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Research Article

Analysis of Hypertension Risk Factors in Ship's Men: The Role of Age, Smoking Habit, and Noise Exposure

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Abstract: Hypertension is a critical health indicator that reflects an individual's cardiovascular condition. This study aims to analyze risk factors associated with hypertension among seafarers in Semarang, focusing on age, smoking habits, and noise exposure. Using a cross-sectional design, the study involved 43 seafarers from three ships at Tanjung Mas Port. Data were collected through questionnaires and blood pressure measurements using a sphygmomanometer, while noise exposure was measured with a sound level meter. The results showed a significant association between age and blood pressure, with individuals over 30 years of age having higher levels of prehypertension and hypertension ($p = 0.021$). Conversely, no significant correlation was found between smoking habits ($p = 0.880$) or noise exposure ($p = 0.290$) and blood pressure levels. These results suggest that while age is a significant risk factor for hypertension, smoking and noise exposure may not have a direct impact. This study highlights the need for comprehensive health monitoring and interventions targeting lifestyle changes among seafarers to reduce the risk of hypertension and improve overall health and safety in the maritime work environment.

Keywords: age; health; hypertension; physical work environment; smoking.

1. Introduction

Blood pressure is one of the most important health indicators and reflects the condition of a person's cardiovascular system [1]. An uncontrolled increase in blood pressure can lead to various serious complications, such as coronary heart disease, stroke, and kidney failure. Various factors that can affect blood pressure include age, smoking habits, and exposure to unhealthy environments, such as noise (Septiasary et al., 2024). Crews, especially those working in Semarang City, are often exposed to challenging work environments, including high noise levels, unhealthy lifestyles, and the risk of exposure to hazardous substances such as cigarette smoke. Working conditions that demand high focus and physical and mental job stress make blood pressure one of the important parameters to monitor in maintaining the health of these workers.

Noise pollution is an unwanted sound or sound that comes from the industrial area of the ongoing production process [3]. Noise is measured using a tool called a Sound Level Meter with units of Hertz and frequency or sound waves in units of decibels (Rahmah, 2023). Noise exposure is an environmental factor that has a significant influence on blood pressure. Chronic noise can increase psychological and physiological stress, triggering sympathetic responses that increase heart rate and blood pressure.

According to the Minister of Manpower Regulation No. 5/2018 on Occupational Safety and Health in the Work Environment, workers are allowed to be exposed to noise with an intensity of 85 dBA for 8 hours per day. So, it must be adjusted so that the noise intensity of the work environment does not exceed the threshold value (NAB). If the workplace noise intensity exceeds 85 dBA in 8 working hours, it can cause health problems due to noise.

Workers who do their jobs will experience the risk of hypertension if the work environment and other factors influence them. Hypertension occurs due to various uncontrollable factors, such as age and gender, while controllable risk factors include cigarette consumption, stress, and alcohol consumption [5]. The systolic pressure can increase because

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the arteries become stiffer as a person ages, and the accommodated blood will decrease [6]. Cigarettes contain highly addictive substances, with more than 4000 that can damage the human body, one of which is nicotine; this can make platelets increasingly sticky so that they can injure the heart arteries and form blood clots that can cause plaque [7]. Nicotine can also cause vasoconstriction, increased heart rate, and damage to blood vessels that contribute to increased blood pressure. Based on data from the Indonesian Ministry of Health (2023), the prevalence of smoking in Indonesia reached 70 million people, including 7.4% of adolescents aged 10-18 years. In Central Java, research in 2021 showed a higher figure of 28.24% (Central Java Health Office, 2021). As we age, the elasticity of blood vessels tends to decrease, increasing peripheral resistance and blood pressure [8].

Previous studies have shown that workplace noise exposure is positively correlated with an increased risk of hypertension, but specific evidence in crew members is limited. The characteristics of the marine work environment and shift work patterns may exacerbate the impact of noise on cardiovascular health. Therefore, this study combined the variables of age, smoking habit, and noise exposure to provide a more in-depth understanding of the interaction of these three factors and their influence on crew members' blood pressure in Semarang City.

The urgency of this research is high, given that Semarang City is a major port in Indonesia with heavy ship activity. The health of crew members is critical to shipping operations and safety. Undetected hypertension can increase the risk of occupational accidents and reduce productivity. By understanding the relationship between these risk factors, effective health policies and interventions can be designed to minimize the negative impact on crew health and improve safety.

