



The Relationship Between Working Time, Age, And Workload With Work Fatigue In Processing Workers At Ptpn Iv Regional 1 Pks Rambutan

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Article Info

Article history:

Received 12 Feb, 2026

Revised 29 Mar, 2026

Accepted 20 Apr, 2026

Keywords:

Work Fatigue, Workers, Workload

ABSTRACT

Background: Fatigue is the second leading cause of death after heart disease. Workers in the processing section are very vulnerable to work-related fatigue which can have negative impacts on them. Purpose: To determine the relationship between work tenure, age, and workload on work fatigue among workers at PT Perkebunan Nusantara IV Regional 1 PKS Rambutan, Tebing Tinggi City. Method: This study uses a quantitative research design with a cross-sectional approach, involving a sample of 56 respondents. Result: Data collection was carried out using a questionnaire with Chi-Square test analysis. The Chi-Square test results indicate a significant relationship between work tenure and work fatigue with a p-value = 0.027, and a relationship between workload and work fatigue with a p-value = 0.038. This study found a relationship between work tenure and workload with work fatigue among the processing workers at PTPN IV Regional 1 PKS Rambutan and the absence of a relationship between age and work fatigue.

INTRODUCTION

Labor is a vital element in the production process and has a central role in the company. The management of the organization is responsible for the welfare of workers, including ensuring safety, protection, and increasing work morale as stipulated in Law of the Republic of Indonesia No. 1 of 1970. Therefore, the implementation of occupational safety and health (K3) needs to continue to be improved consistently. The WHO states that severe fatigue is in second place as the cause of death related to working conditions after heart disease. A study by the Japanese Ministry of Manpower on 12,000 companies with 16,000 respondents showed that 65% of workers experienced physical fatigue, 28% experienced mental fatigue, and 7% experienced psychological stress and isolation at work. Research on the production sector in Indonesia also found complaints of fatigue in the form of headaches, shoulder strain, and back pain in workers.

Work fatigue is influenced by internal and external factors. External factors include the type of work, working hours, shift system, night work, and work environment (physical, chemical, biological, ergonomic, and psychological). Internal factors include the age, gender, and physical condition of the worker. Research by Maulani et al. (2020) showed that 22 workers (31.0%) with a long working period experienced moderate levels of fatigue, caused by the accumulation of monotonous workloads. Widiaworo (2019) emphasized that the longer the working period, the higher the risk of fatigue due to long-term workload. Research by Nor Andini et al. (2021) showed that 27 workers (65.9%) experienced age-related fatigue, where elderly workers experienced physical decline but had better emotional stability. Bangun et al. (2019) also stated that workers over 45 years old are more susceptible to fatigue because the peak of work ability occurs at the age of 25–30 years. Arfan et al. (2020) found a significant relationship between fatigue and shift system, workload, and nutritional status ($p < 0.05$), where 84.2% of workers with moderate-heavy workloads experienced fatigue, while working period, heat exposure, and noise were not significantly related ($p > 0.05$).

The Palm Oil Mill (PKS) is an industry that processes Fresh Fruit Bunches (FFB) into Crude Palm Oil (CPO) and palm kernel through a sustainable process using machines, so it has a high potential for occupational hazards. Work risks can cause accidents and health impacts for workers. PT Perkebunan Nusantara III is a state-owned enterprise as a result of the restructuring of the plantation sector which later formed PTPN I-XIV.

PKS Rambutan, one of the PTPN IV Regional 1 units, is located in Paya Bagas Village, Serdang Bedagai Regency, North Sumatra, with a production capacity of 30 tons/hour. The factory has a history of organizational change from 1983 to the merger and separation of management in 2015 and 2020. The production process involves several workstations such as FFB containers, sterilizers, and threshers.

Based on observations at PKS Rambutan, the majority of workers are over 30 years old with a working period of more than five years. The work system uses two shifts (07.00–19.00 WIB and 19.00–07.00 WIB) which take place every day with weekly changes. In addition, workers often experience additional working hours when FFB increases, so rest time is disrupted. This condition causes fatigue complaints in the form of back, leg pain, and headaches.

Based on this description, the researcher is interested in researching the relationship between working time, age, and workload and the level of work fatigue in production employees at PT Perkebunan Nusantara IV Regional 1 PKS Rambutan, Tebing Tinggi City.

METHODS

This study uses a quantitative design with a cross-sectional approach to analyze the relationship between working time, age, and workload and the level of work fatigue in employees of PT Perkebunan Nusantara IV Regional 1 PKS Rambutan, Tebing Tinggi City. The research was carried out at PKS Rambutan located in Paya Bagas Village, Serdang Bedagai Regency, North Sumatra, in December until it was completed. The research population is all employees of the processing department as many as 56 people, which are also used as samples with total sampling techniques. The independent variables in this study include working period, age, and workload, while the dependent variable is the level of work fatigue.

