



# Correlation between Nutritional Intake, Physical Activity, and Occupational Stress with Blood Pressure in Dockworkers at Indonesia Fishing Port

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## Abstract

**BACKGROUND:** Hypertension in the population can result in lost productivity due to an increased risk of premature death and a decline in work productivity. The study on hypertension in workers in Indonesia has primarily focused on formal workers with regular working hours, with little attention paid to informal workers.

**AIM:** This study aims to analyze the correlation between nutritional intake, physical activity, and occupational stress with blood pressure in dockworkers at the fishing port (TPI) Kendal, Indonesia.

**METHODS:** There were 51 male dockworkers recruited. We used a 24-h recall to assess nutritional intake over three non-consecutive days. The physical activity index was measured using the Questionnaire for the Measurement of a Person's Habitual Physical Activity. Data on occupational stress were obtained through interviews using the Workplace Stress Scale questionnaire. Pearson's product moment and Spearman's rank were used to performing a correlation test between variables.

**RESULTS:** The majority of dockworkers had prehypertension (35.3%). There was a correlation between BMI and systolic ( $p = 0.001$ ;  $r = 0.554$ ) and diastolic ( $p = 0.001$ ;  $r = 0.459$ ) blood pressure. Meanwhile, age was related to systolic blood pressure ( $p = 0.022$ ;  $r = 0.320$ ), and cholesterol intake was associated with diastolic blood pressure ( $p = 0.040$ ;  $r = 0.289$ ). Blood pressure was not associated with physical activity and occupational stress.

**CONCLUSION:** Dockworkers should reduce sedentary activities and maintain healthy body weight to prevent hypertension.

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## Introduction

The number of people with hypertension in the world has doubled over the last three decades, from 331 million women and 317 million men in 1990 to 626 million women and 652 million men in 2019 [1]. In Indonesia, the prevalence of hypertension among people aged 18 and over has risen from 25.8% in 2013 to 34.1% in 2018 [2], [3]. According to the World Health Organization (WHO), one in every four men has hypertension, which is more than one in every five women [4]. Between 2013 and 2018, the percentage of male hypertension sufferers increased by nearly 10%, from 22.8% in 2013 to 31.34% in 2018 [3]. Factors of age, gender, occupation, lifestyle (smoking behavior, alcohol consumption, and physical activity), and consumption patterns, particularly consumption of vegetables and fruit, and caffeinated foods are some of the causes of hypertension [4], [5]. The increased risk of hypertension in low socioeconomic groups is associated with occupation, education, and income [6]. Compared to office workers, non-office workers have a higher prevalence of hypertension according to a

Korean study [7]. Laborers, farmers, and fishermen had the highest rate of hypertension in Indonesia's working population, at 25.0% in 2013. The rate of hypertension among laborers, drivers, and household assistants rose to 30.22% [3].

Hypertension is a worldwide epidemic that could lead to stroke, myocardial infarction, heart failure, dementia, kidney failure, and blindness if left uncontrolled [8]. An increase in the number of hypertensive people in a population can result in lost productivity due to an increased risk of premature death and a decrease in work productivity. In Japan, middle-aged workers (aged 40–54 years) bear the brunt of lost productivity because this age group accounts for 38.7% of the total working population and has a high prevalence of hypertension. In workers aged 30–39 years, the death rate from untreated hypertension reaches 13.2%. Hypertension is estimated to cause a loss of 3.1 million productivity-adjusted life years (PALYs) and an economic loss of US\$ 242.9 billion [9].

Globalization affects lifestyle habits such as eating and physical activity [10]. It led to a transition in disease patterns from infectious diseases associated with

undernutrition to chronic diseases such as hypertension triggered by obesity [11]. So far, research on hypertension in workers in Indonesia has primarily focused on formal workers with regular working hours, with little attention paid to informal workers. In fact, with irregular working hours, there is a possibility that poor eating and physical activity patterns in groups of informal workers can trigger non-communicable diseases such as hypertension. In addition, the psychological factor of occupational stress, which increases the risk of hypertension, is not only experienced by office employees but also by field workers [12]. A case-control study on mining workers in China found that the body's response to occupational stress causes hypertension [13].

