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Relationship between Heat Pressure and Age with Work Fatigue among Workers at Department Factory I of Pt. Maruki International, Makassar in 2017

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ABSTRACT

PT. Maruki International Indonesia is the only company in Indonesia that exports Butsudan. Production activities are divided into 6 factories. The initial process that has high activity and has high heat pressure sourced from the engine takes place in Factory 1. Hence, this can cause workers to experience fatigue easily. This study aimed to determine the relationship of heat pressure and age with work fatigue experienced by Factory 1 workers at PT. Maruki International Indonesia Makassar City. The type of research is observational analytic with a cross sectional study approach. Data collection from 48 workers took place from April 10 to April 15, 2017. The work fatigue measurement technique used the Reaction timer tool, heat pressure using Heat Stress Monitor equipment, and age through direct interview. Data analyses were done using Chi-square test. The results showed that there was a relationship between heat pressure $p = 0.014$ ($p < 0.05$) and age $p = 0.026$ ($p < 0.05$ with work fatigue at factory I workers of PT. Maruki International Indonesia.

Keywords: *PT. Maruki International, Fatigue, temperature and factory I workers.*

Introduction

Fatigue is a mechanism for protecting the body so that the body can avoid further damage resulting in recovery after rest[1].The term fatigue leads to the condition of weakening of energy to carry out an activity. Symptoms of subjective and objective fatigue include feelings of lethargy, sleepiness, dizziness, lack of concentration, lack of alertness, poor and slow perception, reduced arousal for work and decreased spiritual and physical performance. Fatigue can affect work productivity, so that if the level of productivity of a workforce is disrupted caused by physical or psychological factors, then the result will be felt by the company in the form of decreased in productivity[2].

Workers will be able to carry out activities well and work optimally under conducive working environment. The comfort of a workplace is influenced by several factors, one of which is the work climate. Work climate is a combination of air temperature, air humidity, air movement speed and radiation temperature in a work environment[3]. If these four components interact with heat, it will potentially cause heat stress. Excessive heat pressure can lead to various health problems, work accidents to death. Human ability to adapt to environmental temperature is generally seen from changes in body temperature. Humans are considered able to adapt to changes in environmental temperature if temperature changes do not occur or changes in body temperature whereby still in a safe range[4]. The local temperature and existence of life are very closely related, as are the effects of work weather on labour power. Work efficiency is greatly influenced by working weather in areas where work is not cold and not hot. The recommended temperature in the workplace is around 24-26 ° C (cold temperature) and humidity of 65% - 95%[3].

Workers in hot environments, such as around furnaces, smelters, boilers, ovens, heat sinks or working under the hot sun can experience heat stress[5]. These thermal conditions can affect the performance of workers both working outside and inside buildings. The effectiveness of the performance of workers in the two work locations is strongly influenced by the comfort of the work environment where they are located, especially for workers who are in building[6]. The United States Emergency Department reports that the number of work

accident patients due to heat stress in the workplace has increased significantly from 3,192 cases in 1997 to 7,452 in 2006[7]. Based on research conducted by Indriawati[8] about the effect of heat pressure on the fatigue level of work at the concert slab steel plant I PT. Krakatau Steel Cilegon, Banteng shows that there is a relationship between heat pressure and work pressure in the concrete section, namely the higher the heat pressure in the work environment, the higher the level of fatigue of workers. Conversely the lower the heat pressure in the workplace the lower the work fatigue of the workers.

Individual factors such as age, nutritional status and haemoglobin levels also greatly influence the occurrence of work fatigue. Research by Damopoli et al.[9] concluded that there is a relationship between age and work fatigue at the Manado-Amurang bus driver at Malayan terminal. The age of bus driver is directly proportional to the level of fatigue. The results of research conducted by Febriani et al.[10] on the relationship of heat pressure to fatigue in tofu maker workers of Tofu Factory in East Bara-Barayya Sub-District, in 2016 showed that as many as 43 respondents obtained more work fatigue in the status category. 29 respondents (82.9%) experienced abnormal nutritional compared to the normal nutritional status category as many as 14 respondents (50.0%).

