

ORIGINAL ARTICLE

Prevalence of Hypertension and Its Determinant Factors among Workers at Port Container Terminal

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ABSTRACT

Introduction: Port container terminal workers have high potential to develop hypertension due to their work nature that exposed to high altitude working area, long working hours and other risk factors. Most workers at port container terminals were male who are at higher risk to get hypertension according to National Health and Morbidity Survey 2019. It is important for the port workers to maintain a healthy lifestyle for them to improve their quality of work as well as to avoid from getting chronic diseases like hypertension. **Objective:** This cross-sectional study was aimed to determine the most significant risks factors associated with hypertension among the port workers. **Methods:** A total of 200 male port container terminal workers participated in this study. Sociodemographic background, lifestyle, and work-related factors were obtained by using questionnaire which consists of 5 sections; A: Socio Demographic Information; B: Working Characteristics; C: Disease History; D: Sample Measurement; and E: Daily Dietary Intake. The blood pressure of the workers was obtained by using Omron HEM-7221-Z Automatic Blood Pressure Monitor. **Results:** The prevalence of hypertension among the workers was 50.5%. The most significant risk factors associated with hypertension were education level (OR=2.4, 95% CI: 1.14, 4.88) and BMI (OR=2.7, 95% CI: 1.09, 6.67). **Conclusion:** The high prevalence of hypertension among the workers were contributed by low level of education and unhealthy BMI. Thus, intervention programs are needed to be initiated by the company to educate the workers along with regular health monitoring to counter this problem from getting more serious.

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INTRODUCTION

Port terminal is a place that provide large number of facilities and simple terminal where materials or cargo being transshipped.¹ It is normal of the port to be known as a huge workplace as it provides huge storage facilities for both loaded and empty container from various countries. High precision and concentration needed for every single movement during the working time especially for the crane workers. The work task of the workers includes moving, weighing and hoisting attachment like sling and spreaders.² Working at a port container terminal, with long irregular working hours and the work intensity is not an easy work that everyone willing to do. Workers usually work in shifts make their lifestyle changed from the normal that can lead to many diseases. One of the most common diseases suffered is hypertension.

Hypertension usually associated with the blood pressure and cardiovascular events that suffered by the elderly, yet it also can be suffered by the youngers. It was defined as a condition where the blood vessels have persistently raised pressure that created by force of the blood against the blood vessels as it is pumped by the heart. Therefore, high pressure will make the heart pump the blood harder.³ Hypertension may cause by many determinants or factors that already mentioned in previous studies. High dietary sodium intake was associated with the prevalence of hypertension among rural Malay population.⁴ In a study conducted among patients attending teaching hospital in Malaysia, it stated that education on effective lifestyle modification would be great benefit in controlling high blood pressure and preventing complications.⁵ Other than that, a few studies showed significant association with work shift as work shift can reduce the quality and quantity of sleep, anxiety, depression and increase neuroticism.^{6,7} Hypertension also increasing among those with high BMI^{8,9} and obesity.¹⁰ In another study, dietary intake showed higher incidence of hypertension.¹¹ Male workers in sales, construction, personal service, precision production

trades and mechanics have high potential to develop hypertension.¹² However, every country has different determinants according to their socio-demographic, lifestyle and cultures.¹³ As the port workers have high potential to develop hypertension based on their work nature and lifestyle, it was important to conduct study among them. Unfortunately, there was limited study in Malaysia related to hypertension among port container terminal workers. In addition, 6.4 million Malaysian having hypertension and male have higher prevalence of hypertension compared to women according to National Health and Morbidity Survey 2019.¹⁴

As most of the workers at the port container terminal were male, it is important to investigate in case of some of the workers are not aware of their health and have undiagnosed hypertension that may cause by some of the determinants of interest. The workers may also lack of awareness about hypertension especially on their improper dietary intake and eating time as they work in shift. Work shift can be a reason as it is varying working hours and interferes with the social and domestic life. Other than that, work shift also changes the work and behavioural rhythms in sleep, physical activities and nutrition of the workers.¹⁵

Port workers commonly linked with study related to whole body vibration that lead to diseases related to musculoskeletal disorder rather than chronic diseases like hypertension.¹⁶ As the trend of hypertension in Malaysia increasing throughout the years,¹⁴ and limited study done on hypertension among port workers, it is crucial to determine the prevalence of hypertension at port container terminal. Every possible determinant or factor need to be taken into consideration to determine the true risk factors of the hypertension among the workers at port container terminal. Therefore, an appropriate interventional study can be done accordingly.

