



(RESEARCH ARTICLE)



## Correlation between individual characteristics, physical workload, and mental workload on operational workers in terminal Jamrud Surabaya

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### Abstract

**Introduction:** Work fatigue is a condition experienced by the workforce that can lead to a decrease in vitality and work productivity. There are several causes of fatigue, including age, length of service, nutritional status, physical workload, and mental workload. Based on observations at PT Pelindo Multi Terminal's Jamrud Terminal, many operational workers complain of work fatigue due to the heavy workload at work. Therefore, the purpose of this study is to determine the factors associated with fatigue to serve as the basis for the preparation of interventions.

**Methods:** This quantitative research was carried out through analytical observational design. The number of samples taken was 25 people using total sampling. In this case, the independent variables measured were age, work period, nutritional status, physical workload, and mental workload. Meanwhile, the dependent variable studied was work fatigue using reaction timer tool.

**Results:** The research results show that the age variable has a weak relation with work fatigue at 0.106, work period at 0.161, nutritional status at 0,212, and mental workload at 0.042. Meanwhile, the physical workload has a moderate relation with work fatigue at 0,306.

**Conclusion:** The physical workload has the strongest relation with work fatigue.

**Keywords:** Work Fatigue; Physical Workload; Mental Workload; Work Period; Nutritional Status

### 1. Introduction

In the world, the number of work accidents and occupational diseases is still relatively high. Based on data from the ILO (International Labor Organization) in 2013 also stated that 1 (one) worker every 15 seconds died due to work accidents and as many as 160 workers experienced occupational diseases (1). In addition, according to data from the ILO in 2018, it was found that 13.7% of 2.78 million workers died due to work accidents or occupational diseases. Meanwhile, workers who were injured due to work accidents amounted to 374 million people worldwide (2).

Based on data from the International Labor Organization, as many as 2 (two) million workers died due to work accidents due to fatigue factors. In a survey conducted by the ILO, it also stated that 32.8% or around 18,828 of the 58,118 samples studied experienced work fatigue which affected productivity. According to research conducted by the National Safety Council (NSC) in 2017 to more than 2 thousand workers, 97% of workers have one fatigue risk factor in the workplace and more than 80% of workers have two or more fatigue risk factors in the workplace. Every year, there are almost a thousand times more non-fatal workplace accidents than fatal workplace accidents and fatigue is one of the biggest

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causes of accidents (2). Work fatigue can occur in workers in all industrial sectors, one of which is the port service sector. PT Pelindo Multi Terminal Branch Jamrud Nilam Mirah is one of the branches of PT Pelindo Multi Terminal located in Surabaya. One of the terminals that handles all loading and unloading services including general cargo, liquid bulk, and dry bulk is Jamrud Terminal. The many types of loading and unloading services offered by this industry have the potential to cause work fatigue in operational workers at Jamrud Terminal. Based on this background, the researcher took the topic of job fatigue in operational workers at Jamrud Terminal to determine the frequency distribution and several factors associated with work fatigue.

## 2. Material and Methods

This study is an observational analytic study using a cross-sectional approach. Respondents involved in this study are 25 employees at Terminal Jamrud Surabaya who were taken using total population technique. Data collection was conducted in October 2023. In this case, the independent variables in this study are individual characteristics (age, working period, and nutritional status), physical, and mental workload. Meanwhile, the dependent variable is work fatigue. Data on individual characteristics (age, working period, and nutritional status) were obtained through filling out a questionnaire. Furthermore, physical workload were measured %CVL (Cardiovaskular Load) using pulse oxymeter. Mental workload was measured using NASA-TLX Questionnaire. The dependent variable (work fatigue) was measured using reaction timer tool. The technique of filling out the questionnaire was carried out by giving instructions to the respondent to answer the questions in the questionnaire according to the circumstances experienced by the respondent. Furthermore, this research was conducted after obtaining approval for the implementation of research from the Health Research Ethical Clearance Commission Universitas Airlangga with number 1323/HRECC.FODM/XII/2023. In addition, data were analyzed univariately and bivariately. However, before the bivariate test, researchers first conducted a normality test using Kolmogorov-Smirnov. Then, bivariate analysis was carried out with the Spearman statistical test because the data were not normally distributed with a significance level of 0.05.

