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Description of the Sound Intensity of Smartphones Used by Students of SMAN 1 Permata Bener Meriah

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ABSTRACT

Hearing aids/PLDs (Personal Listening Devices) such as earphones, headphones, or headsets are often used by people to listen to sound from smartphones in order to get a good sound experience. The recommended sound volume when using PLDs is no more than 60% of the maximum volume. The use of PLDs in intensities above 85 db and for a long period of time can cause non-NIHL (non occupational noise induced hearing loss). This study aims to determine the description of the sound intensity of smartphones used by students of SMAN 1 Permata bener Meriah in the academic year 2022/2023 The method used in this study is descriptive. This study uses a cross sectional approach, namely taking primary data through checking the sound intensity when using PLDs with SLM (sound level meter). From a total of 100 samples of students of SMAN 1 Permata bener Meriah in the 2022/2023 academic year, it was found that the average sound intensity heard using PLDs was 73.76 db with a minimum value of 63.1 db and a maximum of 89 db. The conclusion of this study is that students of SMAN 1 Permata bener Meriah use PLDs with sound intensity exceeding the recommended limit

INTRODUCTION

Based on data from WHO and rISKESDAS, it has been stated that the prevalence of hearing loss is still quite high both in the world and in Indonesia. One of the risks of hearing loss is listening to music sounds using PLDs for too long. Along with the development of the era, the use of gadgets such as smartphones is increasingly used by the wider community, especially teenagers. Teenagers or students at SMAN 1 Permata bener Meriah also call using smartphones which may also pose a risk of hearing loss. Because there has never be research on the use of smartphones that threaten hearing in students of SMAN 1 Permata bener Meriah, researchers are interested in examining how the use of smartphones in these students. On the basis of this, the researcher is interested in examining how the description of smartphone sound intensity in students of SMAN 1 Permata Bener Meriah.

METHOD

1. Type of Research

This type of research uses a descriptive method, which is a research method that describes a population, situation, or phenomenon under study. In this study, the researcher wanted to try to describe the intensity of smartphone sound in students of SMAN 1 Permata. This study uses a cross sectional approach because the object of research is measured or collected simultaneously (at the same time).

2. Location and Time of Research

This research will be conducted at SMAN 1 Permata from January to February 2023.

3. Research Population and Sample

a. Population

The population in this study were students of SMAN 1 Permata in the academic year 2022/2023 with a total of 100 people

b. Sample

The sample in this study was the entire population who had inclusion criteria for conducting research:

Inclusion criteria:

Research Population and Sample

- Willing to be a respondent
- Students of SMAN 1 Permata

Exclusion Criteria:

- The samples had clinical manifestations of conduction, sensorineural and mixed deafness.

c. Sample size

The sample size in this study is the same as the population of 100 people.

d. presented in the table below. Sampling Technique

The sampling technique in this study was total sampling. The reason for taking total sampling is because the population is 100. So, the number of samples in this study were 100 people.

e. Research Instruments

The research instrument used was a smartphone, in the form of an Agam doll, and a record sheet of the results of the sound level meter examination.

f. Data Analysis

At this stage, it is done by analysing the results obtained at the data processing stage. The steps in data analysis to test the relationship between variables include:

• Univariate Analysis

Univariate analysis is an analysis used to describe the characteristics of the independent variable and the dependent variable. By doing this analysis, it can be used to determine the frequency distribution of subject responses from each variable.

RESULTS AND DISCUSSION

1. Research Data

The data sources in this study used primary data sources collected by researchers from students of SMAN 1 Permata bener MeSriah in the 2022/2023 school year who were used as subjects in this study.

2. Research Results

• Univariate Analysis

This univariate analysis aims to explain or describe the characteristics of the variables studied in the form of a frequency distribution and is presented in the table below. In the form of a percentage table based on primary data collected through Informed consent filling and sound intensity check of smartphone use with sound level meter / Agam doll.

