

# The Relationship Between Occupational Noise Exposure and Work Fatigue Among Apron Workers at Tampa Padang Airport

Nurul Pratiwi Army<sup>1</sup>, Annisa Suwahru<sup>2</sup>, Astaman Sultan<sup>3</sup>, Suci Setiani Annisa<sup>4</sup>,  
Yusniar Anggraeny<sup>5</sup>, Rizky Maharja<sup>6</sup>, A. Mifta Farid Panggeleng<sup>7</sup>, Bambang  
Hermawan<sup>8</sup>

<sup>1,3,4,5,6,7</sup>Occupational Health and Safety Program, Faculty of Health Sciences, Universitas Sulawesi Barat, Majene, Indonesia.

<sup>2</sup>Dental Therapy Program, Faculty of Health Sciences, Universitas Sulawesi Barat, Majene, Indonesia

Email: nurulpratiwi.army@unsulbar.ac.id, annisa.suwahru@unsulbar.ac.id, astaman.sultan@unsulbar.ac.id,  
andisucisetiani@unsulbar.ac.id, yusniar.anggraeny@unsulbar.ac.id, rizkymaharja@unsulbar.ac.id, a.miftafarid@unsulbar.ac.id,  
bambang.hermawan@unsulbar.ac.id

Work fatigue is a condition characterized by a decrease in work efficiency and physical endurance, with direct implications for workforce productivity and occupational safety. Apron workers at airports are simultaneously exposed to multiple occupational risk factors, most notably high levels of noise continuously generated by aircraft engines and ground support equipment operations. In addition to noise, age, workload, working hours, and length of service also influence the occurrence of work fatigue. This study analyzed the relationships between age, workload, working hours, length of service, and noise intensity with work fatigue among apron workers at Tampa Padang Airport, Mamuju. An observational analytic design with a cross-sectional approach was applied, conducted in January–February 2026. A total of 71 workers were selected through proportionate stratified random sampling from a population of 242. Work fatigue was measured using a reaction timer, workload via working pulse rate monitoring, and noise intensity using a sound level meter. Data on age, working hours, and length of service were collected through structured questionnaires. Univariate and bivariate analyses were performed using the chi-square test ( $\alpha = 0.05$ ). Results showed that 48 workers (67.6%) experienced work fatigue. Significant relationships were found between age ( $p = 0.001$ ), workload ( $p = 0.001$ ), working hours ( $p = 0.001$ ), length of service ( $p = 0.001$ ), and noise intensity ( $p = 0.017$ ) with work fatigue. Management is advised to align working hours with regulatory standards and to enforce the mandatory use of hearing protection devices (earplugs/earmuffs) for all apron workers.

**Keywords:** Work Fatigue, Apron Workers, Noise Intensity, Occupational Health.

This is an open access  
article under the [CC BY-NC](#)  
license



## Corresponding Author:

Annisa Suwahru  
Universitas Sulawesi Barat  
Jalan Prof. Dr. Baharuddin Lopa, S.H  
annisa.suwahru@unsulbar.ac.id

## 1. Introduction

The apron is the airside area of an airport designated for aircraft parking, passenger boarding and disembarkation, cargo handling, aircraft refueling, and maintenance operations. Workers assigned to this zone are continuously subjected to high-intensity noise generated by aircraft engines and ground support equipment, posing persistent occupational hazards with significant potential to induce work-related fatigue. The International Labour Organization (ILO) estimates that nearly two million workers die annually from occupational accidents, a substantial proportion of which are precipitated by fatigue-related impairment [1].

The elevated noise levels in the apron environment represent a critical occupational health and safety (OHS) concern. Activities such as cargo loading and unloading, aircraft refueling, and ground support equipment movement generate noise ranging from 80 to 110 dB, which is known to elicit physiological disturbances

including cardiovascular strain and elevated cortisol secretion as well as psychological impairments such as reduced concentration and heightened cognitive load, collectively contributing to work fatigue [2]. These consequences directly affect operational safety and workforce productivity at airports; therefore, systematic and periodic monitoring of work fatigue among apron workers is essential [3].

