

RELATIONSHIP BETWEEN HEAT PRESSURE WITH CHANGES IN BLOOD PRESSURE ON WORKERS IN THE PTPN VIII CIATER SUBANG YEAR 2015

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Abstract

Indonesia is among countries with the level of safety is low. An average of 99,000 cases of occupational accidents occur each year in Indonesia. Approximately 70% of these result in death and lifelong disability. Data from the Manpower mentioned until 2013 in Indonesia is not less than six workers died every day as a result of workplace accidents. Work environment with high temperatures can damage the health of the workforce. In the work environment of heat, regulate body temperature by the evaporation of perspiration accelerated by the widening of blood vessels which is accompanied by increased pulse rate and blood pressure, thus increasing cardiovascular load. The purpose of this study to determine whether there is a relationship between heat stress with changes in blood pressure on workers in the tea perkebuan Ciater Subang Year 2015.

The method used is observational, cross sectional approach, with a population of 75 people. Determination large sample using the formula proportions so large sample in this study was 42. Data collection techniques using primary and secondary data, namely the analysis used univariate and bivariate using Chi-Square.

The results showed: there is a relationship between heat stress with changes in blood pressure on workers in the tea plantations of production space Ciater Subang 2015. Based on the results, the expected results of this research can dijadikan reference to working with K3 hall or related agencies to create a safety program and occupational health to prevent occupational disease.

Keywords: Heat Pressure, Blood Pressure, NAB

A. Introduction

Development and growth of a nation, either now or in the future certainly will not be separated from the role of industrial processes. To be able to build a workforce that is productive, healthy and quality, the need for management of Health Safety ⁽¹⁾. Health and safety at work is included in a container hygiene companies working (Hiperkes). Has occupational health objectives, including the maintenance of the degree of physical, mental, and social well-being of workers in all levels of employment ⁽¹⁷⁾.

Indonesia is among countries with the level of safety is low. An average of 99,000 cases of occupational accidents occur each year in Indonesia. Approximately 70% of these result in death and lifelong disability. Data from the Manpower mentioned until 2013 in Indonesia is

not less than six workers died every day as a result of workplace accidents. The figure is relatively high compared to European countries that only two people died per day due to occupational accidents ⁽¹⁰⁾.

One factor that is often physical dangers encountered by workers is heat stress. Work environment with high temperatures can damage the health of the workforce, such as heat cramps, heat exhaustion, heat stroke, and millaria ⁽¹⁷⁾.

Donoghue research and Bates on underground iron mine workers in Australia, with a range of ISBB (Indeks Suhu Basah Bola) 26.0°-28.0°C, found as many as 65 cases of acute heat exhaustion. According to Randell and Wexler, about 6 million workers in the United States exposed to heat stress with the most

reported cases of deaths occurred in construction, agriculture, forestry, fisheries, and manufacturing. Research conducted by Tawatsupa in Thailand found almost 20% of respondents experiencing heat exposure. After statistical analysis, it was found that exposure to heat has a significant relationship with the occurrence of occupational diseases⁽¹⁰⁾.

According to the provisions of the legislation temperature of the workplace, in the decision of the Minister of Labour No.PER.13 / MEN / X / 2011 on Threshold Limit Values workplace physical factors, in the lowest NAB set to work space is 25°C, and the highest NAB is 32,2°C. Depending on the workload and working time arrangements.

Metabolic processes that interact with the heat in the environment would result in workers experience heat stress. This heat stress can be caused by the heat source as well as poor ventilation⁽⁸⁾.

Risk factors of hypertension in workers divided into, facta a risk that cannot be controlled (major) such as heredity, gender, and age. While the risk factors that can be controlled (minor) that exercise, smoking, drinking alcohol, use of certain medications, hot environment, working life, and work attitudes are also socioeconomic class⁽¹²⁾.

Heat stress also affects the increase in blood pressure, Increased blood pressure due to an increase in blood volume or blood vessel elasticity. Conversely, a decrease in blood volume will lower blood pressure. hot work environment, regulate body temperature by the evaporation of perspiration accelerated by the widening of blood vessels which is accompanied by increased pulse rate and blood pressure, thus increasing the burden of cardiovascular⁽¹⁷⁾.

