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Occupational Noise and Work Productivity among Tailors in Gowa Regency, Indonesia

Running title: Noise and productivity among tailors

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Abstract

Background: Occupational noise may impair attention and performance, but evidence from small tailoring workplaces in Indonesia is limited. **Objective:** To examine the association between workplace noise and work productivity among tailors in Gowa Regency. **Methods:** This cross-sectional study included all 32 workers in December 2023. Area noise was measured using a calibrated sound level meter; worker characteristics and productivity were assessed by questionnaire. Chi-square tests were performed in SPSS 21. **Results:** Noise was associated with productivity (p=0.001). Age, education, sex, work tenure, working duration, and smoking were not associated with noise category (all p>0.05). Mean area noise levels ranged 76.60–90.68 dB(A). **Conclusion:** Workplace noise was associated with productivity. Source and engineering controls should be prioritized; causality cannot be inferred.

Keywords: occupational health; occupational noise; tailors; textile industry; work productivity

Research Highlights

- Workplace noise was significantly associated with work productivity among 32 tailors (p=0.001).
- Mean area sound levels varied from 76.60 to 90.68 dB(A), indicating heterogeneous workplace noise conditions.
- Noise control should prioritize source and engineering controls.

1 Introduction

Occupational noise is a persistent physical hazard in many workplaces and can affect both auditory health and work performance. Repeated hazardous exposure contributes to permanent hearing loss and may also interfere with speech perception, communication, concentration, and task performance [1,2]. The World Health Organization continues to identify excessive noise exposure as an important preventable cause of hearing loss worldwide [3].

The occupational relevance of noise extends beyond hearing impairment. Reviews have described associations with annoyance, stress, sleep disturbance, cardiovascular outcomes, and changes in cognitive or neurobehavioral performance [4,5]. Experimental evidence indicates that higher noise levels can alter attention, mental workload, and brain activity patterns [6], while a systematic review and meta-analysis found that low-frequency noise may influence cognitive performance depending on task and exposure characteristics [7]. Industrial evidence has also linked noise with poorer work performance and higher stress, including at levels below permissible limits [8].

In Indonesia, Ministry of Manpower Regulation No. 5 of 2018 uses 85 dB(A) as the occupational reference level for an 8-hour workday [9]. This is consistent with the National Institute for Occupational Safety and Health recommended exposure limit of 85 dBA as an 8-hour time-weighted average [10,11]. However, area or spot sound-level measurements are not equivalent to an individual 8-hour time-weighted-average exposure; interpretation requires information on measurement duration, work pattern, and worker location relative to noise sources [11].

Tailoring and garment-related work may involve continuous or intermittent mechanical noise from sewing machines, cutting equipment, motors, compressors, and nearby production activities. Studies among textile workers have documented substantial occupational noise exposure and hearing problems [12,13], while broader evidence indicates that occupational noise-induced hearing loss remains important in industrial populations [14,15]. Indonesian studies similarly support workplace noise prevention and have reported associations between noise and worker productivity in industrial settings [16–19]. Evidence from small-scale tailoring workplaces, however, remains limited.

This study examined the association between workplace noise and work productivity among tailors in Gowa Regency, South Sulawesi, Indonesia. It also assessed whether age, education, sex, work tenure, working duration, and smoking were associated with the study classification of workplace noise.

2 Materials and Methods

2.1 Study design and setting

This quantitative analytical study used a cross-sectional design. Data collection was conducted in December 2023 in tailoring/textile workplaces in Gowa Regency, South Sulawesi, Indonesia.

2.2 Population, sampling, and sample size

The study population comprised 32 workers. All 32 workers were included in the analysis using total population sampling.

2.3 Variables and measurements

Workplace noise was the principal exposure variable and work productivity was the principal outcome. Noise was measured using a calibrated sound level meter at nine area sampling points (A–I). Measurements were conducted in the morning and afternoon, and a mean sound level was reported for each point. Age, education, sex, work tenure, working duration, smoking status, and work productivity were obtained using a questionnaire. Noise was categorized relative to the occupational threshold used in the study; for contextual interpretation, Indonesian occupational regulations use 85 dB(A) for an 8-hour workday [9]. Because the available measurements were area measurements rather than documented personal dosimetry, they were interpreted as workplace sound levels rather than individual 8-hour time-weighted-average exposures [11].

