

MEASUREMENT OF MENTAL WORKLOAD AND FATIGUE OF PRODUCTION OPERATOR

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Abstract- *The human body is designed to be able to perform daily work activities. On the one hand, work is very important for progress and achievement so that achieving a productive life is one of the goals of life. Every worker has a burden as a form of responsibility. This burden can be in the form of a physical burden or a mental burden. From an ergonomic point of view, any workload received by a person must be commensurate with the physical ability to bear the burden, cognitive abilities, and human limitations. Overload will only cause worker fatigue. This study aims to determine the impact of mental workload on worker fatigue. The results of the study stated that the mental workload had an impact on the level of work fatigue in employees. The average level of work fatigue experienced by some company employees is in the low to medium category.*

Keywords: *work standards, body condition, work activities, physical limitations, mental workload, fatigue level.*

INTRODUCTION

Routine work carried out by workers has the potential to create boredom. In addition to boredom, fatigue will also occur if the workload is too excessive. Fatigue is synonymous with a general stress response over time. Work fatigue can occur during or after work, it may also occur before work when the body has not recovered from previous fatigue through a regular period of rest before the start of the next job. Fatigue due to work is usually defined as a process of decreasing efficiency, quality of work and reduced endurance to be able to complete a task or job. Fatigue can affect cognitive performance disorders, impaired memory and information processing, reduce the effectiveness of skills, decrease activity, concentration, and motivation. Fatigue can also damage the sense of agency, namely the loss of a sense of responsibility for one's own actions (Howard et al., 2016). Causes of fatigue can come from inside or outside the workplace (Fan & Smith, 2020). The fatal result of work fatigue is the occurrence of work accidents.

Work fatigue can be caused by a workload that is too high. Workload is the amount of work that must be done by a position/department of the organization and is the result of multiplying the work volume and working time (Darmawan & Djaelani, 2021). Workload is determined by the interaction of task demands, the circumstances in which the task is performed, skills, behaviors, and individual perceptions. According to Hoonaker et al. (2011), workload is a design that serves to find out how much a person's physical and mental limitations are in completing a job. Workload is also influenced by external demands of a job, such as environmental factors, organizational factors, psychological, and so on. Workers feel bored because they have higher abilities than the job requirements they face. Vice versa, workers with abilities below the job requirements will experience a workload that will cause worker fatigue. There are three workloads given to employees, namely workloads that meet standards, workloads that are too high (over capacity) and workloads that are too low (under capacity). Work activities carried out involve all body organs, muscles, and brain so that an increase in work activity indicates an increase in workload (Davis et al., 2009). The workload of each job can be in the form of physical workload and mental workload.

Task demands in the form of carrying out physical actions (physical workload) and cognitive tasks (mental workload). The impact of this action depends on the ability of the individual who carries it out. Physical workload requires more energy than mental work. But in terms of roles and responsibilities, mental work requires more energy. Mental workload is a state at work where information requires the brain in the thought process to be understood (Wickens, 2008). Mental workload is formed in the mind and can be seen from the work activities carried out. Mental workload is often measured subjectively because subjective measurements are considered to have higher validity than other measurements. The workload must be adjusted to the conditions of the workers because it can have a positive or negative impact on the company (Arifin et al., 2022).

PT. MTK is a company engaged in the production of motor vehicle spare parts in Pasuruan City. The total number of employees working in this company is 336 people. Working hours are from 07.00 WIB to 17.00 WIB. Work as a production operator is considered to have a high mental workload and fatigue. This is because the work that is done every day includes monotonous work with the same body movements as the work that must be according to standards. Punctuality in completing each job is also an indicator of performance appraisal (Fatimah et al., 2018). Therefore, employees must try to complete their tasks on time. Another factor that affects employee fatigue is working overtime due

to deadlines that must be completed and fluctuating market demand. This study is about observing and measuring mental workload. This study was conducted to determine the impact of mental workload on the level of fatigue experienced by employees of PT. MTK while doing work.

