



Complaints and hearing habits of portable stereo set users

Queixas e hábitos auditivos de usuários de equipamento portátil de som

Quejas y los hábitos de los usuarios de la audición de sonido portátiles

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Abstract

*Exposure to noise in leisure activities, especially with the use of headphones, can affect the health, labor and social relations of users of these devices, especially with regard to the intensity and the sound exposure time. **Objective:** To characterize the complaints and hearing habits of a group of adults in their use of portable stereo set. **Methods:** A semi-structured questionnaire about hearing habits was applied to a group of students during a social event at the University. Eighty subjects answered questions about habits and hearing complaints and had the sound pressure level of sound equipment (MP3, mobile phone, iPod) estimated by means of a sound pressure level meter. **Results:** The main complaints reported after the use of the equipment were buzzing, trouble understanding and need to increase the volume of television or radio after listening to music. Hearing problems were more frequent among those users who listened to music at a higher intensity. **Conclusion:** The majority of respondents reported hearing problems after portable stereo set use, which were more frequent among those who listened to music at a higher intensity.*

Keywords: Noise; Music; MP3 player; Hearing Loss; Noise Effects; Noise Measurement.

Resumo

*A exposição a ruídos em atividades de lazer, especialmente com o uso de fones de ouvido, pode afetar a saúde, o trabalho e as relações sociais de usuários desses dispositivos, sobretudo no que diz respeito à intensidade e ao tempo de exposição ao som. **Objetivo:** Caracterizar as queixas e hábitos auditivos de um grupo de usuários de equipamento portátil de som. **Método:** Foi aplicado um questionário semiestruturado sobre hábitos auditivos em um grupo de alunos e profissionais de uma universidade privada durante um evento social na própria instituição. Oitenta sujeitos responderam perguntas sobre hábitos e queixas*

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auditivas e tiveram o nível de pressão sonora do equipamento de som (MP3, celular, iPod) estimado por meio de um medidor de nível de pressão sonora. **Resultados:** As principais queixas referidas após o uso do equipamento foram zumbido, dificuldade para entender e necessidade de aumentar o volume da televisão ou rádio após ouvir música. As queixas auditivas foram mais frequentes entre aqueles usuários que ouviam música em mais elevada intensidade. **Conclusão:** A maioria dos entrevistados relatou queixas auditivas após o uso do equipamento portátil de som (EPS), sendo mais frequentes entre aqueles que ouviam música em mais elevada intensidade.

Palavras-chave: Ruído; Música; MP3-Player; Perda Auditiva; Efeitos do Ruído; Medição de Ruído.

Resumen

La exposición al ruido en actividades de ocio, especialmente con el uso de auriculares, puede afectar a la salud, el trabajo y las relaciones sociales de los usuarios de estos dispositivos, especialmente en relación con la intensidad y el tiempo de exposición al ruido. **Objetivo:** Caracterizar las quejas y hábitos de escucha de un grupo de adultos debido al uso portátil equipo de sonido. Se aplicó un cuestionario semi-estructurado sobre hábitos de escucha en un grupo de estudiantes durante un evento social en la Universidad. **Método:** Ochenta sujetos respondieron preguntas sobre los hábitos y recibir las quejas y tenía el nivel de presión sonora de equipos de sonido (MP3, teléfonos móviles, iPod) estimado utilizando un medidor de nivel de presión sonora. **Resultados:** Las principales quejas reportadas después de la utilización de los equipos zumbaban, problemas para comprender y necesitan aumentar la intensidad de la televisión o la radio después de escuchar música. las afecciones auditivas fueron más frecuentes entre aquellos usuarios que escucharon música a una mayor intensidad. **Conclusión:** La mayoría de los encuestados declaró haber oído las quejas después de EPS de uso, que fueron más frecuentes entre los que escuchaban música a una mayor intensidad.

Palabras clave: Ruido; Música; Reproductor MP3; Pérdida Auditiva; Efectos del Ruido; Medición del Ruido.

Introduction

Noise is one of the most common pollutant agents. The exposure to excessive noise is a major cause of hearing deficiency around the world. It is estimated that 10% of the world population is exposed to levels of sound pressure that can cause noise-induced hearing loss¹. In addition to the hearing loss, other harmful effects of noise to health are also known, such as difficulty to understanding speech, tinnitus and intolerance to intense sounds, dizziness, impact on communication, understanding speech, performance in school and social relationship, nervousness, irritability, headache, insomnia, circulatory changes, eyesight changes, reading, memory, attention, gastrointestinal changes, sleep disorders, cardiovascular effects²⁻⁵. Moreover, it is known that music, with its physiological and psychological action, has positive

effects on controlling anxiety, reducing pain and improving humor and quality of life⁶.

