigue. There were 7 participants in group 2 experienced the mild level of audio physical fatigue. Then it was followed by the participants in group 3 with 5 participants experiencing the mild level. There were 3 participants in group 1 experiencing the mild level of audio physical fatigue. Altogether there were 15 participants experiencing the mild level of audio physical fatigue.

There were 9 participants in group 1 experienced the medium level of audio physical fatigue. Then, there are 8 participants in group 2 experienced the medium level. Meanwhile, there were 6 participants in group 3 experienced the medium level of audio physical fatigue. The total number of participants experiencing the medium level of audio physical fatigue was 23 participants.

There was only one participant of each age group experiencing the severe level of audio physical fatigue. It means that there were 3 participants experiencing this level.

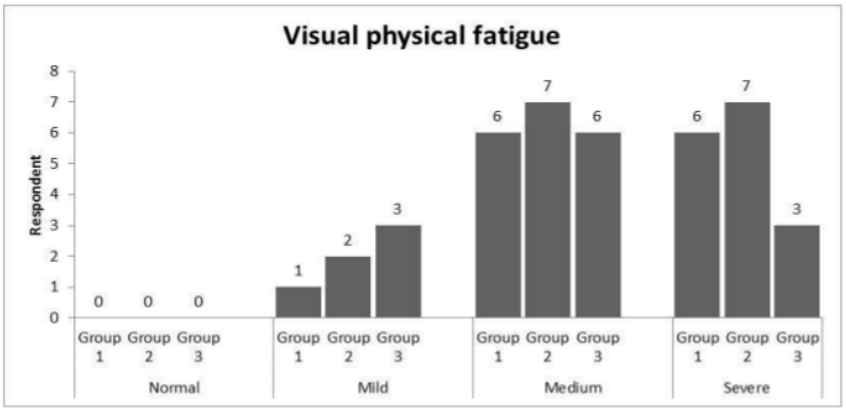

Figure 2. Visual Physical Fatigue Measurement

It was not different from the audio physical fatigue, there was no participant experiencing the normal level in visual audio physical fatigue. Then, there was 1 participant from group 1 who experienced the mild level of visual physical fatigue. There were 2 participants from group 2 experienced the mild level of visual physical fatigue. And there were 3 participants from group 3 experienced the mild level of visual physical fatigue. The total numbers were 6 participants experienced the mild level of visual physical fatigue.

The numbers of participants experiencing the medium level of visual physical fatigue were 19 participants. There were 6 participants experiencing the visual physical fatigue from group 1. This number was also found in group 3. While in group 2, it was found that there were 7 participants experiencing the visual physical fatigue in medium level.

The participants in this research who the experienced severe visual physicals level fatigue are less than the participants who experienced the medium level of visual physical fatigue. It was found that there were 16 participants who experienced the severe level of visual physical fatigue. These numbers were spread from age group 1, 2, and 3. There were 6 participants in group 1, seven participants in group 2, and 3 participants in group 3. It was noted that there were less participants in group 3 who experienced the severe level of visual physical fatigue than the participants from other groups. In which it was known that the participants in group 3 are older that other groups.

Mental Fatigue Measurement

The next data were gained from measuring the mental fatigue using Bourdon Wiersman test. There were 3 types of mental fatigue analysed in this test. The first type was mental fatigue on working speed which meant that the participants experienced the mental fatigue due to the

working speed. The second type is mental fatigue on working accuracy which meant that the participants experienced fatigue by working accurately. The last type was mental fatigue on working consistency. It meant that the participants experienced the mental fatigue dealing with working consistently.

There were 4 levels of mental fatigue classified in this measurement; they were good, fair, adequate, and doubtful level. In the first type of mental fatigue on working speed, it was found that there were 37 participants experiencing good level of mental fatigue on working speed. It means that most of the participants did not experience mental fatigue on working speed. The participants spread in all age groups. There were 12 participants in group 1, 14 participants in group 2, and 11 participants in group 3. Meanwhile, there were 3 participants experiencing fair level of mental fatigue on working speed. There was only 1 participant from age group 1 and 2 participants from group 2. There was no participant experiencing the fail level of mental fatigue on working speed from group 3. On the other hand, there was 1 participant from group 3 experiencing adequate level of mental fatigue on working speed but there was no participant from other groups. There was no participant from all groups experiencing the doubtful level of mental fatigue on working speed.

