

**FACTORS RELATED TO WORK FATIGUE AMONG WORKERS AT
PT. BOILERTECH PEKANBARU**

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Abstract

Work fatigue is one of the occupational health problems often experienced by industrial workers due to high workloads and unfavorable work environment conditions. This condition can reduce productivity, increase the risk of work accidents, and negatively impact workers' physical and mental health. This study aims to determine the factors associated with work fatigue in workers at PT. Boilertech Indonesia, Pekanbaru City in 2025. This type of research uses a quantitative method with a cross-sectional design. The study was conducted with 30 respondents as a sample selected using an accidental sampling technique. Data were collected through an Industrial Fatigue Research Committee (IFRC) questionnaire and temperature measurements using a digital thermometer. Analysis was carried out univariately and bivariately using a simple linear regression test with a 95% confidence level ($\alpha = 0.05$). The results showed that most workers experienced moderate levels of fatigue with an average score of 8.93. The bivariate test showed no significant relationship between age and work fatigue ($p = 0.804$) and no significant relationship between length of work per day and work fatigue ($p = 0.714$). However, there is a significant relationship between work environment temperature and work fatigue ($p=0.000$; $r=0.731$) with a very strong positive relationship direction.

Keyword: work fatigue, work environment, temperature, work hours, age,.

INTRODUCTION

Work fatigue is one of the most common occupational health problems experienced by workers in various industrial sectors. This condition affects productivity, increases the risk of work accidents, and causes both physical and mental health disorders. Fatigue is multidimensional, encompassing physical, mental, and emotional aspects, which are generally triggered by high work demands without adequate rest (Hastoro, 2022)[1].

According to reports from WHO and ILO (2021), more than 2.78 million workers die each year due to occupational diseases and accidents, with approximately 750,000 deaths directly related to excessive working hours. Long working hours (>55 hours per week) increase the risk of ischemic heart disease and stroke, especially in the Southeast Asia and Western Pacific regions[2].

In Indonesia, data from the Ministry of Manpower (2010) recorded that work-related fatigue accidents occurred most frequently in the construction sector (31.9%) and manufacturing sector (31.6%). More than 65% of workers also reported fatigue complaints at company clinics[3]. The factors contributing to fatigue include workload, environmental temperature, physical condition, age, nutritional status, and psychological state (Linoe et al., 2023)[4].

Work-related fatigue is a physical or mental condition that weakens an individual's ability to work safely and effectively. This condition can be caused by long working hours, insufficient rest periods, and disruption of the body's circadian rhythm (Muhammad Alfiansyah, 2024)[5].

Observations at PT. Boilertech indicate that air circulation in indoor work areas is quite good. Available ventilation allows air to move and helps reduce heat buildup in the workspace.

However, conditions are different for workers working outdoors. The ambient temperature in the field feels much hotter because they are directly exposed to extreme weather and very hot sunlight. Based on temperature measurements in Pekanbaru City, current daily temperatures can reach up to 36°C, so outdoor workers face a higher risk of heatstroke than indoor workers. This situation has the potential to increase work fatigue and disrupt worker comfort and safety during their activities.

RESEARCH METHODS

This study employed a quantitative method with a cross-sectional design, which observes data from a population or sample at a single point in time. The population in this study consisted of 30 workers at PT. Boilertech. Data were collected using a structured questionnaire. The research location was at the PT. Boilertech worksite in Pekanbaru, Riau, and the study was conducted from September to October 2025.

RESEARCH RESULTS

Univariate Analysis

Table 1. Frequency Distribution of Work Fatigue Among Workers at PT. Boilertech Pekanbaru in 2025

Variabel	Mean	Minimal-Maksimal
Work fatigue	8,93	1 - 18

(Primary Data Source, 2025)

Based on table 1, it is known that the work fatigue score for respondents has a minimum value of 1 and a maximum of 18, with an average value of 8,93

Table 2. Frequency Distribution of age Among Workers at PT. Boilertech Pekanbaru in 2025

Variabel	Mean	Minimal-Maksimal
Age	33,20	25- 45 Tahun

(Primary Data Source, 2025)

Based on Table 2 above, it can be seen that the respondent's age variable has a minimum value of 25 years and a maximum of 45 years, with an average value of 33.20.

Table 3. Frequency Distribution of temperature Among Workers at PT. Boilertech Pekanbaru in 2025

Variabel	Mean	Minimal-Maksimal
Temperature	28,13	24- 35°C

(Primary Data Source, 2025)

Based on Table 3, it can be seen that the temperature in the work area has a minimum value of 24°C and a maximum of 35°C, with an average (mean) of 28.13°C.

Table 4. Frequency Distribution of length Among Workers at PT. Boilertech Pekanbaru in 2025

Variabel	Mean	Minimal-Maksimal
Working periods	9,73	8 - 12 jam

Based on Table 4, it can be seen that the minimum value is 8 hours and the maximum is 12 hours, with an average of 9.73 hours.

Bivariate Analysis

Table 5. Relationship between Age and Work Fatigue in Workers at PT. Boilertech in the City in 2025

Variabel	r	R ²	Line equation	P Value
Age	0,047	0,002	KPB = (7.139) + 054*age	0,804

The results of statistical tests using the simple linear regression method showed no significant relationship between age and worker fatigue ($p=0.804$)

Table 6. Relationship Between Temperature and Work Fatigue Among Workers at PT. Boilertech in Kota, 2025

Variabel	r	R ²	Line equation	P Value
Temperature	0,731	0,534	KPB = - 23,099 + (1,139)*temperature	0,000

There was a strong, positive relationship between temperature and work fatigue ($r=0.731$), meaning that the higher the temperature, the greater the risk of fatigue. The coefficient of determination of 0.731 indicates that 73.1% of the variation in fatigue is explained by temperature, with statistical tests showing a significant relationship ($p=0.000$).