## 3. Results and Discussion

### 3.1. Distribution of Individual Characteristic, Physical Workload, Mental Workload, and Work Fatigue

Data on the characteristics of respondents can be seen in Table 1. Based on this data, it can be seen that most of them are aged 25-36 years by 60%. In addition, most of the work period respondents were 6-10 years at 60%. Meanwhile, most of the respondents' nutritional status was overweight at 44%.

**Table 1** Distribution of Individual Characteristic

| Category                | Frequency | Percentage (%) |
|-------------------------|-----------|----------------|
| <b>Age</b>              |           |                |
| 25-34 years             | 15        | 60             |
| 35-44 years             | 4         | 16             |
| 45-55 years             | 6         | 24             |
| <b>Work Period</b>      |           |                |
| 1-5 years               | 1         | 4              |
| 6-10 years              | 15        | 60             |
| >10 years               | 9         | 36             |
| <b>Nutrition Status</b> |           |                |
| Normal                  | 9         | 36             |
| Overweight              | 5         | 20             |
| Obese                   | 11        | 44             |

Data on the physical workload, mental workload, and work fatigue of respondents can be seen in Table 2. The physical workload is categorized into 5 (five) namely light, medium, medium, heavy, and very heavy. However, the physical workload of operational workers included in the light and medium categories. Most operational workers at Jamrud

Terminal have a light physical workload with a percentage of 64%. The mental workload is categorized into 5 (five) namely normal, light, medium, high, and very high. However, the mental workload of operational workers included in the high and very high categories. Most operational workers at Jamrud Terminal have a high mental workload with a percentage of 80%. Work fatigue is categorized into 5 (three) namely normal, mild, moderate, high, and very high. However, the work fatigue of operational workers included in the mild and moderate categories. Most operational workers at Jamrud Terminal have a mild work fatigue with a percentage of 64%.

**Table 2** Distribution of Physical Workload, Mental Workload, and Work Fatigue

| Category                 | Frequency | Percentage (%) |
|--------------------------|-----------|----------------|
| <b>Physical Workload</b> |           |                |
| Mild                     | 16        | 64             |
| Moderate                 | 9         | 36             |
| <b>Mental Workload</b>   |           |                |
| High                     | 20        | 80             |
| Very High                | 5         | 20             |
| <b>Work Fatigue</b>      |           |                |
| Mild                     | 16        | 64             |
| Moderate                 | 9         | 36             |

**3.2. Correlation of Individual Characteristic, Physical Workload, Mental Workload**

Based on Table 3 above, it can be seen that there is a weak and positively correlated relationship between age and fatigue. Older workers have the potential to experience more fatigue than younger workers. This is due to loss of muscle fibers and muscle atrophy, making physical work more tiring for older workers. Sustained muscle activity among workers can cause muscle soreness. Sustained muscle activity during work (both physical and sedentary work) causes muscle fatigue which can lead to the development of pain. This can result in an imbalance between work demands and capacity and cause fatigue (3).

**Table 3** Correlation between age and work fatigue

| Age         | Work Fatigue |          | Total | Coefficient Correlation |
|-------------|--------------|----------|-------|-------------------------|
|             | Mild         | Moderate |       |                         |
| 25-34 years | 10           | 5        | 15    | 0.106                   |
| 35-44 years | 3            | 1        | 4     |                         |
| 45-55 years | 3            | 3        | 6     |                         |
| Total       | 16           | 9        | 25    |                         |

**Table 4** Correlation between work period and work fatigue

| Work Period | Work Fatigue |          | Total | Coefficient Correlation |
|-------------|--------------|----------|-------|-------------------------|
|             | Mild         | Moderate |       |                         |
| 1-5 years   | 1            | 0        | 1     | 0.161                   |
| 6-10 years  | 10           | 5        | 15    |                         |
| >10 years   | 5            | 4        | 9     |                         |
| Total       | 16           | 9        | 25    |                         |

Based on Table 4 below, it can be seen that there is a weak and positively correlated relationship between working period and work fatigue. The working period will have a positive influence positive influence when the longer a person working will be experienced in doing his job. Conversely, it will have a negative influence if the longer the work will cause fatigue, boredom and the more exposed to hazards posed by the work environment (4). This study is in line with Langgar's research in 2014 which states that there is a significant relationship between work period and work fatigue in employees of Bu Pudji's Baxo Tofu Company in Ungaran (5).

