



## Worker Fatigue Determinants and Work Productivity Levels in Operator Workers at Public Fuel Filling Stations in Makassar City



### ARTICLE INFO

#### Article Type

Descriptive Study

#### Authors

Pasanre A.A.\*<sup>1</sup> BSc  
Muis M.<sup>1</sup> MSc  
Thamrin Y.<sup>1</sup> PhD  
Wahyu A.<sup>1</sup> MSc  
Saleh L.M.<sup>1</sup> MSc  
Amqam H.<sup>2</sup> MSc

#### How to cite this article

Pasanre AA, Muis M, Thamrin Y, Wahyu A, Saleh LM, Amqam H. Worker Fatigue Determinants and Work Productivity Levels in Operator Workers at Public Fuel Filling Stations in Makassar City. Health Education and Health Promotion. 2025;13(3):481-485.

### ABSTRACT

**Aims** One of the main sources of fire risk is fuel stations located in residential areas. Gas stations pose a fire hazard, as incidents have been reported globally, especially in developing countries. Fuel station operators are expected to work quickly and responsibly, using both physical and mental energy. This study aimed to examine the determinants of work fatigue and assess the level of work productivity among fuel station operators in Makassar City. **Instrument & Methods** This cross-sectional observational analytic research was conducted on 135 sample operators in two Tamalanrea and Biringkanaya subdistricts of Makassar City from May to June 2024. The research instrument included questionnaires and measuring tools, such as scales, height gauges, and reaction time gauges. Data were analyzed using univariate, bivariate, and multivariate analyses employing SPSS 25 software.

**Findings** Significant associations were found between work fatigue and operator productivity ( $p=0.043$ ), monotonous work and operator productivity ( $p=0.047$ ), and nutritional status and operator productivity ( $p=0.030$ ).

**Conclusion** Work fatigue, monotonous tasks, and nutritional status are significantly related to productivity levels.

**Keywords** Work Performance; Fatigue; Activity Cycles; Nutritional Status

<sup>1</sup>Department of Occupational Health and Safety, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

<sup>2</sup>Department of Environmental Health, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

#### \*Correspondence

Address: Department of Occupational Health and Safety, Faculty of Public Health, Hasanuddin University, Street of Perintis Kemerdekaan KM 10, Makassar City, Indonesia. Postal Code: 90245

Phone: +62 (878) 5492 0231  
andiardiansyahpasanre@gmail.com

#### Article History

Received: June 8, 2025

Accepted: July 25, 2025

ePublished: August 19, 2025

### CITATION LINKS

[1] Indonesia's National Occupational Safety and Health ... [2] The impact of employee productivity on service quality in retail ... [3] Education & giving of exercise as a program for the prevention of work fatigue complaints in caregivers ... [4] Monitoring and evaluation of Indonesian ... [5] Regulation of the Minister of Manpower ... [6] Measurement of physical and mental workload using the CVL, Brouha ... [7] Siting of fuel stations within residential areas in Ghanaian ... [8] Factors related to work fatigue among petrol station operators in Percut Sei ... [9] The effect of shift work implementation on work motivation and performance productivity among ... [10] Analysis of work fatigue on employee ... [11] Nutritional status ... [12] An overview of factors affecting work fatigue among ... [13] The relationship between nutritional status and ... [14] The relationship between parenting patterns and stunting ... [15] The influence of education level, age, gender, and work ... [16] The influence of the working environment on employee productivity ... [17] Differences in Work Fatigue Levels and Productivity Between Monotonous and Non-Monotonous ... [18] An examination of the factor affecting consumer ... [19] Company hygiene ... [20] The influence of education, training, gender, ... [21] The relationship between length of service, workload ... [22] The relationship between age, gender, length ... [23] Physical activity and stress as risk ... [24] Analysis of the influence of length of service, wages and age on the productivity of cigarette rolling ... [25] Determinants of manufacturing micro firms' productivity in Ecuador. Do industry and canton ... [26] Factors associated with occupational fatigue of gas station ...