Based on the above background, this study aims to analyze the relationship between nutritional intake, physical activity, and occupational stress with blood pressure in dockworkers at a fishing port in Indonesia.

## Methods

### Study design

The study design used is an observational method with a cross-sectional study approach. This study's population consisted of 51 dockworkers from the fishing port (TPI) Cepiring in Kendal, Central Java, Indonesia. The sample is the total population which is entirely composed of men.

### Measurement

Body weight was measured with a digital scale (Omron, Japan) with a 0.1 kg precision, and height was measured with a stadiometer with a 0.1 cm precision. Body mass index (BMI) is calculated using weight and height data by dividing body weight (kg) by height squared ( $m^2$ ). Nutritional intake data were obtained through the 24-h recall for three non-consecutive days. The portion of food in the recall form is converted in grams and then analyzed using Nutrisurvey software to measure the intake of macronutrients (energy, protein, fat, and carbohydrate) and micronutrients (cholesterol, dietary fiber, sodium, and potassium) that can affect blood pressure. The physical activity index was measured using the Questionnaire for the Measurement of a Person's Habitual Physical Activity. The physical activity index was measured in three categories: Work activity, sports activity, and leisure activity. Each item is scored from 1 to 5 (except for exercise intensity and duration), and the average score for each category of physical activity is determined. The overall physical activity index is the sum of each category's scores (work, sports, and leisure activity). Sports intensity is divided into three categories based on average

energy expenditure as follows: 1) Low level (average energy expenditure of 0.76 MK/h such as billiards and sailing; 2) Middle level (average energy expenditure of 1.26 MJ/h such as badminton, cycling, swimming, and tennis; and 3) High level (average energy expenditure of 1.76 MJ/h such as boxing, basketball, and football) [14]. Meanwhile, occupational stress data were obtained through interviews with the Workplace Stress Scale questionnaire developed by Marlin Company, North Haven, CT, USA, and the American Institute of Stress, Yonkers, NY, USA [15]. Participants answered eight questions by choosing one of the following options: never, rarely, sometimes, often, and very often, with a score of 1 for never and 5 for very often. The total score will represent the occupational stress level as follows: (1) Stress is not much of an issue (total score of 15 or lower), (2) Fairly low (total score 16 to 20), (3) Moderate stress (total score 21–25), (4) Severe (total score 26–30), and (5) Stress level is potentially dangerous (total score 31–40). Blood pressure was measured using a standardized digital blood pressure device (the Omron Digital HEM-8712, Japan). Blood pressure measures for adults were classified according to The Seventh Report of The Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC VII) 2003 (Table 1).

This study has received ethical approval (No. 114/EA/KEPK-FKM/2022) from the Health Research Ethics Committee, Faculty of Public Health, Diponegoro University, Semarang, Indonesia.

### Statistical analysis

Statistical analysis was carried out using SPSS software version 23. Before univariate and bivariate analysis, the normality test was first performed using the Kolmogorov–Smirnov test. A descriptive analysis of the mean standard deviation (SD) and correlation test using the Pearson Product Moment test was performed on data with a normal distribution, while a Rank Spearman test and a descriptive analysis of the median (minimum-maximum) were carried out for data that were not normally distributed. Statistical analysis was performed with a 95% confidence level or  $\alpha$  5%.

## Results

Table 2 shows the baseline characteristics of dockworkers at TPI Cepiring, Kendal, Indonesia. The average age of the dockworkers is 42.75 years, and most of them have blood pressure in the prehypertension category (35.3%), followed by the normal category (27.5%).

Overall, dock workers did not feel too stressed over their work. Most dockworkers never feel

**Table 1: Classification of blood pressure for adults [16]**

Blood pressure classification	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
Normal	<120	<80
Prehypertension	120–139	80–89
Stage 1 hypertension	140–159	90–99
Stage 2 hypertension	≥160	≥100

unpleasant or unsafe at work (80.4%), never affected negatively because of the job (74.5%), never have too much work to do (62.7%), and the job pressures never interfere with their personal life (88.2%). Nearly a third of dockworkers in this study said that they receive appropriate recognition or rewards for their good performance (Table 3).