MATERIALS AND METHODS

Study Design, Sampling Population and Sample Size

A cross sectional study was conducted in a port container terminal located at the northern-west region of Peninsular Malaysia. This is a longest and older port that had been operated since January 1994. The port provides the main entrance to the Northern region of Malaysia and Southern Thailand serving the basins of the Straits of Malacca and the Gulf of Bengal.¹⁷ Total number of workers at the port were approximately 1500 workers that include crane operators and office workers. The crane operators work in shift while office workers work in normal office hour. The main target group of this study was the crane operators which also the shift workers with the total number of 800 workers, approximately. The crane operators have 4 types of cranes which are rubber tyre gantry (RTG), rail mounted gantry (RMG), quay gantry crane (QGC) and prime

mover (PM). Every worker operated the 4 different types of cranes. This port was chosen due to the number of workers fulfil the requirement for appropriate sample size for sampling. There were five operation units that were involved in this study which were marine, cargo conventional, container business, IT and workshop.

The target population was the workers of port container terminal. The respondents were chosen using purposive sampling method from the targeted population. Malaysian and male crane operator workers that age over 18 years old were included except for those that were not willing to participate. The total number of samples calculated for this study were 210, based on sample size calculation formula by Daniel¹⁸ and previous prevalence of hypertension by National Health and Morbidity Survey 2015 that showed the prevalence of hypertension was 13.1%.¹⁹ Therefore, the calculation of sample size as follows:

$$N = (1.96/0.05)^2 \times 0.131 (1-0.031) \\ = 175$$

Additional 20% of the sample size were included to offset the missing or incomplete data.

$$N = 175 + 35 (20\% \text{ of } 175) \\ = 210$$

There were 200 crane operators recruited. All of them met the inclusion criteria and voluntarily participated in the study. Data collection was carried out in five days in January 2020 with permission by the management of the company to conducted health screening program at the port container terminal.

Instruments

Questionnaire

A standardized, pre-tested and validated questionnaire was used in bilingual (Malay and English). It consists of 52 questions and can be completed in 15 minutes via face-to-face interviewed method. Pre-test questionnaire was conducted among 21 factory workers in Perak that have similar work nature as the port workers for validity and reliability purposes. The pre-test was performed to assure that the questionnaire was understandable and appropriate to be used to obtain information needed in the study. Unclear and misleading questions were rectified. The questionnaire included six sections: Socio demographic information, working characteristics, disease history, sample measurement, daily dietary intake and physical activities.

Section A: Socio Demographic Information

This section consists of seven questions that required respondent to provide information regarding their age, gender, education level, marital status, and monthly income. The age then was categorized into youth

(18-40 years old) and elderly (40 years old and above).²⁰ Level of education was categorized into secondary and tertiary education and marital status consists of single, married and divorced. Lastly, monthly income was categorized into B40 (\leq RM3855) and T20 ($>$ RM3855).²¹

Section B: Working Characteristics

This section consists of six questions that required respondents to give information on the types of shift, working departments and working duration.

Section C: Disease History

In this section with four questions in total, respondent need to clarify the disease they have, if any, related relatives that have the same disease and how long they had been suffering from the disease.

Section D: Sample Measurement

This section obtained anthropometric measurements such as weight and height as well as the blood pressure measurement. Anthropometry measurements were measured using Omron HBF- 516 Full Body Sensor. The classification of BMI was based on Ministry of Health Malaysia as all the respondents were Malaysian workers.²²

Blood Pressure Measurement

Systolic and diastolic pressures were measured by using Omron HEM-7121- Z Automatic Blood Pressure Monitor. The procedure of the measurement followed Clinical Practice Guidelines on Management of Hypertension Fifth Edition.²³ The workers were advised to not smoking, eat or exercise before measurement taken. After that, they need to relax for 1 minute while seating with arm and back supported. During the measurement, they cannot talk and cross their legs. The reading was taken for three times at least for each measurement to obtain average value. Between each of the reading, the respondent rested for one to two minutes. The classification of blood pressure was based on Clinical Practices Guidelines Management of Hypertension Fifth Edition 23 The workers with blood pressure measurement of 140 for systolic and/ or 90 mmHg for diastolic were categorized as having hypertension and labelled as "Yes" while the respondents that did not exceed the standard labelled as "No".

