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WORK FATIGUE: AN ANALYTICAL STUDY OF WORKERS AT PT. DISTRIBUSI ENERGI MANDIRI, MAKASSAR CITY, INDONESIA

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Abstract

Work fatigue is a work-related tiredness that can become severe, inflict sleeping problems, and even threaten workers' lives. The International Labor Organization (ILO) recorded annual deaths of approximately two million workers due to fatigue-induced accidents. The authors studied the factors promoting work fatigue in workers at PT. Distribusi Energi Mandiri (DEM) using an analytic survey method. This involved the entire workers as the study population and a questionnaire as the data collection method. In our findings, the chi-square test analysis revealed that work duration (p= 0.718 (> 0.05)), age (p= 1.000 (> 0.05)), and work posture (p= 0.176 (> 0.05)) have no relationships with work fatigue, but not with workload (p= 0.003 (> 0.05)). We, therefore, suggested that the management of PT. DEM continues and maintains the ongoing work duration, but provides assistive devices to workers with excessive workloads. In addition, it is necessary to supervise them to change body positions, stretch up and rest periodically during work. We advised workers to take proper breathing and intake, along with paying attention to occupational health and safety.

Keywords: *Work fatigue; Chase age; Work posture; Duration of work; Workload*

1. Introduction

Occupational Health and Safety is an inevitable program for a company or industry to prevent or reduce work-related accidents and occupational diseases. The program works by analyzing the potentiality of a task, work, or job to inflict accidents and diseases, anticipating them, and providing actions when they occur. The sole purpose of the program is to provide comfort and safety for workers to maintain work productivity and reduce the risk of occupational accidents and diseases (Medianto, 2017).

As stated within the Law of the Republic of Indonesia, Act No. 13 of 2003 concerning Manpower, in Art. 86, every worker has the right to obtain protection for occupational safety and health to realize optimal work productivity (Undang-Undang Republik Indonesia Nomor 13 Tahun 2003 Tentang Ketenagakerjaan, 2003). Indonesian industrial sector developments have become the current mainstays in the national developmental scheme, in which they positively contribute to employment, equitable development, and increase in income. The fact that Indonesia is a country with a large population as a readily-available, sizable

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workforce has made the workforce a central actor within this scheme (Nearti et al., 2020).

Work fatigue is a work-related tiredness that can become severe, inflict sleeping problems, and even threaten workers' lives. The International Labor Organization (ILO) records annual deaths of approximately two million workers due to fatigue-induced accidents. There are three indications of work fatigue, namely physical exhaustion, weakening of activity, and decreased work motivation. Although its experiences can differ across individuals, it is commonly reported to be accompanied by a decrease or loss in work efficiency and endurance, work capacity, and eventually work productivity. Factors for work fatigue are usually self-inflicted, including duration, workload, age and posture.

A workload is defined as a process or an activity that must be completed by a worker within a predetermined period to achieve a predetermined target. Meanwhile, a work duration is the amount of time spent by workers (in hours) to carry out work activities in a day, excluding time for rest. The duration of work will greatly determine the health status of workers, efficiency, effectiveness, and work productivity.

In reality, when this predetermined period in a day cannot or is assumed to not be able to cover to achieve a daily target, overtime beyond the working hour is usually required. However, an excessive workload can decline working performance and quality, as manifested in decreasing reaction time, repetitive errors in decision-making, less concentration, and increasing potential for workplace accidents, besides lower productivity. The workload obtained by a human body must be by or balanced with his or her ability or physical capacity (Yusuf & Rifai, 2019).

PT Distribusi Energi Mandiri is both a supplier and a contractor company engaged in the mechanical and electrical fields. Established on September 27th, 2009 in Makassar, the company has collaborated with State-Owned Enterprises, Government Agencies, Factories & Industrial Areas, Housing, Hotels, and also Private Corporations. A similar study was done locally in 2017 on a different company with similar feats, the LPG Depot PT. Pertamina (Persero) MOR VII Makassar, by Mahardika (2017), where found relationships between age (p= 0.016 (p,0.035)), workload (p= 0.025 (p,0.05), Body Mass Index (p= 0.004 (p,0.05)) and work posture (p= 0.045 (p,0.05)) and work fatigue among workers. It is therefore interesting to explore the possible factors related to work fatigue in workers at PT. Distribusi Energi Mandiri (PT DEM).

