BKM Public Health & Community Medicine
Berita Kedokteran Masyarakat

Volume 40 **Number** 11, 2024, **Pages** e12334
DOI: 10.22146/bkm.v40i11.12334

Earplug usage routine with tinnitus and hearing loss among food processing factory workers

Julita Melisa Dewi[1]*, Dwi Marliyawati[1], Muyassaroh[2]

Submitted :
February 23rd, 2024
Accepted :
November 25th, 2024
Published:
November 30th, 2024

[1]Department of Otorhinolaryngology-Head and Neck Surgery, Faculty of Medicine Dipenogoro University, Semarang, Central Java, Indonesia

[2]Dr. Kariadi Semarang General Hospital, Semarang, Central Java, Indonesia

***Correspondence:**
ijulitamelisa@gmail.com

Abstract

Purpose: The earplug usage routine for workers exposed to noise serves as a preventive measure against the adverse effects of noise. Approximately 76.9% of earplug usage routines that are not adhered to during work are associated with tinnitus and hearing loss among workers. To know the correlation between earplug usage routine and the incidence of tinnitus and hearing loss among production workers. **Methods:** Analytical descriptive research with a cross-sectional design. A sample of workers exposed to noise in the production section of the food processing factory (92-110 dB) reported experiencing tinnitus and hearing loss. Tinnitus and earplug usage routines were assessed from the anamnesis, hearing loss was evaluated based on audiometry results, and noise level was measured using a sound-level meter. Data analysis was done using the chi-square test. **Results:** All samples consisted of 80 males, with an age range of 28 to 54 years (mean age 47.78±8.74 years). The duration of occupation was>10 years for 62 (77.5%) and <10 years for 18 (22.5%). Tinnitus was present in 48 samples (60%), hearing loss in 61 samples (76.25%), and routine earplug use in 51 samples (63.75%). Notably, earplug usage routines correlate with both the incidence of tinnitus ($p < 0.000$) and hearing loss ($p < 0.000$). **Conclusion:** The routine use of earplugs correlates with tinnitus and hearing loss in workers exposed to noise.

Keywords: earplug; hearing loss; noise; tinnitus

INTRODUCTION

Tinnitus and hearing loss are hearing disorders that can be caused by various conditions affecting the outer, middle, and inner ear, which may result from exposure to loud noise during production. Ministry of Manpower regulations specify an intensity limit of 85 dB for a work environment, with a maximum exposure of 8 hours. According to the Occupational Safety and Health Administration, noise exposure limits depend on the length of exposure, frequency, noise intensity, and individual sensitivity. High-scale noise has a greater impact on hearing than low-frequency noise [1].

There are an estimated 22.4 million workers worldwide who are exposed to high noise levels [2]. Workers worldwide, especially in developing countries, experience hearing loss due to noise, affecting approximately 7-21% of workers [3]. According to the National Committee for the Prevention of Hearing Loss and Deafness in Indonesia, in 2014, approximately 36 million, or 16.8% of the total population, experienced hearing loss due to noise exposure. This figure is among the highest in Southeast Asia [1].

The last study reported that the misuse of earplugs among workers caused tinnitus and poor hearing. Of the 10 workers observed, six (60%) did not use personal protective equipment (PPE) while working [4]. Other research on vehicle factory workers in Pakistan has shown that 78.4% of workers who occasionally use earplugs have been diagnosed with noise-induced

hearing loss (NIHL) [5]. Prevention measures can be taken, including wearing ear protection according to the noise intensity, which is commonly used in the work environment [6,7]. Research on tinnitus and hearing loss criteria at various decibel levels, including the use of earplugs in factories, has not been conducted in Semarang. This research aims to investigate the relationship between earplug usage routines and the incidence of tinnitus and hearing loss among workers exposed to noise in food processing factories.

METHODS

Analytical descriptive research with a cross-sectional design. The sample consisted of workers exposed to noise in a food processing production factory with a noise intensity of 92-110 dB. Noise levels were measured using a sound level meter. Tinnitus and earplug usage routines were identified from the anamnesis, and hearing loss was assessed from the audiogram results. Prior hearing loss, systemic disease, tympanic membrane perforation, and a history of smoking were excluded. The sample size determined was 80. This research has received ethical approval number 1533-EC-KEPK-RSDK-2023 for data analysis using the Chi-Square test.

RESULTS

This study found that all respondents were male, aged 28 years to 54 years, with an average age of 47.78±8.74 years. Table 1 shows that 55 workers (68.75%) were aged between 50 and 59 years. A total of 62 workers (77.50%) had been working for more than 10 years. Additionally, 51 workers (63.75%) routinely used earplugs. Furthermore, 58 respondents (72.50%) did not experience tinnitus, while 61 workers (76.25%) had hearing loss.

