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Noise induced hearing loss among furniture factory workers PT Chitose Cimahi

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ABSTRACT

Noise Induced Hearing Loss (NIHL) is a quite common health problem among factory workers, including furniture manufacturing factories. Noises above the threshold intensity for a long time can conduct to hearing loss, either temporary or permanent. If this is not taken seriously, it conducts to auditory and non-auditory impacts. The purpose of the study was to determine the prevalence of noise-induced hearing loss, worker characteristics, length of work, PPE use habits and auditory/non-auditory symptoms among workers at PT Chitose in Cimahi, West Java. Subjects were 66 workers consisting of 62 men and 4 women who were selected by total sampling, with a cross-sectional descriptive research method. Anamnesis was performed by filling out a questionnaire, physical examination of the ear, and pure tone audiometry. The results showed that the prevalence of NIHL was found in 37 people (56%). Out of patients with NIHL the average age was 37.8 years, male gender 95%, the workplace was from production department 73%, the average length of work was 16.6 years, never used PPE 54%. The most perceived auditory symptoms were tinnitus 54%, and the most non-auditory symptoms were difficulty sleeping 19%. The prevalence of NIHL among PT Chitose Cimahi workers is quite high. This is due to exposure to noise and is influenced by various risk factors. Occupational preventive program is needed from the company and rehabilitation for workers to overcome this. In conclusion, hearing loss found in PT Chitose Cimahi furniture factory workers is hearing loss caused by noise.

Keyword: factory, furniture, hearing loss, noise, workers

INTRODUCTION

Noise induced hearing loss (NIHL) is one of the most common occupational diseases particularly in several types of industries. Occupational Noise induced hearing loss (ONIHL) is a significant health worldwide problem. Worldwide, ONIHL is responsible for 16% of cases of disabling hearing loss in adults. ONIHL does not directly increase the mortality rate but does result in serious disability and reduce quality of life. [1-4]

The impact of ONIHL is an enormous increase in financial burden and

disease, both individually and socially. The economic burden on communities is very high and continually increasing. Several studies have shown that workers in construction, agriculture, utility, manufacturing, mining, and transportation, industries, military personnel, and musicians are at the highest risk for ONIHL. [5-8]

Indonesia is one of 4 countries with a fairly high prevalence of deafness, by 4.6%. The other 3 countries are Sri Lanka (8.8%), Myanmar (8.4%) and India (6.3%). Although not the highest, the prevalence of 4.6% is quite sufficient to be able to cause social problems in the community. One survey result in Indonesia noted that in 8 provinces of Indonesia, where the prevalence of ear, nose and throat (ENT) morbidity was 38.6%; and NIHL cases, ear morbidity was 18.5%, hearing loss 16.8% and deafness was 0.4%.[9] Hong found out that there were significant NIHL problems among operating engineers in construction industries in US· Over 60% of a total of 623 op operating engineers showed hearing loss in the noise-sensitive higher frequencies of 4 and 6 kHz [6]

According to Factory and Machinery Act 1989 a worker should not be exposed to noise level greater than 85dB(A) for 8 hour ito avoid the risk of hearing loss. [10]Loud noise produces sound waves that damages the tiny hair cell in the organ corti within the cochlea of the inner ear, and may cause trauma to ears, can cause damage and result in hearing loss.[11]

There are other risk factors that increases the likelihood of ONIHL. These includes age, cardiovascular disease, diabetes, smoking, chemical exposure, temperature and noise related activity or hobby.[12,13]

A recovery period is required after one noise exposure for the hair cells to return to their original position to overcome hair cell damage caused by noise exposure in the workplace. The use of Personal Protective Equipment (PPE) is mandatory to reduce noise intensity so as to minimize the occurrence of NIHL. [23]

PT. Chitose International is one of the companies in the furniture industry located in Cimahi| [14] This study investigates NIHL among furniture industry workers PT Chitose in Cimahi Indonesia with particular emphasis on prevalence, characteristics, risk factors and auditoric/nonauditoric effect. The purpose of this study was to (1) determine the prevalence of noise-induced hearing loss among workers in furniture industry PT Chitose Cimahi, (2) determine the risk factors among workers (3) determine the auditory and non auditorysymptoms among workers (4) the Personal Protection Equipment habit