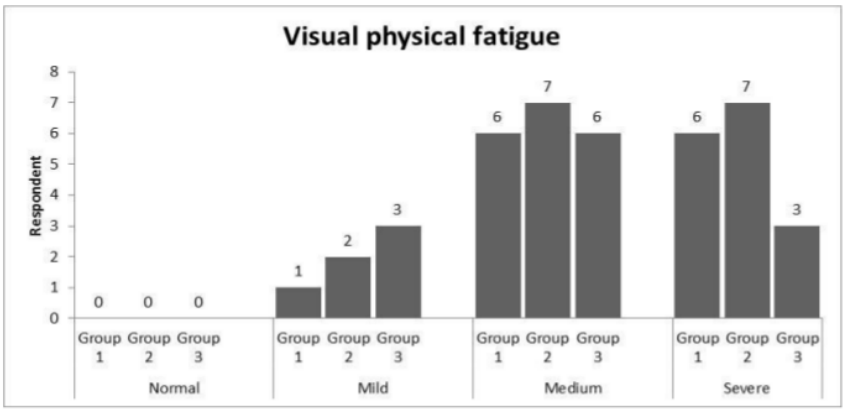

Figure 3. Mental Fatigue on Working Speed Measurement

It was very different from first type, in the second type of mental fatigue on working accuracy, it was found that there was no participant experiencing good and fair level of this mental fatigue. There were 10 participants experiencing an adequate level of mental fatigue on working accuracy from group 1, group 2 are 13 participants, then group 3 has 4 participants. This number showed that younger participants more experienced mental fatigue on working accuracy than the old ones.

On the other hand, 3 participants in group 1 and 2 experiencing doubtful level of mental fatigue on working accuracy. There were 8 participants experiencing doubtful level of mental fatigue on working accuracy. It meant that the older participants had problem with mental fatigue on working accuracy.

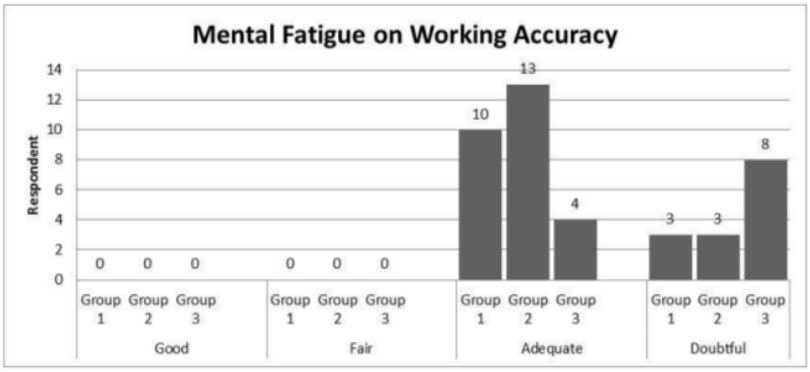

Figure 4. Mental Fatigue on Working Accuracy Measurement

In line with mental fatigue on working accuracy, there was also no participant experiencing mental fatigue on working consistency in good and fair level. But, there was one participant from group 3 experiencing fair level of mental fatigue on working consistency. There were 23 participants experiencing mental fatigue on working consistency. There were 8 participants from group 1, 10 participants from 2, and 5 participants from group 3. In doubtful level of mental fatigue on working consistency, it was found that there were 5 participants from group 1, 6 participants from group 2, and 6 participants from group 3. It can be seen from the Figure 5.

