

Effects of Personal Music Players and Mobiles with Ear Phones on Hearing in Students

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Abstract:

Objective: To measure hearing loss in students using personal music players and mobiles with ear phones.

Methods: Conventional frequency audiometry (0.25-8kHz) was performed on 122 students - 61 personal listening device users and 61 non-users.

Results: Statistically significant differences were found between the control group and the test group. Thus there is a strong relationship between hearing threshold and daily use of portable music players. Hearing loss occurred in 36.06% of students using ear phones. The variables like "duration of usage" of ear phones and "years of usage" had a poor correlation whereas the variable loudness has a good correlation.

Conclusion: Portable music players can have a deleterious effect on hearing threshold. Users of PLDs should sensibly control the loudness so as to avoid developing NIHL.

Keywords: Hearing loss, noise-induced hearing loss, personal listening device.

Abbreviations: NIHL – Noise Induced Hearing Loss, PLD – Personal Listening music Devices, PMP – Personal Music Player.

I. Introduction

Noise-induced hearing loss (NIHL) is the most frequently occurring preventable disability. It can be caused by recreational or occupational sources of sound. It is a significant social and public health problem. Efforts to reduce NIHL have concentrated on reducing risks from occupational noise exposure in adults. However, several studies have reported an increasing trend of NIHL in children and adolescents.¹ Ear phones are able to deposit sounds within the range of maximum levels around 80-115dB directly into the ear canal.² The insertion depth of the ear bud of the ear phone into the ear canal, the maximum output provided by the device and the type of music are factors affecting the amount of sound deposited in the ear canal.³

Pathology can occur at any point in the auditory pathway. Chronic noise exposure damages sensory hair cells in the cochlea, which are responsible for stimulating the auditory nerve. The permanence of noise-induced hearing loss emphasizes the importance of the prevention of noise damage.

Evidence supporting the relationship between PMP use and hearing damage is mixed.^{2,4} Damage to the auditory system is a cumulative process and that once injury from loud noise is sufficiently severe enough to be measured; the loss is substantial and irreversible.

II. Materials And Methods

The subjects for this study were the students of an urban Medical University. Ethical clearance was obtained for this study. A sample size of 150 was selected out of which only 122 were selected, as the rest came under the exclusion criteria. It consisted of a control group in which the subjects did not use ear phones and a test group which consisted of subjects who used ear phones on a regular basis for more than a year. There were 70 females and 52 males; age range was 23-30 years. Subjects who were having continuous exposure to loud noise, history of previous ear disease, use of ototoxic previously diagnosed hearing impairment (causes other than noise exposure) and recurrent upper respiratory tract infection were excluded from the study.

The test group completed a questionnaire (annexure - 1) regarding their history of noise exposure which included duration of using ear phones per day (minutes), presence of external noise, years of usage of ear phones and preferred level of loudness on a scale of 1-10.

Following an otoscopic examination audiometry was performed for both the groups in a sound treated room using a calibrated Interacoustics Clinical audiometer-AC-40 (Denmark). The transducers used for the testing were TDH 39 Supra Aural Head phones and Radio Ear B 71 bone vibrator. Modified Hughson-Westlake procedure (ASHA 1978) was used for the threshold estimation. The threshold was determined based on the American National Standard Institute (ANSI 1978, 1986). It was done at the following frequencies: 250, 500, 1000, 2000, 4000 and 8000Hz.

Statistical analyses were done using independent T test and Pearson correlation test.

III. Results

Significant differences were found between the control group and the test group. The P values of right ear low frequency average, high frequency average and left ear low frequency average, high frequency average in both test and control is less than 0.001 which is statistically significant (TABLE – 1, Fig - 1). Thus there is a strong relationship between hearing threshold and daily use of portable music players.

Table - 1. Results of hearing thresholds (dB).