• Frequency distribution of respondents

Respondents in this study were students of SMAN 1 Permata in the academic year 2022/2023 who had fulfilled the inclusion criteria. The number of samples in this study was 100 people. The characteristics of respondents in this study are described based on gender, age, the results of the tuning test, smartphone brand, type of PLDs and intensity of smartphone sound use.

Based on the results of the study, the with a minimum value of 63.1 db and a maximum of 89 db. Based on the results of the study, the distribution of characteristics based on data on the use of sound intensity can be seen in the following table:

Table 1. Sample Demographic Data by Gender

Gender	Frequency (n)	Percentage (%)
Male	50	50,0
Women	50	50,0
Total	**100**	**100**

Source: Primary Data 2023

Table 1 shows that the male sample and the female sample are equal in number, namely 50 students each (50%).

Based on the research results, the distribution of characteristics based on sound intensity when using PLDs can be seen in Figure 1 below:

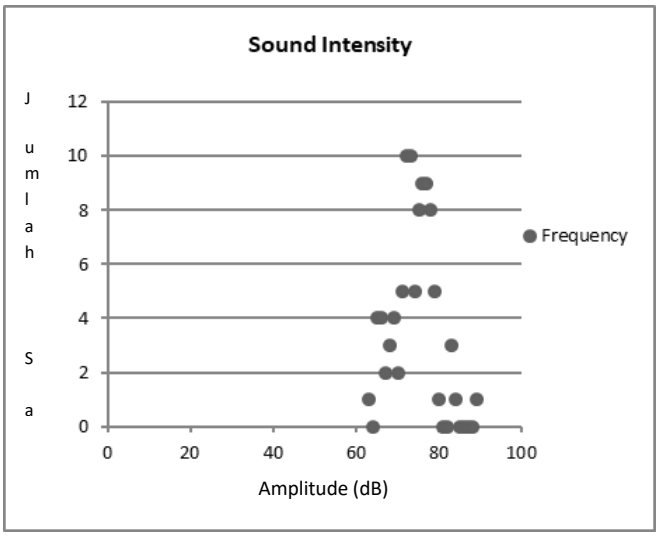

Figure 1. Overview of Smartphone Sound Intensity Used by Students of SMAN 1 Permata Bener Meriah

Based on the graph in Figure 1, it shows that 99 samples heard sound intensity with PLDs less than 85 db and 1 sample with sound intensity greater than 85 db.

Based on the results of the study, the distribution of characteristics based on the intensity of the sound heard by PLDs can be seen in Table 2 below:

Table 2. Sound Intensity Data Heard While Using PLDs

N	Mean	Mode	Median	Std. Deviation	Minimum	Maximum
100	73.76 dB	72.5 dB	73.7 dB	4.57 dB	63.1 dB	89 dB

Table 2 shows that the average sound intensity heard by the sample when using PLDs is 73.76 db based on the results of the study, the distribution of characteristics based on data on the use of sound intensity can be seen in the following table:

Table 3. Voice Intensity Usage Data of Students of SMAN 1 Permata Bener Meriah

Use of Sound Intensity	Frequency (n)	Percentage (%)
Safe ≤ 85 dB	99	99%
Unsafe > 85 dB	1	1%
Total	**100**	**100%**

Table 3 shows that the majority of students of SMAN 1 Permata, 99 samples, heard sound intensity with PLDs at an unsafe limit of more than 85 db while only 1 sample heard sound intensity with PLDs at a safe limit of below 85 dB.