2.4 Statistical analysis

Data were analyzed using SPSS version 21. Descriptive analysis summarized participant characteristics and measured variables. Bivariate analysis used chi-square tests to examine associations between categorical variables. Statistical significance was set at $p<0.05$. Crude odds ratios (ORs) with 95% confidence intervals (CIs) were reported for worker characteristics in relation to noise category. No multivariable model was performed.

2.5 Ethical considerations

Written informed consent was obtained from all participants before data collection.

3 Results

3.1 Participant characteristics

All 32 workers were included in the analysis. Women comprised 53.1% of participants, 68.8% had worked for more than 6 years, and 40.6% reported working more than 8 hours per day. Participant characteristics are summarized in Table 1.

Table 1. Participant characteristics (N=32)

Characteristic	Category	n	%
Age	>45 years	9	28.1
Age	17–45 years	23	71.9
Sex	Male	15	46.9
Sex	Female	17	53.1
Education	Low education	17	53.1
Education	Higher education	15	46.9
Work tenure	>6 years	22	68.8
Work tenure	0–6 years	10	31.3
Working duration	>8 hours/day	13	40.6
Working duration	0–8 hours/day	19	59.4
Smoking status	Smoking	13	40.6
Smoking status	Not smoking	19	59.4

Note: Percentages are based on N=32 and may not total 100 because of rounding.

3.2 Area noise measurements

Mean area sound levels across the nine sampling points ranged from 76.60 to 90.68 dB(A). Five sampling points had mean values above 85 dB(A), although these area measurements should not be interpreted as individual 8-hour time-weighted-average exposures.

Table 2. Mean area noise levels by sampling point

Sampling point	Mean noise level, dB(A)
A	90.68
B	88.88
C	87.23
D	90.30

Sampling point	Mean noise level, dB(A)
E	84.98
F	79.93
G	76.60
H	82.28
I	89.20

Note: Values represent area sound-level measurements at the reported sampling points.

3.3 Worker characteristics and noise category

The study classified 22 workers in the above-threshold noise group and 10 in the within-threshold group. None of the examined worker characteristics was significantly associated with noise category: age (p=0.644), education (p=1.000), sex (p=0.456), work tenure (p=0.544), working duration (p=0.821), or smoking status (p=0.420).

Table 3. Worker characteristics in relation to noise category (N=32)

Variable/category	Above threshold, n	Within threshold, n	Crude OR	95% CI	p-value
Age: >45 years	7	2	2.2	0.4–11.5	0.644
Age: 17–45 years	15	8			
Education: low	12	5	1.3	0.4–4.1	1.000
Education: higher	10	5			
Sex: female	11	6	1.8	0.6–5.4	0.456
Sex: male	11	4			
Work tenure: >6 years	16	6	0.5	0.1–2.4	0.544
Work tenure: 0–6 years	6	4			
Working duration: >8 hours/day	9	4	0.8	0.3–2.6	0.821
Working duration: 0–8 hours/day	13	6			
Smoking status: smoking	8	5	0.700	0.248–1.979	0.420
Smoking status: not smoking	14	5			

Note: OR = odds ratio; CI = confidence interval.

3.4 Noise and work productivity

Workplace noise category was significantly associated with work productivity among the tailors (chi-square p=0.001). An effect estimate with a 95% confidence interval was not available for this primary association.

4 Discussion

The principal finding was a statistically significant association between workplace noise and work productivity among the 32 tailors. This finding is consistent with Indonesian industrial studies reporting relationships between workplace noise and productivity [18,19] and with broader industrial evidence linking noise to poorer work performance and increased stress [8]. Because the present study was cross-sectional, the observed relationship should be interpreted as an association rather than a causal effect.