This study focuses on the relationship between individual factors (age and length of service), occupational factors (workload and working hours), and environmental factors (noise intensity) with work fatigue among apron workers at Tampa Padang Airport, Mamuju. This scope was defined to ensure analytical focus on variables amenable to intervention through OHS management policies within the apron work environment [4]. The objective of this study was to analyze the relationships between age, workload, working hours, length of service, and noise intensity with work fatigue among apron workers at Tampa Padang Airport, Mamuju, during January–February 2026.

## 2. Literature Review and Problem Statement

Work fatigue is defined as a state of diminished work efficiency, performance, and physical endurance that leads to reduced productivity and an elevated risk of occupational accidents [5]. From an ergonomic perspective, fatigue emerges from the interaction between individual worker characteristics including age and physical condition and the demands imposed by the work environment [6]. Russeng and Saleh previously documented a significant relationship between noise intensity and work fatigue among apron workers at Tampa Padang Airport [7], and analogous findings were reported by Ahmadi et al. in a cross-sectional study linking physical workload and occupational fatigue [2].

Workload and length of service have been identified as significant contributors to occupational fatigue. Saleh et al. reported that heavy workload was significantly associated with work stress and fatigue among aviation workers in Indonesia [4]. Timanta et al. documented elevated occupational health risks including hearing damage among ground workers at a major Indonesian international airport [8]. Although several studies have addressed the determinants of work fatigue in general, a comprehensive, integrated examination of five concurrent factors age, workload, working hours, length of service, and noise intensity within the specific context of Tampa Padang Airport's apron operations remains limited [9].

Based on this research gap, the present study addresses the following problem statement: Is there a statistically significant relationship between age, workload, working hours, length of service, and noise intensity with work fatigue among apron workers at Tampa Padang Airport, Mamuju? The hypothesis is that each of the five independent variables is significantly associated with work fatigue in this occupational setting.

## 3. Method

This study employed an observational analytic design with a cross-sectional approach, conducted during January–February 2026 at Tampa Padang Airport, Mamuju, specifically within the Apron Section of PT. Garuda Indonesia. The cross-sectional design was selected because it enables simultaneous measurement of independent and dependent variables in an efficient manner consistent with the categorical nature of the data analyzed [10]. The study population comprised 242 apron workers; a sample of 71 workers was selected using proportionate stratified random sampling to ensure adequate representation from each operational work unit.

Work fatigue was objectively measured using a reaction timer, which quantifies neuromuscular response latency as a proxy for fatigue status. Workload was assessed by measuring working pulse rate, categorized

as heavy or light based on established physiological thresholds. Occupational noise intensity was measured using a calibrated sound level meter positioned at each worker's primary workstation. Data on age, working hours, and length of service were collected through a structured questionnaire supplemented by direct interviews. The analytical framework assumed independence of observations and appropriateness of categorical data for nonparametric statistical testing. Univariate analysis described the frequency distribution of each variable, while bivariate analysis applied the chi-square test at a 95% confidence level ( $\alpha = 0.05$ ) to examine associations between variables

#### 4. Results and Discussion

Analysis of 71 apron workers at Tampa Padang Airport revealed that 48 workers (67.6%) experienced work fatigue, while 23 workers (32.4%) did not. The age distribution was dominated by younger workers (aged <35 years), comprising 64.8% of the sample. Heavy workload was present in 56.3% of workers; non-compliant working hours (>8 hours/day) in 46.5%; long service tenure ( $\geq 35$  years) in 78.9%; and non-compliant noise intensity levels in 53.5% of workers. The complete frequency distribution is presented in Table 1.

**Table 1.** Frequency Distribution of Characteristics and Occupational Exposure Among Apron Workers at Tampa Padang Airport, Mamuju(n=71)

Variable	n	%
<b>1. Age</b>		
Older ( $\geq 35$ years)	25	35.2
Younger (< 35 years)	46	64.8
<b>2. Workload</b>		
Heavy Workload	40	56.3
Light Workload	31	43.7
<b>3. Working Hours</b>		
Non-compliant (> 8 hours/day)	33	46.5
Compliant ( $\leq 8$ hours/day)	38	53.5
<b>4. Length of Service</b>		
Long ( $\geq 3$ years)	56	78.9
Short (< 3 years)	15	21.1
<b>5. Noise Intensity</b>		
Non-compliant (> 85 dB)	38	53.5
Compliant ( $\leq 85$ dB)	33	46.5
<b>6. Work Fatigue</b>		
Fatigued	48	67.6
Not Fatigued	23	32.4