METHODS AND SUBJECT

The design of this study was cross sectional with descriptive observation. The research was conducted the furniture industry workers of PT Chitose in Cimahi Indonesia. Research was conducted in December 2021. The population of this study were all PT Chitose furniture workers who met the inclusion criteria, by aged 15 - 64 years; never worked in other noisy places; have no history of hearing disease; and willing to be a respondent. The data obtained were worker characteristics, length of work, PPE use habit, smoking status and auditory/non-auditory symptoms and audiometric test for both ears among workers at PT Chitose in Cimahi, West Java. The data collection technique was carried out by interview using a questionnaire and audiometric examination with an audiometer. The ethical approval from the ethics committee of RS Dustira with the number Etik,RSD/034/VIII/2021.

RESULTS AND DISCUSSIONS

Of the 66 people who were screened, there were 37 (56%) people who experienced noise-induced hearing loss from the results of the audiometric examination. The results are shown in table 1.

Table 1 Audiometric Result of PT Chitose workers

Audiometric result	**N**	**%**
NIHL	37	56
Not NIHL	29	54
Total	66	100

From table 1, we can see that more than half of the workers who were screened had NIHL. Age ranges from 22-49 years, with an average of 37.8 years. 35 were men (95%) and 2 women (5%). Most of the workers in the furniture industry are male and young adult. The workplaces of workers with NIHL can be seen in table 2

Table 2. The workplace of workers with NIHL

Workplace	**N**	**%**
Sizing	1	3%
Production	27	73%
Operator	4	11%
Construction	2	5%
Technician	2	5%
Enginering	1	3%
Total	37	100%

Table 2 shows the distribution of workers with NIHL and its workplace. Data from table 2 said that majority of the workers work at production department (73%), operator (11 %), construction (5%), technician (5 %), and mechanis (3 %). Their nature of work involved physical work duty and constantly exposed to noise. This result in agreement with previous research that discovered manual labor workers from construction has high risk of hearing loss.

Workers from the production division had the highest percentage and this condition in good agreement with previous research that 68% of machine operators were exposed time-weighting average of 85 dBA and 18% of them exceeded the permissible limit of 95 dBA. Another study also found that the machine or heavy equipment operator had the highest noise exposure level.[2, 15] Table 3 shows the work duration of workers with NIHL.

Table 3**.** Work duration of workers with NIHL

Work duration	**Frekuensi(year)**
Minimal	0,3
Maximal	30
Average	**16,6**

Table 3 describes the work duration range is about 0.3 years (4 months) to 30 years. NIHL commonly happens on the duration of 5-15 years, but in PT Chitose Cimahi it happened with a shorter duration, depend on the loud intensity and other risk factors. The habitual pattern of using personal protective equipment showed in table 4.

Table 4. PPE Use Habit

PPE		N	%
PPE Availability	Not available	17	46
	Available	20	54
PPE types	Ear plug	17	46
	Ear muff	0	0
	Helmet	0	0
PPE use habit	Always	6	16
	Sometime	11	30
	Never	20	54

The data from table 4 shows that the company provides earplugs, but most of the workers (46%) said that PPE is not available in the workplace. Most likely because the company had provided PPE but did not monitor the availability of PPE on a regular basis. Most workers (54%) have never used PPE when working in a noisy place. 30% of workers said they sometimes use ear protection and 16% of workers said they never use ear protection. Strict monitoring from relevant institutions regarding the availability of ear protective equipment and worker discipline to use PPE for workers is very important. Table 5describes the types of symptoms experienced by workers exposed to noise.