Data collection is carried out through primary and secondary data. Primary data were obtained by distributing the IFRC questionnaire to measure work fatigue and NASA-TLX for workload, accompanied by initial interviews with workers. Meanwhile, secondary data was obtained from PT Perkebunan Nusantara IV Regional 1 PKS Rambutan. The research instrument was in the form of a structured questionnaire that was filled out directly by the respondents. Data analysis was carried out quantitatively using statistics. Univariate analysis is used to describe the frequency and percentage distribution of each variable, while bivariate analysis uses chi-square test to determine the relationship between variables with a significance level of $p \leq 0.05$ as the basis for decision-making.

RESULTS

Overview and Research Locations

PT Perkebunan Nusantara IV is one of 14 state-owned enterprises engaged in the plantation sector, with the main focus on oil palm and rubber commodities. The company has a long history that began with the nationalization of a number of Dutch-owned plantation companies by the Indonesian government in 1958, which was later changed to a State Plantation Company after independence.

The Rambutan Palm Oil Mill (PKS) is one of 12 mills managed by PT Perkebunan Nusantara IV. The factory began operations in 1983 with a production capacity of 30 tons per hour and receives a supply of Fresh Fruit Bunches (FFB) directly from its own orchards. Over time, the organizational structure of the factory underwent several changes. At the beginning of its establishment in 1983, this factory was part of the plantation unit owned by PT Perkebunan V (Persero). Then, in April 1996, there was a merger between PTP III, IV, and V into one unit under the auspices of PT Perkebunan Nusantara.

Geographically, PKS Rambutan is located in Paya Bagas Village, Tebing Tinggi District, Serdang Bedagai Regency, North Sumatra Province, precisely at the coordinates of 03° 22' 36" North Latitude and 99° 09' 56" East Longitude, about 85 km from Medan City to the southeast. PT Perkebunan Nusantara III Tebing Tinggi unit employs around 150 people consisting of field personnel, administrative staff, and laboratory personnel. PKS Rambutan employees are grouped into three main categories, namely:

1. Staff Officers
2. Permanent employees
3. Honorary employees

Table 1 Number of Workers of PTPN IV Regional 1 PKS Rambutan

No	Sections	Quantity
1.	Karpin	7
2.	Processing (2 shifts)	56
3.	Laboratory and Sorting	19

4.	Engineering, Traction and DS	27
5.	Personnel and Security Guard Administration	22
6.	Production Admin	6
7.	Assistant Personnel	6
8.	Honorary personnel	3
9.	Passenger car	2
TOTAL		148

Univariate Analysis

Table 2 Univariate Analysis Results

Age	n	%
Early Adult (≤ 35 years)	33	58,9%
Late Adult (> 35 years)	23	41,1%
Workload		
Low (≤ 60)	21	37,5%
Height (> 60)	35	62,5%
Tenure		
≤ 5 Years	19	33,9%
> 5 Years	37	66,1%
Work Fatigue		
Low (≤ 45)	33	58,9%
Height (> 45)	23	41,1%

Based on the distribution of respondents' working periods, it was recorded that 19 people (33.9%) had five years or less of work experience, while another 37 people (66.1%) had worked for more than five years.

When viewed from the age group, most of the respondents were in the early adult phase, namely 33 people (58.9%), while the remaining 23 people (41.1%) were included in the late adult age group.

Dari sisi beban kerja, sebanyak 21 responden (37,5%) masuk dalam kategori beban kerja lightweight, and as many as 35 respondents (62.5%) were classified as having a high workload.

Meanwhile, in terms of the level of work fatigue, 33 respondents (58.9%) experienced fatigue at a low level, while 23 respondents (41.1%) were recorded to be at a high level of fatigue.

Bivariate Analysis

In this study, a bivariate test was carried out between dependent variables, namely work fatigue and independent variables, namely age, working period and workload.

