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Annals of Biology 36 (2) : 276-280, 2020 **Noise Impact to Hearing Disorder at Vocational School Students Using Machinery in Indonesia** INDRA ZACHREINI, JENNY BASHIRUDDIN 1, DAMAYANTI SOETJIPTO 2 AND NYILO PURNAMI* ,3 Medical Faculty of Universitas Malikussaleh, Lhokseumawe, Aceh Province, Indonesia *(e-mail : nyilo@fk.unair.ac.id; Mobile : +628155100081) ABSTRACT **The level of noise** intensity and duration exposure of noise can have an impact on hearing loss.

Studies on the impact of machine laboratory noise in Vocational Secondary School are still rarely examined and published. The present study was undertaken to know the effect of noise generated by practicum machine on hearing impairment of Vocational School students in engineering using machine in Indonesia.

This study was analytical observational which assessed **correlation between noise intensity** of machine laboratory and its impact of hearing disorder by using cross sectional study. Significance of **correlation between noise intensity** with hearing disorder in VSS students using machine in Indonesia, with p value : 0.000, OR : 1.84 and 95% CI : 1.653-1.968. Level of noise intensity from machine laboratory impacted hearing disorder in VSS students in Indonesia.

Key words : Noise intensity, machine practice, hearing disorder 1Medical Faculty of Universitas Indonesia, Jakarta, Indonesia. 2Prevention of Hearing Disorder and Deafness National Committee, Indonesia. 3Department **of Otorhinolaryngology, Head and Neck Surgery**, Medical Faculty of Universitas Airlangga, Surabaya, Indonesia.

INTRODUCTION The learning process of students in Vocational High School is not only done in the classroom but also requires a process of learning in the form of laboratory

practice using machine tools or materials to be studied. In vocational learning process by practicum method has a big allocation to train the skills of learners than in High School.

It is through these labs that educators can observe the students' learning progress to confirm whether the students have achieved the learning goals (Chen et al., 2019). Machines or devices in laboratory room produce noisy and often exceed the threshold value tolerated by hearing. The sound pressure level generated depends on the type of the noise source, distance from the source to the receiver and the nature of the characteristic of the machine tools or material used in the learning process (Eleftheriou, 2018).

Noise threshold value in working place is set at 85 dB and duration of noise exposure, as longest 8 h. WHO program is especially planned for developing countries about the prevalence and causes of deafness and hearing loss (6-8). Occupational Safety and Health Administration (OSHA) recommended that all workers exposed to noise more than 85 dB should be screened for NIHL annually (Jain et al., 2017).

Study by El Dib and others pointed out that interventions such as the obligation to wear hearing aids on workers may increase the use of hearing protection devices (El-Dib et al., 2013). A survey conducted by the National Committee for Hearing and Deafness Response has demonstrated that the noise intensity of MK practice machines in 14 cities in Indonesia is about 90.8-120 dB, above the hearing tolerance limit.

The effects of noise on human health fall into four categories : physical effects, physiological effects, psychological effects and performance effects. Main physical problem is hearing loss and tinnitus, which emerges as ciliated cells in the inner ear are damaged as a result of exposure to intense noise (Bulunuz et al., 2017). For environmental exposure, hearing loss can be caused by long-term, continuous exposure to noise and is generally referred to as NIHL (Le et al .,

2017). The noise in the work environment, especially in the factory, received much attention and supervision from various parties such as trade unions, members of the legal and medical profession, legislative members, compensation organizations, insurance institutions and others, while the impact of noise on hearing and psychiatric disorders at lab in vocational schools in the majors that using mechanical engineering is still not the concern of many parties.

Likewise, noise research in lab in vocational schools using engine techniques is still slightly publicized, unlike research conducted on factory workers. This situation makes

the National Committee for Hearing and Deafness Response feel interested to do research, about the effect of noise to hearing loss caused by exposure to machine noisy practicum continuously received by students when practicing in the laboratory.

