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Enhancing Port Worker Performance through Nutritional and Health Strategies: A Case Study at an Indonesian Container Port

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ABSTRACT

This study measured the relationship between dietary intake and nutritional status, its relationship with health conditions (dyslipidemia, *fatty liver*, and hypertension), and the work productivity of *Quay Crane Container* (QCC) operators. This study uses *a cross-sectional* design. The research was carried out at one of the Container Terminals in Indonesia in February 2023. The subjects in this study were 29 male QCC operators aged 44 - 54 years. The statistical analysis used in this study consisted of logistic regression, *Fisher Exact Test*, *Chi-square*, and *Cramer's V*. There was a positive correlation between the feeding intake of *the shift group* and the nutritional status of QCC operators (r=0.109). In addition, the nutritional status *of overweight* and obesity was able to increase the risk of dyslipidemia (OR=12 and OR=3) and *fatty liver* (OR=6 and OR=49), while hypertension was able to increase the risk of unproductive workers (OR=1.25). However, there was no significant relationship between nutritional status and health conditions with productivity (p=0.601 and p=1,000) and between nutritional status and workers' health conditions (p=0.136 and p=0.865) except *for fatty liver* (p=0.036). Feeding intake affects the nutritional status of QCC operators who work in *shifts*. In addition, abnormal nutritional status increases the risk of dyslipidemia and *fatty liver,* while hypertension increases the risk of unproductive workers.

1. Introduction.

Container terminals are one of the parts of the port that are the center of the driving force of a country's economy (Charłampowicz, 2021). This is because the container terminal is where logistics distribution activities occur domestically (export) and abroad (import) (Gurzhiy et al., 2021). The higher the activity of a container terminal, such as loading and unloading, the more congested a port will be (Charłampowicz, 2021).

Congested activities in a terminal lead to indefinite working hours. Therefore, human resources are needed at container terminals at irregular times. One way to meet these needs is to impose a shift work system, especially on workers directly responsible for field operations.

Shift work is a method outside conventional working hours, where a person can work in the morning, afternoon, or night (Khosravipour et al., 2021). This method is expected to meet the needs of a company's business and economic targets for 24 hours (Hulsegge et al., 2020). There has been an increase in shift workers worldwide by 4 - 13% from 2000 to 2014 (Khosravipour et al., 2021). This increase occurs because the shift method offers high flexibility and productivity (Sun et al., 2018). The Koja Container Terminal is one of the most crowded container terminals in the Tanjung Priok Port area (Safuan et al., 2022). The number of terminal operational workers accounts

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for 35% of the total workers in all divisions. All operational workers at this terminal work on shifts. The shift method is applied by dividing three working hours, namely the morning shift (07.00 - 15.00), the afternoon shift (15.00 - 23.00), and the night shift (23.00 - 07.00). Each shift works for eight hours a day.

Workers who work in shifts are awake and active outside of average chronobiological time so that they can change their eating and sleeping habits. Altered eating habits, circadian rhythm disturbances, and reduced exercise time can increase shift workers' risk of metabolic disorders and disease (Demirci and Kaptanoğlu, 2022). The risk of diseases that increase due to shift work includes depression, sleep disturbances, fatigue, obesity, cardiovascular disease, peptic ulcers, digestive problems, failure to control blood sugar levels, and metabolic syndrome, which are threats to safety and can increase the risk of work accidents (Khosravipour et al., 2021). Fatigue in shift workers is one of the factors that contribute to workplace accidents because a tired person often fails to take safety precautions (Azwar et al., 2018).

One way to avoid or reduce worker risks is to pay attention to nutritional status and health conditions. Good nutritional and health status can affect physical health and good thinking power when doing work. In addition, nutritional status and good health conditions have the potential to achieve high work productivity. Workers with good nutritional status will work harder, be more productive, and be meticulous (Purbaya and Paskarini, 2020). Malnutrition (under or excessive nutritional status) causes workers to experience a decrease in physical ability, motivation, and morale and to be slow to do their work. In addition, workers classified as malnourished can reduce work productivity and are more likely to experience work fatigue. Companies must provide healthy and quality food to improve shift workers' performance and nutritional status, especially on the night shift (VARLI and BILICI, 2016).

