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Factors Related To Fatigue In Tofu Factory Workers In Mejing Candimulyo Village, Magelang

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ABSTRACT

Background: Fatigue is a condition in which the body physically and mentally shows differences that can result in decreased performance and lower body resistance to work activities. This fatigue condition can result in a decrease in work productivity and an increased risk of accidents. Some of the factors that cause work fatigue are age, working period and hot work climate. The existence of this study aims to determine the relationship between fatigue and age, working period and hot work climate in tofu factory workers in Mejing Village, Candimulyo District, Magelang.

Method: this study is a quantitative research using *a cross-sectional approach.* A total of 31 respondents from tofu factory workers in Mejing Village, Candimulyo District, Magelang became research samples obtained by total sampling technique. Instruments used: Respondent data sheets, fatigue measurement table results and hot work climate measurement results. Data analysis using univariate and bivariate *chi-square tests*

Result: The results showed that there was a gap between age and work fatigue (*p-value* 0.001), working period (*p-value* 0.006), and hot work climate (*p-value* 0.001) with the risk of work fatigue in tofu factory workers in Mejing Village, Candimulyo District, Magelang.

Conclusion: there is a relationship between age, working period and hot work climate with work fatigue in tofu factory workers in Mejing Village, Candimulyo District, Magelang.

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1. Introduction

Fatigue is a condition in which the body physically and mentally shows differences that can result in decreased performance and lower body resistance to work activities. This fatigue condition can result in a decrease in work productivity and an increased risk of accidents (Arfan & Firdaus, 2020).

Some of the factors that cause work fatigue are age, working period and hot work climate. Fatigue that occurs in the informal sector can be seen from the results of previous studies where the research sample experienced work fatigue with different levels. There are tofu making workers at the tofu factory who are experiencing fatigue. This makes the informal sector have the potential for fatigue because it is relatively flexible, there are not too many rules, and there is little attention to matters related to fatigue for workers (Maudy *et al*, 2021)

Previous research stated that making tofu involves several phases, starting from cleaning the soybeans, grinding the clean soybeans, then cooking and filtering the soybeans. The next process involves printing tofu. Each of these stages can cause hazards that can cause fatigue and work accidents, including heat exposure from the soybean cooking stove and tofu pulp squeezing activities that can result in disorders in muscles and joints due to equipment incompatibility with workers (Yogisutanti *et al*, 2020)

The average age of workers is under 65 years old, and they have worked for approximately 10 years as tofu makers at the factory. From the results of interviews with a number of factory employees, information was found that there was no provision of lunch or dinner from the factory. However, the employees receive food money every week. Some of the complaints submitted by workers involve feeling weak, headaches, difficulty concentrating, easily sleepy, as well as complaints about the waist, wrists, feet, and the onset of tingling and itching between the workers' fingers also feel a hot work environment that interferes with comfort at work. Work in the production section includes a number of stages, ranging from screening, grinding, washing, cooking, coagulation, packaging, pressing, to salting. From this flow, it can be concluded that there is a risk of heat pressure hazard which can be an additional burden for workers in the production section of the tofu factory, which in turn can cause work fatigue.

2. Materials and Method

This type of research uses a quantitative observation method with *a crossectional study approach*. This research will be carried out at the Tofu Factory in Mejing Village, Candimulyo District, Magelang Regency. The research was carried out for two months. This research will be carried out in October 2024.

The population in this study is all employees of Mejing Candimulyo Magelang tofu making workers with a total of 30 tofu making workers. The number of samples used in the study was 30 total samples at Mejing Candimulyo Magelang. The data collection instruments used were respondent data sheets, fatigue measurements using *reaction timers*, and hot work climate measurements using *Wet Bulb Globe Temperature* (WGBT).

The univariate analysis of this study produced a table of frequency distribution and percentages of data collected such as age, working period, and hot work climate. This bivariate analysis is carried out by statistical testing, namely the *Chi Square test* because the measurement scale used is a nominal scale for age and service life variables, as well as an ordinal scale for heat pressure variables.