Based on the results of the study, the distribution of characteristics based on smartphone brands can be seen in Table 4 below:

Table 4. Smartphone Brands Used by Students of SMAN 1 Permata Bener Meriah

Smartphone Brand	Frequency (n)	Percentage (%)
Advan	1	1
Hotwav	1	1
Infinix	4	4
iPhone	7	7
Mito	1	1
Nokia	1	1
Oppo	21	21
Realme	19	19
Samsung	18	18
Vivo	16	16
Xiaomi	11	11
Total	**100**	**100**

Based on table 4 shows that the sample used 11 smartphone brands consisting of Advan (1%), Hotwav (1%), Infinix (4%), iPhone (7%), Mito (1%), Nokia (1%), Oppo (21%), Realme (19%), Samsung (18%), Vivo (16%), and Xiaomi (11%). The most common smartphone brand used by the sample is Oppo (19%).

Based on the results of the study, the distribution of characteristics based on the type of PLDs can be seen in the following table:

Table 5. Types of PLDs Used by Students of SMAN 1 Permata Bener Meriah

Types of PLDs	Frequency (n)	Percentage (%)
Earphones	16	16,0
Headset	84	84,0
Total	**100**	**100**

Table 5 shows that students of SMAN 1 Permata in the academic year 2022/2023 use PLDs in the form of earphones (16%) and headsets (84%) to listen to sound from smartphones.

Based on the results of the study, the distribution of characteristics based on safe and unsafe sound intensity when using PLDS can be seen in table 6 below:

Table 6. Safe and Unsafe Sound Intensity Data When Using PLDS

Sound Intensity	PLDS Type			
	Headset	Percentage (%)	*Earphones*	Percentage (%)
Safe 85 ≤ dB	84	100%	15	93,75%
Unsafe 85 > dB	-	0%	1	6,25%
Total	**84**	**100%**	**16**	**100%**

Table 6 shows that the number of samples using headsets within safe limits is 84 samples (100%) and there are no samples using headsets exceeding unsafe limits. Meanwhile, the samples using earphones within the safe limit were 15 samples (93.75%) and 1 (6.25%) sample using a headset exceeded the unsafe limit.

From the results of research conducted in the Classroom of SMAN 1 Permata bener Meriah in January 2023 with a sample size of 100 people taken with total sampling technique obtained a gender distribution of 50 men and 50 women. The age of the sample studied ranged from 15-18 years. The results of the tuning test tested on 100 samples also found no abnormalities in the form of sensorineural deafness, conductive deafness, or mixed deafness.

The results of the research that has been conducted on 100 samples show the value of smartphone sound intensity heard by respondents using PLDs is an average of 73.76 db with a minimum value of 63.1 db and a maximum of 89 db. The number of samples using headsets within safe limits is 84 samples and there are no samples using headsets exceeding unsafe limits. Meanwhile, there were 15 samples using earphones within the safe

limit and one sample using a headset exceeding the unsafe limit. There are several reasons why PLDS users use sound intensity that exceeds the safe limit, one of which is the preference of music taste that is adjusted to the sound volume. The rockmetal music genre usually uses high intensity sound volume. The safe limit for using sound intensity in decibels (db) depends on the duration of exposure and the type of sound heard. Prolonged exposure to high intensity sound can cause permanent damage to hearing. The recommended safe sound exposure limit is at an intensity of 85 db for 8 hours per day. The safe duration of exposure should be halved for every 3 db increase. For example, if the sound reaches 88 db, the safe exposure of 8 hours per day should be reduced to 4 hours. The recommended sound intensity of smartphones using PLDs is below 60% volume (1). The average value of music frequency is 440 Hz(2). Using a headset for a long time can cause non- NIHL (non-occupational noice induced hearing loss) (3).

PLDs with sound intensity in the range of 73 db (below 85 db). In contrast to the research conducted by yogi 2021 on students of SMPN 2 Karangpucung, Cilacap Regency stated that most students used PLDs intensity in the range of 37 db, which showed that the sound intensity used was at a safe limit of less than 85 db. Similarly, the sound intensity used by students of SMAN 1 Permata also did not exceed the safe threshold (4).

Age is one of the factors that influence the use of sound intensity when using PLDs. Older people may experience hearing loss and thus tend to increase the sound intensity when using PLDs. In addition, if the environment is noisy, PLDs users will increase the sound intensity to be able to hear clearly. A person who is used to using high sound intensity when using PLDs, tends to continue doing so even when it is not necessary (5).