**Table 5** Correlation between nutrition status and work fatigue

| Nutrition Status | Work Fatigue |          | Total | Coefficient Correlation |
|------------------|--------------|----------|-------|-------------------------|
|                  | Mild         | Moderate |       |                         |
| Normal           | 7            | 2        | 9     | 0.212                   |
| Overweight       | 3            | 2        | 5     |                         |
| Obese            | 6            | 5        | 11    |                         |
| Total            | 16           | 9        | 25    |                         |

Based on Table 5 above, it can be seen that there is a weak and positively correlated relationship between nutritional status and work fatigue. Excessive nutritional status will lead to high levels of job fatigue in operational workers. This study is in line with research conducted by Natizatun in 2018 that there is a relationship between the nutritional status of workers and work fatigue. Good nutrition has an impact on the degree of health, endurance and productivity of workers (6). Nutrition in workers plays a very important role both for welfare, as well as in order to improve discipline and productivity. Lack of nutritional value in the food consumed by workers on a daily basis will have adverse effects on the body such as decreased defense against disease, less physical ability, decreased body weight, pale face lack of enthusiasm, lack of motivation, and slow reaction (5).

**Table 6** Correlation between physical workload and work fatigue

| Physical Workload | Work Fatigue |          | Total | Coefficient Correlation |
|-------------------|--------------|----------|-------|-------------------------|
|                   | Mild         | Moderate |       |                         |
| Mild              | 12           | 4        | 16    | 0.306                   |
| Moderate          | 4            | 5        | 9     |                         |
| Total             | 16           | 9        | 25    |                         |

Based on Table 6 above, it can be seen that there is a moderate and positively correlated relationship between physical workload and job fatigue. High physical workload will potentially cause fatigue in operational workers. The results of this study are in line with the theory which explains that the lightness of the workload received by workers must be in accordance with their ability or work capacity, if the workload received is more than the ability and work capacity, then fatigue will arise. fatigue will arise (7). This research is in line with the theory of Ergonomic Balance which explains that every job is a burden for the perpetrator of the burden which means physical, mental or social. A workforce has its own ability burden in relation to workload. In work that is too heavy and excessive will accelerate the contraction of body muscles, so this can accelerate a person's fatigue (8).

Based on Table 7 below, it can be seen that there is a weak and positively correlated relationship between mental workload and fatigue. High mental workload will potentially cause fatigue in operational workers. This is in line with Ardiyanti's research in 2017 which states that there is a significant relationship between mental workload and work fatigue in nursing and midwifery personnel (9). The workload given to workers needs to be adjusted to the psychological and physical abilities of the workers concerned. Travel conditions, travel time to and from the workplace, which is as minimal and safe as possible, affect occupational health conditions in general and work fatigue in particular. Periodic and specialized mental training can change the tendency to develop fatigue. Work facilities and recreational facilities are of positive value for workers (9).

**Table 7** Correlation between mental workload and work fatigue

| Mental Workload | Work Fatigue |          | Total | Coefficient Correlation |
|-----------------|--------------|----------|-------|-------------------------|
|                 | Mild         | Moderate |       |                         |
| High            | 13           | 7        | 20    | 0.042                   |
| Very High       | 3            | 2        | 5     |                         |
| Total           | 16           | 9        | 25    |                         |

#### 4. Conclusion

There is a very weak relationship between age, work period, nutritional status, and mental workload with work fatigue among operational workers at Jamrud Terminal. There is a moderate relationship between physical workload and work fatigue among operational workers at Jamrud Terminal. It is necessary to develop interventions in accordance with priorities for the prevention of fatigue through the management of physical workload and other related factors.

#### Compliance with ethical standards

##### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

##### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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