3. Results and Discussion

A. Results

1. Univariate Analysis

Table 1 Univariate Analysis

Variable	Frequency (n)	Presentation (%)
Age		
Old	16	51,6
Young	15	48,4
Working period		
Old (≥5)	18	58,1
New (<5)	13	41,9
Hot Work Climate		
Heavy	14	45,2
Light	17	54,8
Work Fatigue		
Heavy	15	48,4
Light	16	51,6
Total	31	100,0

Based on table 1, it can be seen that the distribution of respondent characteristics obtained at the research site is that the majority of workers are in the old category as many as 16 (51.6%) people. Meanwhile, the majority of characteristics based on service period are included in the category of long service period as many as 18 (58.1%) people. In the hot work climate category, the majority are included in the category below NAV with a total of 17 (54.8%) people. And the characteristics of work fatigue, the most respondents who fell into the category of mild fatigue amounted to 16 (51.6%) people.

1. Bivariate Analysis

a. The Relationship Between Age and Work Fatigue

Table 2 Age Relationship with Work Fatigue

Age	Fatigue				Total		p-value	Pr (95%CI)
	Heavy		Light					
	n	%	n	%	n	%	0,001	6,094 (1,642-22,618)
Old	13	41,9	3	9,7	16	51,6		
Young	2	6,5	13	41,9	15	48,4		
Total					31	100		

Based on table 2, the results were obtained that workers whose age was included in the old category experienced severe fatigue as many as 13 (41.9%) workers, while workers whose age was included in the young category experienced severe fatigue as many as 2 (6.5%) workers. Based on *the chi-square* test , the value of p-value=0.001 (p-value < 0.005) means that there is a relationship between age and work fatigue in tofu factory workers in Mejing Candimulyo District, Magelang. Based on the prevalence ratio (PR) = 6.094

(PR>1), it can be concluded that workers whose age is included in the old category can experience severe fatigue 6 times higher risk of experiencing severe fatigue than workers whose age is included in the young category with a *confidence interval* value (95% CI = 1,642-22,618) where the range does not exceed 1 so that age is a risk factor for fatigue in workers and statistically significant.

b. The Relationship Between Working Period and Fatigue

Table 3 The Relationship Between Working Period and Fatigue

Working period	Fatigue				Total		p-value	PR (95%CI
	Heavy		Light					
	n	%	n	%	n	%	0,006	4,694
Old	13	41,9	5	16,1	15	48,4		(1,271-
New	2	6,5	11	35,5	16	51,6		17,340)
Total					**95**	**100**		

Based on table 3, the results were obtained that workers whose working period was included in the long category experienced severe fatigue as many as 13 (41.9%) people. Meanwhile, workers whose working period is included in the new category are 2 (6.5%) people. Based on the hypothesis of the chi-square test, the value of p-value=0.006 (p-value < 0.05) means that there is a relationship between working period and work fatigue in workers of the tofu mejing factory, Candimulyo District, Magelang. Based on the Prevalence Ratio (PR) = 4.694 (PR>1), it can be concluded that workers who have a working period of 4.6 times are at higher risk of experiencing work fatigue compared to workers with a new working period with *a confidence interval* value (95% CI = 1.271-17.340) where the range does not exceed the limit of 1 so that the working period is a risk factor for work fatigue in workers and is statistically significant.

c. The Relationship Between Hot Work Climate and Fatigue

Table 4 The Relationship Between Hot Work Climate and Fatigue

Hot Work Climate	Fatigue				Total		p-value	PR (95% CI)
	Heavy		Light					
	n	%	n	%	n	%	0,001	6,094
Heavy	12	38,7	2	6,5	15	48,4		(1,642-
Light	3	9,7	14	45,2	16	51,6		22,618)
Total					**95**	**100**		

Based on table 6, it was found that workers in the category of work climate exceeding NAV experienced severe fatigue as many as 12 (38.7%) people. Meanwhile, workers with a working climate category below NAV who experienced severe fatigue were 3 (9.7%) people. Based on the results *of chi-square*, the *value of p-value* = 0.001 (p-value < 0.05) means that there is a relationship between the hot work climate and work fatigue in tofu factory workers in Mejing Village, Candimulyo District, Magelang. Based on the value of Prevalence Ratio (PR) = 6.094 (PR<1), it can be concluded that workers who fall into the category of work climate exceeding NAV are 6 times more likely to

experience work fatigue compared to workers with a hot work climate category below NAV with a confidence *interval* value (95% CI = 1,642-22,618) where the range does not include the number 1 so that the hot work climate is a risk factor for work fatigue in workers and statistically significant.