Table 7. Relationship Between Length of Service and Work Fatigue Among Workers at PT. Boilertech in Pekanbaru City

Variabel	r	R ²	Line equation	P Value
length	0,070	0,005	KPB = 10,959+ (-0,208)*length	0,714

Statistical tests revealed no significant relationship between length of service and worker fatigue ($p=0.714$).

DISCUSSION

Relationship between Age and Work Fatigue Among Workers at PT. Boilertech in Pekanbaru City

Based on the simple linear regression test, the p-value obtained was 0.804 (> 0.05), meaning that H_0 failed to be rejected. This indicates that there is no significant relationship between age and work fatigue among workers at PT. Boilertech, Pekanbaru, in 2025. Work fatigue (occupational fatigue) is a condition of decreased physical, mental, and emotional capacity experienced by workers due to excessive, monotonous, or prolonged job demands. This fatigue can appear before, during, or after work activities and is characterized by reduced energy, decreased concentration, and lower motivation and productivity (Wu et al., 2024) [6].

The result is consistent with the study [16] in *Work Stress, Exhaustion, Well-Being, and Related Factors From an Ecological Perspective*, which found that in linear regression analysis, age was not a significant predictor of work fatigue (exhaustion) after considering work stress, work-family conflict, discrimination, and social factors [7]. Similarly, a study by Asri et al. (2023) on workers at PT Distribusi Energi Mandiri also showed that both younger and older workers can experience similar levels of fatigue, depending on job demands and workplace conditions (p -value = 1.000). Work fatigue among workers at PT Distribusi Energi Mandiri was not determined by age but was more likely influenced by other factors such as workload, work environment conditions, work duration, or job pressure [8]

The Relationship Between Temperature and Work Fatigue in Workers at PT. Boilertech in Pekanbaru City in 2025

Based on the results of the simple linear regression test, there was a strong positive correlation ($r = 0.731$), meaning that as the temperature increases, the risk of fatigue also increases. The statistical test results showed a significant relationship between temperature and fatigue ($p = 0.000$), with a p -value of 0.00 (< 0.05). Therefore, H_0 was rejected, indicating a significant relationship between temperature and work fatigue among workers at PT. Boilertech in 2025.

These findings are consistent with the study conducted by Fauziah & Kusumawati (2020) titled "*Relationship Between Heat Stress and Job Fatigue with Stress Levels in Employees at CV. Fatra Karya Logam.*" The results showed that a hot work environment—such as that experienced by workers at CV Fatra Karya Logam, with an average working temperature of 31.4 °C—had a strong influence on stress levels and work fatigue [9].

However, the results differ from those of Mustofani & Dwiyaniti (2019), who found that the temperature factor did not significantly affect the level of work fatigue (p -value = 0.192 > 0.05) [10]. This might be because the workers had already adapted to the hot working environment and had sufficient rest periods.

The researcher assumes that temperature has an influence on the level of work fatigue among workers at PT. Boilertech. In general, workers exposed to high temperatures are those working near areas of construction and maintenance of hot equipment such as boilers, heat exchangers, or systems involving chemical cleaning and refractory coating [11]. These activities generate intense heat exposure, both from machine heat sources and from thermal reactions during the work process. In addition, some workers work outdoors in hot weather conditions. This condition causes heat accumulation in the work environment and accelerates the onset of physical fatigue due to increased body temperature [12].

The Relationship Between Work Length and Work Fatigue in Workers at PT. Boilertech in Pekanbaru City in 2025

Based on the results of the simple linear regression test, a weak correlation was found ($r = 0.070$), meaning that a longer working period does not affect the risk of work fatigue. The statistical test results showed no significant relationship between years of service and worker fatigue ($p = 0.714$). Therefore, H_0 failed to be rejected, indicating that there is no significant relationship between years of service and the occurrence of work fatigue among workers at PT. Boilertech.

This finding is consistent with the study "*The Relationship Among Working Period, Work Shift, and Workload to Work Fatigue in Air Traffic Controllers at Sultan Hasanuddin Airport,*" which examined the relationship between working period, shift work, and workload with work fatigue among air traffic controllers (ATC) at Sultan Hasanuddin Airport, Makassar.

The results showed that there was no significant relationship between years of service and work fatigue ($p = 0.055 > 0.05$) [13].

The researcher assumes that years of service do not directly determine the level of work fatigue [14]. This may be because workers, regardless of how long they have worked, may have become accustomed to or adapted to their workload and work environment. Additionally, other factors such as actual workload, shift work system, psychological stress, sleep quality, and lifestyle play a greater role in determining fatigue levels than years of service alone [15].

Therefore, even though a person has worked for a long period, physiological and psychological adaptation mechanisms to the job can reduce fatigue potential, meaning that years of service do not significantly contribute to work fatigue in this study location [16].

CONCLUSION

The results of the study showed that most workers at PT. Boilertech Indonesia Pekanbaru experienced moderate levels of work fatigue. The majority of respondents were of productive age (25–45 years) and worked an average of 9.73 hours per day with an ambient temperature of 28.13°C. The results of the bivariate test showed a significant relationship between work temperature and work fatigue ($p = 0.000$; $R^2 = 0.731$), while age ($p = 0.804$) and length of work per day ($p = 0.714$) were not significantly related. In conclusion, work temperature is the main factor related to work fatigue, while age and length of work did not have a significant effect. It is recommended that companies provide sufficient drinking water for workers, especially workers who work outdoors, to reduce fatigue levels.

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