Table 5. Workers Symptom

Symptom		N	%
Auditory	Tinitus	9	24
	Hearing Loss	5	14
	Difficult to understand speech	3	8
	NA	23	6
Non Auditory	Concentration disorders	2	5
	Insomnia	7	19
	Anxious/Pounding	1	4
	NA	27	73

The data from table 5 describes the symptoms in workers with NIHL. Symptoms due to NIHL are divided into auditory and non-auditory symptoms. Most of the workers said there were no auditory symptoms (62%), 24% of workers experienced tinnitus, 14% of workers symptomed of hearing loss and 8% symptomed of difficulty understanding speech. 73% of workers said there were no non-auditory symptoms, 19% of workers symptom of insomnia, 5% of workers had concentration problems and 4% of workers

symptomed of anxiety. Table 6 describes the risk factors found in workers who experience NIHL. The risk factor for hypertension was found in 2 workers (5%) none of them experienced hypercholesterolemia, smoking habits were found in 21 workers (57%), and lifestyle exercise habits found that most of the workers sometimes did sports (76%) by 1- 2 times a week.

Tabel 6. Risk Factor of Workers with NIHL

Risk Factor		N	%
Other Disease	Hypertension Diabetes Hypercholesterol NA	2 35	5 95
Smoking	Yes No	21 16	57 43
Sport	Yes Sometime No	1 28 8	3 76 22

DISCUSSION

Noise Induced Hearing Loss (NIHL) is sensorineural deafness that occurs as a result of strong effects of noise over a long period time. NIHL is usually caused by the work environment or is often called Occupational Noise Induced Hearing Loss (ONIHL). Exposure to more than 85 dB 8 hours or more in a day will damage the hair cells in the inner ear and can cause permanent hearing loss. Occupational Safety & Health Administration (OSHA) and the World Health Organization (WHO), set an average or Permissible Exposure Level (PEL) of 90 dB for 8 hours of work per day in accordance with OSHA and Threshold Limit Values (TLV) of no more of 85 dB for eight hours per day or 40 hours per week, as well as vibrations of no more than 4 m/s2 according to WHO and ACGIH 25.27. The definition of noise is unwanted sound and can interfere with or endanger health (Permenkes no. 718 (1987). If the noise level in an area and work environment exceeds the permitted threshold (Kep. MENLH No. 48 of 1996 and Kep. Manaker No. 51 of 1999), it is necessary to handle the sources and creeping points.[16-19]

There were 66 workers in the furniture industry at PT Chitose Cimahi who had their hearing checked and 37 of them (56%) were proven to have NIHL based on the results of the audiometric examination. Research conducted in Indonesia in a steel smelter, found that the prevalence of NIHL was 31.55% at a noise exposure level of 85-105 dB .[22] This research is also strengthened based on the annual report of the Directorate of Housing Environmental Health (PLP) found that noise disturbance in various industries averages above 85 dB, all of which have the potential to cause health problems in the community.[23]

NIHL is a disease that cannot stand alone or is affected by various factors, one of which is age. Patients who experienced NIHL at PT Chitose were in the age range of 22-49 years with an average of 37.8 years, the range that should be no age-related hearing loss. This is in accordance with the literature which states that age is a factor that has a very large influence on NIHL.[19,23] Age is one of the confounding variables for NIHL, where the older a person the more likely he is to suffer from NIHL. Each person has different adaptation to the dangers of noise in his work environment. As they age, their adaptability will decline which can affect their health and in the end can interfere with their performance in the company which will ultimately harm the company. As one way to

avoid or reduce this, the company should move its employees to a new safer work location. Another way is to rotate employees at least once every three years at different work locations. NIHL shows a trend towards older age although some unconventional cases are younger. However, the younger NIHL in the case of PT Chitose Cimahi workers showed a significant influence of risk factors. Most high cases show a combination of high influence from noise exposure, aging and other risk factors such as lifestyle or health condition. [1,19,23]

The sex distribution of the respondents in this study was mostly male 35 people (95%) while only 2 respondents was female (5%). This is because most of the factory employees are male. Most of the furniture factory employees are male, this is different from the garment factory where the opposite is true. The working procedure between the furniture and garment factories is different, where the furniture factory is the process of making hard products, while the garment requires more accuracy and tends to employ female workers. Gender is one of the confounding variables for NIHL.[1]

