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Research Article

The relationship between work period and hearing disorder caused by noise in workers of PT. Kayu Perkasa Raya

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⁶ ABSTRACT

Noise Induced Hearing Loss (NIHL) is sensorineural deafness caused by hearing threshold values in the workplace. According to the Regulation of the Minister of Manpower and Transmigration Number 13 of 2011 it regulates the threshold and chemical factors. The threshold value is 85 dB with 8 hours/day noise exposure time. This study aimed to determine the relationship between work period and the incidence of NIHL in PT. Kayu Perkasa Raya. The type of research used was quantitative with observational analytic methods. Data was obtained from questionnaires and audiometric results. The research design used cross-sectional, a study between measurement and observation variables that were carried out simultaneously. The sampling technique was purposive sampling. The analysis used using chi-square. The distribution was based on a working period. During the working period of ≥ 5 years, there were 10 people (33.3%) who experienced NIHL, and 20 people (66.7%) who did not experience NIHL. During the working period < 5 years, two people (11.1%) experienced NIHL, and 16 people (88.9%) did not experience NIHL ($p=0.081$). In conclusion, no significant relationship exists between the work period and NIHL at PT.Kayu Perkasa Raya.



INTRODUCTION

¹¹ Noise Induced Hearing Loss (NIHL) is a hearing loss caused by hearing threshold values in the workplace. NIHL can have an impact on decreasing the quality of workers because it can cause headaches, sleep disturbances, and a lack of concentration at work (Endra *et al.*, 2021). NIHL can be caused by the duration of exposure, intensity, and spectral noise (Abraham *et al.*, 2019).

³ According to data from the World Health Organization, it is estimated that around 466 million people have hearing loss, and by 2030 there will be approximately 630 million people. WHO estimates that Asia Pacific, South Asia, and Africa have a four times higher prevalence of hearing loss than other regions. Asia Pacific ranks fourth in the prevalence of hearing loss (6.90%) (OMS, 2018). Based on data from the National Committee for Hearing Loss and Deafness, Indonesia has the highest ranking in Southeast Asia, with around 36 million people affected ¹⁴ noise-induced hearing loss (Rizqi Septiana *et al.*, 2017).

A study conducted by Shaza *et al.* at Adi Sumarmo Airport obtained results with workers with a working period of more than five years, as many as 13 people consisting of 7 people experiencing NIHL and 6 people not suffering from NIHL. In comparison, there were 36 people with a working period of less than 5 years, consisting of 35 people who did not suffer from NIHL and n who experienced NIHL (Shaza, Sudrajad and Nugroho, 2017).

Exposure to noise for a particular time and intensity can cause the hair cells in the cochlea to become stiff, resulting in a lack of stimulation. Hair cells die because the stereocilia are lost and replaced by scar tissue. If the intensity and duration increase, the supporting cells and hair cells will be damaged (Bashiruddin and Soetirto, 2017). Hearing threshold values that

exceed 85 dB can cause damage to the inner ear of the organ of Corti. The threshold value is set as a guide so as not to cause ¹⁸aring loss. According to the Regulation of the Minister of Manpower and Transmigration Number 13 in 2011 regulates the threshold and chemical factors; the threshold value is 85 dB with a noise exposure time of 8 hours/day (Menteri Tenaga Kerja dan Transmigrasi Republik, 2011).

The diagnosis of NIHL can be obtained from anamnesis, which includes complaints of poor hearing, which can be accompanied by tinnitus (ringing in the ears) and impaired communication, especially in crowded areas (cocktail party deafness). There is a history of continuous exposure to environmental noise (work or residence) for > 5 years. An increase in blood pressure, pulse, and heart rate may accompany the physical examination. Rinne's tuning fork test is positive, and Weber's is lateralized towards the more hearing ear, Schwabach's is shortened. Pure tone audiometry supporting examination revealed high-frequency SNHL (3000-6000Hz); there was a notch at 4000Hz. Speech audiometry is a recruitment phenomenon (Bashiruddin and Soetirto, 2017).

