

## Personal Stereos: Sound Pressure Levels, Habits and Auditory Symptoms in University Students

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### ABSTRACT

**Introduction:** Nowadays, it is usual to find people who use personal stereos to listen to music, but not everyone knows that the overuse of such equipment may cause irreversible damage to hearing and health.

**Objective:** To assess undergraduates' habits and hearing symptoms, as well as the sound pressure level (SPL) of their personal stereos.

**Method:** It is an exploratory descriptive qualitative study held in a private university in Southern Brazil. A questionnaire was used to survey the habits and symptoms, as well as the estimates of the Sound Pressure Level (SPL), decibel (dB) and A filter, by means of an educational system to measure the sound pressure level. This system was developed by the Dangerous Decibel<sup>®</sup> program and was named Jolene (United States). It is a mannequin with an SPL meter wired to a silicon ear. Statistical analyses were carried out (mean, minimum, maximum) Spearman correlations and Chi-square test at the significance level of 0.05 (5%).

**Results:** 62 undergraduates participated in the study, 67.74% females and 32.26% males, mean age of 22.5 years, minimum of 17 years old and maximum of 53 years old. Most interviewees used personal stereos up to 2 daily hours every day for over 3 years. The main hearing complaints reported after using them were: otalgia, feeling of ear fullness, itching, tinnitus, hearing loss and dizziness. Regarding the SPL of the personal stereos, results showed that maximum SPL ranged from 73 dBA to 120 dBA.

**Conclusion:** Undergraduates featured hearing signs and symptoms related to the use of personal stereos and high SPL. It was evidenced that the higher the SPL from the personal stereos, the higher the number of hearing complaints after their use, which can be considered a risk factor for hearing loss induced by high SPL.

**Keywords:** Hearing, Noise, Noise-induced hearing loss, Music, Habits, Tinnitus

### INTRODUCTION

With the technological breakthroughs, it is common to find people making use of earphones or personal stereos (PS) due to their convenience to listen to music anywhere any time. However, not everyone knows that their overuse in a loud volume may cause irreversible hearing damages [1,2].

Hearing loss, induced by the habit of listening to music with earphones on, is known as hearing loss induced by high sound pressure levels and has similar features to those of noise exposure, that is, hearing loss is progressive, irreversible, neurosensory, usually bilateral, affecting high frequencies, initially and then the other frequencies [2,3]. In addition to the sound intensity level, other risk factors to hearing would be the exposure time and the environment to use those PS.

Studies report that young people have increasingly been using more electronic devices with earphones, and reporting auditory and extra-auditory symptoms [2,4,9]. On the other hand, safe music intensity has positive effects to control

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anxiety, reducing pain, improving mood and quality of life [9].

Based on the aforementioned data, the study aims to assess the habits and hearing symptoms of undergraduates, as well as the SPL of their PS.

### STUDY METHODOLOGY

It is an exploratory, descriptive, quantitative study, approved by the Ethics Board of the Universidade Tuiuti do Paraná, register number 2576.183/2011-8.

Data collection was carried out in a private University in Paraná State, Southern Brazil, in April 2016, during the class breaks along the week actions of the International Noise Awareness Day.

The sample comprised undergraduates, males and females, differing age ranges. Inclusion criterion was to accept the participation in the study (signing the Free Informed Consent Form). There were no exclusion criteria.

A questionnaire was applied with multiple choice questions (**Appendix 1**) for data collection and measurement of the Sound Pressure Levels (SPL) was carried out among the PS users by means of an educational system. The sound pressure meter was configured to SLP dB, A filter, slow mode. This system replicates the mannequin developed by the University of Oregon, USA, internationally known as Jolene DOSHU, which is part of the educational strategies from the Dangerous Decibels® program. It is a mannequin with an SPL meter wired to a silicone ear (<https://www.dangerousdecibels.org.br>).

The undergraduates, who used PS, were guided to turn on their devices in the volume they listened to them, followed by putting the earphones into the ear of the silicone mannequin. Music intensity was assessed for 15 s, recording the maximum decibel values (dBA).

Statistical analyses were held (mean, minimum, maximum, standard deviation), Spearman correlations and Chi-square test, at significance level of 0.05 (5%).

The participants with hearing symptoms were referred to the Speech, Language Therapy Clinic from the University.

All participants were guided and given folders explaining environmental noise and use of PS.

### RESULTS

Sixty-two (62) undergraduates participated in the study, mean age of 22.5 years, minimum age of 17 and maximum age of 53 years (standard deviation=6.5 years), prevalence of females (67.74%). Among those 62 undergraduates, three reported that they did not use PS, therefore, they did not answer questions related to the use of PS or symptoms and did not have the SPL assessed.

It was evidenced that 73% of the interviewed undergraduates used PS every day, 71% used them for over 3 years and 61% used them up to 2 hours a day, 82% listening at volumes ranging from 6 to 10. It was also observed greater use of in-the-ear headphones (75.81% of the sample), followed by the use of on-the-ear headphones (14.52%) and the use of both types among 4.84% of the interviewed.

