Periodicals of
Occupational Safety and Health
April 2026 - Vol. 1, No. 2, Pg. 10-16
e-ISSN: 2962-584X
http://journal2.uad.ac.id/index.php/posh/index

Determinants of Work Fatigue: Workload and Noise Among Convection Tailors

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ARTICLE INFO

Article history
Received February 4, 2026
Revised March 6, 2026
Accepted April 3, 2026

Keywords
Noise
Occupational fatigue
Tailor
Workload

ABSTRACT

Background: Occupational fatigue reduces work efficiency, productivity, and work capacity. In small-scale garment (convection) settings, fatigue may be influenced by work-related factors such as workload and by physical environmental exposures such as noise. This study aimed to examine the association of workload and noise exposure with occupational fatigue among convection tailors in Kauman, Yogyakarta. **Method:** A quantitative approach with a cross-sectional design was used. The sample consisted of 32 tailors at Wijaya Convection, selected by total sampling. The instruments were questionnaires and observation sheets. Data were analyzed using the chi-square test, with Fisher's exact test applied where the expected cell counts were below five. **Results:** A significant association was found between workload and fatigue among tailors in Kauman, Yogyakarta ($p = 0.012$). In contrast, no significant association was found between noise exposure and fatigue ($p = 1.000$). **Conclusion:** Workload is associated with occupational fatigue among tailors in Kauman, Yogyakarta, whereas noise exposure is not. Workload management should therefore be the priority for fatigue prevention in this setting.

1. Introduction

Occupational safety and health (OSH) is an essential aspect of the workplace, aimed at protecting workers, companies, the environment, and society from the risks of occupational accidents and work-related diseases. Protection for workers is not only the responsibility of the company but also a fundamental right of every employee. The International Labour Organization reports that each year there are more than 250 million workplace accidents, 160 million cases of occupational disease, and 1.2 million deaths caused by work-related accidents [1]. These figures indicate that OSH remains a serious global concern.

The Indonesian Ministry of Health has reported that most occupational accidents are influenced by fatigue [2]. Work fatigue not only affects workers' health but also decreases productivity, increases work errors, and triggers workplace accidents [3]. Work fatigue is a condition characterized by decreased efficiency and endurance at work, which can be caused by individual, occupational, or environmental factors. Symptoms of fatigue may include drowsiness, weakness, reduced concentration, and decreased alertness [4]. If left unaddressed, this condition not only reduces the quality of work performance but also endangers workers' safety. The risk factors contributing to work fatigue therefore need to be investigated further.

Several factors associated with work fatigue include workload and environmental conditions such as noise [5]. An excessive workload can cause both physical and mental strain, making workers fatigued more quickly. Noise, in turn, is a physical environmental factor with the potential to disrupt comfort, reduce concentration, and even exacerbate the level of worker fatigue [6]. These two factors are often found in small-scale industries, including the garment (convection) industry.

Previous studies have shown a significant relationship between workload and fatigue. Most tailors with heavy workloads experienced work fatigue [7], and high noise intensity among palm oil factory workers has been associated with subjective fatigue complaints [8]. These findings reinforce the view that workload and noise are important factors in the occurrence of fatigue.

A similar condition was observed in the garment industry. A preliminary study at Wijaya Convection in Kauman, Yogyakarta, found that most workers were women and worked from 08:00 to 16:00, with working hours extended to 22:00 when customer orders increased; the rest break was limited to 12:00–13:00. The workload in this setting is driven by customer demands that require relatively large numbers of orders to be completed within short deadlines, which increases the work pace and prolongs working time. Tailoring work also involves a series of stages—cutting, pattern-making, sewing, and finishing—that require continuous precision, concentration, and repetitive postures for long periods, thereby increasing physical and mental strain. The workplace is located near a main road, and observations and interviews indicated that workers were exposed to persistent traffic noise in addition to sewing-machine noise, which was frequently reported as a barrier to concentration. Workers also reported fatigue-related incidents such as needle pricks due to reduced focus, and back pain associated with prolonged, monotonous working positions.

2. Methods

2.1. Study design and setting

This study used a quantitative analytic observational approach with a cross-sectional design, in which the exposure variables and the outcome were measured at the same time. The research was conducted at Wijaya Convection, Kauman, Yogyakarta, from October to November 2023. Wijaya Convection operates three production sites: a central unit and two branches.