**Table 2: Baseline characteristics of dockworkers at TPI Cepiring, Kendal, Indonesia**

Characteristic	Value
Age (years)	42.75 ± 9.43
BMI (kg/m <sup>2</sup> )	24.54 ± 3.50
Systolic blood pressure (mmHg)	136.04 ± 21.02
Diastolic blood pressure (mmHg)	80.50 (68.50–142.50)
Blood pressure status, n (%)	
Normal	14 (27.5)
Prehypertension	18 (35.3)
Stage 1 hypertension	13 (25.5)
Stage 2 hypertension	6 (11.8)
Physical activity indices	
Work	2.93 ± 0.30
Sports	10.00 (4.00–15.00)
Leisure-time	2.58 ± 0.50
Occupational stress score	14.00 (10.00–25.00)
Nutritional intake	
Energy (kcal/day)	1887.47 ± 386.06
Protein (g/day)	97.21 ± 34.32
Fat (g/day)	33.40 (15.34–94.40)
Cholesterol (mg/day)	466.47 ± 239.56
Dietary fiber (g/day)	12.63 (4.10–29.78)
Carbohydrate (g/day)	258.41 (24.40–1161.10)
Sodium (g/day)	629.01 (164.00–5555.50)
Potassium (mg/day)	2182.65 ± 986.95

Data are mean ± standard deviation or median (minimum–maximum) for quantitative variables and frequency (percent) for categorical variables. BMI: Body mass index

The findings revealed a link between BMI and systolic ( $p = 0.001$ ;  $r = 0.554$ ) and diastolic ( $p = 0.001$ ;  $r = 0.459$ ) blood pressure (Figure 1). Meanwhile, age was related to systolic blood pressure ( $p = 0.022$ ;  $r = 0.320$ ). Among the eight types of nutrients analyzed, only cholesterol intake was associated with diastolic blood pressure ( $p = 0.040$ ;  $r = 0.289$ ). Other variables, such as physical activity and occupational stress, were not associated with blood pressure in the dockworkers (Table 4).

## Discussion

The majority of dockworkers at TPI Cepiring, Kendal, Indonesia, have prehypertension (35.3%), that is, blood pressure is in the range of 120–139 mmHg for systolic blood pressure (SBP) or 80–89 mmHg for diastolic blood pressure (DBP) [16]. This prevalence is the same as prehypertension in physical laborers in China (35.5%) after a study was conducted on 47,495 adults population [17]. In industrial workers/day laborers in urban areas of Bangladesh, the prevalence of prehypertension is slightly higher than in the present study, which is 36.3% [18]. A higher prevalence of

**Table 3: Occupational stress questionnaire for dockworkers at TPI Cepiring, Kendal, Indonesia**

Question	N (%)
Conditions at work are unpleasant or sometimes even unsafe	
Never	41 (80.4)
Rarely	7 (13.7)
Sometimes	2 (3.9)
Often	1 (2.0)
Very Often	0 (0.0)
I feel that my job is negatively affecting my physical or emotional well being	
Never	38 (74.5)
Rarely	7 (13.7)
Sometimes	3 (5.9)
Often	3 (5.9)
Very Often	0 (0.0)
I have too much work to do and/or too many unreasonable deadlines.	
Never	32 (62.7)
Rarely	8 (15.7)
Sometimes	5 (9.8)
Often	6 (11.8)
Very often	0 (0.0)
I find it difficult to express my opinions or feelings about my job conditions to my superiors	
Never	42 (82.4)
Rarely	3 (5.9)
Sometimes	4 (7.8)
Often	2 (3.9)
Very often	0 (0.0)
I feel that job pressures interfere with my family or personal life	
Never	45 (88.2)
Rarely	2 (3.9)
Sometimes	4 (7.8)
Often	0 (0.0)
Very often	0 (0.0)
I have adequate control or input over my work duties	
Never	5 (9.8)
Rarely	33 (64.7)
Sometimes	6 (11.8)
Often	3 (5.9)
Very often	4 (7.8)
I receive appropriate recognition or rewards for good performance	
Never	1 (2.0)
Rarely	18 (35.3)
Sometimes	14 (27.5)
Often	7 (13.7)
Very often	11 (21.6)
I am able to utilize my skills and talents to the fullest extent at work	
Never	13 (25.5)
Rarely	33 (64.7)
Sometimes	3 (5.9)
Often	1 (2.0)
Very often	1 (2.0)