According to the results of previous studies conducted by Sugiyarto (2011) showed that there is a relationship between heat stress with increased blood pressure in the unit Weafing PT. And Lyrical Soekoharjo Surakarta.

PT PTPN VIII, abbreviated PTPN VIII is a state owned enterprise engaged in the tea plantations, rubber, quinine, cocoa, oil palm, and gutta-percha with operations in West Java. In the

process of production, especially the production of tea there are several stages of the harvesting of tea plucking, withering, the grinding process, the oxidation process, and the drying process and that the last stage of packaging. In the production process there are several steps that require heating processes include wilting, drying and there is a room or warehouse to process wood heater. In this process certainly has a hot climate risk working against labor.

Based on preliminary survey of these workers work for 5 working days, on every Tuesday - Saturday. Most workers in the room dryer, wood burning withering and complained about the heat and the room temperature state of the stuffy room, it is in the causes for poorly ventilated working environment, and penghawaan. Dimana temperature in the working environment ranges between 30-35°C, to room size 23.50 m².

Based on the above, the authors were interested in doing research on "Heat Pressure Relationship With Blood Pressure Changes In Labour Prouksi In the tea plantations" Ciater Subang 2015.

Heat stress is a collection of environmental factors and physical activity can increase the amount of heat in the body. Factors - environmental factors include air temperature, radiation heat transfer, air movement, and the partial pressure of water vapor (humidity). Physical activity have contributed to the total heat stress is the activity that causes an increase in metabolic heat in the body according to the intensity of work⁽⁸⁾.

According to OSHA (Occupational Safety and Health Administration), heat stress is when a job related to air temperature is high, radiation from heat sources, high humidity, exposure directly with objects that emit heat, or physical activity continuously which has high potential to cause heat stress⁽¹⁾.

From these definitions, it can be concluded that heat stress is a combination of heat exposure and the environment posed by the heat generated from human or physical activity is also called metabolic heat. Heat exposure is affected by dry air temperature, humidity, wet

climate, global temperatures and the movement of air or wind ⁽⁷⁾.

Heat transfer is the transfer of energy from one place to another because of differences in temperature at the venue. First heat is removed from the organ that produces heat through the skin into the blood circulation, and then experience the exchange of body heat to the environment ⁽⁷⁾.

The heat balance in the Human Body

The human body are warm-blooded, have a system to maintain body temperature to remain constant, even if the body is exposed to various levels of the temperature of the environment. To keep the body temperature is at a safe limit, the body must release or dispose of excess heat. The main process is through the blood circulation and sweating ⁽¹⁾.

Automatic response body heat setting usually occurs when blood temperature exceeds 98.6 ° F and body temperature regulation and control is done by otak. Pengeluaran by the body sweat to cool the body but not to remove fluid from the skin through evaporation. Under conditions of high humidity, evaporation of sweat from the skin will decrease and the body's attempt to maintain body temperature at an acceptable limit will be interrupted ⁽¹²⁾.

This condition will be able to interfere with the ability of working individuals working in hot environments. With the amount of blood that flows to the outer surface of the body, will lead to a decrease in muscle activity, brain, internal organs, decreased strength, and fatigue occurs sooner. Unlike cold-blooded animals such as reptiles body temperature can go up and down depending kndisi temperature in the environment, human body temperature just changed in a very narrow range. In the human body there are various kinds of chemical reactions that are very related to body temperature ⁽¹²⁾.

If the body temperature goes up or down just a few degrees, it will hinder the process of chemical reactions in the body and will harm the human body. If the body temperature began to drop in some degree, the body will shiver,

causing muscle movements of the body that can generate additional heat to help maintain body temperature. If excessive heat is generated only, the body temperature will rise and the longer the body will experience heat stress. The body temperature is more influenced by a person's physical activity. At rest an adult male weighing 154 pounds spent nearly 90 kilocalories per hour produced through metabolism. Very strenuous physical activity will produce more than 600 Kcal / hr. Heat generated through physical activity should be reduced to maintain optimal body temperature ⁽¹⁾.

