

Work Fatigue relations with the Workers Safety Performance Warehouse Logistics Distribution at PT X Surabaya

Arham Syam¹, Deny Ardyanto², Hari Basuki³

*Master Program Study, Occupational Health and Safety Department, Public Health Faculty
Airlangga University, Surabaya, Indonesia¹*

*Occupational Health and Safety Department, Public Health Faculty, Airlangga University,
Surabaya, Indonesia^{2, 3}*

Email: muharham74@ymail.com¹

Abstract- Warehousing is a place to store goods production plans, quantities of manufactured goods and a certain time which is then distributed to the desired location on request. Warehousing in the logistics distribution process is complex and requires immediate management control in achieving a good distribution. Logistics distribution workers must have excellent physical condition in the work. If the performance of the logistics distribution workers decreased due to fatigue, then it may cause delays in the work process of distribution of goods. This study wanted to see the relationship between fatigue with safety performance on workers in warehouse logistics distribution PT. X Surabaya. This research method is an analytic observational study with cross sectional study. The population in this study of 35 people who are working in warehouse logistics distribution PT X Surabaya were then tested the simple random sampling then obtained a sample of 32 people. Measurement of fatigue work carried out by using Accutrend® Plus. Results of the analysis of independent samples t test shows that there are differences in levels of lactac acid is a very significant before and after measurement ($p.value = 0.00$) on the distribution of workers in warehouse logistics PT. X Surabaya. Testing with Pearson product moment correlation test shows that there is a relationship between fatigue with the safety performance ($p.value = 0.012$). The conclusion from this study is there is a relationship between fatigue with safety performance) on the distribution of workers in warehouse logistics PT. X Surabaya. Suggestions for workers should maintain physical fitness with regular exercise and choose healthy food consumption and nutritious.

Keyword: Fatigue, Safety Performance, Warehouse, Logistic Distribution

1. INTRODUCTION

Warehousing is a place to store goods production plans, quantities of manufactured goods and a certain time which is then distributed to the intended location based on the demand for goods. Warehousing management is the process of the work undertaken by each company for cost reductions, reduction of goods, the provision of facilities for further processing, guaranteeing the quality of goods and improve service to every customer^[1].

Logistics distribution warehouse workers at PT. X Surabaya risk for the emergence of fatigue because there is still work to manual material handling is lifting vary so requires a lot of energy to be able to manage the distribution of goods. In the process of manual handling distribution logistics required for optimal performance of workers who continue to work safely in every work process in the warehouse. Workers in prime condition or fatigue then the employer will be susceptible to decreased motivation, poor quality of work and can lead to mistakes and accidents^[2].

In the process of distribution of muscle power usage is mostly done on a physical activity that is manual material handling workers to conduct the appointment, decline, pushing, pulling and moving goods. Material removal is done by manual material handling from warehouse to car or from the car to the warehouse. High workload capacity to move goods quickly and manual material handling processes performed by the worker makes worker performance may decline. The working process is repeated as the appointment and removal activities can lead to material fatigue of workers experiencing subjective or muscle fatigue. Imposition of muscle statically if maintained in a long time will produce (repetitive strain injuries) such as muscle pain, tendon, caused by work that is repetitive^{[3] [4]}.

Work fatigue is influenced by personal characteristics such as motivation, age, education, nutritional status (BMI), smoking habits, exercise habits, tenure and job characteristics such as workload and duration of working time. The purpose of this research is to look at the relationship between fatigue with safety performance on workers in warehouse logistics distribution PT. X Surabaya.

2. METHOD

This research method is an analytic observational research with cross sectional study. The population in this study of 35 people who are working in the warehouse logistics distribution PT . X Surabaya were then tested the simple random sampling then obtained a sample of 32 people :

$$n = \frac{z_{1-\alpha/2}^2 P(1-P)N}{d^2(N-1) + z_{1-\alpha/2}^2 P(1-P)}$$

Specification :

n = number of sample (sample size)

N = population size = 35

Z = the value of the normal curve for Z = 0.05

1.96 (95% confidence level)

p = estimator of the population proportion = 0.50

d = degree of precision = 0.05

Measurement of fatigue work carried out by using Accutrend® Plus. Safety performance measurements carried out by the researcher or assistant enumerator for 4 days with safety performance in the warehouse PT.X Surabaya. Measurement of motivation to work done with a questionnaire which has been developed from previous studies.