2.2. Population, sample, and eligibility criteria

The study population comprised all tailors working at Wijaya Convection (N = 32). Total sampling was applied, so all 32 workers were included as study participants. The inclusion criteria were: (1) being a registered and active tailor at Wijaya Convection during the study period, and (2) willingness to participate by signing an informed consent form. The exclusion criteria were declining to participate and being unavailable during data collection.

2.3. Variables and operational definitions

The dependent variable was occupational fatigue, and the independent variables were workload and noise exposure. Occupational fatigue was measured with the KAUPK2 questionnaire (Kuesioner Alat Ukur Perasaan Kelelahan Kerja, a validated Indonesian instrument for subjective work-fatigue complaints) and categorized as fatigued if the score was at or above the mean (8–17) and less fatigued if it was below the mean (0–7). Workload was categorized as high if the score was at or above the mean (39–50) and moderate if it was below the mean (0–38) [9]. Noise exposure was categorized as exposed if the noise level exceeded 85 dBA and not exposed if it was 85 dBA or below, following the threshold limit value set out in Regulation of the Minister of Manpower of the Republic of Indonesia Number 5 of 2018.

2.4. Data collection procedures

Periodical of Occupational Safety and Health
April 2026 - Vol. 5, No. 1, Pg. 10-16
e-ISSN: 2962-584X

Data collection followed the study workflow: arranging permissions, briefing the research assistant to standardize perceptions, administering the questionnaires, and measuring noise with a sound level meter. Participants completed the KAUPK2 questionnaire for work fatigue and a workload questionnaire assessing physical and mental workload components.

2.5. Data analysis

Univariate analysis described the participant characteristics and study variables using appropriate descriptive statistics: numerical variables were summarized with the mean, median, and standard deviation, and categorical variables as proportions and percentages. Bivariate analysis tested the association between workload and fatigue, and between noise exposure and fatigue, using the chi-square test with $\alpha = 0.05$ (95% confidence level). The chi-square assumptions followed the study criteria: no observed cell frequency of zero; for 2 × 2 tables, no expected count below five; and for larger tables, expected counts below five in no more than 20% of cells. Where these assumptions were not met, Fisher's exact test was used instead.

2.6. Ethical considerations

All participants provided written informed consent before data collection. This study obtained ethical approval from the Health Research Ethics Committee of Universitas Ahmad Dahlan (Approval No. 012310258).

3. Results and Discussion

3.1. Results

This section presents the findings on the association of workload and noise with subjective fatigue complaints among garment workers in Kauman. The data were collected in the field through questionnaires and observation of respondent characteristics, and were then analyzed to describe the relationships between the variables under study.

3.1.1. Univariate analysis

Table 1 presents the frequency distribution of the characteristics of the convection tailors in Kauman. The characteristics observed were age, sex, and length of service. This descriptive analysis provides an overview of the demographic profile of the respondents, which serves as a basis for understanding the background conditions of the study population.

Table 1. Frequency distribution of the characteristics of the convection tailors in Kauman

Characteristics	Frequency (n)	%
Age		
> 35 years	22	69
≤ 35 years	10	31
Sex		
Male	13	41
Female	19	59
Length of service		
> 10 years	9	28
≤ 10 years	23	72
Total	**32**	**100**

Table 1 shows that the majority of respondents were aged over 35 years (69%), while those aged 35 years or below accounted for 31%. Most respondents were female (59%), compared with 41% who were male. In terms of length of service, the majority had worked for 10 years or less (72%), whereas 28% had worked for more than 10 years. These results indicate that the convection workforce in Kauman is predominantly middle-aged, female, and relatively new in terms of work experience.

Table 2 presents the cross-tabulation of respondent characteristics with work fatigue among the garment tailors in Kauman. The variables analyzed were age, sex, and length of service, each compared with the presence or absence of work fatigue. The table provides an overview of how the demographic and occupational characteristics are distributed in relation to reported work fatigue.

Table 2. Cross-tabulation of respondent characteristics with work fatigue among the garment tailors in Kauman

Variable	Work fatigue			
	Yes		No	
	n	%	n	%
Age				
> 35 years	10	31	12	38
≤ 35 years	6	19	4	13
Sex				
Male	5	16	8	25
Female	11	34	8	25
Length of service				
> 10 years	1	3	8	25
≤ 10 years	15	47	8	25

Note: percentages are calculated against the total sample (n = 32).