2. Method

The type of this research is an analytical survey. The researchers tried to find whether a relationship existed between the variables of duration, workload, age, and posture and work fatigue in the context of PT. DEM's workers. This research was conducted in September 2021 at the PT. DEM's site.

The population included all workers at PT. DEM with as many as 50 people, the data of which was sourced from PT. DEM's administration section. The sample in this study was therefore taken using the total sampling method, i.e. all populations were taken in as samples.

Here the primary data was collected using a prepared questionnaire, while the secondary by extracting from the profile data of PT. DEM Makassar. The data were processed using the SPSS program (Statistics Package for Social Science) version 25.0.

The analysis was carried out in two stages. The first was the univariate or descriptive analysis to get an overview of the research problem by describing each variable used in this study. By the exploration of frequency distribution and percentage, the independent variables found include work duration, workload, age, and work posture, while the dependent variable is work fatigue. Meanwhile, the second analysis, bivariate, was performed on two variables that were suspected to be correlated. Here, data analysis was carried out to determine the relationship between work duration, workload, age, and work posture with

work fatigue in workers at PT. DEM Makassar using the Chi-Square method.

The data obtained were presented in the form of tables and narratives. Presentation of data with narrative implies that the results of this study were conveyed using sentences. In this technique, it is very important to use effective sentences and to maintain diction and language style.

3. Result and Discussion

Table 1. Characteristics of respondents based on gender, age and education at PT. Distribusi Energi Mandiri

Characteristics of Respondents	n	Presentation (%)
Gender		
Male	48	96
Female	2	4
Age (years)		
20-30	16	32
31-40	22	44
41-50	12	24
Education		
Senior High School	29	58
Diploma	14	28
Undergraduate (S1)	7	14
Total	50	100

Table 1 above shows the characteristics of our respondents. Based on gender at PT. DEM, 49 respondents are male (96%) while the other 2 are female (4%). On age, 16 of them are in the range of 20-30 y.o. (32%), 22 in the range of 31-40 y.o. (44%) and 12 in the range of 41-50 y.o. (24%). Meanwhile, on educational levels, 29 of our respondents were High School graduates (58%), 14 were Diploma graduates (28%) and 7 were Undergrads (14%).

As shown in Table 2, our questionnaire to 50 respondents at PT. DEM found work fatigue presented in 14 respondents (28%) and not presented in the rest (36 respondents or 72%). Here, work fatigue was seen in several conditions including decreased work performance, decreased motor and neural physiological functions, unfit body perception, and decreased morale. Work fatigue can be detrimental both to the workers themselves and their companies. Work fatigue is proven to contribute to more than 50% of the incidence of work accidents at work (Hastuti, 2015).

Table 2. Distribution of Respondents Based on Work Fatigue, Work Duration, Age, Workload and Work Attitude at PT. Distribusi Energi Mandiri

Research variable	n	%
Work Fatigue		
Present	14	28
Not present	36	72
Working Duration		
Inappropriate	38	76
Appropriate	12	24
Age		
Old	34	68
Young	16	32
Workload		
Heavy	26	52
Light	24	48
Work posture		
Poor	21	42
Good	29	58
Total	50	100

On the next variable, 76%, or 38 respondents perceived the working duration to be inappropriate while the rest 24%, or 12 respondents stated otherwise. The key to achieving high work performance is the balance between work demands and work capacity. In other words, the former should not be lower (underload) nor way more (overload) than the latter. Total work results are not necessarily proportional to working time as a result of other factors. In making work arrangements, efforts must be made to create a balance between the demands of the task, the work environment, and the abilities of the workers. The setting of working hours affects the quality and productivity of work. Therefore setting working hours that are humane, responsible, and proportionate allows employees to work well and produce good quality work as well (Belia & Handayani, 2020).

Meanwhile, on the age variable, 34 or 68% of the respondents were categorized as old while the other 16 or 32% as young. Fatigue level at work is always defined by workers' body condition and therefore age. The older a person is, the greater the level of fatigue he or she has. With the passing of age, the physiological functions of the body gradually decrease, along with the body's endurance and work capacity. One can visibly notice at work when a young

worker is capable of doing hard work within a long period, as compared to his older fellows who avoid physically hard or longer tasks. Workers' age surely affects their working performance (Suma'mur, 2014).