Anthropometric measurement

The instrument for measuring the height of the workers was SECA 206 measuring tape. The instruments were attached to a rigid wall and before measurement the workers were asked to remove their footwear and lean their body close the wall with face facing to the researcher. Omron HBF-516 Full Body Sensor was used to measure the weight and BMI of the workers. Instruction was given to the workers for them to stand straight and hold the equipment properly to make sure accurate measurement were obtained. The height

measurement was used to obtained BMI of workers after key in the height measurement into this instrument. The procedure was based on Physical Measurement Procedure from WHO.²⁴ The BMI was then categorized as normal (18.5-24.9), underweight ($<$ 18.5), overweight (25-29.9) and obese ($>$ 30).²² For statistical analysis purposes, the BMI categories were recategorized into normal BMI and not normal BMI (underweight, overweight, and obese).

Section E: Daily Dietary Intake

This section required respondent to provide information about dietary sodium intake. Questionnaire for dietary sodium intake was adapted from high sodium Food Frequency Questionnaire that had been developed for Malaysian that contribute to the sodium content in daily food intake of respondents.²⁵ This section needed as dietary sodium is one of the positive contributing factors that associated with blood pressure. Hence, the frequency of the sodium intake were asked, not the amount of sodium added during food preparation or consumption. Food Frequency Questionnaire was designed to provide descriptive qualitative data and later the data were rank to high medium and low.²⁶ The frequency of food intake was assessed throughout the amount of serving that they consumed each time they eat the food on standard serving size (piece/bowl/ spoon) as well as frequency intake per week. Recall bias can occur as workers hardly remember their dietary intake throughout the week. Then, scoring method was used as follow; Workers that consumed 1-3 per week were given 1 mark, 4-6 per week 2 marks, 7-9 per week 3 marks and more than 10 per week 4 marks. Meanwhile, not sure answer was given 0 mark. The total marks were calculated and categorized in low category with total marks below or equal to 10, moderate category with total marks 11-20 and high category with total marks equal or more than 21.

Section F: Daily Lifestyle

This section required respondents to provide information on smoking and alcoholic status, as well as the amount and duration they start smoking and/ or drinking alcohol. Respondents also need to provide information regarding physical activities and the frequency whether less or more than 15 minutes in a day.²⁷ The respondents that did physical activities more than 15 minutes a day were labelled as "Yes" and the workers that did physical activities less than 15 minutes in a day were labelled as "No".

Data Analysis

Statistical analysis was performed using SPSS version 25.0. The continuous data were presented as means and standard deviation while the categorical data were presented as percentage. The Pearson's chi-square test was used to determine the significant association between hypertension with the factors, and statistically

significant was set at $p < 0.05$. Multiple logistic regression was used to determine the most significant risk factors of hypertension. The dependent variable was hypertension and the independent variables were the factors; socio demographic background (age, sex, race, marital status, family history, income, education level), lifestyle of the workers (BMI, smoking, physical activities, alcohol consumption, dietary intake) and work-related factor (work shift and working hour).

The independent variables that have significant association with hypertension resulted from chi-square analysis were further analyzed using multiple logistic regression. The predicting factors were controlled for their significant association with hypertension, where variables which did not significantly contribute to hypertension based on the chi-square analysis were excluded from the multiple logistic regression model. The final steps in the regression model for hypertension was selected, where only significant variables (based on $p < 0.05$ and 95% CI values) were included as main predicting factors for hypertension. Results of the logistic regression analysis were expressed as odds ratio and 95% CI. A p-value of < 0.05 was considered statistically significant.

Ethical Approval

Approval for this research was obtained from Ethics Committee for Research Involving Human Subjects

(JKEUPM) with reference number JKEUPM-2019-426. Prior to data collection, each participant was clearly explained about the research and their rights, as well as provided their consent as the research participants.

RESULTS

Socio-demographic Characteristics

Two hundred (N=200) respondents participated in this study which made up 95.2% response rate. The mean age of the respondents (Mean±SD) was 44±8 years old ranging between 25 to 63 years old. Majority of them were Malay (95%) and married (97.5%). Their mean±SD of monthly income was RM3592±982, ranging from RM1000 till RM9000 and 79.5% of them attended secondary school. In addition, the mean±SD duration of working was 17±7 years with normal working hours of 47±4 hours and overtime working hour of 14±5 hours per week. Table I displays the socio-demographic characteristics of the respondents.

Hypertension

The prevalence of hypertension among the workers was 50.5%. The mean±SD for systolic measurements was 140±15 mmHg and ranging between 109-200 mmHg, while the mean±SD for diastolic measurements was 85±11 mmHg and ranging between 54-133 mmHg. The details were displayed in Table II.