## Introduction

High work productivity is determined by the quality of human resources. Skill-oriented human resources enhance individual competencies and character, enabling them to meet job demands effectively. When individuals possess the necessary knowledge, skills, and attitudes, they can perform at their maximum capacity, thereby reflecting greater productivity. As reported by the Ministry of Manpower [1], Indonesia has experienced a rise in labor productivity over the last five years. Labor productivity, which represents the output of goods or services relative to the amount of labor used within a given timeframe, indicates how much labor contributes to economic performance. This metric is calculated by dividing the gross domestic product (GDP) by the total number of workers. Productivity reached IDR 82.56 million per worker annually, with a slight increase in 2019. Despite a decline in 2020 due to the COVID-19 pandemic, productivity rebounded in 2021, reaching a five-year high of IDR 86.55 million. Cumulatively, labor productivity rose by 4.8% from 2018 to 2022. For instance, productivity in Indonesia's information and communication sector reached USD 23.9 per hour per worker, surpassing Malaysia's USD 16.7.

Productive workers not only deliver better customer service but also enhance operational efficiency, thereby increasing a company's competitiveness in a rapidly evolving industry. Since factors, such as motivation, work environment, and training influence productivity, addressing these aspects is essential for improving service quality [2].

Healthcare workers frequently report fatigue as a primary concern. Work-related fatigue can lead to errors and decreased performance across all professions. Therefore, addressing fatigue is essential to maintain productivity and effectiveness, highlighting the need for preventive measures [3].

According to Indonesia's Social Security Agency for Employment [4], in 2021, a total of 147,000 workplace accidents were reported, with an average of 40,273 incidents occurring each day. Among these, 4,678 cases (3.18%) resulted in disabilities, while 2,575 cases (1.75%) led to fatalities—indicating that, on a daily basis, 12 workers suffered disabilities and 7 lost their lives. The Ministry of Manpower reported an average of 414 daily workplace accidents in 2021, with 27.8% attributed to severe fatigue. Approximately 9.5% (39 individuals) suffered permanent disabilities. On average, Indonesia records 99,000 workplace accidents annually, with about 70% resulting in death or lifelong disability [5]. Work fatigue can impair operator concentration, leading to errors such as incorrect cash handling and misinterpretation of customer requests. It also increases the risk of workplace accidents, such as fuel splashes to the eyes due to a lack of focus during refueling [6]. Fuel stations situated within residential neighborhoods present a considerable risk of fire.

Numerous fire incidents have been reported worldwide, especially in developing nations. One such case occurred in Shaanxi Province, China, where an explosion of a fuel tank at a station resulted in several injuries [7].

PT Pertamina (Persero) provides fuel station infrastructure (SPBU) to meet the energy needs of the Indonesian public. Fuel station operators frequently experience fatigue due to prolonged standing and continuous refueling tasks. Additionally, shift work schedules significantly contribute to operator fatigue [8].

In light of the aforementioned issues, this research seeks to examine the correlation between worker fatigue and job productivity among SPBU operators in Makassar City in 2024. Data collection was conducted across several districts, including Biringkanaya, Tamalanrea, Manggala, and Panakukkang, to represent the potential impact of work fatigue on operator productivity. Accordingly, the research is titled "Determinant Analysis of Worker Fatigue and Its Relationship to Work Productivity Among Fuel Station Operators in Makassar City, 2024".

One of the main sources of fire risk is fuel stations located in residential areas. Gas stations pose a fire hazard, as incidents have been reported globally, especially in developing countries. Fuel station operators are expected to work quickly and responsibly, using both physical and mental energy. PT Pertamina provides fuel through a network of public fuel filling stations to meet national needs. However, gas station operators often face the risk of fatigue due to standing and continuously dispensing fuel throughout their shifts, which frequently leads to exhaustion. The objective of this study was to examine the determinants of work fatigue and assess the level of work productivity among fuel station operators in Makassar City in 2024.

## Instrument and Methods

### Design and sample

This cross-sectional analytical observational study was done on employees working at several gas stations in the Tamalanrea and Biringkanaya sub-districts of Makassar City from May to June 2024.