Table 2 shows that, of the 16 respondents who reported work fatigue, 10 (31% of the total sample) were aged over 35 years and 6 (19%) were aged 35 years or below. Female respondents accounted for a larger share of the fatigue cases (34%) than male respondents (16%). By length of service, most respondents who reported fatigue had worked for 10 years or less (47%), while only 3% of the total sample were respondents with more than 10 years of service who reported fatigue.

Because the percentages above are calculated against the whole sample rather than within each subgroup, they describe the distribution of fatigue cases rather than the risk within each group. Read within subgroups, fatigue was reported by 45% of respondents aged over 35 years and 60% of those aged 35 or below; by 58% of female and 38% of male respondents; and by 65% of respondents with 10 years of service or less compared with 11% of those with more than 10 years. This pattern suggests that fatigue was most common among female workers and among those with shorter work experience, which may reflect differences in workload demands, the physical strain of tailoring tasks, and gender roles that place additional responsibilities on female workers. Less experienced workers may also require greater physical and mental effort to meet production targets, which could increase their susceptibility to fatigue.

3.1.2. Bivariate analysis

Table 3 presents the association of workload and noise with work fatigue among the garment tailors in Kauman. The analysis includes the distribution of respondents experiencing fatigue across the different levels of workload and noise exposure, together with the corresponding p-values and odds ratios with 95% confidence intervals.

Table 3. Association of workload and noise with work fatigue among the garment tailors in Kauman

Variable	Work fatigue				p-value	OR (95% CI)
	Yes		No			
	n	%	n	%		
Workload						
High	13	41	6	19	0.012	7.222 (1.440–33.224)
Moderate	3	9	10	31		
Noise exposure						
> 85 dBA	3	9	3	9	1.000	1.000 (0.169–5.903)
≤ 85 dBA	13	41	13	41		

Note: percentages are calculated against the total sample (n = 32). OR = odds ratio; CI = confidence interval.

Table 3 shows that respondents with a high workload accounted for a larger share of work fatigue cases (41% of the total sample) than those with a moderate workload (9%). Within subgroups, 68% of respondents with a high workload reported fatigue, compared with 23% of those with a moderate workload. The chi-square test revealed a significant association between workload and work fatigue ($p = 0.012$). The odds ratio of 7.222 (95% CI: 1.440–33.224) indicates that the odds of experiencing work

Periodical of Occupational Safety and Health
April 2026 - Vol. 5, No. 1, Pg. 10-16
e-ISSN: 2962-584X

fatigue were approximately seven times higher among respondents with a high workload than among those with a moderate workload.

In contrast, noise exposure showed no significant association with work fatigue. Respondents exposed to more than 85 dBA reported fatigue in the same proportion (50% within the subgroup) as those exposed to 85 dBA or below. The p-value of 1.000 and the odds ratio of 1.000 (95% CI: 0.169–5.903) confirm that noise was not a determining factor for work fatigue in this study population. These findings indicate that workload plays a dominant role in influencing work fatigue among the garment tailors in Kauman, whereas noise exposure did not contribute significantly to fatigue levels in this setting.

3.2. Discussion

3.2.1. The association between workload and work fatigue

The results show a significant association between workload and work fatigue among the garment tailors in Kauman (p = 0.012). This finding reinforces the theory that an excessive workload increases the risk of work fatigue, both physically and mentally [10]. In this study, most workers were required to meet sewing targets within strict deadlines. This condition forced them to work overtime, which in turn increased their workload and triggered fatigue. The situation was also evident from the difficulty the researchers faced in collecting data, as respondents rarely had free time to complete the questionnaires.

This study is not in line with the findings of Innah et al. at Pasar Sentral Bulukumba, which reported no significant association between workload and work fatigue (p = 0.187) [11]. The difference may be influenced by the method used to measure workload. The present study employed a questionnaire assessing both physical and mental workload, whereas Innah et al. used the full-time equivalent method, which focuses more on work duration [12]. Consequently, the mental aspects that also contribute to fatigue may not have been measured optimally in the earlier study.