Two studies have been conducted before but only focused on the relationship between nutritional status and productivity or health of workers during regular working hours and workers with fixed shift schedules. The research conducted by Farikha and Ardyanto (2017) aims to see the relationship between nutritional status and individual characteristics with productivity in regular workers. The study showed that those with good nutritional status had better work productivity than workers with abnormal nutritional status (Farikha and Ardyanto, 2017). In addition, another study was conducted by Demirci and Kaptanoğlu (2022) regarding the effect of working with different work shifts on nutritional status (Demirci and Kaptanoğlu, 2022). The study illustrates that working with a shift system generally hurts eating habits and nutritional status. However, the study focused on the quality of life of workers.

This study measured the relationship between food intake and nutritional status of shift workers with health conditions and work productivity at the Koja Container Terminal. This research is expected to benefit the company, namely container terminals and ports, which improve workers' health, especially regarding nutrition.

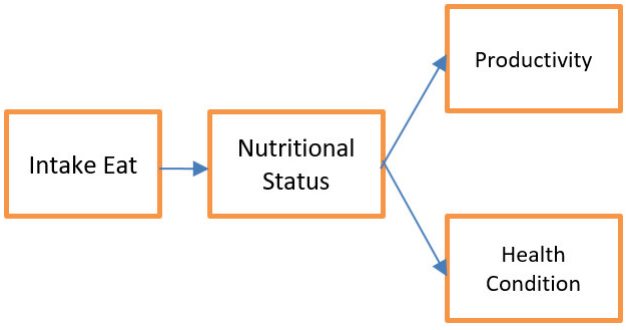
2. Methodology.

This study uses a cross-sectional design to analyze the relationship between independent variables consisting of meal intake between shifts and nutritional status with bound variables such as productivity, health conditions, and nutritional status of workers. The research was conducted at the Koja Container Terminal, North Jakarta, in February 2023. The subjects in this study are 35 Quay Crane Container (QCC) operators. Six are unknown health examination data, so they are excluded from the study. Therefore, the total subjects in this study are 29 men aged 44 - 54 years.

The data collected in this study includes primary and secondary data. The primary data was photos of the leading menu and additional food between shifts.

In contrast, the secondary data used was data on the division of the number of workers between shifts, worker productivity, and health data or medical check-ups of workers. The statistical analysis used in this study consisted of logistic regression, Fisher Exact Test, Chi-square, and Cramer's V. Correlation analysis (r) between the shift group and nutritional status using the Cramer's V test. Logik regression was used to see the relationship between nutritional status and productivity, with significant results if the p-value showed less than 0.05. As for the variables of health conditions and productivity, the Fisher Exact Test is used to see the relationship between dyslipidemia and hypertension conditions and productivity, and the Chi-Square test is used to see the relationship between fatty liver conditions and productivity with significant results if the p-value shows less than 0.05. After that, logistic regression is used to see the relationship between nutritional status and health conditions. Normal nutritional status is used as a reference in calculating the Odds Ratio (OR). All statistical analysis methods are tested with the Statistical Package for the Social Sciences (SPSS).

Figure 1: Methodology Scheme.



Source: Authors.

3. Results & Discussion.

3.1. Results.

There was a difference in food intake between shifts, where shift 2 and shift 3 received additional food. So, as stated in Table 1, there is a difference in the number of calories in each

shift. Table 1 also illustrates that based on the r-value of 0.109, it is known that there is a positive correlation between calorie intake and nutritional status, but the correlation is very weak.

Table 1: Correlation of Dietary Calorie Intake with Nutritional Status of Workers by Shift Group.