Analysis of data using statistical test to test the relationship between independent variables and the dependent variable. The dependent variable in this study is that individual characteristics, job characteristics, job burnout and independent variables in this study were studied were safety performance.

3. RESULT

Respondents in this study were workers in warehouse logistics distribution PT. X Surabaya.

Table 1. The frequency distribution of fatigue (lactic acid concentration) in warehouse PT. X Surabaya

| | Blood lactic acid concentration (Mmol / l blood) | | The increase in the concentration of lactic acid |
|----------|--|------------|--|
| | Before work | After work | |
| Minimum | 0,1 | 1,70 | 1,40 |
| Maksimum | 1,5 | 6,1 | 6,0 |
| Total | 15,4 | 117,4 | 102,6 |
| Mean | 0,48 | 3,66 | 3,20 |
| SD | 0,442 | 1,029 | 1,124 |

Category fatigue based on the concentration of lactic acid according to Fox that the lactic acid concentrations normally range from 0.1 to 1.9 mmol / l of blood, the body will feel fatigue when the lactic acid concentration of 2 to 3.9 mmol / l of blood and body condition if the acid concentration lactate \geq 4 mmol / l of blood, there will be anaerobic processes without oxygen supply or the body again. The average

concentration of lactic acid after work 3.66 mmol / l and the average blood lactic acid concentration difference before and after work 3.20 mmol / l blood. Based on the results of the measurement of lactic acid in the logistics distribution warehouse worker PT . X Surabaya experiencing fatigue ^[5].

Table 2. Frequency distribution warehouse safety performance in PT. X Surabaya.

| Safety Performance | Frequency (Person) | Percentage (%) |
|--------------------|--------------------|----------------|
| Good | 18 | 56% |
| Enough | 8 | 25% |
| Less | 6 | 19% |
| Total | 32 | 100% |
| SD | 11,80 | |

Safety Performance in the study carried out by direct observation to see whether the worker is able to carry out the logistics distribution process safety in the warehouse according to regulations set by OSHA on workplace safety in the warehouse. From the results of research on safety performance, there are 18 people with a good safety performance categories, 8 people have enough categories and 6 people with less criteria. These results provide a descriptive overview that 56 % of workers are already implementing safety processes have applied well but there are 19 % of workers who have not applied properly process safety. ^[6]

Table 3. Test results of correlation between individual characteristics, work with fatigue (lactic acid concentration)

| Variabel | Fatigue (lactic acid concentrations) | |
|--------------------|--------------------------------------|-----------------|
| | p.value | Conclusion |
| Tenure | 0,004 | significant |
| Duration of work | 0,006 | significant |
| Motivation | 0,012 | significant |
| Age | 0,321 | not significant |
| Smoking habits | 0,013 | significant |
| Workload | 0,680 | not significant |
| Education | 0,054 | not significant |
| Exercise habits | 0,655 | not significant |
| nutritional status | 0,014 | significant |

According to the table 3 there are four independent variables that have no relation with fatigue (lactic acid concentration difference of work), results of correlation of independent variables, age, workload, education and exercise habits do not have a relationship with can be seen from p.value greater than 0.05 . There are six independent variables that have a relationship with fatigue (lactic acid concentration difference of work), results of correlation variable working time, working time, motivation, smoking habits, nutritional status (BMI).