2. Literature Review

Research conducted by Amelia et al., (2023) with a sample of 44 crew members of the Directorate of Water Police of Aceh Police consisting of 12 ships. The average noise level is 141.25 dBA. Statistical Test Chi-Square Test. The results showed that the prevalence of hypertension in crew members was 71.36%.

The study by Asrun et al., (2023) aimed to determine the risk factors associated with the prevalence of hypertension in crew members in the Sea Port Coverage of the Poso Port Health Office Bungku Working Area. The sample size in this study was 385 participants. The prevalence of hypertension in crew members was 12.73%. Logistic regression results showed that crew members were overweight (AOR=15.93; 95%CI: 5.080-49.981; p=0.000) and moderate and heavy smokers among crew members (AOR=2.51; 95%CI: 1.038-6.066; p=0.021). Factors associated with the prevalence of hypertension in children with disabilities after control were age >45 years (AOR=22.94; 95%CI: 2.587-203.477; p=0.005) and family history of hypertension (AOR=6.01; 95%CI: 2.741-13.168; p=0.000).

In a study entitled "The Relationship of Noise Level, Age, and Smoking Behavior with Increased Blood Pressure," there is a relationship between noise level, age, and smoking behavior and increased blood pressure of workers in wood processing UD. Cahaya Alba (Rahmah, 2023).

3. Proposed Method

This quantitative study used an analytic observational method and cross-sectional design. The research subjects were crew members on three ships at Tanjung Mas Port Semarang with a population of 43 workers. This study used a total sampling method to determine the sample with inclusion criteria, namely crew workers in good health and willing to become research subjects, and exclusion, namely workers who could not attend at the time of the study.

The independent variables in this study are age, smoking habits, and noise exposure. The dependent variable is blood pressure. Data collection of independent variables using a questionnaire. Blood pressure data was collected using a tensimeter, and noise exposure was measured using a sound level meter. This study analyzed univariate and bivariate data using the Chi-square test. If the data was not normally distributed, it was continued with the Spearman Rank test. This study has received a research ethics certificate with letter number 0008/KEPK-FKM/UNIMUS/2025.

4. Results and Discussion

In this section, the author needs to explain the hardware and software used, dataset sources, initial data analysis, results, and results analysis/discussion. Presenting the results with pictures, graphs and tables is highly recommended. Formulas or evaluation measuring tools also need to be included here. There must be discussion/analysis, and you can't just rewrite the results in sentence form, but you need to provide an explanation of their relationship to the initial hypothesis. In addition, this section needs to discuss and elaborate on important findings.

4.1. Figures and Tables

4.1.1 Univariate Analysis

Table 1. Univariate Analysis of Variables

Variables	Minimum	Maximum	Mean ± Std
Age	20	66	32,77 ± 10,63
Smoking Habit	0	40	6,84 ± 7,95
Noise Exposure	66,5	98,9	83,18 ± 11,74

Based on Table 1, the age variable shows that the minimum age of the respondents is 20 years old, and the maximum is 66 years old, with an average age of 32.77 years old and a standard deviation of 10.63. Smoking Habit, which is measured in the number of cigarettes per day, has a minimum value of 0 (indicating some respondents do not smoke) and a maximum of 40, with an average of 6.84 and a standard deviation of 7.95. Furthermore, Noise Exposure has a minimum value of 66.5 dB and a maximum value of 98.9 dB, with an average of 83.18 and a standard deviation of 11.74, indicating a relatively high noise level.

Table 2. Frequency Distribution of Variables

Variables	Category	Frequency	Percentage (%)
Age	≤ 30 years	22	51,2
	> 30 years	11	48,8
Smoking Habit	No Smoking	15	34,9
	Smoking	28	65,1
Noise Exposure	≤ 85 dBA	18	41,99
	> 85 dBA	25	58,1

Table 2 shows the frequency distribution of respondents based on variables of age, smoking habits, and noise exposure in crew members, where most respondents were under 30 years old (51.2%; n=22) compared to those over 30 years old (48.8%; n=21). In the smoking habit variable, there was a dominance of respondents who smoked (65.1%; n=28) compared to those who did not smoke (34.9%; n=15). Meanwhile, noise exposure showed that more than half of the respondents (58.1%; n=25) experienced exposure exceeding the 85 dBA threshold, while 41.9% (n=18) were exposed to below the threshold value. This distribution reveals a worrying picture of the working environment in the shipping sector, where most workers are exposed to the dual risk factors of smoking and high noise exposure, with an age pattern dominated by young workers who particularly require attention in the context of occupational health.