PT Maruki International Indonesia is the only company in Indonesia that exports Butsudan (furniture that serves as a place to respect and communicate with deceased ancestors). Types of activities carried out at PT. Maruki International Indonesia, namely wood drying, woodcutting, refinement, gluing, colouring, assembly and packaging. Examples of complaints by workers during the research work include quickly feeling tired, fast thirst, dizziness, and excessive sweating. This is the background of researchers wanting to conduct research with the title "Relationship between Heat Pressure and Age with Fatigue among Workers in Factory I Section at PT. Maruki International Indonesia Makassar City 2017.

Methodology

The type of research used is observational analytic research with a cross sectional study approach as the independent and dependent variables will be observed at the same time. This research was conducted at the factory 1 of PT. Maruki International Indonesia Makassar City. Data collection began on 10 April until 15 April 2017 against 48 workers in the factory as samples taken with exhaustive sampling techniques. The data were collected using direct interviews (questionnaires) as to find out the age and heat pressure measurements using a Heat Stress Monitor measuring device. Furthermore, work fatigue measurements were carried out using a reaction timer on a sample of 48 workers. The data obtained is then analyzed using the SPSS computer program and the data is presented in the form of a frequency table and cross tabulation (crosstab) in accordance with the research objectives and accompanied by a narrative as a table explanation.

Result and Discussion

Univariate Analysis: Distribution of respondents according to work fatigue group can be seen in Table 1. Based on Table 1, it is shown that the highest number of respondents is in the reaction time group 198-239 milliseconds as many as 18 respondents or 37.5% while the least number of respondents is in the reaction time group 502-543 milliseconds as many as 2 respondents or 4.3%.

Table 1: Distribution of respondents by fatigue group

Fatigue group	Respondents	
	n	Percentage (%)
198 – 239	18	37.5
240 – 381	5	10.4
282– 323	3	6.2
324– 365	4	8.4
366– 407	3	6.2
408 – 459	3	6.2
460 – 501	4	8.4
502 – 543	2	4.3
544 – 585	3	6.2
586 – 627	3	6.2
Total	48	100

After grouping the fatigue level based on the reaction time of workers, work fatigue in this study is then divided into 2 categories, namely fatigue if the reaction time is ≥ 240 milliseconds and not fatigued if the reaction time is <240 milliseconds. Data in Table 2 presented that from 48 respondents, it was known that respondents who experienced fatigue were 30 people or 62.5% whereas those who did not experience fatigue is as many as 18 people or 37.5%.

Table 2: Distribution of respondents by fatigue category

Fatigue category	Respondents	
	n	Percentage (%)
Experienced fatigue	30	62.5
No fatigue experience	18	37.5
Total	48	100

Data presentation based on distribution of respondent according to heat pressure can be seen in Table 3. Heat pressure is categorized into 2 categories, namely meeting the requirements for Wet Bulb Globe Temperature Index (WBGT) of not exceeding threshold value 28℃ and not meeting the requirements if the WBGT does not pass the threshold value (> 28℃). The data in Table 3 showed that from 48 respondents, it was obtained as many as 32 people or 66.7% who worked under heat pressure did not meet the requirements and 16 people or equal to 33.3% worked on heat pressure that met the requirements.

Table 3: Distribution of respondents by heat pressure category

Heat pressure category	Respondents	
	n	Percentage (%)
Did not meet the requirement	32	66.7
Met the requirement	16	33.3
Total	48	100

Distribution of respondents based on age group is tabulated in Table 4.The age of respondents working at Factory I ranged from 20-59 years. Based on table 4, the highest number of respondents is in the age group 45-49 as many as 11 respondents or 22.9% while the least number of respondents is in the age group 55-59 years as many as 4 respondents or 8.4%.

