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Relationship Characteristic and Heat Pressure With Blood Pressure Increased at Pt. Pln (Persero) Sulseltrabar Tello Regional Generation

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Abstract: ***PT.PLN (Persero) Generation Tello as diesel power generating hot ambient temperature. Heat stress is a collection of symptoms of body heat that comes from the metabolism or environmental factors. High thermal stress resulted in the emergence of various health problems in employees. Complaints that often occur due to heat exposure that is thirsty, feel tired, and muscle cramps in the legs, as well as an increase in blood pressure. This study aims to determine the relationship between heat stress, duration of heat exposure, work period, age, and sport habits (exercise) with an increase in blood pressure. This research use an analytic survey method with cross sectional approach by exhaustive sampling techniques. Data were analyzed using Chi square test. The results showed heat stress temperature reach 28°C-30°C and has passed the threshold value. There is a relationship between heat stress (p value = 0.014), duration of heat exposure (p value = 0.012), work period (p value = 0.000) with an increase in blood pressure due to heat stress. It is necessary to attempt control measures against the working environment and reduced use of drugs, alcohol, obesity, and smoking behavior in to reduce the risk of increase in blood pressure.***

Keywords: Heat Stress, Increase in Blood Pressure, and Employee.

1. Introduction

The workers will face environmental pressures in a work environment. These pressures can be chemical, biological, physical, and psychological. The pressure in the form of heat stress, especially physical have important role in the work environment. Therefore, the working environment must be created in order to obtain as comfortable as possible and improving work efficient of productivity[1] (Santoso, 1985). Work climate is a combination of air temperature, humidity, air velocity, temperature and radiation[2] (Suma'mur).

In accordance with the Circular of the Ministry of Manpower No.SE. 51 / MEN / 1999 on Threshold Limit Values for Workplace Temperature, set: Threshold Limit Value (TLV) for the work climate is a workplace labor standard factor that acceptable without causing disease or illness in a day's work for a period not exceeding 8 hours a day or 40 hours a week with the workload is WBGT for 29,4°C. NAB is the lowest for the work space is 25°C and the highest NAV 32,2°C, depending on workload and working time arrangements[3] (Menakertrans, 1999: 570)².

Based on a preliminary survey obtained subjective complaints of 20 workers, moulding the room that 15 respondents (75%) feel the heat at work, 16 people (80%) of respondents felt quickly feel hungry at work, and 14 people (70%) of respondents felt the disturbance concentration decreases at work. Environmental heat coming from the roof and the engine production process, with a condition like this is very harmful to the health of the workforce. Work climate 26,7°C exceed not only interfere with productivity but endanger the health of workers. This study aimed to determine relationship of characteristis and heat pressure with blood pressure before and after labor exposed to heat stress on PLN Sulseltrabar regional generation.

One of the industry in Indonesia, especially in South Sulawesi Makassar is located in the municipality of PT. PLN (Persero) South Sulawesi, Southeast Sulawesi, West Sulawesi Generation Tello, who had the power generation unit is divided into three parts, namely diesel, steam power plant, and gas power plant. Where environmental conditions have a pressure high enough heat. This condition can lead to the risk of increased blood pressure for labor due to thermal stress generated by power generation machines when running the engine[4].

Based on these descriptions, the authors are interested in conducting research on PT PLN because no one has ever done research on the relationship of heat stress with blood pressure increased, as well as blood pressure often underestimated by someone while they do not know the consequences if they are not often checked his blood pressure. As a result of the increase in blood pressure is a disease usually affects stroke and heart function so that many people who experience a heart attack.

2. Materials and Methods

The populations in this study were all employees of PT PLN (Persero) Sulseltrabar Tello Regional Generation particular on diesel units' generation. The samples in this study were taken by using exhaustive sampling technique and selected 54 people. Primary data were collected by interview using a questionnaire. Heat stress measurement data using a Heat Stress Monitor and blood pressure using a sphygmomanometer. Data was processing by computer program, using Microsoft Excel and SPSS for windows. Data that has been processed is presented in the form of a frequency distribution table and narrative. Data was analysis by chi square test, and using $\alpha = 0.05$.

3. Results

This study was conducted at PT. PLN (PERSERO) Sulseltrabar Tello Regional Generation especially diesel units. Data was collected by distributing questionnaires to selected workers that lasts for one month from the date of 9 June to 15 June 2012. In addition, heat stress measurement is also held in four locations in the area of diesel, as well as the measurement of blood pressure on employees before and after exposure to heat. Then data was processed and presented in the form of frequency tables and crosstab (cross tabulation) in accordance with the purpose of the research and a table accompanied by narrative explanations.