Our respondents at PT DEM were divided into two different categories for the 'workload' variable: 26 (52%) in the heavy category and 24 (48%) in the light. In physical workload muscle, heart, and lung work simultaneously, hence it is impossible to maintain a long duration of work without frequent rests. Moreover, a heavy physical workload requires a higher standard of the three organs conditions. According to Primalia Sukma Putri (2019), as physical workload involves the use of muscles and requires physical effort to do the work, each activity will result in a loss in the amounts of bodily substances composition such as oxygen, temperature, blood lactic acid, blood water, sugar, and salt through dehydration. This means body intake needs to be prioritized during work, including regular oxygen intake by proper breathing and regular bodily substance intake by proper drinking and eating.

As for the 'posture' variable, 29 respondents (58%) have been categorized as practicing good posture category when working whereas the other 21 (42%) poor posture category. Work posture is the position of the worker's body when doing work. While the position of the body at work is largely determined by the different working types, each work position has a different effect on the body (Firmansyah et al., 2014).

Table 3 shows that of the total 38 respondents with the inappropriate work duration, 10 (26.3%) presented fatigue while the other 28 (73.7%) did not. For those with the appropriate duration, 4 (33.3%) presented fatigue while the other 8 (66.7%) did not. Data analysis using the chi-square test harvested a P value of 0.718 (P> 0.05), meaning that there was no relationship between work duration and work fatigue among workers at PT. Distribusi Energi Mandiri. Subsequent bivariate tests with the p-value (p= 0.718>0.05) resulted in no significant relationship between the work duration and the work fatigue in workers at PT. DEM, as compared to the obtained p-value of 1.000 (>0.05). In other words, Ho was accepted and Ha was rejected. This shows that there is no significant relationship between the duration of work and the level of work fatigue in the respondents. The results were in line with the research by Christofel Hutahaean (2018) concerning the relationship between work duration and fatigue levels in tapioca factory workers at PT. Hutahaean, Laguboti sub-district in 2018.

Table 3. Relationship between work duration, age, workload and work attitude with fatigue at PT. Distribusi Energi Mandiri

Research variable	Work Fatigue				Amount		p-value
	Tired		Not tired				
	n	%	n	%	n	%	
Working Duration							
Inappropriate	10	26.3	28	73.7	38	100	0.718
Appropriate	4	33.3	8	66.7	12	100	
Age							
Old	10	29.4	24	70.6	34	100	1.000
Young	4	25	12	75	16	100	
Workload							
Heavy	12	46.2	14	53.8	26	100	0.003
Light	2	8.3	22	91.7	24	100	
Work posture							
Poor	8	38.1	13	61.9	21	100	0.176
Good	6	20.7	23	79.3	29	100	
Total	14	28	36	72	50	100	

Prolonged working time doesn't usually result in optimal work efficiency, effectiveness, and productivity. Normally, there will be a decrease in work quality and results. Working long hours usually creates a tendency for fatigue, health problems, illness, accidents, and dissatisfaction. When working a long duration, a worker's physical condition tends to be decreasing. In this case, it is better to find the perfect time to rest to refresh a worker's body and reduce the risk of work accidents due to work fatigue (Fitriani et al., 2021). The length and frequency of the rest time will depend solely on the calculation between a workload and a worker's capacity.

Meanwhile, in the relationship between age and work fatigue, it is shown that of the total 34 respondents in the old category 10 (29.4%) presented fatigue while the other 24 (70.6%) did

not, as compared to those in the young category with 4 (25%) presented fatigue and 12 (75%) did not. However, the statistical test results in Table 3 had shown no significant relationship between age and work fatigue in workers at PT. Distribusi Energi Mandiri, based on the results of the bivariate test with a value of p= 1.000 > 0.05.

The results of this study are in line with research by Wulan Rilam Sari (2019) in Factors Associated with Work Fatigue in Workers in the Rubber Flavoring Section at PT. Perkebunan Nusantara V Riau, whose age classifications were more diverse. She found 4 respondents (6.5%) presented fatigue while 6 (25.0%) did not in 20-29y.o. category; 17 (27.4%) presented fatigue while 4 (16.7%) did not in 30-39y.o.; 19 (30.6%) presented fatigue while 4 (16.7%) did not in 40-49y.o.; and 22 (35.5%) presented fatigue while 10 (41.7%) did not in 50-59y.o. Her results suggested a P value of 0.061, which was > 0.05, indicating no relationship between age and work fatigue.