Data from PT Chitose states the works has NIHL is working in the production department (73%). Work mechanism at each department has different loudness exposure. Noise intensity is a variable that has a significant relationship and has the greatest influence on NIHL. Workers in places with high noise intensity in their work environment will have a risk of experiencing NIHL one times greater than respondents with low noise intensity at work. [24] The work process at PT Chitose consists of sizing, production, operators, construction technicians and engineering departments. The production department is the part with the highest noise level compared to other departments because. Noise control in the workplace can be addressed in various ways, such as isolation of machinery, placement of barriers in the way of transmitting vibrations, sound suppression and the use of earmuffs or earmuffs or both in the workplace. In addition, the noise level is also affected by the noise intensity, noise frequency, length of exposure per day, the longer the exposure, the riskier, and period of work/stay.[24,25]

Various problems can be caused by noise, both its effect on worker productivity, company performance, health problems and a decrease in the quality of social life of sufferers as well as its impact on health. The effect of noise on health is divided into effects on hearing (auditory) and non-auditory.[26,27,28]

Auditory effects can be divided into 2 categories, Noise Induced Permanent Threshold Shift (NIPTS) and Noise Induced Temporary Threshold Shift (NITTS).[1,11,28] Noise Induced Temporary Threshold Shift is a temporary and non-pathological effect on hearing, where there is still recover after noise exposure. Recovery time varies, when resting outs from a noisy environment, hearing usually returns to normal. A person who is exposed to noise will experience various changes, initially the hearing threshold increases at high frequencies. On audiometric images it appears as a steep "notch" at 4000 Hz, which is also known as an “acoustic notch”. Workers may have difficulty on understanding speech in the early stages of hearing loss. The decreased hearing frequency is generally between 3000–6000 Hz in intensity. The hardest damage to the Corti apparatus for sound receptors occurs at 4000 Hz. In the early stages workers may not realize it because it is a slow and hidden process. This is only proven by audiometric examination. Gradually, the damaging effects of hearing loss will spread to the conversational frequency (500-2000 Hz), if high-intensity noise persists for a long time. Workers will start to feel deaf because they cannot hear the conversations around them. Noise Induced Permanent Threshold Shift (NIPTS) is a pathological and permanent effect on hearing, the damage generally occurs at the 4000 Hz frequency and slowly increases and spreads to the surrounding frequencies. At first a person will find it difficult to carry on a conversation in a crowded place, but when it spreads to lower frequencies it will be

difficult to hear low voices. They will get a notch starting at 3000-6000 Hz, and after some time the audiogram image flattens out at higher frequencies. Hearing loss at a frequency of 4000 Hz will continue to increase and can persist after 10 years and then its development becomes slower. [25.29]

In this study, the work duration of workers with NIHL ranged from 4 months to 30 years with an average of 16.6 years. There was 1 person who worked under 1 year and 9 people under 5 years old, probably due to the very high noise exposure in this furniture factory and other risk factors of these workers. The combination of risk factors for workplace conditions (noise, high temperature), age, smoking habits and the use of PPE can be the cause of the high degree of hearing loss in PT Chitose workers.[8,11,13] It takes 10-15 years to work in a noisy environment, but this also depends on the noise level and a person's sensitivity to noise. Other literature puts a duration from 3.5 to 20 years of exposure, some say only 10-15 years after exposure occurs. The patient may not realize that his hearing has been reduced and only discovered after an audiometric examination. This is influenced by individual susceptibilities, such as race, history of ear disease, cardiovascular disease, smoking, heredity, and other environmental conditions. noise and distance from the noise source.[19,29]

Non-auditory effects can be; illness due to stress (physical and mental/psychogenic stress), fatigue, changes in appearance, and communication disorders. Noise causes various disturbances in the workforce, such as physiological disorders, psychological disorders, communication disorders and deafness.[30]

Physiological effects that occur can be in the form of increased blood pressure (10 mmHg), increased pulse, narrowing of peripheral blood vessels, especially in the hands and feet, and can cause pallor and sensory problems. Psychological disorders can be in the form of discomfort, lack of concentration, difficulty sleeping, and irritability. If the noise is received for a long time, it can cause psychosomatic diseases such as gastritis, stress, fatigue, and others. Communication disorders are caused by masking effects (sounds that cover clear hearing) or impaired voice clarity. Conversational communication should be done by shouting. This problem can cause work interruptions, up to the possibility of errors due to not hearing a signal or warning sign; This communication disorder indirectly endangers the safety of the workforce. Very high noise can give the impression of walking in space or flying, which can cause physiological disturbances such as dizziness (vertigo) or nausea. In this study it was found that most of the workers with NIHL (73%) did not experience non-hearing disorders, while 19% said they had sleep disturbances and 5% lack of concentration problems.[18,23,24]

