

Relationship Between Nutritional Status and Work Posture with Work Fatigue on Crane Operators

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ABSTRACT

Introduction: Work accidents can occur due to two factors, namely unsafe human behavior and unsafe environmental conditions. One of the unsafe human behavior is work fatigue. In addition, work fatigue can also reduce productivity so that it can have a bad impact on the company. This study aims to determine the strength of the relationship and the direction of the correlation between nutritional status and work postures with work fatigue on crane operators. **Method:** This research is included in the type of descriptive observational research with a cross-sectional approach. The sample of this study was taken using total sampling, namely all the population of 30 people. The independent variables in this study were nutritional status and body postures, while the dependent variable was work fatigue. The data were analyzed using the Spearman's correlation coefficient (Spearman rank's correlation coefficient) to see the value of the correlation coefficient. **Results:** The correlation coefficient between nutritional status and work fatigue was -0.169, which means there was a very weak relationship with a negative direction. Meanwhile, the strength of the relationship between work postures and work fatigue can be seen in the correlation coefficient of 0.671, which means there was a strong relationship with a positive direction. **Conclusion:** Workers with overweight and obese nutritional status were more relaxed at work and did not pursue daily targets so that the fatigue experienced was classified as moderate. In addition, poor work postures can cause severe work fatigue.

Keywords: crane operators, nutritional status, secure work, work fatigue, work posture

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INTRODUCTION

A safe and healthy workplace is very important for all companies. If the workplace is safe and healthy, workers can continue their work effectively and efficiently. On the other hand, if the workplace is not organized and contain many hazards, damages and sick absences are unavoidable, resulting in reduced income for workers and reduced productivity for the company. Pressure in the workplace is unavoidable because of the contemporary work environment (World Health Organization, 2020).

Every year there are approximately more than 1.8 million work-related deaths in the Asia and Pacific region. Two-thirds of work-related deaths in the world occur in Asia. More than 2.78 million

people die every year due to occupational accidents or diseases worldwide. More than 380,000 or 13.7% of these deaths are caused by work accidents. Meanwhile, most of these deaths are caused by occupational diseases, which account for around 2.4 million cases or 86.3%. In addition, there are approximately 374 million cases of non-fatal work-related injuries and illnesses each year that result in absenteeism from work (International Labour Organization, 2018).

According to the Minister of Manpower of the Republic of Indonesia, there were 77,295 cases of work accidents in Indonesia in 2019. This figure tends to decrease by 33.05% compared to that in 2018, which was 114,148 cases (Bureau of Public Relations of the Ministry of Manpower, 2020). The number of cases due to work accidents in the workplace is still relatively high because accidents and occupational diseases are still unavoidable. Currently, the industry in Indonesia is starting to develop. However, this development has not

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been accompanied by the awareness of workers in implementing Occupational Safety and Health correctly to prevent work accidents (Biantoro, Kholil and Pranoto, 2019).

It is estimated that 2.1% of all deaths and 2.7% of the burden of disease worldwide can be at risk by occupational risks. This is the result of known cases as more risk was estimated but not published. Non-communicable diseases account for 70% of the total disease burden from occupational risks, with chronic diseases and cancer causing the highest work-related deaths, followed by neck and back pain when disease burden is considered. Health impacts can be avoided by improving the workplace to be healthier and safer (Wolf *et al.*, 2018).

All workers must be at risk of danger in the form of work accidents or work-related illnesses. Work accidents can occur due to two factors, namely unsafe human behavior and unsafe environmental conditions. Work accidents often occur due to unsafe human behavior at work. One of the unsafe behaviors or unsafe actions that can cause accidents to workers is the level of work fatigue (Tarwaka, 2019). In addition, work fatigue can also reduce productivity so that it can have a bad impact on the company (Tuahta, Silaban and Nasution, 2019).

Work fatigue is still a major health problem in Indonesia. It is proven by the previous research showing that 67.3% of workers in one of the construction companies in the city of Semarang experienced work fatigue (Anggorokasih, Widjasena and Jayanti, 2019). Another study also indicated that as many as 83.3% of container crane operator workers at Petikemas Terminal Surabaya experienced work fatigue (Amalia, Wahyuni and Ekawati, 2017). In regard to this, non-standard work environments can cause work fatigue. Some of them are related to individual conditions of workers such as body physiology, history of occupational diseases and monotonous work positions. External factors that can cause work fatigue include unclear division of responsibilities, intensity and duration of physical work. Meanwhile, internal factors that can affect work fatigue include the age of workers, gender, and nutritional status (Rahmawati and Afandi, 2019).