Workload involves not only physical activity but also psychological aspects that demand a high level of concentration. When the workload exceeds an individual's capacity, it can reduce efficiency, lead to errors, and increase the risk of workplace accidents [13]. The high workload among the garment tailors is therefore identified as the dominant factor contributing to work fatigue in this study. Efforts to prevent fatigue caused by workload should focus on working-time management, proper scheduling of rest periods, and adequate nutritional intake. In addition, relaxation and muscle stretching during work breaks can help reduce the physical fatigue that results from prolonged static working positions [14]. Attention to balancing both physical and mental workload is thus essential in maintaining the productivity and health of garment workers.

A critical consideration in interpreting these findings is that the concept of workload is multifactorial and can be influenced by subjective perceptions as well as objective demands. The use of self-reported questionnaires, while valuable in capturing workers' experiences, may introduce response bias or reflect temporary conditions such as peak production periods rather than routine workloads. Moreover, cross-sectional data cannot fully capture the cumulative effects of chronic workload on fatigue, which may develop progressively over time. While this study underscores the importance of workload as a determinant of fatigue, further research using more comprehensive workload assessments and longitudinal designs is necessary to establish causality and to understand the long-term health implications for garment workers.

3.2.2. The association between noise and work fatigue

The results show no significant association between noise and work fatigue among the garment tailors in Kauman (p = 1.000). Although some work areas had noise levels approaching the threshold limit value of 85 dBA, this condition was not sufficient to produce a meaningful impact on fatigue. This may be because the noise experienced by workers did not occur continuously at high intensity and therefore did not impose a significant additional burden.

Excessive noise can disrupt the central nervous system and trigger both physical and psychological fatigue, including reduced concentration, irritability, anxiety, and sleep disturbance [15]. In this study, however, the noise levels approaching the threshold limit value were likely not sustained long enough, or at sufficient intensity, to cause such effects. Another contributing factor was the difference in data collection timing, as the level of activity during the research period was not the same as the conditions observed in the preliminary study. Although noise has the potential to be a risk factor for work fatigue, in the context of the garment workers in Kauman this factor did not show a significant effect. This indicates that other factors, such as workload, play a more dominant role in influencing workers' fatigue levels.

Although noise did not show a statistically significant effect on work fatigue in this study, this does not imply that noise is irrelevant in occupational health. Previous research in industrial settings has demonstrated that sustained exposure to high-intensity noise can lead to fatigue, impaired cognitive performance, and physiological stress responses [16]. In a crumb-rubber factory in Indonesia, for example, noise exposure was correlated with higher fatigue scores [17]. It is possible that in the Kauman garment workshop the noise levels were intermittent or variable, or remained below critical thresholds for long enough to show an effect in a cross-sectional design. Moreover, the stronger influence of workload might overshadow the subtler contribution of noise. Noise might therefore act as a modulating or synergistic factor rather than a primary driver under certain conditions.

Given this, practical interventions should not ignore noise entirely but should integrate noise control as part of holistic workplace ergonomics. First, periodic noise monitoring using dosimeters or sound level meters should be instituted to detect peaks and exposure durations over the working shift. Second, engineering controls—such as maintenance of sewing machines to reduce mechanical noise, sound-absorbing panels, barriers, and vibration dampers—should be considered to lower ambient noise levels. Third, administrative measures such as rotating workers, scheduling quieter tasks during noisier periods, and enforcing rest breaks in low-noise zones can reduce cumulative exposure. Finally, personal protective equipment such as earmuffs or earplugs can be provided, particularly where other controls are impractical. Such layered interventions, combining noise and workload management, offer a stronger defense against cumulative fatigue and long-term health effects [18], [19].

4. Conclusion

This study concludes that workload is a significant determinant of work fatigue among the garment tailors in Kauman, whereas noise does not show a meaningful association. A high workload, driven by strict production deadlines and overtime, increases both physical and mental fatigue, making it the dominant factor affecting workers' health and productivity. Although some noise levels approached the threshold limit value, the exposure was neither intense nor continuous enough to cause substantial fatigue. These findings highlight the need for effective workload management—including proper scheduling, adequate rest, and supportive workplace practices—to reduce fatigue and safeguard the well-being of garment workers.

Declaration

Acknowledgments: The authors thank the owner of Wijaya Convection in Kauman, Yogyakarta, for granting permission and facilitating the research process, and all parties who participated as respondents in this research.

Conflicts of Interest: The authors declare no conflict of interest.

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April 2026 - Vol. 5, No. 1, Pg. 10-16
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