B. Discussion

1. Age Relationship with Work Fatigue

Based on the results of the bivariate analysis that has been carried out using chi-square, a significance value of 0.001 (*p-value* <0.05) which means that there is a relationship between age and work fatigue in tofu factory workers. Based on the value of Prevalence Ratio (PR) = 6 (PR>1), it can be concluded that tofu factory workers who fall into the old age category are at higher risk of experiencing work fatigue compared to tofu factory workers who fall into the young age category. This research is in line with the research conducted by Darmayanti *et al*., (2021), stated that there was a meaningful relationship between age and work fatigue and *p-value* 0,001.

Based on data obtained from the field, it is known that out of 31 workers, there are 13 (41.9%) workers with the old category and are at high risk of experiencing work fatigue. This happens because increasing age will be followed by the degeneration process of organ function so that the ability of the organs will decrease, causing the workforce to be more easily fatigued, besides that age can affect the speed of reaction and the level of fatigue of a person.

Older workers tend to experience a decrease in muscle strength, but this is balanced by better emotional stability compared to younger workers, so they can think more positively at work. A person's age will affect the condition of the body, Older workers tend to feel greater fatigue. Some physical abilities, such as vision, hearing, and reaction speed, decline after the age of 40, which has an impact on work capacity. In old age, the ability to work is reduced due to a decrease in physical condition, which leads to faster fatigue. Meanwhile, younger workers have better physical condition, so they can work at a higher capacity (Wind *et all*, 2021).

Physical conditions, such as fatigue that workers feel while working, can be affected by age. A person's level of fatigue increases with age. Changes in body function can be caused by the individual's endurance and work capacity. Younger workers tend to be better able to carry out heavier work because of their still strong physical condition. On the other hand, older workers experience a decrease in their ability to carry out work due to fatigue easily and limited mobility. This condition is in accordance with the physical condition of the workers' bodies in the tofu factory in Mejing Village, Candimulyo District, Magelang.

2. The Relationship between Employment Period and Work Fatigue

Based on the results of bivariate analysis that has been carried out using the test *chi-square* The result of the significance value was obtained of 0.006 (*P-valuue* <0.05), which means that there is a relationship between working period and work fatigue in tofu factory workers. Based on the value of the Prevalence Ratio (PR) = 4.6 (OR>1), it can be concluded that workers who have a long working period are at a high risk of 4.6 times of work fatigue compared to workers who have a new working period. This research is in line with the research conducted Rusila & Edward, (2022) which states that there is a relationship between the working period and work fatigue and *p-value* by 0.007 (<0.05). Therefore, the working period is one of the risk factors that can cause workers to be at risk of work fatigue.

Based on data obtained from the field, it is known that out of 31 workers, there are 2 (6.5%) workers who have a new working period and are at high risk of working fatigue, as many as 13 (41.9%) workers have a long working period. This happens because the majority of study subjects who have a work history of >5 years tend to experience work fatigue faster than those who have a working period of less

than 5 years. This is because the longer a person works, the more boredom will appear due to monotonous work, which in turn increases fatigue. In accordance with existing theories, a long working period can have both positive and negative impacts. The positive impact is that someone who works longer will have more experience and skills in carrying out work. However, the negative impact that may arise is fatigue and boredom. The longer a person works, the higher the likelihood of being exposed to health risks. This is due to constant exposure to the hazards that workers experience every day during work (Suryadi *et al*, 2020)

Based on data, workers at the tofu factory in Mejing Village, Candimulyo District, Magelang, who have a long working period, often experience fatigue due to work activities. This fatigue mainly occurs in the filtering, printing, and frying parts, which is caused by the accumulation of fatigue from the applied work process, such as standing continuously for a long time, monotonous work, and often working in a static position. In addition, working continuously for long periods of time can affect body mechanisms, such as the circulatory, digestive, muscular, nervous, and respiratory systems, which makes workers more susceptible to fatigue.