The study population consisted of 204 registered employees working at gas stations in the Tamalanrea and Biringkanaya selected through a proportional random sampling. Based on the formula and the total population of 204 gas station operators in the sub-districts, a sample of 135 workers was selected, distributed along the main roads of each sub-district.

### Research instrument

Data were collected through official permits, enumerator training, instrument testing, and tool calibration. Respondents completed a work factor questionnaire, underwent anthropometric measurements, participated in reaction time tests,

provided subjective fatigue assessments, and recorded productivity. Data quality was maintained through double entry and questionnaire auditing.

### Data collection

The primary data in this study were collected through questionnaires to assess the relationship between fatigue and factors, such as age, gender, job monotony, and work shifts. Secondary data were obtained from PT Pertamina in the Tamalanrea and Biringkanaya sub-districts, covering general company information. The tools used included questionnaires, a weighing scale, a microtoise, a reaction timer, and stationery. We employed questionnaires, body scales, a microtoise, and a reaction timer as data collection tools. The body scales and microtoise were standard anthropometric tools, validated and calibrated to ensure reliability. The reaction timer measured reaction time with construct validity, and its reliability was confirmed through the test-retest method, demonstrating consistent results. Thus, all tools were proven to be valid and reliable for this research.

### Data analysis

All collected data, both primary and secondary, were processed through editing, coding, entry, and cleaning stages. Data were analyzed using univariate, bivariate, and multivariate analyses. The analysis included descriptive statistics, bivariate tests (Chi-square test, t-test/ANOVA, Mann-Whitney U test), and multivariate analysis using logistic or linear regression using SPSS 25 software.

## Findings

A total of 63 respondents had optimal productivity, while 72 respondents had suboptimal productivity. Also, 92 respondents experienced work fatigue, while 43 respondents did not. Additionally, there were 80 male respondents and 55 female respondents. Furthermore, 98 workers had a body mass index within the normal category, while 37 workers fell into the abnormal category. Also, 58 respondents reported having monotonous work, while 77 respondents had non-monotonous work (Table 1).

**Table 1.** Participants' characteristics

Parameter		Frequency (%)
Work productivity	Productive	63 (46.7)
	Unproductive	72 (53.3)
Work fatigue	Fatigued	92 (68.1)
	Not fatigued	43 (31.9)
Gender	Male	80 (59.3)
	Female	55 (40.7)
Nutritional status	Normal	98 (72.6)
	Abnormal	37 (27.4)
Job type	Monotonous	58 (43.0)
	Non-monotonous	77 (57.0)

Among the 135 respondents, the majority who reported fatigue experienced both maximum and non-maximum work productivity. There was a statistically significant association between worker fatigue and job productivity among fuel station

operators ( $p=0.039$ ). Most respondents with normal conditions had maximum work productivity, while those with abnormal conditions tended to have lower productivity. There was a statistically significant association between nutritional status and work productivity among fuel station operators ( $p=0.026$ ). Also, a statistically significant association was found between monotonous tasks and work productivity among fuel station operators ( $p=0.025$ ). There was no significant association between gender and work productivity ( $p=0.266$ ; Table 2).

**Table 2.** The relationship between work fatigue, nutritional status, monotonous work, and gender and worker productivity

Parameter	Category	Optimal productivity	Suboptimal productivity	p-Value
Nutritional status	Good nutrition	52 (53.1)	46 (46.9)	0.026
	Malnutrition	11 (29.7)	26 (70.3)	
Monotonous work	Monotonous	34 (58.6)	24 (41.4)	0.025
	Not monotonous	29 (37.7)	48 (62.3)	
Gender	Male	41 (51.2)	39 (48.8)	0.266
	Female	22 (40.0)	33 (60.0)	
Work fatigue	Tired	49 (53.3)	43 (46.7)	0.039
	Not tired	14 (32.6)	29 (67.4)	

## Discussion

This study aimed to examine the determinants of work fatigue and assess the level of work productivity among fuel station operators in Makassar City. Proper fatigue management, such as ensuring adequate rest and reducing excessive workloads, is crucial for enhancing productivity and job satisfaction, as physical and mental fatigue can decrease efficiency, lower work quality, and reduce employee motivation [9]. Work-related fatigue, both physical and mental, has a significant negative impact on productivity. Higher levels of fatigue are associated with lower productivity, increased errors, and a greater risk of workplace accidents.