Table 2 presents the distribution of tinnitus and hearing loss among the workers. Of the 80 individuals studied, 37 workers (46.25%) experienced both tinnitus and hearing loss, while 30 workers (37.50%) exhibited neither condition. A smaller portion experienced either tinnitus (13.75%) or hearing loss (2.50%) only.

Table 3 shows a significant correlation between earplug usage and the incidence of tinnitus and hearing loss. Among workers who routinely used earplugs, only 3 experienced tinnitus, and 10 experienced hearing loss. In contrast, among those who did not routinely use earplugs, 19 reported tinnitus and 51 reported hearing loss. The p-values (0.01 for tinnitus and 0.00 for hearing loss) indicate statistically significant associations.

Table 1. Characteristic of respondents (N=80)

Characteristics	n (%)
Age (years old)	
< 30	6 (7.50)
30 – 39	6 (7.50)
40 – 49	13 (16.25)
50 – 59	55 (68.75)
Duration of occupation (years)	
<10	18 (22.50)
>10	62 (77.50)
Routine use of earplugs	
Yes	51 (63.75)
No	29 (36.25)
Tinnitus	
Yes	22 (27.50)
No	58 (72.50)
Hearing loss (audiometry)	
Yes	61 (76.25)
No	19 (23.75)

Table 2. Distribution of tinnitus and hearing loss among workers

Tinnistus	Hearing loss	
	Yes	No
Yes	37 (46.25)	11 (13.75)
No	2 (2.50)	30 (37.50)

Table 3. The correlation between earplug usage routine and hearing loss and tinnitus

Earplug usage routine	Tinnitus		Hearing loss		*p*
	Yes	No	Yes	No	
Yes	3	36	10	0	0.01
No	19	26	51	19	0.00

(*p*=p-value)

DISCUSSION

The results of this study showed that all samples were male, comprising 80 (100%). The samples were workers exposed to noise (92-110 dB). The average age is 47.78 ± 8.74, with the most common age group being 50-59 years (n = 55; 68.75%). This finding aligns with previous research, which has shown that hearing loss often occurs in individuals aged 40 years or older (90.50%) [4]. Age is a factor that does not directly influence subjective complaints of hearing loss due to noise; however, individuals aged over 40 years are more likely to experience hearing loss and are more susceptible to noise-induced trauma [4].

The duration of Occupation for more than 10 years in this study was 62 workers, or 77.5%. Following previous research, furniture workers in Pekanbaru exhibited a high incidence of NIHL (78%) among those who had worked for more than 16 years. The duration of occupation factor influenced the hearing threshold value, due to the absence of a worker rotation system every five years [8]. The research results showed that 22 samples (27.25%) complained of tinnitus in both ears. The audiometry results of 61 workers (76.25%)

showed poor hearing, while those of 19 (23.75%) were typical. Thirty-seven samples (46.25%) diagnosed hearing loss and tinnitus. High-intensity noise that persists for at least 5 years will cause metabolic and vascular changes [9,10]. The tearing of the hair cells in the organ of Corti leads to degenerative damage, which in turn causes the destruction of the organ and results in permanent hearing loss. Complaints can include hearing loss and slowly progressive ringing in the ears[6].

Noise intensity is one of the factors associated with hearing loss. Many workers experience hearing loss due to prolonged exposure to loud noise, which can last 8 hours or more. Workers continue to be exposed to noise due to the activities and presence of these workers [11,12]. In this study, noise intensity measurements were obtained using a sound level meter application as the measuring instrument. The measurement results indicate that the average noise intensity ranges from 92 to 110 dB.

Hearing loss due to noise exposure occurs in several stages. The first stage typically begins after 10–20 days of exposure. In the second stage, complaints of ringing in the ears (tinnitus) start to appear, although they may not be continuous. This stage can last for months or even years. In the third stage, workers begin to experience hearing loss, as they become unable to distinguish certain sounds, especially when other sounds are present. The fourth stage, Noise-Induced Hearing Loss (NIHL), occurs clearly [13].

The risk of NIHL can be prevented by using Personal Protective Equipment (PPE). According to the Minister of Manpower and Transmigration Regulation Number PER.08/MEN/VII/2010, an earplug is a device to protect against noise or pressure. PPE is the lowest level of use in the workplace compared to other PPE, namely 12% [14]. Tinnitus can also occur if workers are exposed to excessive noise, so implementing an earplug usage routine can help reduce the noise exposure received by workers. The majority of workers, or 76.9%, who never used earplugs at work, experienced tinnitus [15].