Table I : Socio-demographic characteristics of the respondents (N=200)

Variable	n (%)	Mean (SD)	Median (IQR)	Min-Max
Age (Years old):		44 (8)	45 (14)	25-63
Race:				
Malay	190 (95.0)			
Chinese	1 (0.5)			
Indian	9 (4.5)			
Marital Status:				
Single	5 (2.5)			
Married	195 (97.5)			
Monthly Income (RM):		3592 (982)	9000(1000)	1000-9000
Education:				
Secondary school	159 (79.5)			
Tertiary education	41 (20.5)			

Table II : Prevalence of hypertension among the port workers (N=200)

Blood Pressure	Frequency (%)	Mean (SD)	Min-Max
Hypertension	101 (50.5)		
Normal	99 (49.5)		
Systolic		140 (15)	109-200
Diastolic		85 (11)	54-133

Table III : Association between risk factors with hypertension (N=200)

Factors	Hypertension		Total	x ²	p-value
	Yes (%/MR)	No (%/MR)			
Age:				0.807	0.369
Youth	43 (54.4)	36 (45.6)	79		
Elderly	58 (47.9)	63 (52.1)	121		
Ethnicity:				2.738	0.098
Malay	99 (52.1)	91 (47.9)	190		
Non-Malay	2 (20)	8 (80)	10		
Marital status:				0.001	0.982
Single	2 (40)	3 (60)	5		
Married	99 (50.8)	96 (49.2)	195		
Education level:				3.9951	0.046*
Secondary school	86 (54.1)	73 (45.9)	159		
Tertiary education	15 (36.6)	26 (63.4)	41		
Monthly income:					
B40	44 (43.6)	34 (34.4)	78	1.787	0.181
Not B40	57 (56.4)	65 (65.7)	122		
Family history:				4.532	0.033*
Yes	56 (58.3)	40 (41.7)	96		
No	45 (43.3)	59 (56.7)	104		
Dietary intake				0.479	0.787
Low	34 (52.3)	31 (47.7)	65		
Moderate	59 (48.8)	62(51.2)	121		
High	8 (57.1)	6 (42.9)	14		
BMI				5.439	0.020*
Normal	8 (26.9)	19 (70.4)	27		
Not normal	93 (53.8)	80 (46.2)	173		
Physical activities				0.513	0.474
Yes	91 (51.4)	86 (48.6)	177		
No	10 (43.5)	13 (56.5)	23		
Smoking				1.764	0.184
Yes	56 (46.7)	64 (53.3)	120		
No	45 (56.3)	35 (43.8)	80		

*Significant at p<0.05

Associated factors of hypertension

Chi square test analysis was performed to determine the association between hypertension with the factors and the results were shown in Table III. It was found that education level, family history of hypertension, and BMI was significantly associated with hypertension. The result showed that higher percentage of workers with secondary education level (54.1%) obtained hypertension as compared to those in tertiary education level (36.6%). It was not surprising to observe that 58.3% of those with family history of hypertension ended up having hypertension themselves as compared to those who have no family history of hypertension (43.3%).

It also showed that the percentage of the workers with hypertension was higher (53.8%) among those who have not normal BMI as compared to those who have normal BMI (26.9%).

On the other hand, no significant association were observed between age, ethnicity, marital status, monthly income, dietary sodium intake, physical activities and smoking with hypertension as the value of p>0.05. This result showed that lower education level, family history of hypertension, and not normal BMI are the risk factors for hypertension.

Table IV : Result of multiple logistic regression analysis

Variable		Crude OR (95% CI)	B	Wald statistics (df)	p-value
Level of education:	Secondary	2.4 (1.14, 4.88)	0.86	5.32 (1)	0.021*
	Tertiary	0.00			
Family history:	Yes	1.8 (0.98, 3.13)	0.56	3.54 (1)	0.06
	No	0.00			
BMI:	Non-healthy	2.7 (1.09, 6.67)	0.99	4.66 (1)	0.031*
	Healthy	0.00			

The predictors of hypertension

A multiple logistic regression was conducted by including the three significant factors into the model. The results from the analysis (Table IV) showed the most significant risk factors associated with hypertension were BMI ($p=0.031$) and level of education ($p=0.021$) while family history with hypertension showed marginally significant ($p=0.06$). The results of multiple logistic regression analysis explained 9.2% (Nagelkerke, $R^2=0.092 \times 100\%$) variation in hypertension among the workers at port container terminal.