A.Characteristics of Respondents

Tabel 1: Distribution of Respondents by Age Group and Unit Based Job At PT. PLN (Persero) Regional Generation Sulseltrabar Tello in 2012

Characteristics of Respondents	*(n)*	*Percentage (%)*
Age Group		
20-24	14	25,9
25-29	15	27,8
30-34	10	18,5
35-39	9	16,7
40-44	3	5,6
45-49	2	3,7
≥ 50	1	1,9
Total	54	100,0
level of Education		
Operators	30	55,6
Cleaning service	14	25,9
Harmes	7	13,0
Supervisory HSE	3	5,6
Total	54	100,0

The most respondents was in the age group of 25-29 years (27.8%), while the least are in the age group ≥ 50 years (1.9%). Respondents with work unit level is at most as many as 30 people Operators (55.6%) while the least was Supervisor K3 as many as 3 people (5.6%).

Table 2: Results of Heat Stress Measurement on PT. PLN (Persero) Regional Generation Sulseltrabar Tello in 2012

Location	*Time*	*WBGT (i)*	*KepMen No. 13/2011*	*WBGT (o)*	*KepMen No. 13/2011*
Mitsubshi 1	08.30	27,8	qualify	28,7	Not qualify (15.00)
Mitsubshi 2	08.45	28	qualify	29	Not qualify (15.15)
SWD 1	09.00	28	qualify	29,5	Not qualify (18.30)
SWD 2	09.15	28	qualify	30	Not qualify (19.15)

The measurement results of the work environment was known that the highest WBGT measurement results (i) 30.00°C and WBGT (o) 29.5 °C at SWD 1 and 2 were measured at 15.15 am and a low of WBGT (i) 27, 8°C at Mitsubshi 1 were measured at 08.30 am. From the results of these measurements, it is known that there are two areas that do not meet the requirements in the SWD.

Table 3: Distribusi Respondents by Increased Blood Pressure in PT. PLN (Persero) Regional Generation Sulseltrabar Tello in 2012

Blood Pressure	(n)	Percentaage (%)
Increased	25	46,3
Not Increased	29	53,7
Total	54	100

Tabel 3 showed that there were 25 respondents (46.3%) who get increase in blood pressure and 29 respondents (53.7%) who did not increase in blood pressure due to heat stress.

Table 4: Distribusi Respondents by Age, Work Period, Duration of heat Exposure, Sports Habit (exercise), Heat stress on PT. PLN (Persero) Regional Generation Sulseltrabar Tello in 2012

Research Variabel	**(n)**	**Percentage (%)**
Age		
Old (≥ 40 tahun)	6	11,1
Young (< 40tahun)	48	88,9
Total	54	100,0
Work Period		
Lama ≥ 5 tahun	34	63,0
New < 5 tahun	20	37,0
Total	54	100,0
Duration of heat exposure		
Not qualify (> 4 jam)	47	87,0
qualify (≤ 4 jam)	7	13,0
Total	54	100,0
Sports Habit (exercise)		
Less (≤3x week,≤20min)	37	68,5
Enough (>3x/week,>20 min)	17	31,5
Total	54	100,0
Heat stress		
>28 °C	31	57,4
≤28°C	23	42,6
Total	**54**	**100,0**

Table 4 showed that there were 6 respondents with old category or aged ≥ 40 years (11.1%) and most of respondent were have aged < 40 years or young category (88.9%). Based on years of service, most of respondents were work with service life ≥ 5 years old (63.0%), while respondents with the new job < 5 years were 20 people (37.0%). Based on duration of heat exposure, most of respondent were duration of heat exposure > 4 hours or do not qualify (87.0%) and there were 7 people (13.0%) on duration of heat exposure ≤ 4 hours (qualified). There were 37 respondents (68.5%) lack of exercise (sports habit) and there were 17 respondents (31.5%) with adequate exercise (sports habit). There were 31 respondents (57.4%) who get heat stress (exceed 28°C) and 23 respondents (42.6%) get heat stress on temperatur less than 28°C.

Table 5: Relationship Between Age, Work Period, Duration of heat exposure, Sports Habit (exercise) and Heat stress With the increase in blood pressure PT. PLN (Persero) Regional Generation Sulseltrabar Tello in 2012 Year.