hypertension (38.5%) was also found in the manual laborer in South Korea in the Korean National Health and Nutrition Examination Survey (KNHANES) [19]. Prehypertension should be a concern since it increases the risk of hypertension threefold compared to persons with normal blood pressure [20]. In addition, people with

**Table 4: Correlation between body mass index, physical activity, occupational stress, and nutritional intake with blood pressure in dockworkers at TPI Cepiring, Kendal, Indonesia**

Variables	Systolic blood pressure		Diastolic blood pressure	
	r	p	r	P
Age (years)	0.320	0.022 <sup>ab</sup>	0.101	0.479 <sup>b</sup>
BMI (kg/m <sup>2</sup> )	0.554	0.001 <sup>aa</sup>	0.459	0.001 <sup>ab</sup>
Physical activity	0.022	0.877 <sup>b</sup>	0.077	0.593 <sup>c</sup>
Physical activity indices				
Work	0.006	0.966 <sup>b</sup>	0.011	0.940 <sup>b</sup>
Sports	0.035	0.806 <sup>b</sup>	0.040	0.761 <sup>b</sup>
Leisure-time	0.007	0.959 <sup>b</sup>	0.112	0.436 <sup>b</sup>
Occupational stress	0.026	0.856 <sup>b</sup>	-0.089	0.535 <sup>b</sup>
Nutritional intake				
Energy (kcal/day)	0.044	0.761 <sup>a</sup>	-0.022	0.878 <sup>b</sup>
Protein (g/day)	0.059	0.682 <sup>a</sup>	0.123	0.389 <sup>b</sup>
Fat (g/day)	0.016	0.909 <sup>b</sup>	0.045	0.756 <sup>b</sup>
Cholesterol (mg/day)	0.120	0.401 <sup>a</sup>	0.289	0.040 <sup>ab</sup>
Dietary fiber (g/day)	-0.020	0.887 <sup>b</sup>	-0.097	0.498 <sup>b</sup>
Carbohydrate (g/day)	-0.017	0.905 <sup>b</sup>	0.067	0.641 <sup>b</sup>
Sodium (g/day)	0.003	0.984 <sup>b</sup>	0.095	0.509 <sup>b</sup>
Potassium (mg/day)	0.008	0.957 <sup>b</sup>	-0.039	0.788 <sup>b</sup>

BMI: Body mass index. <sup>a</sup>Significant correlation ( $p$ -value<0.05). <sup>b</sup>Pearson Product Moment test. <sup>c</sup>Rank Spearman test