Against Pressure Response Body Heat

Working in a hot environment will accelerate the heart rate. Heart rate can be used to measure heat stress, because the incremental move the blood, causing reddened skin surface. The maximum speed of the heart rate is 100-120 per minute. At this speed the adults may persist in a few minutes. Hot response is different for each individual, it is associated with several factors as follows: ⁽¹²⁾.

a. Acclimatization

Acclimatization is a physiological adaptation process that is characterized by sweating increased, decreased pulse rate, and body temperature as a result of the formation of sweat. For acclimatization to heat is characterized by a decrease in pulse rate and body temperature as a result of the formation of sweat. Acclimatization is addressed to a job and a high temperature for some time eg 2 hours. Given the formation of sweat depends on the increase in body temperature. Heat acclimatization is usually achieved after 2 weeks. By working in high temperatures alone can not produce a perfect acclimatization. WHO in 1969 suggests the existence of small differences acclimatization between men and women. Women can not beraklimatisasi well as men. This is because they have a smaller cardiovascular capacity.

b. Age

One's resistance against heat would decline at an older age. An older person will be

slower secrete sweat because it takes a long time to restore normal body temperature after exposure to heat. One study found that 70% of all patients (Heat Stroke) are those aged over 60 years. Maximum heart rate of maximal work capacity gradually decreases with age.

c. Racial or Ethnic

At certain ethnic hot response different from other ethnic groups, for example between ethnic Arabs and ethnic differences in response to heat Eropa. Tetapi in both ethnic groups more of a difference in diet (diet)

d. Body Size

The big difference in body size will affect the body's physiological reaction to heat. Men with smaller body size can experience heat stress levels are relatively larger. This is because they have a maximum working capacity is smaller. The results showed that workers who weigh less than 50 kg in addition to having a low maximal oxygen intake but also heat-tolerant than those who have an average weight

e. Nutrient

Some nutrients will be lost because of the pressure panas. Misalnya heavy job that requires more than 500 kcal calories will potentially lose zinc from the worker's body, it interferes with the growth, development and health. Work in a hot room minimum required intake of vitamin C 250 mg / hr to the workers concerned. Someone who is ugly nutritional status will show an excessive response to heat stress, it is because the cardiovascular system unstable ⁽⁸⁾.

Blood pressure is the thrust in any direction on the entire surface covered on the inner walls of the heart and blood vessels. Blood pressure refers to the pressure experienced by the blood in the arteries when the blood pump blood by the heart to all members of the human body. Blood pressure created by taking two sizes and is usually measured as follows - 120/80 mmHg. Numbers above (120) shows the upward pressure of the arteries due to the heart beat, and is called the systolic pressure. Lower number (80) shows

the pressure when the heart is at rest between pumping, and is called diastolic pressure ⁽¹²⁾.

The best time to measure blood pressure when labor is in a state of rest and sit or lie down.

Blood pressure is influenced by physical activity, which will be higher during activity and lower when it breaks. Blood pressure is also different in one day, the highest in the morning and lowest at night while sleeping. When blood pressure is known to be higher than normal in a sustainable manner, the person is said to have high blood problems (James Joyce, et al, 2008). The table below shows when it is said that you have a risk of developing high blood pressure or other health problems can be seen in Table 2.1 below:

Table 2.4. Classification Hypertension

Tekanan Darah	Sistolik (mmHg)	Diastolik (mmHg)
Normal	< 120	< 80
Prehipertensi	120-139	80-90
Hipertensi Tingkat 1	140-159	90-99
Hipertensi Tingkat 2	≥ 160	≥ 100
Hipertensi terisolasi	sistolik ≥ 140	< 90

Source: ⁽¹²⁾

Factors Affecting Blood Pressure According to ⁽¹⁾ that normal blood pressure varies greatly depending on:

a. Physical activity

Physical activity and daily activities affect blood pressure higher physical activity performed blood pressure increase.

b. Emotion

Feelings of fear, anxiety, blood pressure tends to rise

c. Stress

This state of mind is also an effect on blood pressure measurements while experiencing.

d. Age

Blood pressure will tend to be higher along with increasing age. Systolic generally will increase in line with increasing age, while diastolic increases until age 55, then declines lagi. Semakin older the person the higher the systolic pressure. Usually associated with the onset of arteriosclerosis.