In addition to several factors that have been mentioned, non-ergonomic work postures can cause musculoskeletal disorders so that workers are more prone to work fatigue due to back pain (Ezzatvar *et al.*, 2020). This statement is supported by research of Amalia, Wahyuni and Ekawati (2017) which showed that there was a relationship between work postures and work fatigue with a significant value obtained.

Thus, work postures that are not ergonomic can cause work fatigue. Another study conducted by Hijah, Setyaningsih and Jayanti (2021) also showed that as many as 40% of workers with high-risk work postures experienced work fatigue.

Based on the magnitude of the problems that have been mentioned, the researchers will examine the relationship between nutritional status and work postures with work fatigue. The correlations carried out in this study aim to determine the strength of the relationship between existing variables and also to see the direction of the correlation between variables.

METHODS

This research is included in the type of descriptive observational research because the research was carried out without giving additional treatment to the object of research. The research design used a cross-sectional design in which the research was carried out at a certain time. The population in this study is all Container Crane (CC) operators and Rubber Tyred Gantry (RTG) operators at Nilam Terminal Surabaya. The sample of this study was taken using total sampling, with a total population of 30 people. This research was conducted at the Surabaya Patchouli Terminal, which is located at Tanjung Perak Port, Surabaya City, East Java. The research took place during March 2021. The independent variables in this study were nutritional status and body posture, while the dependent variable was work fatigue.

The instruments used for data collection included questionnaires, work posture assessment sheets, and reaction timers. The measurements of work postures used the Rapid Upper Limb Assessment (RULA) method, which was carried out when workers was carrying out work activities (Kurnianingtyas, 2017). Meanwhile, to measure work fatigue this research used a reaction timer. Data processing was carried out starting from coding, editing, data entry, cleaning, tabulating, to analyzing. The data were analyzed using the Spearman's correlation coefficient (Spearman rank's correlation coefficient) to see the value of the correlation coefficient.

This research has received an ethical certificate from Universitas Airlangga, Faculty of Dental Medicine, Health Research Ethical Clearance Commission number 037/HRECC.FODM/I/2021.

RESULTS

Overview of Individual Characteristics of Crane Operators at Nilam Terminal Surabaya

The data of individual characteristics of crane operators at Nilam Terminal Surabaya consisting of age, nutritional status, and working period were obtained through the results of questionnaires. The distribution of individual characteristics can be seen in Table 1.

The individual characteristics of crane operators at Nilam Terminal Surabaya which were observed included age, nutritional status, and working period. The age of crane operators was grouped into 4 categories, namely 25-34 years old, 35-44 years old, 45-54 years old, and 56-64 years old. Based on Table 1, it can be concluded that most of the crane operators were in the age range of 35-44 years, accounting for 63.3% (19 people). Based on Table 1, it can be concluded that most workers had normal nutritional status, accounting for 60% or 18 people.

The respondents' working period was calculated from the time a worker entered work as a crane operator until this research was carried out. The working period was categorized into 3, namely <5 years, 5-10 years, and >10 years. Based on Table 1, it can be concluded that most workers have worked at Nilam Terminal Surabaya for >10 years, accounting for 56.7% or 17 people.

Table 1. Distribution of Individual Characteristics of Crane Operators at Nilam Terminal Surabaya in 2021

Individual Characteristic	n	%
Age		
25-34 years old	5	16.7
35-44 years old	19	63.3
45-54 years old	5	16.7
56-64 years old	1	3.3
Nutritional Status		
Underweight	0	0
Normal	18	60
Overweight	2	6.7
Obese	10	33.3
Working Period		
<5 years	3	10
5-10 years	10	33.3
>10 years	17	56.7

Overview of Crane Operators' Work Postures at Nilam Terminal Surabaya

Measurements of work postures of crane operators were carried out when workers were carrying out activities while working. Measurements were carried out using the RULA method. Crane operators' work postures were grouped into 2 categories, namely 'investigation and repair are needed but not immediately' and also 'investigation and repair are needed as soon as possible'. Based on Table 2, it can be seen that most of the workers' work postures required investigation and repair as soon as possible, accounting for 70% or 21 people.

Overview of Crane Operators' Work Fatigue at Nilam Terminal Surabaya

Work fatigue was measured using a reaction timer, which used light and sound stimulation. The results of the measurements of work fatigue can be seen in Table 3. Work fatigue on crane operators was grouped into 2 categories, namely moderate and severe. Based on Table 3, it can be said that most crane operators had severe work fatigue, accounting for 76.7% or 23 people.