Table 4: Distribution of respondents by age group

Age group	Respondents	
	n	Percentage (%)
20-24	6	12.5
25-29	6	12.5
30-34	5	10.4
35-39	5	10.4
40-44	6	12.5
45-49	11	22.9
50-54	5	10.4
55-59	4	8.4
Total	48	100

Bivariate Analysis: The results of cross tabulation between heat stress and fatigue can be seen in Table 5 which revealed that from 48 respondents, most of workers that experienced work fatigue working under heat pressure (did not meet the requirements), as many as 24 respondents or 75.0% compared to those working under heat pressure (met the requirements) of 6 respondents or 37.5%. The number of respondents who did not experience fatigue but worked under heat pressure (within the requirements), were as many as 10 respondents or 62.5% whereas those who worked under heat pressure (did not meet the requirements), namely as many as 8 respondents or 25.0%. Based on data analysis using the Chi square test, the value of p = 0.014. The interpretation is that there is a connection between heat stress and work fatigue.

Table 5: Relationship between heat stress and work fatigue

Heat stress	Work fatigue				Total		p-value
	Experienced fatigue		No fatigue experience		n	%	
	n	%	n	%			
Did not meet requirement (>28℃)	24	75.0	8	25.0	2	66.7	0.014
Met requirement (≤28℃)	6	37.5	10	62.5	6	33.3	
Total	30	62.5	18	37.5	8	100	

The following are the results of cross tabulation between age and work fatigue which can be seen in Table 6. Table 6 showed that of the 48 respondents those who experienced work fatigue were in the old age (35 years and above) category as many as 23 respondents or 74.2% compared to the young age category that is as many as 7 respondents or 41.2%, while the percentage who did not experience work fatigue in the young age category were as many as 10 respondents or 58.8% and in the old category 8 respondents or 25.8%. Based on data analysis using the Chi square test, the obtained p value = 0.026. Thus, there is a relationship between age and work fatigue.

Table 6: Relationship between age and work fatigue

Age	Work fatigue				Total		p-value
	Experienced fatigue		No fatigue experience		n	%	
	n	%	n	%			
Old (≥35 years)	23	74.2	8	25.8	31	64.6	0.026
Young (<35 years)	7	41.2	10	58.8	17	35.4	
Total	30	62.5	18	37.5	48	100	

Discussion

The results of the heat pressure received by workers vary depending on which production process the worker works. In addition to work processes that are exposed to heat, the condition of buildings and roofs made of zinc and not equipped with air vents (exhaust fans) increase the factor of heat stress in the workplace is higher. If workers are exposed to heat, the organs will work harder to remove excess heat from the body, causing the hypothalamus to stimulate the sweat glands so that the body will sweat. In sweat contains various sodium chloride salts, the release of sodium chloride salt with sweat will reduce levels in the body, thus inhibiting the transportation of glucose as an energy source. This will cause a decrease in muscle contraction so that the body experiences fatigue[11]. This was reinforced by complaints from workers when researchers conducted interviews, where most workers experienced dehydration, headaches, excessive sweating and complained of the existence of a hot environment. Based on the results of data analysis and observations, it can be concluded that the higher the heat pressure, the respondents will be at risk of experiencing work fatigue. This research is in line with the research conducted by Indriawati[8] which stated that there is a significant relationship between heat pressure and work fatigue among workers at the Concrete Slab Steel Plan 1 PT. Krakatau Steel Cilegon, Bantensince obtained p value = 0.002.

In this study, there is a relationship between age and work fatigue whereby the older a person is, the lower the body's strength which result in faster work fatigue. A person's age will affect the condition and capacity of the body in carrying out its activities. Workers over the age of 35 have fatigue when doing work under hot temperatures compared to younger workers[12]. The results of this study are not in line with the research conducted by Winwood et al.[13] where young workers are easily tired than old age employees.

Although most respondents who experience work fatigue are included in the old age category, but there are 8 respondents who are in the old age category whom did not experience fatigue. This can be caused by workers utilizing their rest periods well. In addition, in the young age category, 7 respondents experienced work fatigue. Based on the results of interviews, these workers had poor sleep patterns. This is due to other activities after working like additional work, experiencing sleep disorders (insomnia) and the habit of spending time late at night after returning to work.

Conclusion

Based on the results of research and analysis of the variables studied about the relationship of heat pressure and the characteristics of individuals with work fatigue on workers at the factory 1 of PT. Maruki International Indonesia Makassar City In 2017 it can be concluded that:

1. The higher the temperature of the environment in the workplace, the faster the workers experience work fatigue.
2. The older the age of a worker, the faster they experience work fatigue.

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