Currently, one of the very used sources of noise encompasses the portable stereo set (PSS) such as MP3 players, iPods and mobile phones, whose electroacoustic features vary significantly among manufacturers, generate sounds in a range of high frequency and reach levels of sound pressure of up to 125 db (A) without distortion².

In addition to the PSS technology, the types of headphones used (insertion or supra aural), the depth of insertion into the external acoustic meatus, the maximum power provided by the PSS and style of music determine the sound pressure level that reaches the tympanic membrane². Besides the preference for music interfering in the judgment of their intensity, the PSS user realizes their favorite music as less intense than it actually is, compared with another non favorite music, even though both are played in the same intensity.^{7,8}

The objective of this study was to characterize the complaints and hearing habits of a group of students and employees of a University considering their use of PSS.

Methods

This is a descriptive cross-quantitative study. The research was approved by the Ethics and Research Committee of the Pontificia Universidade Católica de São Paulo (PUC-SP) under the number 44001415.0.0000.5482, and the participants of the study signed the Term of Agreement.

Subjects

The random sample was composed of students and staff of male and female genders, which use headphones coupled to the PSS - being this the sole criteria of inclusion - and who attended the campus of PUC-São Paulo and a University in the city of São Paulo at that time. 80 male and female subjects were interviewed, aged 16 to 68 years, with an average of 26,9 years.

Procedures

The individuals, who agreed to participate in the research, responded to a questionnaire about hearing sensation to the audio from their PSS,

hearing habits and discomfort to sounds. The main items that comprised the questionnaire were: a. hearing habits with the PSS, including frequency and period of use, preferred volume, type of headset; b. auditory symptoms after the PSS use – one or more symptoms could be chosen. The questionnaire was given to the participant when the sound level was measured from their headphones coupled to the PSS.

All of the individuals had the sound level of their PSS estimated from the moment their headphones were placed one at a time into a mock-up's ears - Gisele d'Barulho (Brazilian version of Jolene of Project *Dangerous Decibels*), in an environment whose background noise was around 55 dB (A). This mock-up has a microphone of a sound pressure level meter, type 4, coupled in her ear. The volume of the PSS was kept in the same intensity as each subject would keep listening to music. The measurements were carried out on the scale weighting "A" and "slow" measure, with samples of 120 seconds (2 minutes).

The participants of the research also responded to a brief questionnaire about hearing habits and complaints (time and intensity of exposure to music, signals or symptoms perceived after the PSS use, among other topics) (Figure 1) and received orientation about hearing education.

The data were registered on a spreadsheet on a software called Microsoft Excel and analyzed on the software SPSS (version 22.0 for Windows).

1	Gender F () M ()	Age		Occupation			
2	Do you use ...? (choose all the alternatives that apply)	Mobile phone	Computer/ laptop computer	Portable DVD player	MP3 player	IPOD	None
3	Do you use headphones?	Yes	No				
4	How long do you use your headphones for, each time you put them on?	4 hours or more	Between 1 and 4 hours	Between 30 minutes and one hour	Between 15 and 30 minutes	Less than 15 minutes	I don't use them
5	Considering your headphones use, you would conclude you use them in a... volume.	Very loud	Loud	Medium	Low	Very low	
6	Have you had any of these situations after using any of the technologies abovementioned?	Do you raise the volume on your TV or radio to hear better?	Do you realize you say lots of "what" or "hum" while talking in an unaltered voice?	Do you think people have a muffled voice when they speak?	Do you feel tinnitus or noise in your ears?		
7	Intensity obtained from the mock-up	dBA					

Figure 1. Questionnaire used to collect data

Statistical Analysis

A descriptive analysis of data was held by means of absolute and relative frequencies, central tendency averages (mean, median and mode) and dispersion (standard deviation, minimum and maximum values).

For a better characterization of the sample, the time of use reported by the respondents was organized into three groups: use of less than 60 minutes, between 61 and more than 240 minutes a day. In the comparison of the averages, the ANOVA test was administered for the collation among three groups, and when there was a statistically significant difference, the *post hoc* analysis by test Bonferroni was held. The t-Student was used for the comparison of the averages between two groups.