Use of sound intensity above 85 db for more than 8 hours may increase the risk of non-NIHL. The characteristics of non-NIHL are usually the same as those of NIHL in the future. According to the Ministry of Health in 1998, the National Committee on Noise and Hearing Conservation defined the characteristics of NIHL as Always sensorineural (due to damage to the organ corti), Usually bilateral (with a similar pattern in each ear, but the degree of hearing loss can also have a different pattern between ears), usually does not result in hearing loss greater than 40 db at low frequencies and 75 db at high frequencies. Worsening can be reduced when intense noise exposure ends, NIHL does not make the ear more sensitive to noise (as thresholds increase worsening can slow down), hearing loss begins and dominates

at frequencies of 3, 4, and 6 kHz and then progresses to 8, 2, 1, 0.5, and 0.25 kHz. In addition, with stable exposure conditions, worsening can occur in the 3, 4, and 6 kHz range generally stabilising after 10 to 15 years. Patients with NIHL may develop intolerance to loud noises, complain of tinnitus and cannot hear speech clearly, hindering oral communication (6).

The results also found that the sound intensity

heard when using a headset was 73.6 db while when using earphones was 74.66 db. The level of resisting external noise from earphones may vary depending on the type of earphones and the technology used. In general, earphones and headsets with noise-cancelling or noise-isolating features can reduce outside noise with varying effectiveness depending on the environmental conditions and the type of noise present. earphones and headsets with noise-cancelling features can reduce outside noise by 20 to 30 db, while earphones and headsets with noise-isolating features can reduce outside noise by 10 to 20 db. However, these figures may vary depending on the environmental conditions and the type of noise present (7).

In general, earphones and headsets can produce almost the same level of noise depending on the volume setting and the type of device used. However, there are some differences between the two types of devices. Earphones are usually smaller and placed inside the ear, while headsets are larger and cover the entire ear. Due to the larger size and better closure, headsets can help reduce environmental noise more effectively compared to earphones. However, the use of earphones or

headsets at high sound volumes may increase the risk of hearing damage and psychiatric disorders (8).

A study conducted by Liu, Wu, and Hsu (2019) aimed to examine the influence of digital audio players and smartphones on the sound quality of music produced by earphones. The study involved 37 participants who were asked to listen to and rate the sound quality of music produced by five different types of earphones, combined with three types of digital music player devices and three types of smartphones (9).

Research shows that digital music player devices and smartphones affect the sound quality of music produced by earphones. The sound quality of music produced by earphones may vary depending on the type of digital music player device or smartphone used. However, this study found no significant difference between the sound quality of music produced by earphones combined with digital music players and smartphones (9).

Unlike the case with research conducted by Yang M, Jin Z, and Zhang X (2018) which aims to examine the effect of smartphone brands on the sound quality produced by headphones. The results showed that there were significant differences in the sound quality produced by headphones when used with various smartphone brands. Certain smartphone brands are able to produce clearer and more detailed sound, while other smartphone brands tend to produce coarser and less detailed sound. This could be due to differences in the quality of hardware and software used in each smartphone brand (10).

CONCLUSION

Based on the results of the research and discussion that has been described, it is concluded as follows:

• The characteristics of students of SMAN 1 Permata bener Meriah, 50 male and 50 female samples were obtained, while for the age of students, the youngest age was 15 years old and the oldest was 18 years old.

• Students of SMAN 1 Permata bener Meriah, it was found that 93% used android and 7% used IOS/iPhone, while for PLDs 84% used headsets and 16% used earphones.

• The average sound intensity used by the sample when using PLDs was 73.76 db with a minimum value of 63.1 db and a maximum of 89 db.

• The average sound intensity heard using PLDs headset is 73.6 db and earphones 74.66 db.

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