A study [10] on employee fatigue at CV Abadi Tiga Mandiri found that work fatigue has a positive and significant effect on employee productivity. The simple linear regression model was valid for predicting work productivity. The regression analysis revealed that fatigue had a positive and significant partial effect on productivity.

Nutritional status is a key aspect of occupational health that significantly affects work productivity. According to Supariasa's study [11], good nutrition is essential for adults, as poor nutritional status increases the risk of illness. Several studies indicate that employees with poor nutritional status tend to have lower productivity than those with adequate nutrition. Improving nutritional status plays a crucial role in enhancing the quality, health, and productivity of human resources. Balanced nutrition that meets the body's needs is essential, as both nutrient deficiencies and excesses can have negative effects [12].

Bakri *et al.* [13] reveal a significant correlation between employees' nutritional status and their

work productivity at PT Angkasa Pura I in Makassar. Among the 41 participants, individuals with normal nutritional status demonstrated higher productivity levels compared to those who were overweight. They report a statistically significant link between nutritional status and work productivity.

Many workers are engaged in routine tasks that require little initiative or responsibility, with no prospects for advancement or job variation<sup>[14]</sup>. Often, these tasks are far below their capabilities or educational qualifications. In many industries, jobs have been overly simplified into monotonous and repetitive duties, resembling work more suited for machines than for thinking humans.

Other factors, such as physical fatigue and job placement, may affect productivity regardless of work monotony<sup>[15]</sup>. Non-monotonous workers report higher productivity than those with monotonous tasks<sup>[16]</sup>. Many respondents experienced physical fatigue, possibly due to their specific roles or placement as fuel station operators. Questionnaire data further supported the finding that most respondents performed monotonous work.

Utami discovered that there are notable differences in levels of boredom and work productivity between monotonous and non-monotonous jobs at PT Delta Merlin Sandang Tekstil I Sragen. Workers in monotonous roles have higher boredom levels and slightly higher productivity scores compared to those in non-monotonous roles. Productivity is directly related to the nature of the job, whether it is monotonous or not<sup>[17]</sup>.

In terms of strength and muscle power, men and women are different. My experience shows that women's biological cycles do not affect their physical abilities; rather, they have a greater impact on social and cultural aspects. The body shape and muscle strength of each person vary<sup>[18]</sup>. Among these differences, women generally have smaller body sizes and lower muscle strength compared to men. Furthermore, women who experience abnormal menstruation, or dysmenorrhea, may feel pain, which causes them to tire more quickly<sup>[19]</sup>.

Gender refers to the distinctions in roles, functions, and responsibilities assigned to men and women by societal norms<sup>[20]</sup>. It can also influence individual productivity, with studies often indicating that men tend to exhibit higher productivity levels compared to women. These variations suggest that gender differences may play a role in shaping productivity outcomes<sup>[21]</sup>. This finding is consistent with the study by Kurniasari & Ibrahim<sup>[22]</sup> on the relationship between age, gender, length of service, and attitudes toward the hybrid work system and employee productivity. Their results suggest that men tend to be more productive due to perceived physical strength. Similarly, Herwati<sup>[23]</sup> reported that male employees have 0.079% higher productivity than female employees. However, we did not find a significant relationship between gender and

employee productivity, indicating that gender is not always a determining factor in work performance.