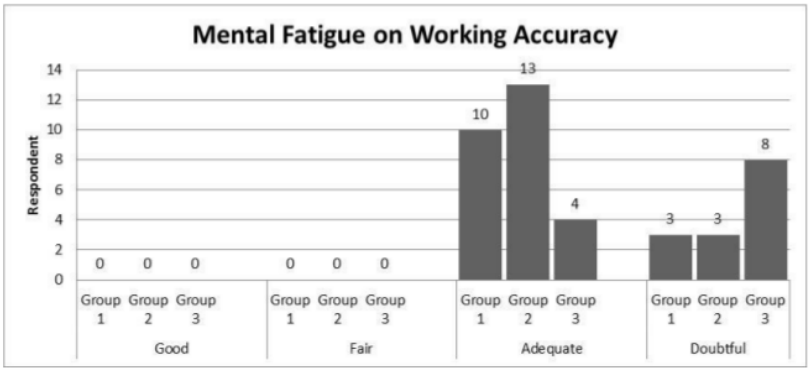

Figure 5. Mental Fatigue on Working Consistency Measurement

3 Results and Discussion

Fatigue during working is the problem which is faced by almost all of the employees in the world. Whatever the occupation, the employees must have experienced fatigue in working. The levels of fatigue are different among the employees based on the kinds of their occupations. Some studies have been conducted to measure the fatigue levels on employees. In this study, the fatigue levels

were measured on employees working with computers. Working with computers is assumed as the easy work since the employees do not perform many physical activities. So, this study tried to prove this argument whether it is accepted or not.

Reaction time is an important component of motor movements. It is one of the important methods to study a person's central information processing speed and fast coordinated peripheral movement response. Audio-visual reaction time is the time taken by an individual to react to an auditory or visual stimulus respectively. Whole body reaction time determines the time taken for moving the whole body in various directions in response to visual stimuli.

Almost half of the employees or around 56,10% experienced audio physical fatigue. More employees in the first group (39,13%) experienced this fatigue. It is quite surprising that the employee with the younger age experienced more audio physical fatigue than the employees with older age. Only a few employees experienced the severe audio physical fatigue.

On the other hand, most of the employees experienced the severe visual physical fatigue. It is a common problem found in people working with computers since working with computer needs more visual activities. The finding in this study is more employees with younger age suffered from visual physical fatigue than the older employees. It indicates that the young computer users do not take care of their eyes health during the working time. The further study needs to conduct to analyse this phenomena.

Some workers have no difficulty with working speed as a result of mental fatigue. Obviously, their work is easier to complete by using machines. In the meantime, older workers had difficulty coping with emotional exhaustion. The quality of their research was difficult for most older workers. That is not the case with younger workers. This finding can be related with the other trial who found that the response time of the entire body in older age groups is substantially increased. There may be a variety of potential explanations for this delay:

1. Axonal and progressing age degeneration and axonal shrinkage. It not only increases mental recovery time, but also reduces the pace at which neurons are stimulated.
2. Lack of coordination with the elderly due to incapacity to keep the balance between agonists and muscles of antagonists, particularly when moving rapidly.
3. Motor skills can be decreased by increasing age.

The audio-visual and body response times rise as age increases with both of these factors. The practical consequence of this result is that elderly people must be vigilant during general movements, since in an unexpected emergency they cannot respond rapidly. To order to avoid future accidents, more rigorous measures will also be applied for renewal of driving license to higher age groups.

This study also revealed that most of the employees experienced the mental fatigue on working consistency. They were having problem to work consistently using the computers. But there was one employee did not experience this condition. This employee came from the third group which means this employee was old in age.

The findings revealed that most workers felt an acceptable degree of intellectual exhaustion. This is recommended to the institutional to reduce the emotional and physical exhaustion of

workers. It can then be inferred that workers operating with a university machine felt emotional and physical fatigue. Further research has to be carried out into the origin of fatigue. The fatigue assessment of lecturers and students will also be a possible research in the future.

4 Conclusion

After analysing the data and making the discussion, it can be concluded that age is not the onset factor for the fatigue experienced by the computer users. The elderly group was having physical and mental fatigue on particular types and so was the younger group. Age is not the factor for the employees experiencing fatigue. The further study is needed to perform to find out the cause of the fatigue on the computer users in Indonesia.