- e. Gender
Blood pressure in women before menopause is 5-10 mmHg lower than men her age, but after menopause increases blood pressure more
- f. Nutritional status (Obesity)
When has the body size, including obesity allows an increase of blood pressure. Body Mass Index of less than 17.0 are included in the category of very thin, for a BMI between 17.0 to 18.5, including 31 categories of underweight, a BMI above 18.5 to 25.0 is included in the normal category, for a BMI above 25, 0 to 27.0 categorized as obese and for BMI over 27.0 are included in the category of very overweight or obese.
- g. Drinking alcohol
Drink excessive alcohol can increase blood pressure and cause resistance to antihypertensive drugs. Several studies have shown a direct relationship between blood pressure and alcohol intake, and among them reported that the effects on blood pressure only visible if you consume alcohol about 2-3 glasses of standard size every day.
- h. Smoking
Smoking is one of the habits that can affect blood pressure. In the state of blood vessels smoking in some parts of the body will be narrowed, in these circumstances it takes a higher pressure so that blood can flow to organs by a fixed amount. For the heart to pump blood more powerful, thus increasing the pressure on the blood vessels. Cigarettes smoked can lead to increased blood pressure. But cigarettes will result vasokonstruksi peripheral blood vessels and vessels in the kidneys, causing an increase in blood pressure. Smoking a daily basis will increase systolic blood pressure of 10-25 mmHg and increase heart rate 5-20 times per minute ⁽¹²⁾.

In addition to the above factors, there are environmental factors that can affect a person's blood pressure, among others:

1) Noise

Noise is unwanted sound, hence the noise often disturbing though to variations in the

amount of interference on the type and hardness of a noise. In general, high-pitched noise is very disturbing, all the more disjointed or which come suddenly and unexpectedly. Distracting noise, so that the concentration and mental alertness decreases. Effects on the autonomic persyarafan seen as a rise in blood pressure, acceleration of heart rate, contraction of the blood vessels of the skin, rapid increases metabolism, decreased activity of the digestive tract. Noise causes fatigue, nervousness, curiosity angry, hypertension and add stress ⁽¹⁷⁾.

2) Pressure Heat

Hot work environment, regulate body temperature by evaporation keringat yang accelerated by the widening of blood vessels which is accompanied by increased pulse rate and blood pressure, thus increasing the burden of cardiovascular ⁽¹⁷⁾.

Pressure / heat exposure of the human body can lead to various health problems and death. Death is caused by various diseases caused by exposure to heat in the body. These diseases include, among others, Heat rash disease is associated with hot, humid conditions where sweat is unable to evaporate from the skin and clothing, Heat syncope is disordered induction heat can seriously dizziness and fainting due to being in a hot environment on a long time, Heat cramps are pain and spasms in the legs, arms and abdomen and a lot of sweat because of the imbalance of fluid and sodium salt during heavy physical labor in a hot environment, Heat Exhaustion caused by reduced body fluid or blood volume. Where the amount of water released as sweat in excess of drinking water during heat affected. The symptoms are sweating so much, pale skin, weakness, dizziness, nausea, breathing short and quick, dizziness, and fainting, his body temperature between 37 ° C-40 ° C, Heat Stroke is a disorder of the heat that threatens the lives of related jobs in great shape Hot and humid weather can cause coma and death. Symptoms of the disease is rapid heart rate, high body temperature 40 ° C or more, hot, dry skin and appear bluish or reddish, No sweat on the victim's body, dizziness, chills, nausea, dizziness, mental

confusion and fainting and Miliary is sweat eccrine which often occur under conditions of high heat. Miliary caused by blockage of sweat ducts, which causes leakage of eccrine sweat into the epidermis or dermis.