Shift Group	Total Calories of Meal Intake (kcal)	Nutritional Status						r*
		Normal		Over Weight		Obesity		
		n	%	n	%	n	%	
1st Shift	951,8	2	40	2	40	3	20	0,109
2nd Shift	1.023,8	4	16,66	8	83,33	3	0	
3rd Shift	1.113,2	2	40	3	20	2	40	

* r-value with Cramer's V test

Source: Authors.

Table 2 shows no significant relationship between nutritional status and health conditions (dyslipidemia, fatty liver, and hypertension) on the productivity of QCC operators. In the nutritional status variable, the P value 0.601 showed insignificant results. The OR value of 0.514 in overweight conditions and 0.360 in obese conditions shows that overweight and obese conditions do not increase the risk of unproductivity compared to standard nutritional status conditions.

In the variable of health condition, dyslipidemia showed a P value of 1,000, showing insignificant results. An OR value of 0.75 indicates that dyslipidemia does not increase the risk of unproductivity compared to non-dyslipidemia. The fatty liver condition showed a P value of 0.356, which showed insignificant results. An OR value of 0.50 indicates that fatty liver conditions do not increase the risk of unproductivity compared to non-fatty liver conditions. As for hypertension conditions, a P value of 1,000 shows insignificant results. An OR value of 1.25 indicates that hypertensive conditions increase the risk of unproductivity by 1.25 times compared to non-hypertensive conditions.

Table 2: The relationship between nutritional status, health conditions, and productivity.

Nutritional Status	Productivity		p value*	Odds Ratio (OR)
	Unproductive	Productive		
Normal	3	5	0,601[a]	Reference
Overweight	7	6		0,514
Obesity	5	3		0,360
Dyslipidemia	11	11	1,000[b]	0,75
Fatty liver	6	8	0,356[c]	0,5
Hypertension	5	4	1,000[b]	1,25

a. P value with logistic regression test
b. P value with Fisher's test
c. P value with Chi-Square test
* significantly if p < 0,05

Source: Authors.

Based on workers' health data (medical check-ups), several types of diseases are suffered, but researchers only selected three diseases with the highest incidence percentage. Table 3 illustrates that nutritional status does not significantly affect the incidence of dyslipidemia and hypertension. The p-value of each variable above 0.05 evidences this. However, nutritional status significantly influenced the incidence of fatty liver because the p-value produced was 0.036 or below 0.05. Although nutritional status did not have a significant effect on dyslipidemia, workers with overweight and obese status showed a 12 and 6 times greater risk of developing dyslipidemia than standard nutritional status. Likewise, the incidence of fatty liver where workers with overweight and obese nutritional status have a 6 and 49 times greater risk chance, respectively, compared to standard nutritional status. There was no association between an increased risk of hypertension events and nutritional status.

Table 3: The Relationship between Nutritional Status and Health Conditions.

Nutritional Status	Health Conditions					
	Dyslipidemia	OR	Fatty Liver	OR	Hypertension	OR
Normal	4	Ref	1	Ref	3	Ref
Overweight	12	12	6	6	4	0,741
Obesity	6	3	7	49	2	0,556
p value	0,136*		0,036*		0,865*	

* significant if p < 0.05

Source: Authors.

3.2. Discussion.

The nutritional needs of QCC operators in one meal were calculated using the 2019 Nutritional Adequacy Number (AKG) with an energy requirement of 844 kcal. The total number of calories from food provided by the company for shifts 1, 2, and 3 exceeded the energy requirement in one meal (energy fulfillment of 113%, 121%, and 132%). Excessive food intake is associated with weight gain and obesity (Sugiura et al., 2020). This can also be seen from the number of overweight and obese workers who are more than workers with normal nutritional status on each shift. In this study, it was found that there was a very weak positive correlation between shifts and nutritional status. A rotating shift system can cause this. Workers with a rotational shift system undergo continuous adaptation to the circadian system, so there is no significant difference between shifts and nutritional status compared to workers with a permanent shift system (Sun et al., 2018). Even so, the nutritional status of workers must still be considered—research conducted by Amin et al. (2019) on field workers of PT. Pelabuhan Indonesia IV (Persero) Bitung Branch shows a meaningful relationship between abnormal nutritional status and worker fatigue. The study also found severe fatigue in workers with abnormal nutritional status (Amin, Kawatu and Amisi, 2019). In addition to abnormal nutritional status (overweight or obesity), abnormal food intake combined with working with a shift system can also cause various kinds of diseases in workers. Diseases related to abnormal eating intake and shift system are metabolic syndrome (dyslipidemia, abnormal blood pressure, and abnor-