Several mechanisms may plausibly link workplace noise with altered productivity. Noise can mask speech and warning signals, increase communication effort, interrupt sustained attention, and increase mental workload. Experimental evidence has demonstrated changes in attention and brain activity under higher noise conditions [6], and systematic evidence indicates that cognitive effects vary with sound characteristics and task demands [7]. Reviews also describe annoyance, stress, sleep disturbance, and neurobehavioral effects that may indirectly influence work organization and performance [4,5]. These pathways are relevant to tailoring work, which requires precision, hand–eye coordination, and sustained concentration.

Area mean sound levels ranged from 76.60 to 90.68 dB(A), indicating substantial variation between sampling points. Several means exceeded the 85 dB(A) reference level used for an 8-hour workday in Indonesia and by NIOSH [9,10]. However, the available area measurements cannot be interpreted as personal daily noise doses without information on measurement duration, worker movement, and time spent at each workstation. Future assessments should combine area mapping with personal dosimetry or well-documented task-based exposure assessment where feasible [11].

Evidence from textile and industrial settings reinforces the importance of controlling occupational noise. Studies among textile workers have documented noise exposure and hearing problems [12,13], and systematic evidence supports a material contribution of occupational noise to hearing loss [14,20]. These studies address auditory outcomes rather than productivity directly, but they establish the relevance of noise as an occupational-health exposure in production environments.

Age, education, sex, work tenure, working duration, and smoking were not significantly associated with the study's noise category. These null associations should be interpreted cautiously because workplace noise is primarily determined by the work environment, equipment, and task rather than by worker demographics. In addition, the sample was small, which limits statistical precision. Individual characteristics may nevertheless modify susceptibility to downstream health outcomes such as hearing loss, hypertension, or stress [15,21].

Noise control should follow the hierarchy of controls. Priority should be given to eliminating or reducing noise at the source through machine maintenance, quieter equipment, vibration damping, isolation, barriers, enclosure, or layout modification before relying on worker behavior [22]. Administrative measures and appropriately selected hearing protection can then address residual exposure, with effectiveness depending on correct selection, fit, and consistent use [17,23]. For small tailoring workplaces, practical measures include preventive machine maintenance, separation of noisier equipment, increasing distance from noise sources, task rotation where appropriate, worker training, and hearing protection when indicated by exposure assessment.

This study has several limitations. The cross-sectional design does not establish temporality or causality, and the small sample limits statistical power and precision. The productivity questionnaire was not described in sufficient detail to evaluate its measurement properties or reproduce its scoring. The noise-measurement protocol was also insufficiently documented to estimate individual 8-hour exposure. In addition, the primary noise–productivity analysis was reported only as a p-value without contingency counts or an effect estimate. These limitations should be considered when interpreting the findings and should be addressed in future studies.

5 Conclusion

Workplace noise was significantly associated with work productivity among tailors in Gowa Regency, while age, education, sex, work tenure, working duration, and smoking were not significantly associated with the study noise category. Mean area sound levels ranged from 76.60 to 90.68 dB(A). These findings support systematic workplace noise assessment and prioritization of source and engineering controls, followed by administrative measures and hearing protection where residual exposure warrants it. The findings should be interpreted as associations because of the cross-sectional design and small sample.

6 Declarations

Ethics approval and consent to participate

Written informed consent was obtained from all participants before data collection.

Consent for publication

Not applicable; no identifiable personal data, images, or individual information are included in this manuscript.

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Competing interests

The authors declare no competing interests.

Author contributions (CRediT)

Vilsyah R.F.: Conceptualization, Investigation, Data curation, Writing – original draft. Sayful Muslim: Investigation, Data curation, Formal analysis. Mardiatunnisa: Methodology, Formal analysis, Writing – review and editing. Andi Assyfa Mappadeceng: Investigation, Data curation, Writing – review and editing. Ranti Ekasari: Conceptualization, Supervision, Methodology, Writing – review and editing, Validation.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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Generative AI statement

Generative AI was used to assist English-language editing and structural formatting of the manuscript. It was not used to generate or alter study data or statistical results. The authors remain responsible for the accuracy, originality, citations, and integrity of the manuscript.

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