The Relationship between Working Time and Work Fatigue in Processing Section Workers at PTPN IV Regional 1 PKS Rambutan

Table 3 Relationship Between Working Time and Work Fatigue

Variabel	Category	Low		Height		Total		P-Value	PR 95 % CI
		n	%	n	%	n	%		
Masa Work	< 5 Years	15	78,9%	4	21,1%	19	33,9%	0,027	3,958 (1,103- 14,201)
	> 5 Years	18	48,6%	19	51,4%	37	66,1%		

Based on the results presented in the table, there is a statistically significant relationship between the duration of the working period and the level of work fatigue. Of the group of respondents who had a working period of five years or less, as many as 15 people (78.9%) were recorded to experience low levels of work fatigue, while 4 people (21.1%) were in the category of high fatigue. On the other hand, in respondents who had worked for more than five years, it was found that 18 people (48.6%) experienced low fatigue and 19

people (51.4%) experienced high fatigue. The p value of 0.027 shows that there is a significant relationship between the working period and the level of fatigue felt by workers.

The Relationship between Age and Work Fatigue in Processing Section Workers at PTPN IV Regional 1 PKS Rambutan

Table 4 Relationship Between Age and Work Fatigue

Variabel	Category	Low		Height		Total		P-Value	PR 95% CI
		n	%	n	%	n	%		
Age	Early Adulthood (≤35 years)	19	57,6%	14	42,4%	33	58,9%	0,513	0,872 (0,295- 2,583)
	Late Adult (>35 years)	14	60,9%	9	39,1%	23	41,1%		

Based on the table above, there is no significant relationship between age and work fatigue. In the early adult group, there were 19 people (57.6%) with low work fatigue and 14 people (42.4%) with high work fatigue. Meanwhile, in the late adult group, there were 14 people (60.9%) with low work fatigue and 9 people (39.1%) with high work fatigue. With an insignificant p-value of 0.513, this shows that there is no relationship between age and work fatigue.

The Relationship between Workload and Work Fatigue in Processing Section Workers at PTPN IV Regional 1 PKS Rambutan

Table 5 Relationship Between Workload and Burnout

Variabel	Category	Low		Height		Total		P- Value	PR 95% CI
		n	%	n	%	n	%		
Load Work	Lightweight (≤60)	16	76,2%	15	23,8%	21	37,5%	0,038	3,388 (1,017- 11,286)
	Weight (>60)	17	48,6%	18	51,4%	35	62,5%		

The results of the analysis shown in the table show a significant correlation between workload levels and work fatigue. In the group of respondents who had a light workload, 16 people (76.2%) experienced fatigue in the low category, while 5 people (23.8%) were in the high fatigue category. On the other hand, from the group with heavy workloads, as many as 17 respondents (48.6%) experienced low fatigue and 18 respondents (51.4%) experienced high fatigue. A p-value of 0.038 indicates that there is a statistically significant relationship between the workload borne and the level of fatigue felt by workers.

DISCUSSION

The Relationship between Working Time and Work Fatigue in Processing Section Workers at PTPN IV Regional 1 PKS Rambutan

Based on the results presented in the table, there is a statistically significant relationship between the duration of the working period and the level of work fatigue. Of the group of respondents who had a working period of five years or less, as many as 15 people (78.9%) were recorded to experience low levels of work fatigue, while 4 people (21.1%) were in the category of high fatigue. On the other hand, in respondents who had worked for more than five years, it was found that 18 people (48.6%) experienced low fatigue and 19 people (51.4%) experienced high fatigue. The p value of 0.027 shows that there is a significant relationship between the working period and the level of fatigue felt by workers. With a PR value of 3,958 (95% CI: 1,103-14,201), therefore workers who have a working period of >5 years are estimated to be 3,958 times more likely to experience work fatigue compared to workers who work with a working period of ≤5 years.

The duration of the working period is one of the factors that also affect the level of work fatigue. The longer a person works, the greater the potential for physiological changes in the body. Workers who have served for more than five years are generally more susceptible to muscle fatigue, suggesting a significant relationship

between the length of work and the fatigue experienced. Nonetheless, individuals with longer working hours tend to have a deeper understanding and experience of job responsibilities than those who are relatively new.

However, workers with longer working hours also have a higher risk of fatigue due to boredom and monotonous work routines. This condition has an impact on increasing psychological and physical burden. In accordance with the theory put forward by Triana, Ekawati, and Wahyuni (2017), a long working period can have a double effect. On the positive side, a long working period will add skills and experience. Meanwhile, from the negative side, this can cause boredom, fatigue, and even health problems due to exposure to occupational hazards that last continuously for a long period of time.

An increase in the duration of the working period is generally followed by an increase in the level of fatigue felt by the individual. This is caused by the accumulation of routine workload, so it can cause boredom and fatigue that continues to increase over time. In addition, fatigue is also closely related to the physical stress that accumulates during the working period. This pressure can lead to decreased muscle function and slowing down movement, which ultimately triggers the onset of work fatigue.