It is expected that the results of this study can be used as a consideration for policy makers in preventing hearing loss in vocational students majoring in engineering that uses the machine nationally. MATERIALS AND METHODS The type of this research is analytical observational with cross sectional design. And data collection technique was done by chance (probability sampling) in simple random sampling.

Sample inclusion criteria in this study were : the students of vocational grade XII in engineering majors who use the machine, the students there were without abnormalities in the ear canal and eardrum, and they were willing to follow the research. Exclusion criteria in this research was the sample on examination of pure tone audiometric found result of deafness.

The sample size according to the Lemeshow formula was at least 316 samples. Independent variables in this research were safe threshold value which was maximal 85 dB and unsafe threshold value which was over 85 dB as measured by using sound levelmetri device which had calibration.

Dependent variable in this research was sensory neural hearing loss as measured by using sound level meter device which had calibration and fill questionnaire. All the data collected are presented in tables. Data were analyzed using statistic computer by cross tabs and Chi-square (X²) test. RESULTS AND DISCUSSION Samples size in this study was 638 samples, of which 579 samples (90.8%) were men and 59 samples (9.2%) were women. Based on Fig.

1 and Table 1, the majority were the samples from komda PGPKT Jawa Tengah (Central Java) which accounted for 232 samples or 36.4%. Based on Table 2, the most samples were the samples from machining technique department which accounted for 240 samples or 37.6%. Based on Table 3, the most age of samples was Fig.1. Distribution of the samples by province. Hearing disorder in vocational school students 277 18 years or 53.91%.

Based on Table 4 and Fig. 2, the most noisy level of practicum machine was unsafe which amounted to 458 schools or 71.8%. Based on Table 5, the distribution of Table 1. Distribution of the samples by province, district/ city Province, district/city Frequency Percentage Aceh 62 9.7 Banda Aceh 17 2.7 Bireuen 15 2.4 Lhokseumawe 30 4.7 Sumatera Utara 50 7.8 Medan 50 7.8 Jambi 30 4.7 Kota Jambi 30 4.7 DKI Jakarta 30 4.7

Jakarta Selatan 30 4.7

Jawa Barat 7 1.1 Kota Bandung 7 1.1 Jawa Tengah 232 36.4 Karang Anyer 46 7.2 Klaten 35 5.5 Solo 6 0.9 Semarang 145 22.7 Jawa Timur 26 4.1 Surabaya 26 4.1 Bali 5 0.8 Denpasar 5 0.8 Kalimantan Barat 39 6.1 Pontianak 39 6.1 Kalinamtan Selatan 22 3.4 Banjarmasin 22 3.4 Sulawesi Selatan 25 3.9 Tana Toraja 25 3.9 Makasar 7 1.1 Sulawesi Tengah 62 9.7 Palu 62 9.7 Maluku Ambon 8 1.3 Papua Barat 40 6.3 Sorong 20 3.1 Bintuni 20 3.1 Total 638 100.0 Table 2.

Distribution of the samples based on Department in Vocational Secondary School
Department Frequency Percentage Metal fabrication 2 0.3 Wood construction 21 3.3 Electricity 3 0.5 Automotive 70 11.0 Production 2 0.3 Software engineering 36 5.6 Engineering weight equipment 7 1.1 Welding technique 59 9.2 Machining technique 240 37.6 Motorcycle engineering 61 9.5 Technical light vehicle 99 15.5 Artificial fiber spinning technique 28 4.4 Woodworking technique 10 1.6

Total 638 100.0 Table 4. Distribution of noisy level of practice machine Noisy level Frequency Percentage Safe 458 71.8 Unsafe 180 28.2 Total 638 100.0 Table 5.

Distribution of frequency hearing disorder on audiometry examination Hearing disorder Frequency Percentage Yes 234 36.7 No 404 63.3 Total 638 100.0 Table 3. Distribution of the samples by age Age Frequency Percentage (years) 17 186 29.15 18 344 53.91 19 92 14.42 20 13 2.03 21 2 0.31 25 1 0.15 Total 368 100.00 Table 6.