The routine use of earplugs in this study was 51 samples (63.75%) of workers who regularly used earplugs. This is due to the high level of awareness and supervision of earplug use at this factory. The use of APT in the form of earplugs is essential for workers with a work environment exceeding the 85 dB threshold and without worker rotation. Routine use of earplugs was associated with tinnitus ($p = 0.01$) and hearing loss ($p = 0.00$). This study builds upon previous research demonstrating a correlation between earplug usage routine ($P = 0.029$) and the development of hearing loss and tinnitus in workers [12].

For factories, it is best to provide PPE at every part that is exposed to noise and carry out health promotions to increase awareness among workers about using earplugs. This should be followed by rotating workers and conducting periodic hearing checks. Workers exposed to noise should use earplugs while working to reduce the risk of tinnitus and hearing loss in the future. The study will help company owners and the government identify the working conditions of workers in noisy environments, enabling them to make necessary adjustments to policies and regulations governing factory noise levels.

CONCLUSION

Noise in the workplace, combined with workers who do not routinely wear earplugs, can cause tinnitus and hearing loss. Based on research, there is a correlation between earplug usage routines and the development of tinnitus and hearing loss.

REFERENCES

1. Septiana NR, Widowati E. Gangguan pendengaran akibat bising. HIGEIA (Journal of Public Health Research and Development). 2017;1(1);73-82.
2. Neitzel RL, Fligor BJ. Risk of noise-induced hearing loss due to recreational sound: Review and recommendations. The Journal of the Acoustical Society of America. 2019;146(5):3911.
3. Lie A, Skogstad M, Johannessen HA, et al. Occupational noise exposure and hearing: a systematic review. International Archives of Occupational and Environment Health. 2016;89:351-372.
4. Marwanto A, Mualim M. Faktor yang berhubungan dengan gangguan pendengaran pekerja di industri pengolahan karet PT. X Kabupaten Seluma Bengkulu. Mitra Raflesia (Journal of Health Science). 2020;12(2).
5. Jamal A, Tanoli Q, Putus T, Savolainen H, Liesivuori J. Noise induced hearing loss and its determinants in workers of an Automobile manufacturing unit in Karachi, Pakistan. Madridge Journal of Otorhinolaryngology. 2016;1(1):1-11.
6. Soetjipto D, Zizlavsky S. Polusi bising dan gangguan pendengaran akibat bising (GPAB). In: Mangunkusumo, editor . Buku teks komprehensif Ilmu THT-KL. Jakarta: EGC; 2019. pp. 115.
7. Hameed S, Chethana K, Sunu Z, Kiran KG. Awareness and usage of personal protective equipment among construction workers and their hearing assessment by pure tone audiometry: A cross-sectional study in South India. Journal of

Family Medicine and Primary Care. 2021; 10(11):4072-4076.
8. Suryani, Mulyadi A, Afandi D. Analisis gangguan pendengaran tipe sensorineural pada pekerja akibat kebisingan di industri mebel kayu di Kota Pekanbaru. Jurnal Ilmu Lingkungan. 2015;9(1):1–11.
9. Eryani YM, Wibowo CA, Saftarina F. Faktor risiko terjadinya gangguan pendengaran akibat bising. Medula. 2017;7(4):112–117.
10. Ibrahim H, Basri S, Hamzah Z. Faktor-faktor yang berhubungan dengan keluhan gangguan pendengaran pada tenaga kerja bagian produksi PT. Japfa Comfeed Indonesia, Tbk. Unit Makassar tahun 2014. Al-Sihah The Public Health Science Journal. 2016;8(2):121–129.
11. Anggraini MT. Hubungan intensitas kebisingan dan penggunaan alat pelindung diri dengan gangguan pendengaran pada pekerja pabrik tekstil. Jurnal Ilmiah Kesehatan. 2022;21(3).
12. Chayandari DRH, Harahap PS, Harianto I. Hubungan intensitas kebisingan dengan gangguan pendengaran pada pekerja wood preparation di PT. Lontar Papyrus Pulp and Paper Industry tahun 2021. Jurnal Inovasi Penelitian. 2023;3(12).
13. Harrianto R, Hardiyanti EA. Buku ajar kesehatan kerja. Jakarta: EGC;2009.
14. Kementrian Tenaga Kerja RI. Peraturan Menteri Tenaga Kerja No. PER.13/MEN/X/2011 tentang nilai ambang batas faktor fisika dan faktor kimia di tempat kerja. Jakarta: Kementrian Tenaga Kerja RI. 2011. Available from: [Website]
15. Syah PB. Effect of using hearing protection and earphone on noise-induced hearing loss and tinnitus in workshop workers. Jurnal Kesehatan Lingkungan. 2018;9(1):21-30.