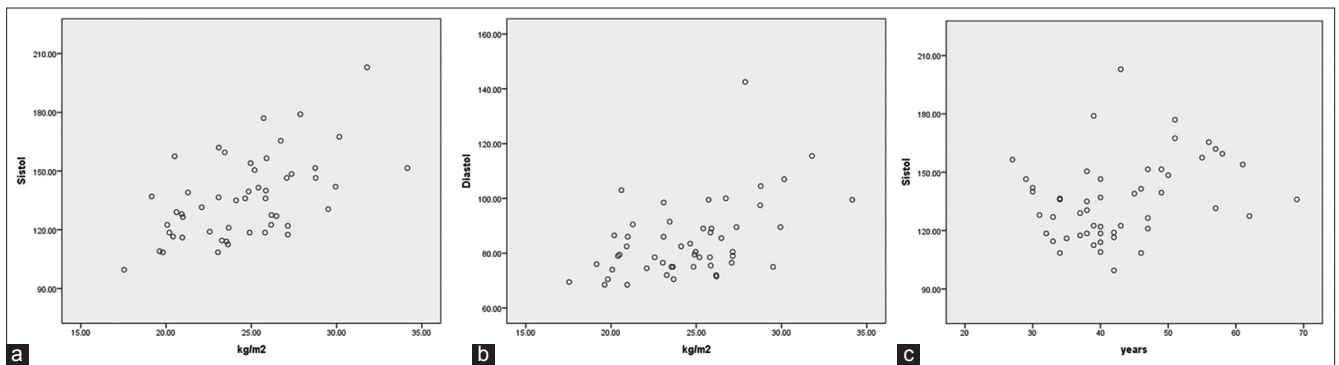


Figure 1: The scatter plots show the significant relationship between variables. (a) Body mass index versus systolic blood pressure. (b) Body mass index versus diastolic blood pressure. (c) Age versus systolic blood pressure

prehypertension have an increased risk of morbidity and mortality from cardiovascular disease. They are 1.7 times and 3.5 times more likely to have coronary artery disease and myocardial infarction, respectively [21].

Blood pressure status in the present study, which was dominated by prehypertension situations, might be because most dockworkers rarely engage in physical exercise other than heavy lifting linked to their occupation at TPI Cepiring. Whereas the decreased risk of hypertension is more related to high and moderate levels of recreational and leisure activity (play, games, sports, or planned exercise) rather than occupational-related physical activity [22]. On the other hand, high levels of work activity can increase the risk of adverse health outcomes and death from cardiovascular diseases [23]. In this study, more than half of the participants spent their leisure time watching TV. In addition, walking or cycling is only done for 5–15 min/day. This is lower than recommended by the WHO, which is 150–300 min per week or at least 20 min/day of moderate-intensity aerobic physical activity [24]. Walking < 30 min a day can increase the risk of prehypertension in healthy adults [25].

This study found a significant relationship between SBP and DBP with BMI. It is in line with an Indian study that found a positive connection between BMI and SBP and DBP in male adults in Delhi's Punjabi community. Men with a BMI overweight or obese have a risk of 1.77 and 2.82 times for prehypertension based on the results of measurements of SBP and DBP, respectively [26]. BMI and blood pressure had a consistently positive association despite the difference in age, household income, occupation, race/ethnicity, marital status, location of residence, education level, smoking status, and history of stroke [27].

BMI's involvement in controlling blood pressure could be related to visceral adipose tissue, which is significantly linked to blood pressure. Excess visceral fat increases the risk of prehypertension in people aged 35–64 [28]. Furthermore, abdominal obesity, which denotes the buildup of fat in the abdomen, is a possibility even in those with normal BMIs. Abdominal obesity is associated with a range of metabolic disorders, one of

which is elevated blood pressure [29]. Furthermore, the Korean National Health and Nutrition Examination Survey (KNHANES) discovered that the prevalence of obesity in male manual laborers (e.g., agriculture, fishery, and forestry workers) has increased over the last two decades as a result of excessive calorie consumption and low physical activity [30].

The occupational stress score was 14.00, indicating that stress is not much of an issue among the dockworkers in TPI Cepiring, Indonesia. It might be because the work of transporting goods from the ship to the port is considered not demanding by the workers, so they are not psychologically affected. It is in line with findings from a study conducted at three Danish ports, in which most dockworkers reported that their jobs were not stressful, and half of the workers had never felt stressed [31]. Furthermore, unlike workers in other industries, dockworkers are jobs that provide a lot of freedom in performing their tasks, decision-making, and working hours so that they generally feel more comfortable [32]. Having flexible working hours and never working overtime is a factor that protects dockworkers from depressive symptoms [33]. Although the study's findings did not show a statistically significant correlation between occupational stress and blood pressure due to the small sample size, it can provide an overview of the level of occupational stress on dockworkers at TPI Cepiring, Kendal, Indonesia.

## Conclusion

In this study, SBP and DBP were associated with BMI in dockworkers at TPI Cepiring, Kendal, Indonesia. Meanwhile, physical activity was not related to blood pressure even though their level of physical activity was in the high level category. We also found that nutritional intake and occupational stress did not correlate with SBP. We recommend that dockworkers reduce sedentary activities and manage body weight to prevent hypertension.



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