Acknowledgments

The authors would like to thank Universitas Negeri Medan (UNIMED) of Faculty of Sport Science for a Grant awarded to the researchers to conduct the fatigue research for the employees in UNIMED.

References

[1] Andersen, J. H., Harhoff, M., Grimstrup, S., Vilstrup, I., Lassen, C. F., Brandt, L. P. A., Kryger, A. I., Overgaard, E., Hansen, K. D., & Mikkelsen, S. (2008). Computer mouse use predicts acute pain but not prolonged or chronic pain in the neck and shoulder. *Occupational and Environmental Medicine*, *65*(2), 126–131. https://doi.org/10.1136/oem.2007.033506

[2] Angus, R. G., & Heslegrave, R. J. (1985). Effects of sleep loss on sustained cognitive performance during a command and control simulation. *Behavior Research Methods, Instruments, & Computers*, *17*(1), 55–67. https://doi.org/10.3758/BF03200897

[3] Binnie, J. (2015). Cognitive behavioural treatment for problematic hoarding: A case study. *International Journal of Psychosocial Rehabilitation*, *20*(1), 5–14.

[4] Blagojević, L., Petrović, B., & Blagojević, J. (2012). Risk factors for health disorders in computer operators in telecom Serbia. *International Journal of Occupational Safety and Ergonomics*, *18*(3), 321–327. https://doi.org/10.1080/10803548.2012.11076935

[5] Blehm, C., Vishnu, S., Khattak, A., Mitra, S., & Yee, R. W. (2005). Computer vision syndrome: A review. In *Survey of Ophthalmology* (Vol. 50, Issue 3, pp. 253–262). https://doi.org/10.1016/j.survophthal.2005.02.008

[6] Boolani, A., Ryan, J., Vo, T., Wong, B., Banerjee, N. K., Banerjee, S., Fulk, G., Smith, M. L., & Martin, R. (2020). Do Changes in Mental Energy and Fatigue Impact Functional Assessments Associated with Fall Risks? An Exploratory Study Using Machine Learning. *Physical and Occupational Therapy in Geriatrics*. https://doi.org/10.1080/02703181.2020.1748788

[7] Bramastyo, A., & Syarifah, D. (2020). The role of perceived organizational support on safety climate in construction workers. *Talent Development and Excellence*, *12*(SpecialIssue2), 583–590.

[8] Buckle, P. (2005). Ergonomics and musculoskeletal disorders: Overview. *Occupational Medicine*, *55*(3), 164–167. https://doi.org/10.1093/occmed/kqi081

[9] Davis, J. M. (1995). Central and peripheral factors in fatigue. *Journal of Sports Sciences*, *13*, S49–S53. https://doi.org/10.1080/02640419508732277

[10] De Gucht, V., Garcia, F. K., den Engelsman, M., & Maes, S. (2017). Do changes in illness perceptions, physical activity, and behavioural regulation influence fatigue severity and health-related outcomes in CFS patients? *Journal of Psychosomatic Research*, *95*, 55–61. https://doi.org/10.1016/j.jpsychores.2017.02.009

[11] Fann, N., Alman, B., Broome, R. A., Morgan, G. G., Johnston, F. H., Pouliot, G., & Rappold, A. G. (2018). The health impacts and economic value of wildland fire episodes in the U.S.: 2008–2012. *Science of the Total Environment*, *610-611*, 802–809. https://doi.org/10.1016/j.scitotenv.2017.08.024

[12] Faucett, J., & Rempel, D. (1996). Musculoskeletal symptoms related to video display terminal use: An analysis of objective and subjective exposure estimates. *AAOHN Journal*, *44*(1), 33–39. https://doi.org/10.1177/216507999604400109

[13] Gander, P., Hartley, L., Powell, D., Cabon, P., Hitchcock, E., Mills, A., & Popkin, S. (2011). Fatigue risk management: Organizational factors at the regulatory and industry/company level. *Accident Analysis and Prevention*, *43*(2), 573–590. https://doi.org/10.1016/j.aap.2009.11.007

[14] Günther, J., Krewerth, D., Lippmann, T., Leuders, S., Tröster, T., Weidner, A., Biermann, H., & Niendorf, T. (2017). Fatigue life of additively manufactured Ti–6Al–4V in the very high cycle fatigue regime. *International Journal of Fatigue*, *94*, 236–245. https://doi.org/10.1016/j.ijfatigue.2016.05.018

[15] Hallowell, M. (2010). Worker Fatigue: Managing Concerns in Rapid Renewal Highway Construction Projects. *Professional Safety*, *55*(12), 18–26.