In the comparison among qualitative variables, the association test by Chi-square was used, and a descriptive level of 5% ($p < 0,05$) was assumed for statistical significance.

Results

Eighty subjects were evaluated with equal distribution between genders. The respondents' average was 26,9 years ($SD = 11,0$), ranging from 16 to 68 years, with median of 23 years and mode of 20 years.

The device which was mostly used to listen to music was the mobile phone (73,8%), and among the subjects researched, the vast majority listened to music through headphones (93,8%) (Table 1).

Table 1. Number and percentage of subjects, according to gender and stereo devices

Variable	Category	n	(%)
Gender	Male	40	(50%)
	Female	40	(50%)
Mobile phone	No	21	(26,2)
	Yes	59	(73,8)
Computer	No	49	(61,2)
	Yes	31	(38,8)
Portable DVD player	No	73	(91,3)
	Yes	7	(8,7)
MP3 player	No	61	(76,3)
	Yes	19	(23,8)
IPOD	No	59	(73,8)
	Yes	21	(26,2)
Amount of stereo sets	One	48	(60,0)
	Two to three	27	(33,8)
	Four to five	5	(6,2)
Use of headphones	No	5	(6,2)
	Yes	75	(93,8)
Total		80	(100,0)

n- number of subjects; % percentage found

The intensity of use of the PSS was measured with volume set in the usual intensity that each participant practiced, and the following values were obtained: minimum intensity of use of 55 dB (A) and maximum 110 dB (A), with mean values of 87.3 dB (A), mode of 80 dB (A) and median of 86 dB (A).

The study, according to the variable "gender", presented statistically significant association ($p = 0,025$). The men have a probability of having a time of use of PSS higher than 240 minutes compared to women (27,5% versus 12,5%), and for the category of "use", they presented less than 60 minutes (37,5% versus 22,5%). It was only for intermediate use - between 61 and 240 minutes - that women had a higher percentage.

Table 2. Number and percentage of patients, according to time of use reported and other variables

Variable	Category	Time of use reported (in minutes)			p
		< 60	61 to 240	> 240	
		n (%)	n (%)	n (%)	
Gender	Male	15 (37,5)	14 (35,0)	11 (27,5)	0,025
	Female	9 (22,5)	26 (65,0)	5 (12,5)	
Amount of stereo sets	One	18 (37,5)	23 (47,9)	7 (14,6)	0,315
	2 to 3	5 (18,5)	15 (55,6)	7 (25,9)	
	4 to 5	1 (20,0)	2 (40,0)	2 (40,0)	
Turn up the volume on the TV or radio	No	19 (33,3)	25 (43,9)	13 (22,8)	0,222
	Yes	5 (21,7)	15 (65,2)	3 (13,0)	
Say lots of "what" or "hum" while talking in an unaltered voice	No	18 (33,3)	24 (44,4)	12 (22,2)	0,359
	Yes	6 (23,1)	16 (61,5)	4 (15,4)	
Consider other people's voices "muffled"	No	21 (31,3)	33 (49,3)	12 (19,4)	0,832
	Yes	3 (23,1)	4 (53,8)	3 (23,1)	
Tinnitus	No	18 (35,3)	22 (43,1)	11 (21,6)	0,245
	Yes	6 (20,7)	18 (62,1)	5 (17,2)	
Total		24 (30,0)	40 (50,0)	16 (20,0)	

n- number of subjects; p- p value

On table 3, it is observed that the subjects who listen to music longer tend to listen at a stronger intensity. It is also verified that the respondents

who have complaints after listening to music are the ones whose PSS has a higher intensity of use.

Table 3. Analysis of the comparison AMONG categories, according to intensity measured

Variable	n	average in dB (A)	(sd)	median in dB (A)	min-max in dB (A)	p
Time of use (in minutes)						
< 60	24	83,9	(12,2)	81	55 - 109	0,007
61 a 240	40	86,5	(9,7)	85	65 - 110	
> 240	16	94,3	(7,6)	95	79 - 106	
Turn up the volume on the TV or radio						
No	57	86,8	(10,5)	86	55 - 110	0,502
Yes	23	88,6	(11,4)	85	65 - 109	
Say lots of "what" or "hum" while talking in an unaltered voice						
No	54	87,3	(11,2)	88	55 - 110	0,198
Yes	26	87,1	(9,7)	84,5	73 - 109	
Consider other people's voices "muffled"						
No	67	87,5	(11,3)	86	55 - 110	0,608
Yes	13	86,1	(6,9)	85	78 - 96	
Tinnitus						
No	51	87,4	(10,3)	86	55 - 109	0,875
Yes	29	87,0	(11,6)	85	65 - 110	

n- number of subjects; sd- standard deviation; min-max: minimal and maximal values of intensity from the PSS; p- p value