In Suma'mur's opinion, this condition can result in muscle weakness, sluggish movements, and fatigue due to work activities. Work activities that take place continuously for a long time can have an impact on the functioning of body systems, including the circulatory system, digestion, respiration, muscles, and nervous system. In addition, the risk of being exposed to various hazards in the workplace, such as physical, chemical, biological, and other factors, tends to increase as the working life increases. This situation has the potential to worsen working conditions and increase the likelihood of work-related illnesses.

The findings in this study are in line with the results of the Rindi Antika (2023) study, which shows a relationship between the length of working period and the level of fatigue in farmers in Wado Village, Kedungtuban District, Blora Regency. Some theories state that the working period can have a varied effect on workers, both in terms of benefits and negative impacts. However, the results of this study further support the view that the working period contributes negatively, especially to the physical endurance of individuals in carrying out tasks, which ultimately triggers fatigue and boredom at work.

The Relationship between Age and Work Fatigue in Processing Section Workers at PTPN IV Regional 1 PKS Rambutan

Based on the table above, there is no significant relationship between age and work fatigue. In the early adult group, there were 19 people (57.6%) with low work fatigue and 14 people (42.4%) with high work fatigue. Meanwhile, in the late adult group, there were 14 people (60.9%) with low work fatigue and 9 people (39.1%) with high work fatigue. With an insignificant p-value of 0.513, this shows that there is no relationship between age and work fatigue. With a PR value of 0.872 (CI 95% 0.295-2.583), therefore workers who have an age of ≤ 35 years are estimated to be 0.872 times more likely to experience work fatigue compared to workers with the age of > 35 years.

The results of this study are in line with a study conducted by Sari (2019), which stated that there is no influence of age on the level of work fatigue. This is because older or older workers usually have higher job satisfaction. They are also considered to be more able to adapt to the work environment thanks to their experience, have better emotional stability, and are able to work more skillfully and confidently.

Therefore, it can be concluded that there is no statistically significant relationship between the age variable and the level of work fatigue. In addition, the absence of this relationship may be due to the fact that the muscular strength of humans, both men and women, generally reaches its peak at the age of 25 to 35. This finding is not in line with the theory put forward by Tarwaka (2010), which states that a person's physical work capacity increases with age to a certain point.

The researchers assume that the lack of a link between age and the level of work fatigue is due to good collaboration between young workers and older workers in completing work. At the age of 35, employees tend to have developed an efficient work strategy based on experience, so that they are able to complete work with less manpower. In addition, more senior workers typically mentor younger colleagues as part of the regeneration process, so the workload is divided and the risk of fatigue decreases.

The results of this study are also supported by findings from Agus Prianto (2021), who stated that workers with older ages have better adaptability compared to younger workers. Experience and skills in managing stress and work fatigue are more prominent in senior workers. Although young workers generally have a high level of physical skills, they tend to be less careful and rushed to get work done, which can increase the risk of burnout.

The Relationship between Workload and Work Fatigue in Processing Section Workers at PTPN IV Regional 1 PKS Rambutan

The results of the analysis shown in the table show a significant correlation between workload levels and work fatigue. In the group of respondents who had a light workload, 16 people (76.2%) experienced fatigue in the low category, while 5 people (23.8%) were in the high fatigue category. On the other hand, from the group with heavy workloads, as many as 17 respondents (48.6%) experienced low fatigue and 18 respondents

(51.4%) experienced high fatigue. A p-value of 0.038 indicates that there is a statistically significant relationship between the workload borne and the level of fatigue felt by workers. With a PR value of 3.388 (95% CI 1.017-11.286), therefore workers who have a high workload are estimated to be 3.388 times more likely to experience work fatigue compared to workers who have a low workload.

Therefore, workload is influenced by various aspects both externally and internally individually. External factors include the workload, the structure of the work organization, and the environmental conditions of the workplace. Meanwhile, internal factors include time pressure, work duration, unclear roles and role conflicts, noise, excessive information, high temperatures, repetitive movements, and high responsibility. In *the Journal of Occupational and Environmental Medicine*, it is stated that excessive workload is closely related to an increased risk of heart attack.