[16] Harrison, Y., & Horne, J. A. (1999). One Night of Sleep Loss Impairs Innovative Thinking and Flexible Decision Making. *Organizational Behavior and Human Decision Processes*, *78*(2), 128–145. https://doi.org/10.1006/obhd.1999.2827

[17] Hwang, Y. H., Chen, Y. T., Yeh, J. Y., & Liang, H. W. (2010). Effects of passive computer use time and non-computer work time on the performance of electronic activity monitoring. *Ergonomics*, *53*(10), 1254–1262. https://doi.org/10.1080/00140139.2010.512985

[18] Janwantanakul, P., Pensri, P., Jiamjarasrangsri, V., & Sinsongsook, T. (2008). Prevalence of self-reported musculoskeletal symptoms among office workers. *Occupational Medicine*, *58*(6), 436–438. https://doi.org/10.1093/occmed/kqn072

[19] Jens Wahlstrom. (2005). Ergonomic, musculoskeletal disorders and computer work. *Occupational Medicine*, *5*, 168–176. https://doi.org/10.1093

[20] Kimura, M., Sato, H., Ochi, M., Hosoya, S., & Sadoyama, T. (2007). Electromyogram and perceived fatigue changes in the trapezius muscle during typewriting and recovery. *European Journal of Applied Physiology*, *100*(1), 89–96. https://doi.org/10.1007/s00421-007-0410-2

[21] Lassen, C. F., Mikkelsen, S., Kryger, A. I., Brandt, L. P. a., Overgaard, E., Thomsen, J. F., Vilstrup, I., & Andersen, J. H. (2004). Elbow and wrist/hand symptoms among 6,943 computer operators: A 1-year follow-up study (The NUDATA study). *American Journal of Industrial Medicine*, *46*(5), 521–533. https://doi.org/10.1002/ajim.20081

[22] Lilliefors, H. W. (1967). On the Kolmogorov-Smirnov Test for Normality with Mean and Variance Unknown. *Journal of the American Statistical Association*, *62*(318), 399–402. https://doi.org/10.1080/01621459.1967.10482916

[23] Lorist, M. M., Klein, M., Nieuwenhuis, S., De Jong, R., Mulder, G., & Meijman, T. F. (2000). Mental fatigue and task control: Planning and preparation. *Psychophysiology*, *37*(5), 614–625. https://doi.org/10.1017/S004857720099005X

[24] Lou, J. S., Kearns, G., Oken, B., Sexton, G., & Nutt, J. (2001). Exacerbated physical fatigue and mental fatigue in Parkinson's disease. *Movement Disorders*, *16*(2), 190–196. https://doi.org/10.1002/mds.1042

[25] Manikanta, Ganesan, C., & Singh, D. (2020). A review of fatigue failure and damage prediction of fiber-reinforced composite laminates. *Test Engineering and Management*, *83*, 14156–14167.

[26] Marwa Ahmed Fadl, M. N. S. (2019). Effects of Visual Exercises on Improving the Serve Performance Level for Junior Volleyball Female Players. *International Journal of Psychosocial Rehabilitation*, *23*(6), 821–840. https://doi.org/10.37200/IJPR/V23I6/PR190850

[27] Mäurer, M., Comi, G., Freedman, M. S., Kappos, L., Olsson, T. P., Wolinsky, J. S., Miller, A. E., Dive-Pouletty, C., Bozzi, S., & O'Connor, P. W. (2016). Multiple sclerosis relapses are associated with increased fatigue and reduced health-related quality of life - A post hoc analysis of the TEMSO and TOWER studies. *Multiple Sclerosis and Related Disorders*, *7*, 33–40. https://doi.org/10.1016/j.msard.2016.02.012

