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EDITORIAL

Noise Exposure and Hearing Health in the Workplace

Pajanan Bising dan Kesehatan Pendengaran di Tempat Kerja

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Noise exposure is a potential occupational hazard found in almost every industrial sector. The Center of Disease Control (CDC) estimates that there are 22 million workers who are exposed to noise each year.[1,2] Of all workers exposed to noise, it is reported that 19% have hearing loss.[1] A study in Canada found that 4 of 10 workers have been exposed to noise in the workplace, and 38% suffer from hearing loss.[3] In Indonesia, from research conducted on workers in workshops, the timber industry and ferries, it was found that the noise intensity was between 85 – 103 dB, and the prevalence of hearing loss due to noise was between 21.7% - 34.5%.[4,-6]

Besides causing hearing loss, high-intensity noise also causes physical and psychological stress, interferes with communication and concentration, reduces work productivity, and even triggers work accidents.[2] However, noise is often accepted as an unavoidable part of industrial processes, causing workers to seem accustomed to the noise and not realizing that it will gradually interfere with hearing and, if left unchecked, can cause permanent/irreversible sensorineural deafness, so Preventive measures are the best option to avoid hearing damage.[7]

Hearing loss due to noise at work / Occupational Noise Induced Hearing Loss (ONIHL) is hearing loss caused by noise (unwanted sound) exceeding the threshold value in the work environment.[8] The characteristics of ONIHL are a decrease in hearing sensitivity at a frequency of 3, 4 and/or 6 kHz, with improvement at a frequency of 8 kHz.[9] Workers who are vulnerable to this are those who work in the construction, manufacturing, mining, agricultural, transportation, public service facilities, military, and musician sectors. However, 82% are found in manufacturing workers.[1,10] Male workers -men are more exposed to noise, maybe because male workers dominate manufacturing workers.[3,10] The amount of noise intensity in the work environment, called the sound pressure level (SPL), is usually measured using a sound level meter with units of decibels (dB). If workers move from one area to another in the workplace when carrying out work tasks, it is better to use personal noise dosimetry to determine the noise exposure they receive.[2,8] With technological advances, workers can download a sound level meter application on a smartphone;. However, the level of measurement accuracy varies; it can be used as a beneficial tool to determine the level of exposure to noise in the work environment.[11] For example, the noise threshold value in Indonesia for working 8 hours a day is 85 dB.[1,12] If the results of noise measurements in the

workplace for workers with a working duration of 8 hours exceed 85 dB, then this means that noise control must be carried out. In addition, a daily noise exposure limit for noise intensity above 85 dB is also set; for example, if the noise intensity in the work environment is 91 dB, then the exposure time limit for workers who are allowed to work in that place is 2 hours a day. Another example of a work area with a noise intensity of 100 dB, the exposure time limit for workers is 15 minutes a day.[12]

In addition to using the noise meter mentioned above, the noise intensity is likely to be above 85 dB if workers have to increase their volume when talking to colleagues who are 1 meter away from them[2] and often repeat words in communication daily.[6] Noise is also a problem in the workplace when workers feel ringing in their ears/tinnitus or experience temporary hearing loss when they come home from work.[2] Complaints of tinnitus were found in 51% of workers who had been exposed to a noisy work environment and complained more by young workers than older workers. These complaints disturb the sleep, concentration and mood of the workers.[3] Tinnitus is the initial stage of damage to the auditory nerve, so one way to detect ONIHL early in workers is to detect tinnitus. The habit of listening to music using earphones while working will also increase the noise exposure received by the ears of workers; it was found that 94.1% of workers with the habit of using earphones while working experienced tinnitus.[4]

Factors that contribute to ONIHL are individual factors (genetic, age, gender) and workplace exposure (noise intensity, duration of exposure, chemicals).[10] The incidence of ONIHL will double if the workplace is exposed to noise together with chemicals such as organic solvents, welding fumes, carbon monoxide and hydrogen sulfide. This is related to the auditory neurotoxicity induced by these chemicals.[4,10] Research on workshop workers exposed to noise of 88.59 dB and a working period of more than 10 years caused ONIHL in 21.6% who worked there. The longer exposure to high-intensity noise, the greater the occurrence of ONIHL, because there is an accumulation effect.[4] When workers receive noise exposure that exceeds the permissible threshold value, temporary hearing loss will occur, and will recover if not exposed to excessive noise. However, if excessive noise exposure is received continuously every day when workers are doing work in the work area, the hearing loss will become permanent.[9] Noise exposure for more than 10 years increases the risk 2 times greater for hearing loss, and six times causes hearing loss to become more severe.[13] This can happen because when exposed to excessive noise intensity it will there is an increase in levels of Reactive Oxidative Species (ROS) in the cochlea resulting in oxidation reactions that damage DNA, fat and protein and the end result is cell death. Noise exposure also causes activation of alpha protein kinase in sensory hair cells which play a role in hearing loss mediated by loss of synapses between inner and outer hair cells in the inner ear.[14]

Prevention is the right choice to limit hearing loss caused by exposure to noise above 85 dB. Prevention requires good cooperation and management between owners, managers and workers. It is necessary to carry out a Hearing Conservation Program in the workplace. The main thing to do is monitor noise exposure in the workplace by measuring noise exposure periodically at work, then reducing noise exposure in the workplace by controlling noise, and detecting early hearing loss by conducting regular audiometric examinations and educating workers about the dangers of noise exposure and its impact on the health of workers and how to prevent it.[2,7] Measuring daily noise exposure independently by workers using personal noise dosimetry shows more effective results, increasing worker motivation in using personal protective equipment when the noise intensity is above the threshold value.[15] The National Institute of Occupational Safety and Health (NIOSH)

recommends a hierarchy of control measures to reduce noise in the workplace so that it is below the set threshold value. The first control step is to eliminate the noise source. Suppose it is not possible to eliminate it. In that case, substitution is carried out, for example, by replacing machines or work equipment that causes excessive noise with machines/equipment that are less noisy. If this is not possible, the next step is technical control to ensure workers are not exposed to noise above the threshold value, for example, by changing the design of machines/equipment to reduce noise sources and installing barriers in the work area. If this still needs to be possible, move on to the next step, administrative control, for example, by creating a work scheme to minimize exposure and provide a quieter and more comfortable place to rest. Then as the last step is the use of personal protective equipment, such as ear plugs or ear muffs, that are comfortable to wear and are obeyed by workers.[1] The use of ear protection devices can reduce the intensity of noise received by the ears.[4,7]

Exposure to noise in the workplace can cause various health problems that can interfere with worker activities, including ONIHL. Therefore, taking various preventive measures is expected to reduce the number of ONIHL incidents and avoid unwanted impacts, and workers can still work productively and safely.

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