Relationship between Crane Operators' Nutritional Status and Work Fatigue at Nilam Terminal Surabaya

The relationship between crane operators' nutritional status and work fatigue at Nilam Terminal

Table 2. Distribution of Crane Operators' Work Postures at Nilam Terminal Surabaya in 2021

Work Posture	n	%
Investigation and repair are needed but not immediately	9	30
Investigation and repair are needed as soon as possible	21	70
Total	30	100

Table 3. Distribution of Crane Operators' Work Fatigue at Nilam Terminal Surabaya in 2021

Work Fatigue	n	%
Moderate	7	23.3
Severe	23	76.7
Total	30	100

Surabaya can be seen from the correlation coefficient value. The cross-tabulation between nutritional status and work fatigue can be seen in Table 4.

Based on Table 4, it can be seen that crane operators who experienced heavy work fatigue had normal nutritional status, accounting for 83.3% or 15 people. The strong and weak relationship between the nutritional status and work fatigue can be seen in the correlation coefficient value, of -0.169, which means that there was a very weak relationship in a negative direction.

Relationship between Crane Operators' Work Postures and Work Fatigue at Nilam Terminal Surabaya

The relationship between crane operators' work postures and work fatigue at Nilam Terminal Surabaya can be seen from the correlation coefficient value. The cross-tabulation between work postures and work fatigue can be seen in Table 5.

Table 4. Relationship between Crane Operators' Nutritional Status and Work Fatigue at Nilam Terminal Surabaya in 2021

	Work Fatigue				C
	Moderate		Severe		
	n	%	n	%	
Underweight	0	0	0	0	-0.169
Normal	3	16.7	15	83.3	
Overweight	1	50	1	50	
Obese	3	30	7	70	
Total	7	23.3	23	76.7	

Table 5. Relationship between Crane Operators' Work Postures and Work Fatigue at Nilam Terminal Surabaya in 2021

W o r k Posture	Work Fatigue				C
	Moderate		Severe		
	n	%	n	%	
Investigation and repair are needed but not immediately	6	66.7	3	33.3	0.671
Investigation and repair are needed as soon as possible	1	4.8	20	95.2	
Total	7	23.3	23	76.7	

Based on Table 5, it can be found that crane operators who experienced severe work fatigue mostly had the work postures that required repairs as quickly as possible, accounting for 95.2% or 20 people. The strengths and weaknesses of the relationship between work postures and work fatigue can be seen from the correlation coefficient of 0.671, which means that there was a strong relationship with a positive direction.

DISCUSSION

Individual Characteristics of Crane Operators at Nilam Terminal Surabaya

Most of the crane operators at Nilam Terminal Surabaya were 35-44 years old. The youngest workers in the Crane Operation Section of the Nilam Terminal Surabaya was 27 years old and the oldest was 55 years old. Based on research conducted by Ukkas (2017), it is said that the working-age of 16-64 years is productive. Meanwhile, those aged 65 years old and over are included in the elderly category.

The body will experience physiological changes along with age. Physiological changes can be in the form of a decrease in body functions such as hearing, breathing, memory loss, and a decrease in the ability to make decisions (Tarwaka, 2019). In addition, age can also affect the level of physical activity. As people get older, they should not do excessive physical activity (Varma *et al.*, 2017). This is in line with research conducted by Suryadinata *et al.* (2020) which stated that age affects physical activity in adults and the geriatric group.

Individual nutritional status related to overweight and underweight can be reviewed from the Body Mass Index (BMI) and anthropometric measurements (Ministry of Health of the Republic of Indonesia, 2018). The majority of Nilam Terminal Surabaya crane operators had normal nutritional status. These results indicate that the crane operators' nutritional status is still relatively good (Ministry of Health of the Republic of Indonesia, 2018).

Based on research of Farikha and Ardyanto (2016), it is said that most workers who have good nutritional status can do a good job as well. Undernourished or excessive nutritional status makes workers have less physical ability, reduced motivation and morale, and slow rate in doing their jobs. In addition, workers who have abnormal

nutritional status can reduce their work productivity and are more prone to work fatigue (Farikha and Ardyanto, 2016).

Most of the crane operators at Nilam Terminal Surabaya have been working for more than 10 years. Longer tenure allows them to have experience related to conditions and problems that often occur in the workplace. In addition, tenure also has a positive effect on work productivity. The longer the employee works, the greater his productivity will be by involving several indicator factors, including loyalty during work, work ability, skills, and work experience (Ramadhani, Prasilowati and Suyanto, 2020).