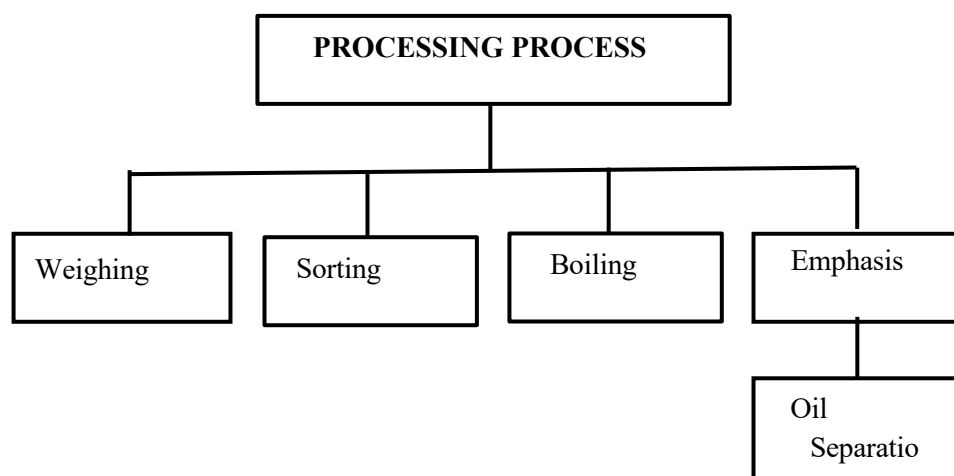
The high workload is one of the main causes of fatigue at work. Work fatigue itself is a condition in which a person experiences a decrease in endurance and efficiency in completing tasks. This condition reflects a decline in physical and mental ability to continue work activities, which ultimately has an impact on a decrease in body capacity and productivity.

The frequency of pulse per minute can affect a worker's physical activity during his or her duties. When the body needs more oxygen to be delivered through the blood, the heart rate increases to speed up blood flow to the muscle tissue. In this condition, the blood vessels will narrow as a natural body response. However, if the pulse rate rises beyond the normal limit, it can be an indication that the individual is experiencing fatigue. According to research by Mariana Hariyati, a high workload can negatively impact a person's physical condition. This happens because of the increased need for oxygen which triggers the heart to work harder in pumping blood, so that the pulse rate increases. This increase can trigger the occurrence of anaerobic metabolism that produces lactic acid, which ultimately leads to fatigue during work.

The level of workload that a worker is able to bear is determined by his physical capacity and suitability in carrying out certain activities during work. The greater the workload given, the shorter the effective working time before the appearance of signs of fatigue or health problems, and vice versa.

According to Tarwaka et al. (2004), too high a workload can trigger fatigue, especially when workers are faced with activities such as lifting, moving things, or doing repetitive work throughout the day. This condition will make the body feel more tired because the workload increases along with the increase in the intensity of physical activity, including an increase in pulse. If the workload incurred exceeds the physical capacity of the worker, then it can reduce efficiency and productivity. Heavy physical loads demand the use of large amounts of energy as well as more intensive muscle work. When the energy used is not fully recovered during the rest period, then fatigue will begin to be felt by the worker.

Figure 1 Oil Palm Processing Process at PTPN IV Regional 1 PKS Rambutan Kota Tebing Tinggi



Source : PTPN IV Regional 1 PKS Rambutan

Too high work pressure has the potential to cause fatigue, both physically and psychologically. Preliminary survey results showed that some employees complained of pain in their backs, heads, as well as pain in the calves after completing their work tasks. One of the steps that can be taken to minimize fatigue due to workload is to distribute tasks according to the capacity and ability of each worker to maintain optimal productivity. Another strategy that can be applied is to rotate work, especially for workers who have long been under heavy loads, to parts with lighter work intensity, and vice versa. Mismatches between individual workloads and abilities can negatively impact employees' health conditions and work capacity.

This finding is in line with the opinion of Suma'mur (2009), who explained that the amount of physical and mental workload borne by workers is an important factor in causing fatigue. When carrying out duties, workers bear burdens as a consequence of the physical activity undertaken. Therefore, high-intensity work requires more frequent rest periods and shorter work durations. If the working time exceeds the capacity that the body can tolerate, then fatigue is very likely.

The findings in this study are in line with the view of Suma'mur (2009), who explains that the large volume of work, both physically and mentally, is a responsibility that must be borne by the workforce. When carrying out tasks, workers experience stress as a consequence of the physical activity performed. Thus, high-intensity work should be accompanied by more frequent breaks and more limited working time. If the duration of work exceeds a person's physical capacity, the likelihood of fatigue will be even greater.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that there is a significant relationship between working time and workload with the level of work fatigue in employees in the processing department at PTPN IV Regional 1 PKS Rambutan, where workers with a working period of >5 years have a 3.958 times greater risk of experiencing fatigue than workers with a working period of ≤5 years. and workers with high workloads have a 3,388 times greater risk of experiencing burnout than workers with low workloads. Meanwhile, no significant relationship was found between age and the level of work fatigue, with a p-value of 0.513, so age was not shown to have an effect on work fatigue in this study.

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