[28] Poolton, J. M., Masters, R. S. W., & Maxwell, J. P. (2007). Passing thoughts on the evolutionary stability of implicit motor behaviour: Performance retention under physiological fatigue. *Consciousness and Cognition*, *16*(2), 456–468. https://doi.org/10.1016/j.concog.2006.06.008

[29] Purvis, D., Gonsalves, S., & Deuster, P. A. (2010). Physiological and Psychological Fatigue in Extreme Conditions: Overtraining and Elite Athletes. *PM and R*, *2*(5), 442–450. https://doi.org/10.1016/j.pmrj.2010.03.025

[30] Razali, N. M., & Wah, Y. B. (2011). Power comparisons of Shapiro-Wilk , Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests. *Journal of Statistical Modeling and Analytics*, *2*(1), 21–33. https://doi.org/doi:10.1515/bile-2015-0008

[31] Rizou, I., De Gucht, V., Papavasiliou, A., & Maes, S. (2016). The contribution of illness perceptions to fatigue and sleep problems in youngsters with epilepsy. *European Journal of Paediatric Neurology*, *20*(1), 93–99. https://doi.org/10.1016/j.ejpn.2015.10.001

[32] Schillings, M. L., Hoefsloot, W., Stegeman, D. F., & Zwarts, M. J. (2003). Relative contributions of central and peripheral factors to fatigue during a maximal sustained effort. *European Journal of Applied Physiology*, *90*(5-6), 562–568. https://doi.org/10.1007/s00421-003-0913-4

[33] Shinar, D. (2017). Fatigue and Driving. In *Traffic Safety and Human Behavior* (pp. 797–857). https://doi.org/10.1108/978-1-78635-221-720162014

[34] Shokri, O., Farahani, M.-N., & Kormi - Nouri, R. (2005). Effect of cognitive styles and learned helplessness (cognitive exhaustion model) on solving cognitive problems. *Psychological Research*, *8*(1-2), 59–83. https://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2007-02633-004&site=ehost-live http://oshokri@yahoo.com

[35] Sillanpää, J., Huikko, S., Nyberg, M., Kivi, P., Laippala, P., & Uitti, J. (2003). Effect of work with visual display units on musculo-skeletal disorders in the office environment. *Occupational Medicine*, *53*(7), 443–451. https://doi.org/10.1093/occmed/kqg120

[36] Simpson, B., & Zambuko, T. (2011). The psychosocial rehabilitation needs of residents of a half-way house for mental health care users in Durban, South Africa. *International Journal of Psychosocial Rehabilitation*, *16*(1), 18–28.

[37] Sneddon, A., Mearns, K., & Flin, R. (2013). Stress, fatigue, situation awareness and safety in offshore drilling crews. *Safety Science*, *56*, 80–88. https://doi.org/10.1016/j.ssci.2012.05.027

[38] Sørengaard, T. A., Saksvik-Lehouillier, I., & Langvik, E. (2019). Longitudinal and cross-sectional examination of the relationship between personality and fatigue among shift workers. *Cogent Psychology*, *6*(1). https://doi.org/10.1080/23311908.2019.1574095

[39] Techera, U. D. (2017). Measuring and Managing Construction Worker Fatigue. *ProQuest Dissertations and Theses*, 199. http://search.proquest.com.libraryproxy.griffith.edu.au/docview/1904509423?accountid=14543%0Ahttp://hy8fy9jj4b.search.serialssolutions.com/directLink?&atitle=Measuring+and+Managing+Construction+Worker+Fatigue&author=Techera%2C+Ulises+D.&issn=&title=Measur

[40] To, M., Strutton, P. H., & Alexander, C. M. (2019). Central fatigue is greater than peripheral fatigue in people with joint hypermobility syndrome. *Journal of Electromyography and Kinesiology*, *48*, 197–204. https://doi.org/10.1016/j.jelekin.2019.07.011

[41] Van Dongen, H. P. A., & Dinges, D. F. (2005). Sleep, circadian rhythms, and psychomotor vigilance. In *Clinics in Sports Medicine* (Vol. 24, Issue 2, pp. 237–249). https://doi.org/10.1016/j.csm.2004.12.007

[42] Walker, M. T. (2006). The Social Construction of Mental Illness And it's Implications for the Recovery Model. *International Journal of Psychosocial Reha Bilitation*, *10*(1), 71–87.