The length of the working life affects the level of productivity that can be achieved. The longer a worker carries out his job, the more skilled and faster he will be in producing products. This happens because in the production process requires perseverance and adequate skills. Workers with longer working periods tend to be better able to detect, understand, and find the cause of errors that arise, so that they can reduce errors in the production process. However, the longer the working period, the higher the risk of workers being exposed to diseases in the workplace. Previous research has also shown that work experience has a positive and significant influence on work productivity (Aulia *et al* , E, 2020)

Excessive working hours are often the cause of workers feeling that the wages they receive are disproportionate, and this can also threaten a decline in their physical and mental abilities. The ILO (International Labour Organization) has adopted several instruments that regulate the provision of working hours to minimize the decrease in productivity due to excessively long working hours. In Indonesia, the limit of working hours that are considered excessive is 48 hours per week, in accordance with ILO Conventions No. 1 and No. 30. Meanwhile, based on the Manpower Law No. 13/2003, the maximum working hours regulated are 40 hours per week (Krisdiana *et al* , 2022)

3. The Relationship between Hot Work Climate and Work Fatigue

Based on the results of bivariate analysis that has been tested using the *chi-square* A significant value of 0.001 (*p-value* <0.05), which means that there is a relationship between a hot work climate and work fatigue. Based on the value of Prevalence Ratio (PR) = 6 (OR<1), it can be concluded that workers who fall into the category of hot work climate exceeding NAV are at 6 times higher risk of experiencing work fatigue compared to workers who fall into the category of work climate below NAV. This research is in line with the research conducted Hijah *et al*., (2021) There is a relationship between hot work climate and work fatigue and *p-value* 0.005 (<0.05). Therefore, a hot work climate is one of the risk factors that can cause workers to be at risk of work fatigue.

Based on data obtained from the field, it is known that out of 31 workers, 12 (38.7%) are included in the category of heavy work climate experiencing severe fatigue and while workers who are included in the category of hot work climate below NAV experience severe fatigue as many as 3 (9.7%) workers. This happens because when working, the body will interact with environmental conditions which include air temperature, humidity, and airflow. In a hot work environment, workers will face an additional burden in the form of heat, while the body also produces heat through metabolic processes. Excessive heat exposure during prolonged work can lead to fatigue.

A hot work climate is one of the factors that cause work fatigue. The additional burden of the work environment, which is a burden beyond the main duties of the worker, comes from environmental conditions that have potential hazards. One of the factors that causes work fatigue is the hot work climate. The working climate is a combination of temperature, humidity, airflow velocity, radiant heat, and the rate of heat release from the worker's body (Aswin & Halim, 2022)

In the workplace, workers often face additional burdens caused by environmental conditions. This burden can come from chemical, physical, biological, physiological, or psychological factors. Temperatures that are too hot can lead to fatigue and drowsiness, while temperatures that are too cold can reduce concentration and cause tension, which negatively impacts work that requires thought. However, high-temperature environments generally pose more problems compared to low-temperature environments, as the human body is more adaptable to cold temperatures than hot temperatures. The comfortable temperature for Indonesians is in the range of 24-26ºC (Maftuh *et al*, 2021)

Considering that factory workers are one of the jobs that are at high risk of experiencing fatigue due to work related to age, working period and hot work climate. So several control measures are needed to prevent fatigue in tofu factory workers. Fatigue prevention can be done by giving breaks and taking a break from work. If workers feel tired and continue to force themselves to continue working, fatigue will increase, which can hinder the smooth running of work and negatively affect the workers themselves. Rest is a recovery effort that can be done by taking a break from work activities, sleeping at night, or taking time off. Fatigue can be overcome or reduced with a variety of approaches that involve common matters as well as manager*set a*work conditions and work environment in the workplace (Yunus, 2021)

Tofu factory workers are individuals who work in industries or factories that produce tofu, a food made from soybeans. The main duties of tofu factory workers include soybean processing, soy milk production, processing into tofu, and product packaging. They are also responsible for ensuring the quality of the tofu produced according to standards and maintaining the cleanliness and smooth production process. These workers need to have skills in handling production equipment and understand the procedures required to produce tofu properly and safely. Any work done with good intentions and in accordance with sharia principles can be considered a legitimate and endowed profession, including work as a tofu factory worker. Islam teaches that work is worship, as long as it does not contradict the laws of Allah and does not harm others.