One that can affect NIHL is smoking. Cigarettes contain 28 cancer-causing agents, of which smoking increases the risk of cancer in humans (CDC). In Indonesia, one cigarette contains 12-20 chemicals depending on the type and brand. Of the 20 chemicals, only 1 (one) type of substance, Toluene, has symptoms of tinnitus which can affect NIHL (EHC 52, 1986), while 2 (two) other chemicals based on research can affect the results of the study. audiogram i.e. Carbon monoxide and Vinyl chloride [23,29]

Protecting workers from harmful noise in the workplace is the most effective way to prevent NIHL. Hearing protection or PPE should be used when engineering controls and work practices such as device substitution and elimination are not possible to reduce noise exposure to a safe level. PPE is a device designed to reduce the intensity of sound reaching the eardrum. Ear muffs, ear plugs, ear canal caps and helmets are the main types of hearing protection.[30] In this study, 54% of workers stated that they never used PPE, sometimes 30% and only 16% said they always used PPE. Each worker should have received individual training in the selection, installation, use, repair and replacement of hearing protection. The most common reasons reported by workers for not wearing hearing protection included

discomfort, hearing impairment, and the company's lack of supervision over the availability of ear protectors and the level of discipline in the habit of using PPE. The NIOSH recommendation says workers are required to wear hearing protection when performing work that exposes them to noise equivalent to or exceeding 85 dBA as an 8-hour TWA. Company's obligation is to provide free hearing protection to workers. The PPE must be able to attenuate enough noise to keep workers' "real world" exposure below 85 dBA as an 8-hour TWA. Workers exposed to single-impulse noise levels over 140 dBA, workers whose 8-hour TWA exposure exceeds 100 dBA should wear dual hearing protection (that is, they must wear earmuffs and earmuffs simultaneously).[29,30]

CONCLUSION

Noise is one of the harmful industrial pollutants and can cause hearing loss. Workers who work in the furniture industry are at high risk of hearing loss due to noise. Awareness should be raised among workers regarding the dangers of noise-induced hearing loss through continued education and training program. Companies should also implement better occupational health programs to reduce harm to workers. Further research studies should be conducted to assess the dangers of noise exposure in various other industries.

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DECLARATION OF INTERESTS

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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REFERENCES

1. Sliwinska-Kowalska M, Davis A. Noise-induced hearing loss. Noise Health 2012;14:p274-80
2. Mazlan N, Yahya K, Haron Z. Characteristic of Noise-induced Hearing Loss among Workers in Construction Industries. E3S Web of Conferences 34, 02025.2018.
3. T. Robinson, J. Whittaker, A. Acharya, D. Singh, and M. Smith. Prevalence of noise-induced hearing loss among woodworkers in Nepal: a pilot study. Int J Occup Environ Health. 2015; 21(1):p14-22.
4. J. Dement, K. Ringen, L. Welch, E. Bingham, P. Quinn. Hearing loss among older construction workers: Updated analyses. Am J Ind Med. 2018 Apr;61(4):p326-335.
5. Nelson D, Nelson R, Barientos MC. The global burden of occupational noise-induced hearing loss. Am J Ind Med. 2005 Dec;48(6):p446-58.
6. OS. Hong. Hearing loss among operating engineers in American construction industry. Int Arch Occup Environ Health. 2005 Aug;78(7):p565-74.
7. Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012;380:p2163–96.
8. Masterson EA, Bushnel PT, Themann CL, Morata TC. Hearing impairment among noise-exposed workers — United States, 2003–2012 MMWR Morb. Mortal. Wkly. Rep. 2016;65:p389–94.
9. Kemenkes RI. Kemenkes Terus Upayakan Kurangi Masalah Gangguan Pendengaran, Direktorat Jenderap Pencegahan dan Pengendalian Penyakit, Available at http://p2p.kemkes.go.id/kemenkes-terus-