DISCUSSION

All the respondents in this study were men workers with mean age of 44 years old and ranging from 25-63 years old. Out of 200 respondents, majority of them (95%) were Malay, while 0.5% were Chinese and 4.5% were Indian. In other study previously conducted at this port terminal with total number of respondents $N=240$ who consists of crane workers showed that the socio demographic information was likely similar with 92.5% Malays and mean age was 4years old.² These showed that Malays are the dominant race employed as crane operators at this local port terminal.

Majority of the workers were married, whereas the rest were single, with 97.5% and 2.5% respectively. This finding was inline with the previous finding which was conducted a decade ago at the same place.² The mean of their monthly income was RM 3592 and ranging from RM1000 till RM9000. That showed majority of the crane workers earned a moderate income which placed them among the 40 percent bottom-tier household group, or B40. B40 category is the group of households that have total income of RM 3855 and below.²¹ 79.5% of them had attended secondary school while 20.5% finished their tertiary education. This may explain the income level they earned as normally it is associated with the level of education background.

The workers mostly had been working at the port terminal for over than 17 years as the mean of duration of working of the respondents was 17 years and ranging

between 1-39 years. The past research at the port terminal shown the mean duration of working of the respondents was 8 ± 5 years, this may be because of this study was conducted in 2014 and most of the respondents were new workers ranging from that duration of years. The age range was also different where in this study, the age ranged from 25 to 63 years while in the past study, it ranged from 38 to 52 years old.²

Majority of the respondents (84%) work in shift working hour while another 16% work in normal working hour. The crane workers work in shift hours and expose to high altitude work area. They need to move and transfer the container from the ship to the port terminal and vice versa. The average for normal working hour of the respondent was 47 hours and ranging between 30-72 hours per week. However there were those who worked until 72 hours per week. The mean of overtime working hour was 14 and ranging between 0-24 hours per week. The normal working hours for a worker will be 48 hours per week without overtime. According to Malaysian Employment Act 1955, a worker can work 48 hours a week with maximum of 6 working days per week and 8 working hours per day.²⁹ Long working hours can lead to many health risks from overwork such as reduced performance on the job, obesity, injuries, and a wide range of chronic diseases.¹⁵

Among 200 respondents, 101 (50.5%) of them had high blood pressure. The mean for systolic measurements was 139 ± 15 mmHg and ranging between 109-200 mmHg, while the mean for diastolic measurements was 85 ± 11 mmHg and ranging between 54-133 mmHg. The prevalence of workers having hypertension was higher than workers not having hypertension as expected. The prevalence of hypertension in this current study was higher than previous findings.^{13, 19, 30} In the NHMS report in 2019, the prevalence of Malaysian having hypertension were 15.9%.¹⁹ The prevalence of hypertension among factory shift workers in Ethiopia was 42.9%, significantly higher than normal time workers.¹³ On the other hand, the prevalence of hypertension among general Malaysian adult recruited from Malaysian Community Salt Study³⁰ was 49.39%. This study finding can be alarming to the port management as the prevalence

of hypertension among the workers was higher as comparison.

The result showed that workers that attended secondary education had 2.4 times risk to develop hypertension compared to the workers that attended tertiary education. Similar finding was reported by Lim and Yong¹⁰ and Zaki et al³⁰ where hypertension was associated with lower education level. It was evidenced that the higher level of education lead to greater awareness regarding health and diseases, such as shown in a study conducted in the northern region of Peninsular Malaysia.⁸

Meanwhile, those with not normal BMI (underweight, overweight, and obese) showed 2.7 times as likely to develop hypertension compared to those with normal BMI. Similar findings was found by Lim and Yong¹⁰ and Zaki et al³⁰ which stated that BMI was strongly associated with hypertension among Malaysian. However, contrast result was reported by Asfaw et al¹³ among their Ethiopian workers. There was a study conducted in Northern Chinese adults which found that BMI was significantly associated with hypertension and the researchers' concluded BMI was strongly associated with hypertension as the relative risk regression models showed higher prevalence ratio for hypertension. Unhealthy BMI was a well-known nutritional and lifestyle risk factor of hypertension. Increases of weight that will also increase the BMI can lead to increases of body fluid volume and resulting to functional constriction and structural hypertrophy and cardiac output.²⁸

Family history showed marginal significant association with hypertension in this study. This pattern is consistent with a study conducted in Sri Lanka which showed that respondents with family history have a higher risk to develop hypertension by 1.29 times compared to those without family history of hypertension. However, the prevalence of hypertension for female respondents was higher than male respondents.³¹ Similar result was also found by Asfaw et al.¹³