Age has been deemed the main culprit in the emergence of work fatigue where it affects reaction time and fatigue perception. Increased age is often related to lower performance because it is generally accepted that growing older is followed by decreasing organic abilities commonly associated with the degeneration process. There has been a consensus among scholars that the older workforce easily experiences fatigue which can be associated with decreased performance and productivity. However, this was not the case with the relationship between age and work fatigue in workers at PT. Distribusi Energi Mandiri. While young workers generally have a stronger physique, our older respondents were less physically fit but had tenacious abilities to work. In conclusion, we found no relationship between age and work fatigue in our study. This is in direct contradiction to the theory that older person develops a greater level of work fatigue.

However, the statistical calculation results in Table 3 show an interesting finding on workload as compared to other variables concerning fatigue in our case. Of the 26 respondents categorized as having a heavy workload, 12 (46.2%) presented fatigue while 14 (53.8%) did not, as compared to those having a light workload with 2 (8.3%) presenting fatigue and 22 (91.7%) did not. Based on data analysis using the chi-square test, the value of p= 0.003 (p <0.05) means that there is a relationship between workload and fatigue among workers at PT. Distribusi Energi Mandiri.

Workers whose workload is too heavy are bound to develop fatigue. This usually involves lifting or moving too much material and/or involves repetitive or static movements. A long-duration, heavy workload produces pain in the muscles, bones, and tendons. Working conditions with static muscles will inhibit blood flow, resulting in the narrowing of blood vessels. As a result, lactic acid accumulates and causes fatigue (Utami et al., 2020)

There is a similarity between our study and Putri Mahardika's (2017) who found a relationship between workload and work fatigue in cylinder filling workers at the LPG Depot PT. Pertamina (Persero) Makassar City. She suggested that each workload is bound to the physical and cognitive conditions, as well as the limitations of the recipient of the workload. The amount of workload and the worker's abilities can be used as a basis for determining work time. She argued that a heavier workload needs to be done in a shorter working time to prevent fatigue and physiological disturbances.

Nowadays, assistive devices have been regularly used to aid workers in the industrial fields out of increasing demands of effectiveness and efficiency, especially for those with heavy workloads. At PT. Distribusi Energi Mandiri, manual material handling (MMH) activities can include lifting, shouldering, pulling, pushing, and carrying. The likely assistive devices can include mobile lift tables, sack trucks, and stackers.

Regarding the work posture variable on work fatigue, 21 (42%) of our respondents have practiced poorly, and the other 29 (58%) have good work postures. In the poor category 8 (38.1%) showed fatigue and 13 (61.9%) did not, while in the good category 6 (20.7%) presented fatigue and 23 (79.3%) did not. Data analysis

using the chi-square test obtained a value of p= 0.176 (p>0.05), meaning that there is no relationship between work posture and fatigue in workers at PT. DEM. The results of this study are in line with Mayang Kumala Sari & Kresna Febriyanto's research (2020) concerning the relationship between work posture and work fatigue among firefighters in the city of Samarinda. Their Chi-Square test revealed p= 0.126 (p> 0.05), similarly implying that there was no relationship between work posture and work fatigue in firefighters at the Samarinda City Fire Department in 2019.

Work posture is described as the posture of the body when carrying out a job. An inappropriate work posture involuntarily increases workload because it impedes a worker to exert abilities optimally. Inappropriate work postures are generally caused by improper task demands, work tools, and workstations. In this study, there was no relationship between work posture and work fatigue. This was because all workers had received training after being hired at PT. Distribusi Energi Mandiri, including maintaining good work posture. However, when not reminded workers tend to shift into bad postures. Moreover, it is necessary to supervise workers to change body positions, stretch up and rest periodically during work.

4. Conclusion and Suggestion

We have found no relationship between work duration and work fatigue, age and work fatigue, nor work posture and work fatigue. There is, however, a relationship between workload and work fatigue.

Several suggestions can be advised for the management of PT. DEM. These include: (a) continuing and maintaining the ongoing work duration, (b) providing assistive devices to workers with excessive workloads, (c) supervising workers to change body positions, stretch up and rest periodically during work, (d) motivates proper breathing exercises and body intakes during work, and (e) motivate proper attention to occupational health and safety.

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