**Table 2.** Relationship Between Independent Variables and Work Fatigue Among Apron Workers at Tampa Padang Airport, Mamuju

Independent Variable	Fatigued		Not Fatigued		Total n	Total %	p-value
	n	%	n	%			
<b>Age</b>							
Older ( $\geq 35$ years)	24	96.0	1	4.0	25	100	0.001

Independent Variable	Fatigued		Not Fatigued		Total	Total	p-value
	n	%	n	%	n	%	
Younger (< 35 years)	24	52.2	22	47.8	46	100	
<b>Workload</b>							
Heavy	46	82.1	10	17.9	56	100	0.001
Light	2	13.3	13	86.7	15	100	
<b>Working Hours</b>							
Non-compliant (> 8 h/day)	29	87.9	4	12.1	33	100	0.001
Compliant ( $\leq$ 8 h/day)	19	50.0	19	50.0	38	100	
<b>Length of Service</b>							
Long ( $\geq$ 3 years)	47	83.9	9	16.1	56	100	0.001
Short (< 3 years)	1	6.7	14	93.3	15	100	
<b>Noise Intensity</b>							
Non-compliant (> 85 dB)	21	55.3	17	44.7	38	100	0.017
Compliant ( $\leq$ 85 dB)	27	81.8	6	18.2	33	100	

The chi-square test results presented in Table 2 confirm statistically significant associations between all five independent variables and work fatigue. The prevalence of fatigue (67.6%) is consistent with findings reported by Dahlan and Widanarko (2022), who demonstrated that occupational fatigue significantly impairs human performance and elevates safety risks in Indonesian workers [11], and Al-Harthy et al. (2022), who documented a high prevalence of occupational health risks attributable to noise exposure among airport ground workers [9]. The comparatively lower prevalence in the present study may be attributable to differences in job characteristics and the implementation of shift rotation systems at Tampa Padang Airport.

The pattern of association between age and work fatigue is consistent with established ergonomic theory, which posits that physical work capacity including neuromuscular reaction time tends to decline after the age of 30 years as a consequence of physiological aging [3]. Older apron workers ( $\geq$ 35 years) exhibited a fatigue prevalence of 96.0%, compared to 52.2% among younger workers. Similarly, heavy workload was associated with work fatigue in 82.1% of workers, corroborating the findings of Saleh et al. [4]. Noise levels exceeding the threshold limit value ( $\geq$ 85 dB) contributed to physiological and psychological disturbances that trigger fatigue, as demonstrated by Ahmadi et al. [2] and Lecca et al., whose study of airport ground staff confirmed noise exposure disrupts autonomic control and elevates physiological strain [12].

Based on these findings, all five independent variables are significantly associated with work fatigue among apron workers. These results provide a robust empirical basis for the development of targeted OHS interventions, including work rotation scheduling, enforcement of working hour limits in accordance with regulatory standards, and mandatory use of personal protective equipment specifically earplugs or earmuffs to reduce cumulative noise exposure and its associated occupational health consequences [13], [14].

## 5. Conclusion

This study concludes that statistically significant relationships exist between age, workload, working hours, length of service, and noise intensity with work fatigue among apron workers at Tampa Padang Airport, Mamuju. These findings are consistent with the occupational health literature identifying individual

characteristics, occupational demands, and environmental noise as primary determinants of work fatigue among aviation transport workers.

From a practical standpoint, the results advocate for the alignment of working hours with the standards prescribed by the Minister of Manpower Regulation No. 5 of 2018, the implementation of structured shift rotation systems, and the rigorous enforcement of mandatory hearing protection device usage for all apron personnel. The study's limitations include a cross-sectional design that does not permit causal inference, and restriction to a single airport location. Future research is recommended to employ a longitudinal multi-site approach incorporating psychosocial variables such as occupational stress and job satisfaction as well as inter-shift rest period data, to provide a more comprehensive understanding of fatigue determinants in the aviation ground operations workforce [15].