Discussion

The most frequent complaints after the use of the PSS reported by participants of this research agree with other researchers, whose results showed that tinnitus, as well as other hearing complaints, were recurrent among adolescents and young adults who use personal stereo sets regularly⁹⁻¹⁴. Previous studies have found prevalence of hearing complaints three times higher among users of PSS aged 15 to 30 years, when compared to non-users¹⁰ of this equipment. Other studies even found non-hearing complaints such as sleep disorder¹⁵ and fatigue after sound exposure¹⁶, which were not reported by the participants of this research.

Behavioral factors seem to be more important for the tinnitus among the young than in the elderly. Young US citizens report a higher prevalence of behavior-influenced tinnitus than the elderly do. The main behavioral factors include the use of PSS, MP3 and / or MP4 players, and exposure to noise during night outs¹².

Tinnitus, presented as a complaint among the subjects analyzed, cannot be assigned exclusively to the use of PSS since the etiology of tinnitus is diverse and includes plenty of possibilities (hearing loss, otitis, high noise, cerumen, Ménière disease, ototoxic drugs, anxiety and depression, multiple sclerosis, injury in the head or neck, anemia by iron deficiency, hypercholesterolemia, thyroid diseases, vitamin B12 deficiency, migraine, nasal congestion, among others¹⁷). Nevertheless, the influence of exposure to high sound levels cannot be rejected.

By comparing the time of use between the genders, the men present statistically higher time of use in relation to women (27,5% versus 12,5% with use of more than 240 minutes). Most women use the PSS for an intermediate period, between 61 and 240 minutes. Also in regard to the time of PSS use, a minority (3,6%) listens to it for less than 15 or 30 minutes; 50% of respondents listen to music between 61 and 240 minutes, similarly to other studies^{16,18} that found daily use between 1 and 2 hours among most subjects interviewed. It is recommended to limit the use of headphones to 1 hour or less a day in a gain control set at 60% of maximum¹⁹.

Other studies observed that the effects of PSS use were higher among men, who listen to music longer and in stronger intensity^{16,20,21}. This is because men are more likely to get involved in noisy

leisure activities than women; many young people cannot know how to live in the silence, consider amplified sounds normal and believe it is safe to listen to music for a period between three and five hours a day. This overestimation of the sense of safety of hearing habits can reduce the perception of susceptibility and the motivation for changing behavior^{10,22,23}.

In the present study, the subjects who listen to music at higher intensity (Table 3) showed more hearing complaints, similarly to the findings by Vogel *et al*²⁴, whose results demonstrated that the subjects who reported to listen to music in high intensity, experienced almost twice as temporary and permanent hearing symptoms, including up to two times more self-declared symptoms of depression and suicidal thoughts among those who complained permanent. In the study by Hoover, Krishnamurti²⁵, one-third of the respondents declared to listen to music in the maximum volume of the PSS, and on the research carried out by Kahari, Åslund, Olsson¹⁶, 53% of the people chose to use the maximum volume, while only 26% chose 75% of the maximum volume of the PSS to listen to music. These data call attention, since it is recommended that the volume levels should be less than 50% for the normal hearing status²⁶.

In another research, among the subjects with higher exposure, 46% chose a level of hearing ≥ 90 dB, and 17% chose to listen to the PSS in intensity ≥ 95 dB¹⁶. Other studies concluded that most PSS users were at an increased risk of noise-induced hearing loss: 58,2% of the subjects exceeded the exposure to 85 dB 8 hours a day²⁷, and 28,6% had exposure estimated in 89 dB (A) for more than an hour a day²⁸.

Due to the growing exposure to noise, actions are required to inform and make the population aware of the effects of high noise, especially among children and the young.

Conclusion

Most respondents, among students and staff of a university, reported hearing complaints after the use of the PSS, being more frequent among those who listened to music at high intensity. The complaints prevailed among men and among those who listen to music longer. Health education actions are necessary to make the population aware of the risks involved when listening to music at high intensity.

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