Tabel 4. Results of correlation between individual characteristics, job characteristics with safety performance.

| Variabel | Safety Performance | |
|--------------------|--------------------|-----------------|
| | p.value | Conclusion |
| Tenure | 0,002 | Significant |
| Duration of work | 0,130 | not significant |
| Motivation | 0,110 | not significant |
| Age | 0,040 | Significant |
| Smoking habits | 0,477 | not significant |
| Workload | 0,231 | not significant |
| Education | 0,002 | Significant |
| Exercise habits | 0,836 | not significant |
| nutritional status | 0,020 | Significant |
| Fatigue | 0,012 | Significant |

Based on Table 4 there are five variables that have no relation with the safety performance results of correlation of independent variables, duration of work, motivation, smoking habit, workload and exercise habits have no connection with the safety performance, can be seen from p.value greater than 0,05. There are four independent variables linked to safety performance, a variable length of service, age, nutritional status (BMI), education regarding the safety performance, can be seen from p.value less than 0.05. Work fatigue related to safety performance with p.value 0,012.

4. DISCUSSION

Fatigue occurs due to the accumulation of waste products in the muscles and blood circulation, where these waste products are restrictive continuity of muscle activation. These waste products affect nerve fibers and central nervous system, causing people to be slow work if already tired. Foods that contain glycogen, to flow into the body through the bloodstream. Contraction of muscles will always be followed by a chemical reaction (glucose oxide) that converts glycogen into energy, heat and lactic acid (a waste product) ^{[7] [8]}.

Lactic acid (lactate acid) is a product of carbohydrate metabolism without using oxygen. The lactic acid produced in muscle cells when oxygen supply is not sufficient to support the production of energy and when the muscles are contracted continuously the oxygen supply to the muscle cells is reduced. Shifting energy source that originally muscle activity when insufficient oxygen supply derived from fatty acids, switching on other energy sources that do not require modification or catabolism oksigen. During body physical exercise or heavy work the body to compensate the process of respiration is rapid, as a result the body is deficient oxygen. Destroy the muscle glycogen or used as energy by the process is anaerobic glycolysis or ended with the formation of lactic acid ^[8].

Glucose that is not immediately needed by the body to be converted into glycogen and stored in the

liver and muscles. Muscle glycogen as a source of heat and energy for muscle activity. When glycogen oxidation to carbon dioxide and water, to form energy-rich compound is adenosine triphosphate (ATP). When the muscles contract, ATP energy is released in line with amendments to adenosine diphosphate (ADP). When glycogen oxidation of pyruvic acid is formed. If a lot of oxygen, as in the general movement, pyruvic acid is broken down into carbon dioxide and water. This process release energy to make more ATP, if oxygen is insufficient, pyruvic acid is converted to lactic acid, which causes muscle fatigue when piling up ^[9].

High lactic acid may arise as a result of the heavy workload, it is because of the inability of aerobic energy supply system, so that the supply of energy from the energy source aneorobik dominate. Works with high intensity will increase lactic acid levels. Increased levels of lactic acid in the muscles and blood will affect less favorable for the activity of the cell due to disruption of the performance of a number of enzymes that work at neutral or alkaline pH as a catalyst in a variety of metabolic processes ^[10].

Lifting high load capacity to move goods quickly and manual material handling processes performed by the worker makes worker performance may decline. The working process is repeated as the appointment and removal activities can lead to material fatigue of workers experiencing subjective or muscle fatigue. ^{[11] [12]}.

The concept of ergonomics according Manuaba, explains that the performance or appearance of a person is dependent upon the rate and magnitude of the demands of duty with the magnitude of their capacity, whereas if the ratio of job demand is greater than the ability of a person on working capacity, there will be discomfort, overstress fatigue work and work accidents, otherwise when the demands of duty are lower than on one's ability on working capacity then there will be a final appearance in the form of boredom, Saturation, lethargy and unproductive. Optimum performance that occurs when the dynamic balance between the demands of the task with capabilities. ^{[13] [14]}.

Safety performance results displayed for workers when crafting goods have done well at work. For compliance use personal protective equipment workers only use safety shoes and safety helmet. Sanctions to workers not to smoke inside the warehouse environment is very firm even sanctions in the form of direct discharges of leadership. Forklifts used in warehouses up to 5 tons, operator of the forklift should be in accordance with SOP (Standard Operation Procedure) which has been established by the management company. Usage *Logout-tagout* is not heeded, there is no locking or labeling of hazardous energy sources. Sorting pallet and pallet every week checking supervision. Pallet nice it would be easier to

arrange the goods safely. In the process of packing and unpacking of workers already use a good tool like a hammer, cutter safely.