The longer the employee's working period, the higher his productivity, while the shorter the working period, the lower his work productivity (Ariono, 2017). A long working period means a lot of work experience, meaning that employees who have a long working period will have a lot of work experience so that work productivity is high. Meanwhile, employees with short tenure (new employees) are still inexperienced, so their productivity is also low (Ariono, 2017). Based on research conducted by Aprilyanti (2017), it is said that tenure has an effect of 8.3% on worker productivity.

Crane Operators' Work Postures at Nilam Terminal Surabaya

The results of the measurements of work postures on crane operators at Nilam Terminal Surabaya showed that most of the respondents were classified as requiring further inspection and repair as soon as possible. The investigation that can be carried out is by evaluating and repairing the equipment used by crane operators during work. These tools result in non-ergonomic work postures because workers must follow the direction of movements of the tools. Workers are required to bend down to operate the container cranes and rubber tyred gantry cranes so that the body position is bent for a long time. In addition, workers often rotate their wrists to operate the buttons on the container cranes and rubber tyred gantry cranes.

Based on research of Ezzatvar *et al.* (2020), it is stated that working in a sitting position has a high risk of causing musculoskeletal pain. Sitting still position continuously without having rest or other movements should not exceed 15-30 minutes because it can cause back pain (Antle *et al.*, 2018). Thus, it is necessary to use physical therapy methods for workers who experience low back pain to reduce

pain intensity and improve work postures (Shipton, 2018). Suggested therapies for treating low back pain are yoga, exercise, biofeedback, relaxation, massage, therapy, and interdisciplinary rehabilitation (Chou *et al.*, 2018). Rest and muscle stretching and diligent exercise can maintain muscle flexibility so that low back pain can be minimized (Suryadi and Rachmawati, 2020).

The improvements that can be made to the equipment are by installing a camera and monitor screen on the equipment used by the crane operators. Such proposal needs to be made so that workers do not have to bend down or bend over to operate the tool (Soler-Font *et al.*, 2019). This is in line with research of Novianti and Tanjung (2016) which stated that the proposed improvement is needed to provide space for workers to move freely and reduce the level of risk of musculoskeletal disorders.

Immediate intervention is needed to improve the working conditions of workers. It aims to support the safety and welfare of workers. Improving working conditions for workers can help create a good working environment. By creating a good work environment, workers can develop their ability to work and awareness of occupational health and safety supported by a health culture (Sorensen *et al.*, 2019).

Work postures that are not ergonomic can cause the body not to conform to its natural position or changes in body postures such as bending over, tilted shoulder position, and so on. This is usually experienced by workers who follow the direction of motion of the tools used during work and have lack of knowledge and awareness about a good working position (Nurhalimah, Sutangi and Handayani, 2017). The higher the risk of work posture analysis, the greater the category of low back pain complaints (Suryadi and Rachmawati, 2020).

Crane operators' Work Fatigue at Nilam Terminal Surabaya

The results of the measurements of work fatigue on crane operators at Nilam Terminal Surabaya showed that most of the respondents experienced severe fatigue. Work fatigue was measured using a reaction timer with sound and light stimulation. In a tired state, the ability of workers to react will be longer. The more severe the fatigue that occurs in workers, the longer it takes to react (Tarwaka, 2019).

Most of the crane operators at Nilam Terminal Surabaya experienced severe work fatigue. This is

similar to research conducted by Asriyani, Karimuna and Jufri (2017) which stated that most factory workers at PT. Kako Industri Kendari experienced severe work fatigue. In addition, research conducted by Amalia, Wahyuni and Ekawati (2017) stated that most of the crane operators at Petikemas Terminal Surabaya experienced moderate work fatigue.

The very high workload is the main factor causing severe work fatigue for crane operators at Nilam Terminal Surabaya. This is supported by research conducted by Herdianti and Maryana (2019) which stated that there is a significant relationship between workload and work fatigue. Workers who have a heavy workload are more likely to experience work fatigue compared to workers who have a light workload (Herdianti and Maryana, 2019). This is because workers must focus and concentrate during work with a duration of 8 hours per day. Nilam Terminal Surabaya has four units of container cranes and one unit of rubber tyred gantry crane. Each unit in the container cranes is filled with six workers, while in the unit of the rubber tyred gantry there is only one worker.

In addition, severe work fatigue on crane operators is also caused by non-ergonomic work postures where the operator has to bend over while working for a long time. This non-ergonomic working posture causes fatigue from the neck to the operator's back. Improper work postures thus can cause fatigue in the body (Tarwaka, 2019).