Gender affects employee motivation and performance. It is well known that high motivation can increase work productivity<sup>[24]</sup>. In developing countries, the motivation and productivity of male and female workers can differ depending on their jobs. The overall productivity level of women is lower in the field of science, which is typically male-dominated, but this perspective changes when viewed on an individual basis<sup>[25]</sup>. The dominance of one gender in a profession can impact productivity levels. Additionally, gender plays an important role in influencing productivity levels in small industries, such as the shuttlecock industry<sup>[22]</sup>. This is influenced by various factors, including those specific to women, such as a lack of physical strength, a tendency to use emotions at work, or biological factors, such as the need for maternity leave<sup>[26]</sup>. Gender impacts productivity and reflects the distinctions in roles, duties, and functions between men and women shaped by social constructs. Those with experience in this field are expected to obtain positions that match their abilities.

The limitations of this study include the difficulty in engaging many fuel station operators in the Tamalanrea and Biringkanaya districts of Makassar City due to their busy work schedules and short break times.

## Conclusion

Work fatigue, monotonous tasks, and nutritional status are significantly related to productivity levels.

**Acknowledgments:** We extend our heartfelt thanks to all those involved. I also express my highest appreciation and gratitude to all the leaders at every gas station in the Biringkanaya and Tamalanrea subdistricts who allowed us to conduct research in the field.

**Ethical Permissions:** This research was granted an ethics code with the number: 379/UN4.14.1/TP.01.02/2025.

**Conflicts of Interests:** There are no conflicts of interests to declare.

**Authors' Contribution:** Pasanre AA (First Author), Introduction Writer/Methodologist/Main Researcher/Discussion Writer/Statistical Analyst (30%); Muis M (Second Author), Introduction Writer/Discussion Writer/Statistical Analyst (20%); Thamrin Y (Third Author), Introduction Writer/Assistant Researcher/Discussion Writer/Statistical Analyst (20%); Wahyu A (Fourth Author), Introduction Writer/Discussion Writer/Statistical Analyst (10%); Saleh LM (Fifth Author), Assistant Researcher/Discussion Writer/Statistical Analyst (10%); Amqam H (Sixth Author), Introduction Writer/Discussion Writer/Statistical Analyst (10%)

**Funding/Support:** No external sources provided funding for this study.

## References

1- Kementerian Ketenagakerjaan. Indonesia's National Occupational Safety and Health Profile 2022. Jakarta: Kementerian Ketenagakerjaan; 2022. [Indonesian]