Several studies state that one of the sectors with a high noise level is wood processing (Zheng, Juang and Yiin, 2020). A study conducted in Nepal with a noise frequency of up to 93.9 dB found that 44% of carpenters and 31% of carpenters met the NIHL criteria (Robinson *et al.*, 2015). Abdul Malik 2020 stated that the characteristics of carved furniture workers in Petekeyan Jepara village were not using personal protective equipment when working, including ear protectors (Malik and Kristina, 2020). This is a risk of NIHL occurring in workers.

Based on this background, this study aimed to investigate whether there is a relationship



between work experience and the incidence of NIHL in PT. Kayu Perkasa Raya workers. This company operates in the medium-scale furniture industry located in Pati, with 100 employees. Sixty production workers were exposed to noise intensity of 87-89 dB, most of whom had worked >5 years.

METHODS

The type of research used was quantitative with observational analytic methods. The research design used cross-sectional, a study between measurement and observation variables that were carried out simultaneously. The sampling technique used was purposive sampling. The population in this study was the production section workers of PT. Kayu Perkasa Raya was exposed to more than 88-89 dB noise. Inclusion Criteria: willing to undergo examination, aged 17-60 years. Exclusion criteria: exposure to noise outside of work, such as listening to loud music, shooting, currently experiencing inflammation of the ear, suffering from congenital abnormalities, taking ototoxic drugs, and having experienced acoustic trauma such as an explosion. By using a total sampling of 60 employees in the production section. This

research was conducted at PT. Kayu Perkasa Raya in December 2022.

The research was carried out by collecting primary data through anamnesis questionnaires and followed by an audiometric examination. This examination was conducted in a quiet room, one by one, and by an audiometric expert. The tool used was a calibrated LK-225 LCD Digital Audiometer. The data analysis used was univariate and bivariate analysis using the Chi-Square test. This research was conducted after issuing a letter from the Ethics Commission of the Faculty of Medicine, Muhammadiyah University of Semarang No.: 105 / EC / KEPK-FK / UNIMUS / 2022.

RESULTS

Univariate Analysis

Table 1. shows that most respondents aged ≥ 40 years were 25 people (52.1%). During their working period, the majority worked ≥ 5 years, namely 30 people (62.5%). Most respondents did not experience NIHL, as many as 36 people (75%).

Table 1. Characteristics of Respondent

Variable	Frequency	%
Age		
≥ 40 years	25	52.1
< 40 years	23	47.9
Work period		
≥ 5 years	30	62.5
< 5 years	18	37.5
NIHL		
NIHL	12	25.0
Non NIHL	36	75.0



Bivariate Analysis

Table 2. Correlation between working period with NIHL

Variable	NIHL				P	OR (95% CI)
	NIHL		Non NIHL			
	N	%	N	%		
Work Period						
≥ 5 years	10	33.3	20	66.7	0.081 [†]	4.00 (0.77 – 20.92)
< 5 years	2	11.1	16	88.9		

Table 2 shows no relationship between length of service and the incidence of noise-induced hearing loss at PT. Kayu Perkasa Raya. Based on work experience ≥ 5 years, 10 people experienced NIHL and 20 people did not experience NIHL. During work period < 5 years, 2 people experienced NIHL, and 16 people did not experience NIHL.

DISCUSSION

The results of this study obtained a p-value of 0.081, which means that there is no relationship between years of service and the incidence of noise-induced hearing loss. This is supported by research conducted by Prasetyowati et al. on 10 finishing workers in Banyumas district. The results of the analysis test using simple regression, the sound intensity variable obtained results $p = 0.178 > \alpha (0.05)$ and length of service $p = 0.806 > \alpha (0.05)$, which means there is no relationship between sound intensity and years of service with complaints of disturbance hearing in workers because the workers move from place to place (Prasetyowati, Wangge and Purwitoadi, 2019).

Based on the research results of age distribution at PT. Mighty Wood at most. ≥ 40 years as many as 25 people (52.1%). During their working period, the majority worked ≥ 5 years, as many as 30 people (62.5%). Most respondents did not experience NIHL, as many as 36 people (75%). This was following research conducted

by Endra and Setyawan Harris, which stated that older humans will experience pathological changes in the hearing organs. People over 40 will experience significant hearing loss, making them more susceptible to noise-induced hearing loss (Endra *et al.*, 2021).