Factory workers know the responsibility to ensure that the products produced conform to good quality standards and do not harm consumers. In Islam, taking care of the health and safety of others is part of the moral principle that must be applied.

4. Conclusion

1. There was a relationship between age and work fatigue in tofu factory workers in Mejing Village, Candimulyo District, Magelang with *a p-value* of 0.001 (<0.05).
2. There was a relationship between working period and work fatigue in tofu factory workers in Mejing Village, Candimulyo District, Magelang with *a p-value* of 0.006 (<0.05).
3. There was a relationship between hot work climate and work fatigue in tofu factory workers in Mejing Village, Candimulyo District, Magelang with *a p-value* of 0.001 (<0.05).

5. References

1. Arfan, I. & Firdaus, R. Factors Associated with Work Fatigue in Production Workers in Palm Oil Processing Plants. *A. Health Sciences. Masy.* **9**, 232–238 (2020).
2. Maudy, C. K., Ruliati, L. P. & Doke, S. Complaints of Musculoskeletal Disorders and Work Fatigue in Loading and Unloading Workers at Tenau Port. *Health Media. Masy.*

3, 312–321 (2021).
3. Yogisutanti, G., Firmansyah, D. & Suyono, S. The Relationship between the Physical Environment and the Work Fatigue of Production Employees at the Galih Dabeda Silk Tofu Factory. *Dis. Prev. Public Heal. J.* **14**, 30 (2020).
4. Darmayanti, J. R., Handayani, P. A. & Supriyono, M. The Relationship of Age, Hours, and Work Attitudes to Work Fatigue of Workers of the Office of Small and Medium Enterprises Cooperatives of Central Java Province. *Pros. Semin. Nas. UNIMUS* **4**, 1318–1330 (2021).
5. Wind. Working from home: Mismatch between access and need in relation to work–home interference and fatigue. *Scand. J. Work. Environ. Heal.* **47**, 619–627 (2021).
6. Rusila, Y. & Edward, K. The Relationship Between Age, Working Period and Physical Workload with Work Fatigue in Workers at the Subur Cracker Factory and the Sahara Cracker Factory in Yogyakarta. *J. Health Lantern. Masy.* **1**, 39–49 (2022).
7. Suryadi, I., Yuliadi, I., Rinawati, S., Rachmawati, S. & Nugraheni, B. The Relationship between Heat Stress and Physical Workload with Worker's Hydration Status in Tirtonadi Bus Station Surakarta. *E3S Web Conf.* **202**, 1–7 (2020).
8. Aulia, R., Safira, D. & Nurdiawati, E. The Relationship Between Subjective Fatigue Complaints, Age and Working Period on Work Productivity in Workers. **7**, 113–118 (2020).
9. Krisdiana, H., Krisdiana, H., Ayuningtyas, D., Iljas, J. & Juliati, E. The Relationship between Health Workers' Workload and Work Fatigue at the Sukmajaya District Health Center, Depok City During the Pandemic The Relationship between Health Workers' Workload and Work Fatigue at the Health Center of Sukmajaya District, Depok City During the Pandemic Relationship Wo. **2**, (2022).
10. Hijah, N. F., Setyaningsih, Y. & Jayanti, S. Work Climate, Work Posture, and Working Period on Work Fatigue in Welding Workshop Workers. *J. Researcher. and Developer. Health. Masy. Indones.* **2**, 11–16 (2021).
11. Aswin, B. & Halim, R. The Relationship between Workload and Heat Work Climate with Work Fatigue Incidence in Areca Nut Farmers. *J. Nursing and Physiotherapists.* **4**, 222–227 (2022).
12. Maftuh, M., Haryanti, T. & Johar, S. A. Effect of Hot Work Climate on Work Fatigue in Steam Operators in PT. XYZ Boyolali. **2**, 141–147 (2021).
13. Jonah, Y. L. THE RELATIONSHIP BETWEEN WORK FATIGUE AND WORK STRESS IN TECHNICIANS AT PT . EQUIPORT INTI INDONESIA BITUNG INTRODUCTION Fatigue is a condition every year (HSE, 2019). **10**, 18–25 (2021).