Another disease that usually arises is heart disease, high blood pressure, kidney disorders and psychiatric disorders. Diseases caused by exposure to heat is caused by rise / drop in body temperature. Anata normal body temperature ranges from 37-38°C (99 - 100°).

Changes in core body temperature rise / fall 2 °C may cause interference in the body. The body temperature must be maintained in order to remain at normal temperature so that the whole organ can work normally. When changes in the body's core temperature then some organ function will be impaired.

Metabolic system of the body can naturally react to maintain the normality of body temperature as with sweating, shivering and increase / reduce blood flow to the body. Regulation of body temperature externally there are 7 factors to be controlled are: air temperature, humidity, air velocity, clothing, physical activity, heat radiation from various heat sources and the length of time of exposure to heat ⁽⁷⁾.

Workers who are exposed to heat in the working environment will experience the heat strain..Indikator heat strain is increased pulse rate, blood pressure, body temperature, sweating and weight loss. Exposure to heat stress on healthy individuals cause a variety of physiological reactions that are important for thermoregulation. One is an increase in blood flow through the skin. If the ambient temperature increases, the physiological effects that occur are:

- a. Increased fatigue
- b. Increased heart rate.
- c. Increased blood pressure.
- d. Reduce the activity of the digestive organs.
- e. A slight increase in core temperature and a sharp increase in the temperature of the shell (skin temperature will rise from 32° to 36-37°C).
- f. Increased blood flow through the skin.

- g. Increase the production of sweat, which become redundant if the skin temperature reaches 34 °C or more.

Effect of heat stress can be divided into three, namely:

- a. Physical
The heat causes the liquid, solid, and gas experience expansion in all directions.
- b. Chemistry
Chemical reaction speed will increase with an increase in temperature. This can be seen in the reaction of oxidation increases with an increase in temperature. This corresponds to Van Hoff law which states that the permeability of the cell membrane will be increased in accordance with increase in temperature. On the network will increase in line with increased metabolism of chemical exchange between the body with body fluids.
- c. Biological
Biological effect of heat on the sumasi of heat effects on the physical and chemical. An increase in total white blood cells and inflammatory reaction phenomena and dilatation (widening) of blood vessels resulting in increased circulation (circulation) of blood as well as increased capillary pressure. Pressure O₂ and CO₂ in the blood increases while blood pH will decline ⁽¹⁾.

B. Method

The method used is observational, cross sectional approach. Because this research is used to study the dynamics of the correlation between risk factors with effects. By way of approach, observation, or the collection of data at a time ⁽²¹⁾.

The sample size in this study was 42, which is taken from each production space, namely the drying of as many as 14 people, withering space 17, and the combustion chamber firewood as many as 11 people.

B. Results And Discussion

After measurements at 42 workers in each room is a drying room, withering, and burning

firewood showed that changes in blood pressure, as follows on Tabel 4.1

Based on Table 4.1 it is known that most of as many as 32 people (76.2%) experienced changes in blood pressure after exposure to heat stress. Based on the measurement of heat stress and blood pressure to 42 workers, in each room are drying room, withering, and burning firewood hasilsebagai then get the following:

Based on Table 4.2 it is known that more than half as many as 2 (67%) the room has a heat stress is not in accordance with the NAB.

Based on Table 4.2 it is known that more than half as many as 25 (59.5%) workers who were in the room with the production of heat

stress does not fit NAB.

Heat Pressure Relationship With Blood Pressure Changes In Worker At Tea factory production room ".Ciater Subang 2015.

Analyze the relationship between heat pressure with changes in blood pressure in workers exposed in the production of hot tea factory Ciater Subang 2015, using Chi-Square which can be seen in the table below.