[43] Westbrook, T. D., Maddocks, K., & Andersen, B. L. (2016). The relation of illness perceptions to stress, depression, and fatigue in patients with chronic lymphocytic leukaemia. *Psychology and Health*, *31*(7), 891–902. https://doi.org/10.1080/08870446.2016.1158259

[44] Woods, V. (2005). Musculoskeletal disorders and visual strain in intensive data processing workers. *Occupational Medicine*, *55*(2), 121–127. https://doi.org/10.1093/occmed/kqi029

[45] Zafran, H., Tallant, B., & Gelinas, I. (2011). A first-person exploration of the experience of academic reintegration after first episode psychosis. *International Journal of Psychosocial Rehabilitation*, *16*(1), 29–46.

Fatigue and Its Relationship with Age: A Study of Indonesian Computer-Using Employees in Higher Institution

ORIGINALITY REPORT

15%	10%	6%	7%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.ntnu.no Internet Source	<1%
2	www.theartsjournal.org Internet Source	<1%
3	publichealthmy.org Internet Source	<1%
4	www.cim.mcgill.ca Internet Source	<1%
5	researchopen.lsbu.ac.uk Internet Source	<1%
6	www.ijddc.com Internet Source	<1%
7	www.theaca.net.au Internet Source	<1%
8	Submitted to Universiti Kebangsaan Malaysia Student Paper	<1%
9	Catherine Cook, Robin Burgess-Limerick,	

	Sungwon Chang. "The prevalence of neck and upper extremity musculoskeletal symptoms in computer mouse users", International Journal of Industrial Ergonomics, 2000 Publication	<1%
10	igmpublication.org Internet Source	<1%
11	Submitted to University of New England Student Paper	<1%
12	J S Kalkman. "Experienced fatigue in facioscapulohumeral dystrophy, myotonic dystrophy, and HMSN-I", Journal of Neurology, Neurosurgery & Psychiatry, 2005 Publication	<1%
13	www.mech.utah.edu Internet Source	<1%
14	calhoun.nps.edu Internet Source	<1%
15	iaap-journals.onlinelibrary.wiley.com Internet Source	<1%
16	research.vu.nl Internet Source	<1%
17	physoc.onlinelibrary.wiley.com Internet Source	<1%
18	Zhiping Lu, Ming Li, Wei Zhao. "Normality of	

	Ethernet Traffic at Large Time Scales", Mathematical Problems in Engineering, 2013 Publication	<1%
19	npao.ni.ac.rs Internet Source	<1%
20	Submitted to Help University College Student Paper	<1%
21	Submitted to Sultan Agung Islamic University Student Paper	<1%
22	www.mcgill.ca Internet Source	<1%
23	www.aging-us.com Internet Source	<1%
24	ATHENA P. KENDALL, MARY A. KAUTZ, MICHAEL B. RUSSO, WILLIAM D. S. KILLGORE. "EFFECTS OF SLEEP DEPRIVATION ON LATERAL VISUAL ATTENTION", International Journal of Neuroscience, 2009 Publication	<1%
25	shura.shu.ac.uk Internet Source	<1%
26	era.library.ualberta.ca Internet Source	<1%
27	Merve Eser, Gülay İrak. "chapter 11 Analysis of	

	the Barriers to Green Supply Chain Management Implementation", IGI Global, 2020 Publication	<1%
28	Submitted to University of Surrey Student Paper	<1%
29	Shoimatun Febriyani, Hadi Suwono, Ibrohim. "Guided inquiry model combined with edutainment to increase junior high school students' science of learning interest", AIP Publishing, 2020 Publication	<1%
30	www.stir.ac.uk Internet Source	<1%
31	Submitted to CSU, Los Angeles Student Paper	<1%
32	John A. Taylor, Anthony J. Jakeman. "Identification of a distributional model", Communications in Statistics - Simulation and Computation, 2007 Publication	<1%
33	Nicola Magnavita. "chapter 13 Engagement in Health and Safety at the Workplace", IGI Global, 2016 Publication	<1%
34	sinta3.ristekdikti.go.id Internet Source	<1%