RESEARCH METHODS

This type of research is quantitative research. Quantitative research emphasizes objective phenomena and is studied quantitatively. The objectivity of this research design was maximized by using statistical processing numbers, structures, and controlled experiments. The object of research is some production operators who work at PT. MTK is 121 who work in one shift. The data taken is the result of distributing questionnaires.

The research procedure was carried out in several stages. The first stage is a literature study on theories related to fatigue and mental burden. Then conduct a field study to determine the location that will be the object of research. The next stage is the identification of problems in the field. Then collect data with questionnaires and perform data processing. Processing of data in the form of data from questionnaires then carried out statistical tests. The results of data processing are then analyzed to obtain results and conclusions. The last step is to provide repair solutions to overcome the existing mental load and fatigue problems. The analysis tool is linear regression to determine the effect of one variable with another variable which is assisted by the SPSS 26 application.

RESULTS AND DISCUSSIONS

Measurements of 100 workers in one shift were obtained after conducting a description analysis. Table 1 shows the results of the percentage of work fatigue levels

Table 1.
Percentage of Overall Work Fatigue

Work Fatigue Rate	Number of Workers	Percentage (%)
Low work fatigue	67	55,4%
Middle work fatigue	35	28,9%
High work fatigue	19	15,7%
Total	121	100%

Source: processed by the author

The level of work fatigue is low with the highest number of workers, namely 55.4%. The level of work fatigue is medium, namely 28.9%, and the last is the high level of work fatigue with a percentage of 15.7%. This explains that the average level of work fatigue experienced by some company employees is in the low to medium category. Furthermore, testing the effect of mental workload on the level of fatigue using linear regression test.

The t test is a regression coefficient test to determine the effect of the mental workload variable on the variable level of worker fatigue. The impact of mental workload on the level of fatigue will later produce a simple linear regression model. SPSS output is obtained as shown in Table 2 below.

Table 2
Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	44.333	2.899		15.294	.000
	X	3.067	.473	.511	6.480	.000

a. Dependent Variable: Y

Source: SPSS Output

Based on the SPSS output in Table 2, the following regression model is obtained. $Y = 44,333 + 3.067X$. This means that the mental workload has a significant impact on worker fatigue, in this case the production operator as the respondent. This result can be addressed by the company by creating a physical environment that does not interfere with the operator's work or create comfortable working conditions. There are also some improvements that can be made due to fatigue. According to Blachowicz & Letizia (2006) there are several consequences of excessive work fatigue, namely, reduced memory function, slowed information processing, irritability, disruption of problem solving and critical thinking

processes in the brain, deviations in attention to detail, concentration and decreased decision-making abilities, and reduced motivation.

The improvements that can be made to reduce high fatigue on production operators are as follows. Physical condition can be improved by exercising regularly, doing short exercises and relaxing movements in between work activities (Åhsberg et al., 2000). In addition, operators can carry out regular health checks at the company's clinic. Energy can be increased with adequate rest and eating nutritious foods, avoiding spicy and high-fat foods because they can interfere with digestion and sleep patterns. Efforts to overcome drowsiness at work by the operator can do power naps, namely taking a short nap for 30-45 minutes before work. This is considered to increase one's awareness. It also maintains a normal sleep pattern of 7-9 hours per day. Operators have high time requirements, this is related to repetitive work, operators can take advantage of waiting time and prayer breaks for work breaks (Sinambela et al., 2022). On the other hand, there is also punishment if the operator does not work according to the procedure and commits a disciplinary violation.

CONCLUSIONS

Based on the research that has been done, the results obtained are mental workloads have an impact on the level of work fatigue in employees. The average level of work fatigue experienced by some company employees is in the low to medium category. Fatigue that occurs can be caused by various factors including external factors such as age, disease history, sleep duration, body mass index, and commuting time.

Work fatigue can be overcome by getting enough rest, eating nutritious food, exercising, doing simple exercises and getting enough sleep. The high mental workload can be overcome by adjusting the workload with the operator's ability, giving rewards and motivating workers. Companies can hold socialization or training about the importance of mental workload & fatigue awareness.

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