4.1.2 Bivariate Analysis

Relationship between Age and Blood Pressure

Table 3. Distribution of Age with Blood Pressure

Variables	Blood Pressure										
	Normal		Pre Hypertension		First Degree Hypertension		Second Degree Hypertension		Total		P
Age	f	%	f	%	f	%	f	%	f	%	
≤ 30 years	1	4,5	15	68,2	5	22,8	1	4,5	22	100	0,021
> 30 years	2	9,5	9	42,9	8	38,1	2	9,5	21	100	

Based on the results showed that in the age group less than 30 years, there was 1 respondent (4.5%) with normal blood pressure, 15 respondents (68.2%) had pre-hypertension, 5 respondents (22.8%) were in the first-degree hypertension category, and 1 respondent (4.5%) had second-degree hypertension. Meanwhile, in the age group of more than 30 years, there were 2 respondents (9.5%) with normal blood pressure, 9 respondents (42.9%) had pre-hypertension, 8 respondents (38.1%) were in the first-degree hypertension category, and 2 respondents (9.5%) had second-degree hypertension. This study's total number of respondents was 43, with a p-value of 0.021, indicating a significant difference in blood pressure distribution between the two age groups. These results suggest that the prevalence of pre-hypertension and hypertension increases with age, with the age group over 30 years showing a higher proportion in the hypertension category.

Based on research conducted by Giri et al., (2024), there is a significant relationship between age and hypertension. Respondents over the age of 30 tend to be more susceptible to hypertension; this is due to a decrease in organ function with age, which makes individuals more susceptible to various diseases [12]. Meanwhile, individuals with normal blood pressure often have a good diet, low stress levels, and regular sleeping habits [13].

Age is one of the important factors affecting blood pressure; where the older a person gets, the more likely they are to develop hypertension. Research conducted by Amanda & Martini (2018) shows that the prevalence of hypertension increases in individuals over 35 years. The results indicated an association between age and hypertension in adult outpatients, which is caused by structural changes in large blood vessels. With age, blood vessels tend to narrow, and their walls become stiff, contributing to increased blood pressure. Another opinion in line with these findings was delivered by Muhammad Yunus et al (2021), who also stated that hypertension increases with age. If this condition is not treated quickly and appropriately, the risk of complications will be more severe.

Limiting table salt in every dish can help prevent hypertension. Limiting salt intake reduces sodium levels in the body [16]. By reducing salt consumption, systolic blood pressure can be lowered between 2 and 8 mmHg. In addition, regular physical activity according to individual abilities, such as leisurely walking, jogging, or cycling, is recommended 3 to 4 times a week for 30 to 45 minutes.

Relationship between Smoking Habits and Blood Pressure

Table 4. Distribution of Smoking Habits with Blood Pressure

Variables	Blood Pressure										
	Normal		Pre Hypertension		First Degree Hypertension		Second Degree Hypertension		Total		P
Smoking Habbit	f	%	f	%	f	%	f	%	f	%	
No Smoking	3	20	6	40	3	20	3	20	15	100	0,880
Smoking	5	17,9	13	46,4	7	25	3	10,7	28	100	

Based on Table 4, in the non-smoking group, there were 3 respondents (20%) with normal blood pressure, 6 respondents (40%) had pre-hypertension, 3 respondents (20%) were in the first-degree hypertension category, and 3 respondents (20%) had second-degree hypertension. Meanwhile, in the smoker group, there were 5 respondents (17.9%) with normal blood pressure, 13 respondents (46.4%) had pre-hypertension, 7 respondents (25%) were in the first-degree hypertension category, and 3 respondents (10.7%) had second-degree hypertension. This study's total number of respondents was 43, with a p-value of 0.880, indicating no significant difference between smoking habits and blood pressure status.

This is supported by research by Zaenurrohmah & Rachmayanti (2017), which shows that not all smokers experience the same increase in blood pressure. Several influencing factors, such as genetics, diet, level of physical activity, and other health conditions, can affect how the body responds to exposure to nicotine and other harmful substances in cigarettes.

Smoking is often associated with other risk factors that can affect cardiovascular health, such as an unhealthy diet, lack of physical activity and stress levels [18]. In the context of this study, if respondents who smoke also have other unhealthy life habits, it will be difficult to separate the effects of smoking on blood pressure. Research by Almutairi et al. (2025) shows that overall lifestyle, including diet and physical activity, has a greater impact on heart health than smoking.