**Table 1** shows the habits and symptoms after the use of the PS.

Most undergraduates do not attend noisy places; gym is attended by 9.7% of the interviewees, shows/night clubs by 15% and noisy workplace by 8% of them.

Among the participants, 93% report that they can hear well, and state that maximum sound intensity may cause hearing loss.

Most interviewees denied earlier hearing symptoms, but some of them reported symptoms such as otalgia (30%), hearing loss (13%), ear fullness (21%), tinnitus (18%), itching (16%).

Concerning SPL results, values ranged from 73 dBA to 120 dBA (standard deviation=10.6 dB) and 90% of the interviewees, who listen to PS, SPL are equal to or greater than 85 dBA.

Regarding the number of users and hearing complaints after the use of the PS, the higher the SPL, the greater the number of hearing complaints. By correlating age to SPL and gender to SPL, there were not significant correlations ( $p=0.0895/p=0.0710$ , respectively).

**Table 1.** Distribution of the sample according to habits and symptoms after the use of personal stereos (N=59).

Habits And Symptoms	Absolute Frequency (N)	Relative Frequency (%)
<b>Sleeping with Music On</b>		
No	44	74.57
Yes	15	25.42
<b>Talking while listening to music</b>		
No	24	40.67
Yes	34	57.62
<b>Do people around you ask you to turn down the volume?</b>		
No	44	74.57
Yes	15	25.42
<b>Tinnitus</b>		
No	50	84.74
Yes	9	15.25
<b>Sensation of ear fullness</b>		
No	49	83.05
Yes	9	15.25
<b>Hearing loss</b>		
No	52	88.13
Yes	7	11.86
<b>Dizziness</b>		
No	58	98.3
Yes	1	1.69
<b>Otalgia</b>		
No	56	94.91
Yes	3	5.08

**DISCUSSION**

Most undergraduates have used PS daily up to 2 h a day for over 3 years, corroborating other studies [2,4,6,8,10].

As for the symptoms after the use of PS (**Table 1**), the number of cases with tinnitus (15.25%), ear fullness (15.25%) and hearing loss (11.86%) are noteworthy. Such findings also corroborate other studies [6,9], although, in the current study, the occurrence of symptoms after their use is lower if compared with other studies [6,9]. Several studies have shown that the incidence of tinnitus among the users of PS is significantly higher than among non-users [5,7,9,10,14,15].

Habits were also observed unveiling overuse and risk for hearing loss, such as sleeping with music on (25.42%), difficulty in talking while listening to music (57.62%) and people around asking to turn down the volume (25.42%). Study carried out by Luz and Borja [6] evidenced that 46.2% of the interviewees reported the habit of sleeping music on. In another study [4], 14.5% of the participants reported that other people asked them to turn down the volume and 54.1% stated that they knew that loud volume may cause hearing loss.

Concerning noisy places, most participants do not attend them, evidencing lower frequency than in the study held by Danhauer et al. [4], where 34.2% of the young people frequently attended noisy places.

In relation to the hearing perception and environmental noise, results showed greater occurrence of interviewees who can hear well and state that loud volumes may cause hearing loss. Although people are aware of the probability for hearing loss due to exposure to high sound pressure levels, they believe that they will only be affected at older age [12].

As for the noise present at several places, results suggest that the young are not worried about the harmful effects of loud noise. Keeping in mind that environmental noise is something surrounding our daily life, young people are not concerned about that, and view it as something natural [13]. It usually takes years for people to perceive the effects to high sound pressure levels, decreasing the feeling of risk; even acknowledging the risk, people continue exposing to it. If the SPL perception is unpleasant or painful, the risk will be overestimated; otherwise, the risk will be underestimated.

Concerning the SPL of the PS, in this study, as well as in other studies, most users also reported to use PS at a loud volume, with mean values close to the ones in the current study [6,9,11].

Most interviewees in this study use PS with SPL over 85 dBA and some reach up to 130 dBA, levels considered deleterious to hearing [16].

In Brazil, law number 11,291 from 2006, demands manufacturers of individually portable stereo devices to warn users about the harmful hearing effects above 85 dB [17]. However, it is necessary that PS users to be aware of the risk they take.

Therefore, the implementation of prevention programs is recommended, stressing hearing health education. An example could be the DD program, evolved from theories of health communication, using interactive educational tools on risky noise exposure, outcomes for such exposure and ear protection. In 2015, Brazil Dangerous Decibels program was created, in a partnership with the Brazilian Academy of Audiology (<http://www.audiologiabrasil.org.br/ddbrasil/>). 'Jolene', as already mentioned, is one of the educational DD resources, and despite the acoustic imprecision of the measures found, the resource was effective to call undergraduates attention to the SPL of their PS.

In addition to educational programs, the application of behavioral theories for safe hearing, educational campaigns and the use of friendly hearing health technologies are recommended [18].

## CONCLUSION

Undergraduates evidenced symptoms related to high sound pressure levels from their PS. It was also evidenced that the higher the SPL from their PS, greater the number of hearing complaints after their use, which can be considered a risk factor for hearing loss induced by high SPL.

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