Duration of hearing loss based on questionnaire Duration of hearing loss Frequency Percentage Below 1 year 217 92.7 1-3 years 15 6.4 Over 3 years 2 0.9 Total 234 100.0

Fig. 2. Hearing disorder caused by noise-induced hearing loss. 278 Zachreini, Bashiruddin, Soetjipto and Purnami hearing disorder on audiometric examination was, hearing disorder which amounted to 404 samples or 63.3%.

Based on Table 6 and Fig. 3, duration of hearing loss based on questionnaire was below one year which amounted to 217 samples or 92.7%. Based on Table 7, there was **significant correlation between noise level** and hearing disorder on VSS students with p value : 0.000; OR : 1.804 and 95% CI : 1.653-1.965. Based on this research, there was a significant relationship between noise level and hearing loss experienced by vocational school students at the level of XII majoring in mechanical engineering, where p : 0.000; OR : 1.804 and 95% CI : 1.653-1.968.

The **results of this study** were **in accordance with the** results of Zachreini and Putri (2014) studies showing that there was correlation between the noise level and hearing impairment of vocational students using engineering in North Aceh district (p : 0.000;

OR : 7.5 and 95% CI : 1.82- 3092). Exposure to high intensity noises caused Fig. 3. **Duration of noise exposure** in day. Table 7.

Correlation of noise level hearing disorder on vocational school students Hearing Noise level Total OR P value disorder (95% CI) Unsafe Safe (> 85 dB) (< 85 dB) N % N% N %
Yes 234 100 0 0 234 100 1.804 0.000 (1.653-1.968) No 224 55.4 180 44.6 404 100 Total
458 71.8 180 28.2 638 100 disorders such as inability to communicate with others, reduced the quality of life of the human-being and their socialization, a phenomenon known as socioacusia.

Possible causative factors of hearing loss in the workplace should be considered. The nature of noise, noise intensity, frequency of noise, exposure time, individual susceptibility, diseases of the middle ear and different toxic products (e. g. carbon dioxide, arsenic, toluene and so on; Sierra-Calderon et al ., 2017).

Prolonged **exposure to high levels of noise** had negative effects on a person's health, well- being and – in extreme cases – may lead to hearing impairment. Hearing protection must be worn if **the level of noise is 85 dB or higher** (Jozwik et al., 2018). In this research, there was **significant correlation between noise level** and hearing disorder on VSS students using machine department with noise of machine practice amounting to 71.8% as unsafe (the intensity of noise from machine practice more than 85 dB).

Besides, **duration of noise exposure** more than 4 h in day amounted to 42.62% (Table 4 and Fig. 2). This hearing disorder suffered vocational school students less than 1 year (92.7%), it showed the students began to suffer hearing disorder after more than two years of noise exposure in their school (Table 6).

The causes of the engine noise level exceeding the safe limits were : 1. Using of practicum machine such as iron cutting machine, welding machine and others simultaneously. Because students were divided into several practice groups and each of which used different tools or machines so that it can cause an increase in noise. 2. The machines used for the practicum were old, non-standard (assembled Hearing disorder in vocational school students 279 machines), using parts that do not conform to the specifications, or machines that were given less care. 3.

The practicum room used did not reach the standard, the room was too small or in one room there was a big machine so the noise was increasing. The noise level was also increasing in the practicum room with inadequate ventilation. 4. The number of students who entered the practice room was too much, and also due to the noise generated by the practicum machine the students often had to speak in a loud voice so as to increase

the noise in the room.

CONCLUSION Based on this research, it can be concluded that there was significant correlation between noise levels with hearing impairment in vocational students in engineering majors using machines in Indonesia. REFERENCES Bulunuz, N., Bulunuz, M., Orbak, A.Y., Mulu, N. and Tavsanlı, Ö. F. (2017). An evaluation of primary school students' views about noise levels in school. *Int. Electron. J. Elem. Educ.* 9 : 725-740. Chen, H. J., Liao, L. L., Chang, Y. C.,

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