Recearch Variables	*Increased Blood Pressure*						*P value*
	Increased		*Not Increased*		*Totaly*		
	N	*%*	*n*	*%*	*n*	*%*	
Age							
Old (≥40)	2	33,3	4	66,7	12	100	*0,675*
Young (<40)	23	47,9	25	52,1	42	100	
Work Period							
Long (≥5)	23	67,6	11	32,4	34	100	*0.000*
New (<5)	2	10	18	90	20	100	
Duration of heat							
> 4 hours	25	52,5	22	46,8	47	100	*0,012*
≤ 4 hours	0	0	7	100	7	100	
Sports Habit							
Less	16	43,2	21	56,8	37	100	*0,711*
Enough	9	52,9	8	47,1	17	1000	
Heat stress							
not qualify	19	61,3	12	38,7	31	100	*0,022*
qualify	6	26,1	17	73,9	23	100	

Table 5 showed that most of respondents with age ≥ 40 years old (old category) not increased blood pressure and most of respondents with age < 40 years old (young category) not increased blood pressure. Results of statistical analysis of the relationship between age with an increase in blood pressure obtained p = 0.675. So there is no relationship between age and blood pressure increase on the employee PT PLN (Persero) Sulseltrabar Tello Regional Generation.

Base on work period, from the 34 respondents with a long work period (≥ 5 years) there were 23 people (67.6%) who had increased on blood pressure and 11 people (32.4%) who did not increased on blood pressure. While respondents with the new work (<5 years), most of them (90.0%) did not get increased on blood pressure. The results of the analysis of the relationship between the work period with blood pressure increased obtained p = 0.000 (p <0.05). This means that there is a significant relationship between work period with blood pressure increased in the employee of PT PLN (Persero) Sulseltrabar Tello Regional Generation.

Based on a duration of heat exposure, from 47 respondents with duration of heat exposure > 4 hours /day, most of them (52.5%) get increase in blood pressure and 22 people (46.8%) did not get an increase in blood pressure. While respondents with duration of heat exposure ≤ 4 hours/day, all of them (100%) did not get increase in blood pressure. So there is a relationship between duration of exposure with increase in blood pressure on the employees of PT. PLN (Persero) Sulseltrabar Tello Regional Generation (p = 0,012).

Based on the sports habit (exercise), there were 37 respondents were less of exercise, 56,8 % of them not get increase in blood pressure and 43,2 % get increase in blood pressure. While there were 17 respondents with enough of exercise, most of them (52,9%) get increase in blood pressure. The results of the analysis of the relationship between obtained p = 0.711. So there is no relationship the sports habit (exercise) with increase in blood pressure on the employees of PT. PLN (Persero) Sulseltrabar Tello Regional Generation.

Base on heat stress, of the 31 respondents who get heat stress (> 28^0 C), 19 people (61.3%) get an increase in blood pressure and 12 people (38.7%) did not get an increase in blood pressure. While the 23 respondents who get heat stress (≤ 28^oC), 6 people (26.1%) get an increase in blood pressure and 17 people (73.9%) did not get an increase in blood pressure. Results of statistical analysis of the relationship between the heat stress with increase in blood pressure obtained p = 0.022. This means that there is a significant relationship between heat stress with increased in blood pressure on the employee PT PLN (Persero) Sulseltrabar Tello Regional Generation.

4. Discussion

4.1 Decription of Heat Pressure

Heat pressure measurements performed on the diesel area stated that the indoor WBGT index MITSUBSHI 1, MITSUBSHI 2, SWD 1, and 2 SWD measurement results ranged 28,7°C-30,0°C during late evening until evening. It caused of the machine is active at the time of the afternoon until the morning.

4.2 Description of Blood Pressure

There were 25 people (46.3%) who get increase in blood pressure. It could happen because of the exposure to heat continuously can reduced a lot of sweat and fluids in the body, this condition will cause employees have complaints.

4.3 The Relationship of Age with increase in Blood Pressure

There is no relationship between age with increase in blood pressure, because although workers in the diesel work with continuous exposure to heat with a fairly high frequency of both young and old age, but there are other factors that influence. These factors are smoking behavior, life style, life burden, exercise habit, changes in the organs, cardiovascular and hormonal systems (Suma'mur, 2009).

4.4 The relationship of Work period with Increase in Blood Pressure

There is a significant relationship between work period with an increase in blood pressure. It suggesting that future work on this research affect the increased blood pressure. The reason of this relationship because Someone working lives can affect the body in receiving hot working environment, because the longer the workers exposed to heat stress in the workplace environment, the body has to adapt to the heat.