Fatigue workers are physical and mental capabilities as a result of excessive usage that would weaken the physical organ function and decrease the safety performance of workers. In a state of fatigue if it lasts a long time for the repetitive work can lead to decreased working capacity, decreased motivation, slow down even likely to provide opportunities in industrial accidents ^{[15] [16]}.

5. CONCLUSION

There is a relationship between job burnout and safety performance to workers in warehouse logistics distribution PT. X Surabaya, when workers experience fatigue will decrease the safety performance on her.

6. SUGGESTION

To workers should maintain physical fitness with regular exercise and choose healthy food consumption and nutritious. To workers should further raise awareness to keep using personal protective equipment when working.

Acknowledgments

Thanks to the logistics distribution workers PT. X Surabaya, which was willing to become respondents in this study.

REFERENCES

- [1] Tomkins, J.; Smith, J. (1998): The Warehouse Management Handbook, pp. 19-42.
- [2] Jungyong, L.; Maury, A; Gyouhyung, K. (2014): effect Of work experience on work methods during dynamic pushing and pulling. *International Journal of Industrial ergonomic*, 44(5), pp. 647-653.
- [3] Heidar, M.; Majid, M.; Mohammed, A. (2013): Manual material handling assesment among workers of Iranian casting Workshops. *International Journal of Occupational Safety and ergonomics*, 19(4), pp. 675-681.
- [4] Marie, S; Denys, D; Daniel, I; Marie, L. (2005): Work factor affecting manual material handling in a warehouse superstore. *Journal of industrial ergonomic*. 8(4), pp. 33-46.
- [5] Fox, EL; Bower, R; Foss, M. (1993): The Physiological Basis of exercise and sport. Wm. C. Communication. Vol 24 No 1, pp. 94-175.
- [6] OSHA, (2004): Pocket Guide Workers Safety Series Warehousing, , pp. 1-15.
- [7] Bower, R.; Fox, EL. (1992): Sport Physiology. Wm. C. Brown Publisher. Kepper Boulevard, Dubuque, pp. 108-112.
- [8] Suma'mur. (2009): Higiene Perusahaan dan kesehatan kerja (HIPERKES). CV. Sagung Seto. Jakarta.
- [9] Filipe, D.; Ricardo, D.; Ana, L; Eduardo, S. Renata, D.; Marcio, R. (2015): Glycemic and blood lactate response to maximal incrementall treadmill test .*International Journal Of Sport Science*, 5(2) pp. 59-64.
- [10] Saltin, B.; Edstrom, L. (1981): effect of lactac acid accumulation and ATP decrease On Muscle tension and Relaxation. *Am J Physiol*. 240, pp. 121-126.
- [11] Janssen, PJM. (1989): Training lactate pulse rate. edisi bahasa Indonesia yang diterjemahkan oleh Prianggoatmodjo dan Muthalib (1993). Latihan laktat dan denyut nadi KONI DKI Jakarta, hlm, 1-62 .80-110.
- [12] Kulkarni ,S; Darsana , LN. (2013): Muskoskeletal risk assessment among nurses in patient manual material handling in hospital ward. A Cross Sectional study. Vol. 5. N0.8p. 137.
- [13] Manuaba, Tarwaka, Bakri, S & Sudiajeng, (2004): *Ergonomi untuk Keselamatan, kesehatan Kerja dan produktifitas*. Surakarta, UNIBA Press.
- [14] Zurada, J. ;Karwowski, W ; Marras , W. (2004): classification of jobs with risk of low back disorders by applying data mining techniques. *International Journal of Industrial ergonomic*, 4(4), pp. 291-305.
- [15] Lalu, MS., (2015): Indikator prediktif safety performance pada karyawan air traffic control (ATC) di Indonesia, Disertasi. Fakultas Kesehatan Masyarakat. Universitas Airlangga, pp. 39-45.
- [16] Au Yong, H.; Suhaiza, H. (2011): Factors Affect safety and healthy behavior of logistic worker in Malaysia. *International Conference on Industrial management Kuala Lumpur*, pp. 1125-1132.