This study found no association between hypertension and the other sociodemographic risk factors such as age, ethnicity, marital status, and monthly income. Malays were the dominant race in this study and showed high prevalence of hypertension. In a study conducted in Perak, it stated that the differences prevalence of hypertension between race may because of the variety in environmental and genetic factors. Malays also have high sensitivity of beta-adrenergic receptor normotensive according to clinical evidence compared to other races.⁹

This study found no association between working duration, normal working hour, over time working hours, and shiftwork with hypertension among the

crane port workers. In a previous study among local crane workers, high prevalence of job strain among port workers was found which resulting from physical job demand, anxiety, physical isometric and muscle ache among port workers. This is because long duration of working hour usually leads to work stress or work strain and the workers have less time to eat and rest.² In another study which was conducted on the relationship between shift work and the onset of hypertension among male east-coast Malaysian workers, the researcher concluded that shift work was a risk factor for onset of hypertension.⁷ The contrast of the result may be due to the different in the nature of the work. The workers from the previous study were workers of a semiconductor manufacturing company.

This study found no significant association between the dietary sodium intake with hypertension among the workers. This current study finding was not in agreement with a previous study. An association between dietary intake and lifestyle was found and it was concluded that low-risk dietary and lifestyle factors was significantly associated with lower incidence of hypertension. However, the respondents in the previous study were women while the respondents in this study were men. The different may be due to different dietary intake between men and women.¹¹ In a more recent Malaysian study, which involved urban and rural household, the prevalence of hypertension was higher among those who consume high sodium diet, males, 60 years and older urban population with low education level.³²

The high prevalence of hypertension among the crane port workers in this study was not significantly association with the physical activities. This is in contrast with previous findings. Published articles stated that there were positive relationship between physical activities with hypertension.¹⁰ Furthermore, there was a study conducted in 2013 showed decreasing number of hypertension incident with the increasing total volume of physical activities.³³

On the other hand, no significant association was found between smoking status of the workers with hypertension in this study. Smoking was not a risk factor for hypertension in this study but previous studies associated hypertension with smoking status among men^{10, 34}. The reason of this result is because smoking has cardiovascular actions that can lead to a rise in arterial pressure of the smoker.²⁵ However, this study showed no association between smoking status with hypertension may due some of the smokers were considered newbies that started 1-2 years before and some of them just smoke while working or gather with friends and not a 'full time' smokers.

Study Strength and Limitation

The strength of this study was it provided data about

hypertension among workers of port container terminal. The data is a significant contribution to the body of knowledge and can be used as references for future study. The findings of this research can be the important inputs for the company to plan for proper programs to improve the quality of life of their workers.

There were several limitations of this study that should be taken into consideration. Firstly, this was a cross-sectional study that may not demonstrate the cause and effect of the variables as there will be no follow up study for the workers. This study findings may not be generalized to the whole workers community in Malaysia as it was conducted at one port container terminal only. The data collection was also conducted in a limited time due to approval from the company. Besides, recall bias might occur during answering the questionnaire as the workers may not really remember their dietary intakes. .

CONCLUSION

The overall percentage of hypertension among the workers at port container terminal was 50.5% with the mean of systolic and diastolic measurement 139 mmHg and 85 mmHg, respectively. The findings from this study were quite alarming as compared to the NHMS 2019 report that showed only 15.9% of Malaysian having hypertension.

The risk factors that have significant association with hypertension were level education, family history and BMI. However, the most significant risk factors associated with hypertension in this study were low education level and unhealthy BMI where those with low education level has 2.4 times while unhealthy BMI has 2.7 times increase of risk to have hypertension.

As for recommendation, large population-based cohort studies among port container terminal in Malaysia is recommended to be conducted to show continuous, strong, and graded relationship between factors associated with hypertension. Besides, future research may focus on the developing an intervention study to prevent the increase trend of hypertension among the workers at port container terminal.

Other than that, involvement of large sample size may be recommended so that the finding can be generalized into other population as well. Careful training and a series of measurements should be done among the investigators to improve the accuracy of the data collected in a study. Lastly, as the prevalence of hypertension at the port container terminal was alarming, action need to be taken to prevent hypertension from getting more serious. Intervention program can be conducted and focusing on hypertension like healthy diet program. Port management also need to supervise the time of

working duration of each of the workers to make sure they do not exceed the time limit as stated in Malaysia Employment Act 1995.

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