35	www.psychresearch.ir Internet Source	<1%
36	rosap.ntl.bts.gov Internet Source	<1%
37	G. Comi, M.S. Freedman, L. Kappos, A. Miller, T.P. Olsson, J.S. Wolinsky, J.-L. Delhay, J. Li, P. Truffinet, P.W. O'Connor. "Effect of teriflunomide on lymphocyte and neutrophil counts in patients with relapsing multiple sclerosis: Results from the Tower Study", Journal of the Neurological Sciences, 2013 Publication	<1%
38	Mehta, Jay P., Steven A. Lavender, Richard J. Jagacinski, and Carolyn M. Sommerich. "Exploring the Effects of Seated Whole Body Vibration Exposure on Repetitive Asymmetric Lifting Tasks", Journal of Occupational and Environmental Hygiene, 2015. Publication	<1%
39	Submitted to Study Group Australia Student Paper	<1%
40	Submitted to University of Winchester Student Paper	<1%
41	www.journalofoptometry.org Internet Source	<1%

42	S Sriadhi, S Gultom, M Martiano, R Rahim, D Abdullah. "K-means method with linear search algorithm to reduce Means Square Error (MSE) within data clustering", IOP Conference Series: Materials Science and Engineering, 2018 Publication	<1%
43	Submitted to CSU, Dominguez Hills Student Paper	<1%
44	Bahadir Bakim, Ugras Erman Uzun, Oguz Karamustafalioglu, Basak Ozcelik et al. "The Combination of Antidepressant Drug Therapy and High-Frequency Repetitive Transcranial Magnetic Stimulation in Medication-Resistant Depression", Klinik Psikofarmakoloji Bülteni-Bulletin of Clinical Psychopharmacology, 2016 Publication	<1%
45	Submitted to University of Bradford Student Paper	<1%
46	www.scopus.com Internet Source	<1%
47	erc.bioscientifica.com Internet Source	<1%
48	research.bangor.ac.uk Internet Source	<1%
49	ejournal.undip.ac.id Internet Source	<1%

50	repository.unair.ac.id Internet Source	<1%
51	repository.tudelft.nl Internet Source	<1%
52	annuaire.ifremer.fr Internet Source	<1%
53	Noraini M. Noor. "Malaysian Women's State of Well-Being: Empirical Validation of a Conceptual Model", The Journal of Social Psychology, 2006 Publication	<1%
54	issuu.com Internet Source	<1%
55	www.biomeddefine.com Internet Source	<1%
56	Submitted to Institute of Technology, Tralee Student Paper	<1%
57	search.crossref.org Internet Source	<1%
58	czasopisma.uni.lodz.pl Internet Source	<1%
59	boris.unibe.ch Internet Source	<1%
60	pubs.asha.org Internet Source	<1%

61	bmcpregnancychildbirth.biomedcentral.com Internet Source	<1%
62	www.maastrichtuniversity.nl Internet Source	<1%
63	Submitted to Ryerson University Student Paper	<1%
64	Linda Kurnia Mustafa, Suyanta. "Exploring Students' Integrated Ability and Creativity: Using 7e Learning Cycle Model in Chemistry Learning", Journal of Physics: Conference Series, 2019 Publication	<1%
65	bioone.org Internet Source	<1%
66	propertibazar.com Internet Source	<1%
67	Cavit Boz, Murat Terzi, Bilge Özer, Recai Turkoglu et al. "Comparative analysis of fingolimod versus teriflunomide in relapsing–remitting multiple sclerosis", Multiple Sclerosis and Related Disorders, 2019 Publication	<1%

Exclude quotes	Off	Exclude matches	Off

Exclude bibliography Off