upayakan-kurangi-masalah-gangguan-pendengaran/ accessed on 2022 March 20th
10. National Institue of Environmental Health Science. Hearing protection. NIEHS. Connecticut. 2010.
11. P. Dawes, H. Fortnum, D.R. Moore, R. Emsley, P. Norman, K. Cruickshanks, K. Munro. Characteristic of Noise-Induced Hearing Loss among workers. Ear Hear. 2014
12. J. Shargorodsky, S.G. Curhan, R. Eavey, G.C. Curhan. A Prospective Study of Cardiovascular Risk Factors and Incident Hearing Loss in Men Laryngoscope. 2010; 120(9):p 1887–91.
13. O. Hong, J. Buss, E. Thomas. Type 2 diabetes and hearing loss. Disease-a-month: DM. 2013;59(4):p139-46
14. Profil PT Chitose Cimahi http://www.chitose-indonesia.com/tentang-kami/. 2000
15. R. Neitzel, N. Seixas, B. Goldman, W. Daniell. Comparison of Perceived and Quantitative Measures of Occupational Noise Exposure. Annals of Occupational Hygiene. 2008;53(1):p41-54
16. Kryter, K. D., The Effects of Noise on Man, 2nd Ed. Chapter 2, Physical Measures of Sound and Noise, page 6. Academic Press, INC. London. 2005.
17. Soetirto I, Bashiruddin J. Gangguan pendengaran akibat bising. Disampaikan pada Simposium Penyakit THT Akibat Hubungan Kerja & Cacat Akibat Kecelakaan Kerja, Jakarta, 2 Juni, 2001.
18. Lintong F, Gangguan Pendengaran Akibat Bising. Jurnal Biomedik. 2009;1(2),p81-6
19. Kandou LF, Mulyono. Hubungan karakteristik dengan peningkatan ambang pendengaran penerbang di balai kesehatan penerbangan Jakarta. The Indonesian Journal of Ocupational Safety and Health 2013; 2(1): p1-9.
20. Suryani S, 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):p1-11
21. Wald, P. H., Stave, G. M., Physical and Bilogical Hazards of the Workplace. 2nd edition. Page 279-90. John Wiley and Sons, Inc., New York. 2012.
22. Siti Fatimah, Pengaruh Kebisingan TerhadapNoise Induced Hearing Loss (NiIhl) Karyawan Di Pt. SCTI Jakarta Timur Tahun 2008. FKM UI.2008.
23. Barbara, A., Miland Jill.. Industrial Noise dalam Fundamenal of Industrial Hygiene. New York. 2012
24. Hastono, S. PBasic Data Analysis for Health Research. Fakultas Kesehatan Masyarakat, Universitas Indonesia. 2017.
25. Si, Kate Lewkowski, Lin Fritschi, Jane Heyworth, Danny Liew, and Ian Li. Productivity Burden of Occupational Noise-Induced Hearing Loss in Australia: A Life Table Modelling Study. Int J Environ Res Public Health. 2020;17(13):p4667.
26. Mukono, MS, MPH, Prinsip Dasar Kesehatan Lingkungan. Airlangga University Press (UNAIR). Surabaya. 2000.
27. Roestam AW. Program Konservasi Pendengaran di Tempat Kerja. Cermin Dunia Kedokteran (CDK). 2004
28. Setiawan, FEB. Prevention of noise induced hearing loss in worker: A literature review. Jurnal Kedokteran dan Kesehatan Indonesia. 2021;12(2)
29. The International Programme on Chemical Safety (IPCS). Environmental Health Criteria (EHC) 215. Vinyl chloride. www.ipcs.com. [last accessed on 2022 Feb 12].
30. Center for disease control and prevention. Reducing Noise Exposure: Personal Protective Equipment. Available from: https://www.cdc.gov/niosh/topics/noise/reducenoiseexposure/adminppe.html[last accessed on 2022 Jan 8].