Furthermore, although smoking is recognized as a risk factor for various cardiovascular diseases, smoking may cause a temporary increase in blood pressure after smoking a cigarette. However, this effect may not be significant enough to affect overall blood pressure status in the long term [20]. Research by Garwahusada & Wirjatmadi (2020) shows that although smoking can cause fluctuations in blood pressure, individuals who quit smoking often experience a significant drop in blood pressure over time, which suggests that other factors also play a role in blood pressure management.

Although the results of this study showed no significant association between smoking and blood pressure, this does not diminish the importance of prevention efforts and health interventions. Smoking remains a significant risk factor for many diseases, including heart disease and stroke. Therefore, reducing smoking and promoting healthy lifestyles should remain a priority, especially among high-risk groups of workers, such as crew members.

Relationship between Noise Exposure and Blood Pressure

Table 5. Distribution of Noise Exposure with Blood Pressure

Variables	Blood Pressure										
	Normal		Pre Hypertension		First Degree Hypertension		Second Degree Hypertension		Total		P
Noise Exposure	f	%	f	%	f	%	f	%	f	%	
≤ 85 dBA	2	11,1	7	38,9	8	44,4	1	5,6	18	100	0,290
> 85 dBA	1	4	17	68	5	20	2	8	25	100	

Based on the table above, in the group with noise exposure below 85 dB, there were 2 respondents (11.1%) with normal blood pressure, 7 respondents (38.9%) had pre-hypertension, 8 respondents (44.4%) were in the first-degree hypertension category, and 1 respondent (5.6%) had second-degree hypertension. Meanwhile, in the group with noise exposure above 85 dB, there was 1 respondent (4.0%) with normal blood pressure, 17 respondents (68%) had pre-hypertension, 5 respondents (20%) were in the first-degree hypertension category, and 2 respondents (8%) had second-degree hypertension, with a p-value of 0.290, indicating no significant difference between the two groups in terms of blood pressure distribution.

The results showed interesting differences in the distribution of blood pressure categories between groups with noise exposure <85 dB and >85 dB, although not statistically significant (p=0.290). The group with >85 dB exposure showed a higher percentage of pre-hypertension (68%) than the <85 dB group (38.9%). These findings are in line with research by Andjani & Mediana (2020). who found that chronic noise exposure >80 dB correlates with an increased risk of cardiovascular disorders through oxidative stress and activation of the sympathetic nervous system.

The results showed that noise exposure did not significantly affect blood pressure (p = 0.290). This finding can be explained through several physiological and environmental mechanisms. First, the human body has adaptability (habituation) to chronic noise exposure, where the autonomic nervous system stress response (such as increased heart rate and blood pressure) may decrease over time if the noise is constant [22]. Second, individual factors such as psychological resilience and sensitivity to noise play an important role. Third, the effects of noise can be neutralized by the body's compensatory mechanisms, such as increased parasympathetic system activity that stabilizes blood pressure [23].

In addition, the duration and intensity of exposure in this study may not have reached a threshold sufficient to trigger clinical changes in blood pressure. According to WHO (2021), noise below 85 dB (such as heavy traffic or the sound of factory machinery) generally does not directly cause hypertension unless exposure occurs continuously in the long term. Protective factors such as physical fitness, healthy diet, or absence of smoking history in participants may also reduce the impact of noise on blood pressure. The effect of noise on blood pressure is highly dependent on the interaction between the environment and individual conditions (Tasyania et al., 2022). For example, nighttime noise can disrupt sleep and increase oxidative stress, but the impact can be minimized if a person is accustomed to noisy environments or uses hearing protection.

5. Conclusions

Based on the results of the study conducted, there was a significant relationship between age and blood pressure, where the age group above 30 years showed a higher prevalence of pre-hypertension and hypertension compared to the age group below 30 years. In contrast, no significant association was found between smoking, blood pressure, and noise exposure and blood pressure, although interesting distribution differences existed. This suggests that other factors such as diet, physical activity, and individual health conditions also play an important role in influencing blood pressure. Therefore, hypertension prevention should focus on managing a wider range of risk factors, including a healthy lifestyle, increasing physical activity and regular health monitoring. Further research is needed to explore other factors affecting blood pressure, including the interaction between noise, stress and individual health conditions.

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