According to Suma'mur that the longer a person in the work, the more he was exposed to various hazards and health problems caused by the work environment. The longer they work in one place, the greater the likelihood of exposure to physical environmental factors and chemicals that can cause

occupational diseases resulting in lower labor productivity of workers.

4.5 Relationship of Duration of Heat Exposure with Increase in Blood Pressure

There is a significant relationship between duration of heat exposure to elevated blood pressure. This means that long exposure will affect the increase in blood pressure. The existence of this relationship because workers employed in diesel specially continuously working operator, working only occasionally enter the room of coolant in the engine area. Workers are not allowed to leave the engine running too long because if not supervised bad possibilities will explode.

Workers should also be noted every 10 minutes engine running results from. According to the labor law, which allowed the working length is 8 hours or 40 hours a week, if extended usually accompanied by the emergence of a variety of health complaints. on NAV physical factors in the workplace, heat stress should 28,0°C 50% of working time and resting time of 50%. So 4 hours and 4 hours of rest with the workload being, if exceeded will cause health problems.

4.6 Relationship Sports Habit with Blood Pressure Increase

There is no relationship between sports habit (exercise) with blood pressure increase. It caused the most of employee (workers) rarely to do sports exercise (≤ 3x ≤ 20 minutes a week), and another factors that not be identified in this research. Exercise is very beneficial for health, by exercising the body's metabolism to be smooth so that the distribution and absorption of nutrients in the body to become more effective and efficient. If the exercise is done properly and in the right portions and the right procedures, either directly or indirectly will bring positive results in both physical as well psychological health.

Sports not only makes the body becomes fresh, but also tightens the muscles and increase blood flow, because the heart works faster when doing sports. When compared to people who often do not often exercise with the sport that people do not often easily tired, and susceptible to disease. Although the work performed by the employees of PT. PLN requires physical labor, but exercise is recommended as it will keep the shape of the body.

4.7 Relationship Heat Stress (Pressure) with Blood Pressure Increase

There is relationship between Heat stress (pressure) with increase in blood pressure. Heat is a potential danger that exist in virtually all workplaces, especially during the summer. Heat is the danger of a typical tropical climate. Industrial heat the heavy work which regularly produce the high potential for problems due to the heat add the heat load on the worker by the metabolic heat in general. Pressure measurements were performed on a hot diesel engine area stated that the indoor WBGT index is the lowest in the Mitsubshi I 27,0°C measured in the morning, and the highest is in the SWD II 30,0°C measuring on night.

So if a person or worker exposure to heat, the productivity in the work will decrease. The decline in labor productivity will lead to many problems one of which is the reduced concentration at work so do the job with one and then there was work accidents and occupational diseases. Energy use in the production process are less equipped with thermal control system is one of the facto occurrence of the above (Suma'mur PK, 2009).

5. Conclusion and Acknowledgements

Based on the results of this research. The relationship of heat stress with an increase in blood pressure before and after working on the employee PT. PLN (Persero) Regional Sulseltrabar, Tello Generation In 2012, it can be concluded that:

5.1 There is no association of age with an increase in blood pressure on the employees of PT. PLN (Persero) Regional Generation Sulseltrabar Tello in 2012 ($p = 0.675$). This means that the younger age category (<40 years), elderly (≥ 40 years) had the same risk for increased blood pressure.

5.2 There is relationship between work period with the increase in blood pressure on employees are encouraged PT. PLN (Persero) Regional Generation Sulseltrabar Tello in 2012 ($p = 0.00$)

5.3 There is a relationship between duration of heat exposure with increase in blood pressure on the employees of PT. PLN (Persero) Regional Generation Sulseltrabar Tello in 2012 ($p = 0.012$).

5.4 There is no relationship between Sports habits (exercise) with increase in blood pressure on the employees of PT. PLN (Persero) Regional Generation Sulseltrabar Tello in 2012 ($p = 0.711$).

5.5 There is a relationship between heat stress with increase in blood pressure on the employees of PT. PLN (Persero) Regional Generation Sulseltrabar Tello in 2012 ($p = 0.022$).

As for the suggestion are:

1 To the company:

a. Set the hours of work and rest appropriately based on workload and WBGT value. Especially in workers who work section the operator must find a way out so that adequate rest time.
b. Increasing air movement through the cooling vents to expand her work area generating machine.
c. Implement training so employees know the K3 basic instructions if interference occurs due to heat exposure.

2. To the employee:

a. Employees should know the impact of other factors that can worsen the effects of exposure such as lack of exercise, smoking behavior and life style.
b. Learning to recognize the signs and symptoms of heat stress on yourself and co-workers, do not work alone.

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