Based on research conducted at PT. Kayu Perkasa Raya, the distribution of working years is at ≥ 5 years, namely as many as 30 people (62.5%). Because the majority of employees who work ≥ 5 years are <40 years old. This follows research conducted by Kantu et al. on 18 respondents who obtained a p-value = 0.066 (> 0.05). It means there is no relationship between the length of work and incidents due to noise in the workplace. The results are not related because the workers are <40 years old, which causes no degenerative process (Kantu, Jusuf and Prasetya, 2022).

NIHL is based on a mechanism in the form of mechanical and metabolic stress in the sensory organs or damage in the cochlea, specifically in the organ of Corti. Hair cells in the organ of Corti show increased degeneration with duration and intensity of exposure. Increasing the intensity and duration of exposure will cause the outer hair cell stereocilia to become stiff, resulting in a lack of reaction to stimuli. The basal area is the first area to be affected. Because the stereocilia are lost, the hair cells die and are replaced by scar tissue (Chen, 2020). Suppose the intensity and duration increase, the hair and supporting cells will be damaged.



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Neurodegeneration can result from extensive damage to hair cells, this can be found in the auditory neurons of the brainstem (Bashiruddin and Soetirto, 2017). Exposure to high-energy noise will cause damage to peripheral hearing organs and cause a temporary increase in the hearing threshold (TTS or temporary threshold shift) (Sliwinska-Kowalska, 2020).

While the workers lack discipline in their work, the workers often turn off the machine, causing not full exposure to noise for 8 hours. In addition, there is also a rolling of workers between production and non-production. To reduce the risk of hearing loss due to noise in the workplace, workers can wear ear protection such as earplugs or earmuffs (Bashiruddin and Soetirto, 2017).

The results of this research follow Rezky Abdullah's 2020 research, which examined NIHL in PT Semen Tonasa workers South Sulawesi. There is no relationship between the length of service and the type of deafness (Abdullah, Purnomo and Ihsani, 2020). The results of Rezky Abdullah's research align with the study of Hidayat et al. (2019) who previously conducted research in the same place that the length of work may not be related to the type of deafness (Hidayat et al., 2019). Semen Tonasa has implemented a mutation system for workers for a certain period, but the time and number of workers transferred are still minimal. Besides the company's mutation system, workers with a medical check-up and abnormal results can request to be transferred and processed to move to another work unit (Abdullah, Purnomo and Ihsani, 2020).

The results of this study are not following research by Rina et al., which examined the working period of 77 worker respondents who

were exposed to noise. The results showed that there was a significant relationship between work experience and the incidence of NIH. (Rina, Sukwika and Abdullah, 2021) This study's results are also not in accordance with Lazuardi's research that stated there is a relationship between the length of service, attitudes, and use of ear protection equipment with hearing loss in employees at PT. ICSM Liang Anggang Village, Bati-Bati District, Tanah Laut Regency (p-value = 0.000) (Lazuardi, 2020). This difference is because most workers in this study have less disciplined work hours. There is a habit of coming to work late, taking longer breaks, and leaving early. Meanwhile, some workers are disciplined according to the rules. This causes bias in the work period variable, which is one of a weakness of this study.

This research also has limitations because it only analyzes work period variables. Further research needs to be conducted that examines several risk factors for NIHL, such as noise exposure, comorbid diseases, use of ear protection, exposure to noise in the living environment, and habit of using headsets/earphones (WHO, 2018) (Armia Putri, Halim and Suryani Nasution, 2021).

CONCLUSION

Production workers at PT Kayu Perkasa Raya are exposed to production machine noise with an intensity of > 85dB. Most production workers have worked for >5 years. This causes the risk of NIHL in workers. Despite this, only a small percentage of production workers suffer from NIHL. There is no significant relationship between work period and the incidence of NIHL PT. Kayu Perkasa Raya workers.



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