## 6. Referensi

- [1] International Labour Organization, "World Statistics: The Enormous Burden of Poor Working Conditions," 2023. doi: 10.54394/SNCP1637.
- [2] M. Ahmadi, A. Choobineh, A. Mousavizadeh, and H. Daneshmandi, "Physical and psychological workloads and their association with occupational fatigue among hospital service personnel," *BMC Health Serv. Res.*, vol. 22, no. 1, Dec. 2022, doi: 10.1186/s12913-022-08530-0.
- [3] Tarwaka, *Industrial Ergonomics: Fundamentals of Ergonomic Knowledge and Workplace Applications*. Surakarta: Harapan Press, 2022.
- [4] L. M. Saleh *et al.*, "The Development of a Work Stress Model for Air Traffic Controllers in Indonesia," *Kesmas*, vol. 17, no. 1, pp. 40–47, Feb. 2022, doi: 10.21109/kesmas.v17i1.5001.
- [5] M. S. Dr. Suma'mur P.K., *Industrial Hygiene and Occupational Health (Hiperkes)*, 3 rd. Jakarta: CV. Sagung Seto, 2022.
- [6] Lalu Muhammad Saleh, *Work Fatigue in Aviation Workers: An Occupational Health and Safety Review*. Yogyakarta: Deepublish, 2023.
- [7] S. S. Russeng, L. Muhammad Saleh, Y. Thamrin, and S. Aulia Utami S, "RELATIONSHIP OF NOISE AND FATIGUE AT TAMPA PADANG AIRPORT APRON WORKERS," *EPH - International Journal of Medical and Health Science*, vol. 5, no. 3, pp. 20–24, Sep. 2019, doi: 10.53555/eijmhs.v5i3.125.
- [8] A. E. Timanta, B. Haryanto, and R. A. Wulandari, "Workers' Characteristics of Hearing Loss at Soekarno-Hatta International Airport, Indonesia," *Kesmas: Jurnal Kesehatan Masyarakat Nasional*, vol. 18, no. 1, pp. 93–98, Jul. 2023, doi: 10.21109/kesmas.v18isp1.7087.
- [9] N. A. Al-Harthy, H. Abugad, N. Zabeeri, A. A. Alghamdi, G. F. Al Yousif, and M. A. Darwish, "Noise Mapping, Prevalence and Risk Factors of Noise-Induced Hearing Loss among Workers at Muscat International Airport," *Int. J. Environ. Res. Public Health*, vol. 19, no. 13, Jul. 2022, doi: 10.3390/ijerph19137952.
- [10] C. Morais, J. Ribeiro, and J. Silva, "Human factors in aviation: Fatigue management in ramp workers," *Open Engineering*, vol. 13, no. 1, Jan. 2023, doi: 10.1515/eng-2022-0411.
- [11] A. Dahlan and B. Widanarko, "A Study on The Impact of Occupational Fatigue on Human Performance among Oil and Gas Workers in Indonesia," *Kesmas*, vol. 17, no. 1, pp. 54–59, Feb. 2022, doi: 10.21109/kesmas.v17i1.5390.
- [12] L. I. Lecca *et al.*, "Response of the cardiac autonomic control to exposure to nanoparticles and noise: A cross-sectional study of airport ground staff," *Int. J. Environ. Res. Public Health*, vol. 18, no. 5, pp. 1–9, Mar. 2021, doi: 10.3390/ijerph18052507.
- [13] Ministry of Manpower of the Republic of Indonesia, "Peraturan Menteri Ketenagakerjaan Nomor 5 Tahun 2018 tentang Keselamatan dan Kesehatan Kerja Lingkungan Kerja," Jakarta, 2018.

- [14] N. Mawaddah Syafitri, L. Muhammad Saleh, S. S. Russeng, F. Naiem, and A. Bintara Birawida, "NOISE MAPPING AND HEALTH PROBLEMS OF APRON EMPLOYEES PT GAPURA ANGKASA IN INTERNATIONAL AIRPORT SULTAN HASANUDDIN MAKASSAR," *Turkish Journal of Physiotherapy and Rehabilitation*, vol. 32, no. 3, [Online]. Available: [www.turkjphysiotherrehabil.org](http://www.turkjphysiotherrehabil.org)
- [15] W. Karwowski, B. Fouladi, S. Jun-Ya, and S. Rui-Shan, "Pilot fatigue survey: A study of the mutual influence among fatigue factors in the ``work'' dimension."