As for the improvements that can be made so that workers do not experience work fatigue, a shift work system in turns should be implemented. Based on research of Härmä *et al.* (2018), an irregular work shift is one of the risk factors that can increase work fatigue. Varied work schedules and shift schedule adjustments are needed to reduce the risks associated with job burnout (Chang, Yang and Hsu, 2019). This intervention needs to be carried out because workers who experience high levels of work fatigue can have reduced intention to go to work (Liu *et al.*, 2016).

Workers who experience work burnout are likely to experience several impacts and risks, some of which are decreased work motivation, decreased performance, and a number of mistakes in work that can cause work accidents and occupational diseases. If there are many cases of accidents and occupational diseases in workers, it will reduce work productivity (Tarwaka, 2019).

Relationship between Crane Operators' Nutritional Status and Work Fatigue at Nilam Terminal Surabaya

The results of this study indicate that as many as 15 operators had normal nutritional status but experienced severe work fatigue. The correlation coefficient between nutritional status and work fatigue was -0.169, which means that there was a very weak relationship. The negative direction means that the lower the nutritional status of the workers, the more severe the work fatigue experienced.

This study showed a very weak relationship between nutritional status and work fatigue with a negative direction because based on field observations, workers with overweight and obese nutritional status were more relaxed at work and did not pursue daily targets. Thus, the work fatigue experienced by most workers with overweight and obese nutritional status can be said to be moderate. Meanwhile, workers who had normal nutritional status tended to work with the maximum ability so that the work fatigue experienced by the majority of workers with normal nutritional status can be said to be severe or high. In addition, operators with overweight and obese nutritional status did not immediately get off the tool after work, so it can be said that the level of work fatigue might be reduced when they get off the tool once they finish work.

This is in line with research of Salsabila and Mulyono done on installation workers (2021), which said that there was a relationship between nutritional status and work fatigue, but the relationship can be said to be very weak. This is also in line with Amin, Kawatu and Amisi's (2019) research on field workers of PT Pelindo IV (Bitung Branch) which stated that the nutritional status of workers with work fatigue had a negative relationship direction. A similar result was also found in the results of research by Juliana *et al.* (2021) which showed that there was no relationship between nutritional status and work fatigue in workers.

Although nutritional status has a relationship with work fatigue, the relationship between the two variables is very weak, so the nutritional status of workers must be considered. This is because nutritional status can affect worker productivity (Purabaya and Paskarini, 2020). Workers with normal nutritional status have high productivity while workers with obese nutritional status have low productivity (Purabaya and Paskarini, 2020).

Relationship between Crane Operators' Work Postures and Work Fatigue at Nilam Terminal Surabaya

The strength of the relationship between work postures and work fatigue can be seen in the correlation coefficient of 0.671, which means there was a strong relationship with positive relationship. The direction of the positive relationship means that the worse the work postures carried out by the crane operators, the more severe the work fatigue experienced.

This is in line with research of Fachrin, Baharuddin and Samsualam (2020) which stated that there was a significant relationship between the work attitude of body parts and work fatigue. The working attitude in question was the body postures, especially the back posture while working. A similar result was also found in research of Deyulmar, Suroto and Wahyuni (2018) which stated that there was a relationship between work postures and the level of work fatigue. The relationship between the two was significant. Workers with a slightly bent body position complained pain in the back, pelvis, and buttocks.

In line with research of Thamrin *et al.* (2020), most of the respondents who worked in a bent position in their study experienced musculoskeletal disorders characterized by pain in the back. Similarly, research conducted by Odi, Purimahua and Ruliati (2018) showed that there was a relationship between work postures and work fatigue. It was stated that fatigue is caused by awkward and monotonous work postures and working for a relatively long time (more than 8 hours a day).

In this present research, the working postures of crane operators at Nilam Terminal Surabaya requires further investigation and improvement as soon as possible so that the work postures becomes ergonomic. Incorrect or non-ergonomic work postures tend to experience fatigue more quickly. Blockage of blood flow can occur because the body is in a static position for a long time, which can result in a lack of oxygen and glucose in the blood. If this happens continuously, it will cause the body to get tired easily (Wan *et al.*, 2017).

CONCLUSION

From the results of research that has been carried out on crane operators at Nilam Terminal Surabaya, it can be concluded that the majority of workers in the crane operation section had

normal nutritional status and experienced severe work fatigue. Meanwhile, more than half of the workers needed an investigation and repair as soon as possible on their work postures. The strength of the relationship between nutritional status and work fatigue can be said to be very weak in a negative direction. Workers with overweight and obese nutritional status were more relaxed at work and did not pursue daily targets so that the fatigue experienced was classified as moderate. Meanwhile, the strength of the relationship between work posture and work fatigue was strong with a positive relationship.

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