mal blood sugar) (MORENO et al., 2019). This can also be seen in the results of the MCU examination of QCC operators, which show that the three most commonly found health conditions are dyslipidemia, fatty liver, and hypertension.

Productivity can be interpreted as the average efficiency of workers in producing a reasonable (Yunieswati, Marliyati and Setiawan, 2020). This study measured worker productivity based on how many containers were loaded and unloaded. Based on the statistical analysis results, no significant relationship was found between nutritional status and productivity. This result aligns with previous research conducted by Yunieswati et al., 2020, where no significant association was found between nutritional status based on body mass index (BMI) and productivity. Various factors can influence this weak link; one is that a person's productivity is more influenced by micronutrient status, such as iron (Yunieswati, Marliyati and Setiawan, 2020). In addition, the measurement related to the correlation of worker efficiency with nutritional status can be seen more through the measurement of the percentage of attendance and attendance compared to the measurement of productivity (Grimani, Aboagye and Kwak, 2019; Yunieswati, Marliyati and Setiawan, 2020). The measurement can better see the influence of nutritional status on health conditions that lead to the total or absence of workers and health claims (van Duijvenbode et al., 2009; Robroek et al., 2011).

The subjects in this study are QCC operators aged 44 - 54 years, averaging 47.89 years. People over the age of 40 have a higher risk of developing non-communicable diseases and chronic diseases than people of other ages (Yunieswati, Marliyati and Setiawan, 2020). Dyslipidemia, fatty liver, and hypertension are among some of the non-communicable diseases with the highest incidence percentage. Based on statistical analysis, there is no significant relationship between health conditions and worker productivity. This condition is by research conducted by Huber et al., 2018 and Yunieswati et al., 2020 where dyslipidemia, fatty liver, and hypertension are not directly related to productivity. However, all three can be risk factors for chronic diseases or diseases over a long period that occur slowly (Huber et al., 2019; Yunieswati, Marliyati and Setiawan, 2020). This can reduce worker productivity. Although there was no significant association, the incidence of hypertension made the risk of unproductive workers 1.25 times higher. Hypertension causes several symptoms, such as dizziness, headaches, and blurred vision, that cause a decrease in worker productivity (Yunieswati, Marliyati and Setiawan, 2020; Lee et al., 2021).

Of the three diseases experienced by QCC operators, dyslipidemia and hypertension did not have a significant relationship with the nutritional status of workers. Nutritional status also does not increase the risk of hypertension, which increases the risk of dyslipidemia and fatty liver. The leading cause of overweight and obesity is high levels of fat in the body. High body fat levels can result in metabolic disorders where fat levels in the blood increase, referred to as dyslipidemia. Excess fat levels in the. The body can also be stored in the liver, where overweight and obesity are one of the main factors. This condition is called fatty liver (Huber et al., 2019). Therefore, nutritional status is a risk factor for dyslipidemia and fatty liver. Hypertension has no association because this event is more related to sodium intake (Islawati, Abadi and Dhesa, 2023).

Conclusions.

There was a positive correlation between the feeding intake of the shift group and the nutritional status of QCC operators. In addition, abnormal nutritional status can increase the risk of dyslipidemia and fatty liver, while hypertension can increase the risk of unproductive workers. However, no significant relationship was found between nutritional status and health conditions and productivity and between nutritional status and health conditions of workers except fatty liver. Even though there is no significant relationship, companies still have to pay attention to the nutritional status of workers through food intake, menu composition, and nutrition according to their needs.

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