- 2- Tahulending A, Assa'ady CU. The impact of employee productivity on service quality in retail companies. *MUSYTARI: JURNAL MANAJEMEN, AKUNTANSI, DAN EKONOMI*. 2024;5(4):47-57. [Indonesian]
- 3- Handayani PA, Noviyanti LK, Sari DV. Education & giving of exercise as a program for the prevention of work fatigue complaints in caregivers at the Bhakti Asih orphanage for multiple disabilities Semarang. *JURNAL PENGABDIAN MASYARAKAT KESEHATAN*. 2023;9(1):35-40. [Indonesian]
- 4- BPJS Kesehatan. Monitoring and evaluation of Indonesian workers. Jakarta: BPJS Kesehatan; 2022. [Indonesian]
- 5- Kemenakertrans RI. Regulation of the Minister of Manpower and Transmigration. Republic of Indonesia. Number PER.13/Men/X/2011. Jakarta: Kemenakertrans RI; 2011. [Indonesian]
- 6- Melliya M, Anggela P, Djanggu N. Measurement of physical and mental workload using the CVL, Brouha and NASA-TLX methods on Pertamina petrol station operators 64.783.14. *JURNAL TEKNIK INDUSTRI UNIVERSITAS TANJUNGPURA*. 2023;7(1):95-100. [Indonesian]
- 7- Abdulai IA, Abubakari MA, File DJM. Siting of fuel stations within residential areas in Ghanaian cities: Perceptions of residents in Wa on fire disaster risks. *Heliyon*. 2024;10(8):e29964.
- 8- Prima LA. Factors related to work fatigue among petrol station operators in Percut Sei Tuan subdistrict. *J Health Technol Med*. 2023;9(2):2615. [Indonesian]
- 9- Akbar MN. The effect of shift work implementation on work motivation and performance productivity among employees. *JURNAL BISNIS DIGITAL DAN SISTEM INFORMASI*. 2023;4(2):35-40. [Indonesian]
- 10- Ramli RH, Afsah FF, Nasrulyati TS. Analysis of work fatigue on employee productivity at CV. Abadi Tiga Mandiri. *SITEKIN*. 2022;19(2):440-6. [Indonesian]
- 11- Supariasa DN. Nutritional status assessment. Jakarta: EGC; 2001. [Indonesian]
- 12- Agustin A, Ihsan T, Lestari RA. An overview of factors affecting work fatigue among textile industry workers in Indonesia. *JURNAL KESELAMATAN KESEHATAN KERJA DAN LINGKUNGAN*. 2021;2(2):138-51. [Indonesian]
- 13- Bakri AS, Fachrin SA, Yusriani, Hardi I. The relationship between nutritional status and employee productivity at PT ANGKASA PURA I (PERSERO) in Makassar. *Window Public Health J*. 2021;2(6):1043-9. [Indonesian]
- 14- Bella FD, Fajar NA, Misnaniarti M. The relationship between parenting patterns and stunting in toddlers from poor families in Palembang City. *Indones J Nutr*. 2019;8(1):31-9. [Indonesian]
- 15- Febianti A, Shulthoni M, Masrur M, Safi' MA. The influence of education level, age, gender, and work experience on work productivity in Indonesia. *SAHMIYYA*. 2023;2(1). [Indonesian]
- 16- Fau JF, Buulolo P. The influence of the working environment on employee productivity at the South Nias District Samsat office. *REMIK*. 2023;7(1):533-6. [Indonesian]
- 17- Utami SR. Differences in Work Fatigue Levels and Productivity Between Monotonous and Non-Monotonous Jobs Among Employees at PT DELTA MERLIN SANDANG TEKSTIL I SRAGEN [dissertation]. Central Java: Muhammadiyah University Of Surakarta; 2022. [Indonesian]
- 18- Hanaysha JR. An examination of the factor affecting consumer purchase decision in the Malaysia retail market. *PSU Res Rev*. 2018;2(1):7-23.
- 19- Suma'mur PK. Company hygiene and occupational health. Jakarta: Gunung Agung; 1996. [Indonesian]
- 20- Hartoko Y. The influence of education, training, gender, age, marital status, and region of residence on the length of time spent seeking employment by educated workers in Indonesia. *JURNAL PENDIDIKAN EKONOMI*. 2019;8(3):201-7. [Indonesian]
- 21- Suryaatmaja A, Eka Pridianata V. The relationship between length of service, workload, noise intensity and work fatigue at PT Nobelindo Sidoarjo. *J Health Sci Prev*. 4(1):14-22. [Indonesian]
- 22- Kurniasari R, Ibrahim R. The relationship between age, gender, length of service and attitudes towards hybrid working systems with employee productivity. *JURNAL PENELITIAN DAN KARYA ILMIAH LEMBAGA PENELITIAN*. 2022;8(1). [Indonesian]
- 23- Herawati. Physical activity and stress as risk factors for hypertension in people aged 45 years and over. *Jurnal Kesehatan Masyarakat STIKES Cendekia Utama Kudus*. 2020; 7(2).
- 24- Prayudo AN, Fathorrahman F, Karnawati TA. Analysis of the influence of length of service, wages and age on the productivity of cigarette rolling labourers at SKT Gebog, PT. Djarum Kudus. *JURNAL EKONOMI MANAJEMEN DAN BISNIS*. 2020;1(1):1-10. [Indonesian]
- 25- Guevara-Rosero GC. Determinants of manufacturing micro firms' productivity in Ecuador. Do industry and canton where they operate matter?. *Reg Sci Policy Pract*. 2021;13(4):1215-49.
- 26- Salmawati L, Farid A, Nur R, Arifuddin A, Hendra S, Ngemba HR. Factors associated with occupational fatigue of gas station operators in Palu City. *Am Res J Humanit Soc Sci*. 2019;2(6):21-5.