From table 4.3 above can be explained that most of as many as 24 (94%) of workers who work in the room with heat stress does not match the NAB experience changes in blood pressure and a fraction is 1 (4.0%) workers who were in the room with the pressure heat does

Table 4.1 Frequency Distribution of Blood Pressure Changes In Production Workers at the Tea Plantation Room Ciater Subang 2015

No	Perubahan Tekanan Darah	Frekuensi	Persentase (%)
1	BERUBAH (+)	10	23.8
2	TDK BERUBAH (-)	32	76.2
Total		42	100.0

Table 4.2 Frequency Distribution of Heat Pressure Tea plantation production room Ciater Subang Tahun 2015

No	Tekanan Panas	Ruangan			F	%
		pengeringan	pelayuan	Pembakaran kayu		
1	Sesuai NAB		26,5 ^o C		1	33
2	Tidak Sesuai NAB	28,6 ^o C		28,1 ^o C	2	67
Total		1	1	1	3	100

Table 4.3 Frequency Distribution Workers Who Was in room Production In Tea Plantation Ciater Subang 2015

No	Tekanan Panas	Frekuensi	Persentase (%)
1	Sesuai NAB	17	40,5
2	Tidak Sesuai NAB	25	59,5
Total		42	100.0

Table 4.4 Heat Pressure Relationship with Blood Pressure

Tekanan Panas	Perubahan Tekanan Darah		Jumlah	P.Value
	YA	TIDAK		
Sesuai NAB	8 (47,1%)	9 (52,9%)	17 (100%)	0,00
Tidak Sesuai NAB	24 (96,0%)	1 (4,0%)	25 (100%)	
TOTAL	32 (76,2%)	10 (23,8%)	42 (100%)	

not fit NAB did not change blood pressure.

Statistical analysis showed that the P value of $0.00 < \alpha$ (0.05), we conclude that H_0 is rejected, then there is a relationship of heat stress by changes in blood pressure on workers in the tea plantations production room Ciater Subang 2015.

Heat Pressure Relationship with Blood Pressure Change After calculation using the Chi-Square, obtained pvalue value of $0.00 < \alpha$ (0.05), thus the test results revealed H_0 is rejected, then there is a relationship between heat stress with changes in blood pressure on workers in the tea factory production space Ciater Earring 2015.

Workers who are exposed to heat in the working environment will experience the heat strain. Heat strain or thermal strain effect is taken into the body at the expense of the working climate. Heat strain involves core body temperature, heart rate and sweating. Another important response is the allocation of body fluid volume, the concentration of electrolytes in the intra and extra cellular space, hormone levels, and blood pressure. Heat indicator strain is increased pulse rate, blood pressure, body temperature, sweating and weight loss. Exposure to heat stress on healthy individuals cause a variety of physiological reactions that are important for thermoregulation. One is an increase in blood flow through the skin.

Responses physiological will be apparent to workers with the climate hot work, such as increased blood pressure and pulse rate as the result of research that states that there are differences increase blood pressure significantly on labor before and after exposure to heat, which obviously would worsen the condition workers. Results of this study confirmed the existence of a previous study conducted by Agus Sugiyarto in 2011 showed that the relationship between heat stress with increased blood pressure in the unit Weaving PT. And Lyrical Soekoharjo Surakarta.

D. Conclusions

Based on the results of research and discussion that has been presented researcher in

the previous chapter, the researchers can draw some conclusions have the following:

1. There are changes in blood pressure after exposure to heat pressure on the workers in the tea plantations of production space Ciater Subang
2. More than half of workers are in the room with the production of heat stress does not fit NAB, and a small percentage of workers were in the production room which has a hot pressure space suit NAB.
3. There is a relationship between heat stress with changes in blood pressure in workers exposed in the production room hot tea plantations Ciater Subang 2015.

Suggestions for PTPN VIII Tea Factory Subang Ciater expected results of this study can be used as a reference for working with K3 institution or related agencies to make occupational health and safety programs to prevent occupational disease. As well as consideration and input to the tea plantation PTPN VIII Ciater Subang on exposure to heat the room in order to be made into comfortable as possible for the workers, for example by making more ventilation and serve drinks to the workers that are not thirsty or dehydrated.

We hope this research can be used as a reference for further research in conducting research on the relationship of heat stress with changes in blood pressure, and is also expected to further researchers can examine the variables that have not been researched by the author, including external factors, namely noise and internal factors that include age, gender, and physical activity.

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