		N	MEAN	P VALUE
RIGHT EAR LFA	TEST	61	21.5847	<0.001
	CONTROL	61	14.46995	
RIGHT EAR HFA	TEST	61	17.97814	<0.001
	CONTROL	61	13.65027	
LEFT EAR LFA	TEST	61	21.51913	<0.001
	CONTROL	61	13.03825	
LEFT EAR HFA	TEST	61	16.39891	<0.001
	CONTROL	61	10.4918	

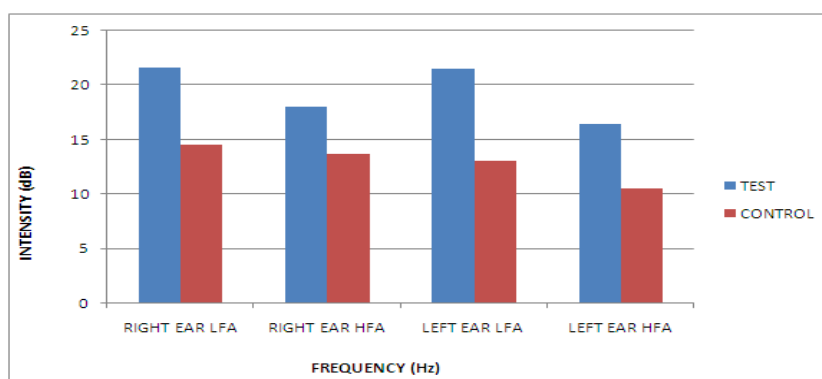


Figure-1. Graph showing hearing threshold of the test and the control group.

According to the hearing thresholds in the range of 0.25 to 8 kHz, the PLD group could be divided into two subgroups: the normal-hearing subgroup and the hearing-impaired subgroup. The subjects with normal hearing thresholds in the range of 0.25 to 8 kHz (<25 dB HL) were classified as the normal-hearing subgroup. Those with abnormal hearing thresholds in one or more frequencies in the range of 0.25 to 8 kHz (> 25 dB HL) were classified as the hearing-impaired. There were 39 subjects in the normal-hearing group and 22 subjects in the hearing-impaired group according to this criterion. Thus hearing loss occurred in 36.06% of students using ear phones.

Table-2. Hearing threshold in the presence and absence of external noise.

	EXT. NOISE	N	MEAN	P VALUE
RIGHT EAR LFA	YES	20	22.17073	<0.001
	NO	41	20.38333	
RIGHT EAR HFA	YES	20	18.45529	<0.005
	NO	41	17	
LEFT EAR LFA	YES	20	22.7561	<0.001
	NO	41	18.98333	
LEFT EAR HFA	YES	20	17.35772	<0.001
	NO	41	14.43333	

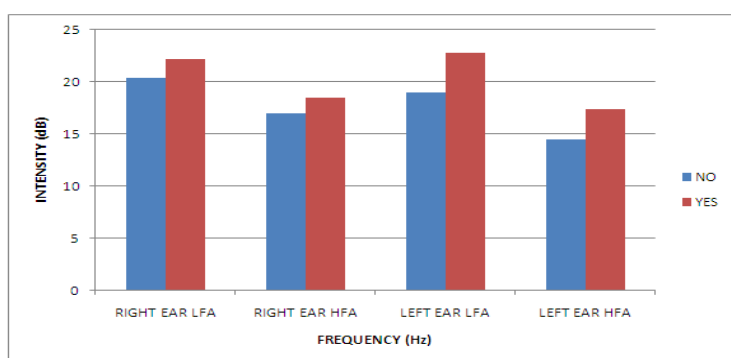


Figure-2. Graph showing hearing threshold in the presence and absence of external noise.

We tend to increase the volume of the music player in the presence of external noise. In the present study, the P value of high frequency average and low frequency average is less than 0.001 and 0.005 which is statistically significant (TABLE – 2, Fig – 2). We found that 50 students (81.4%) used mainly earphones (insert type), whereas only 11 (18.5%) used headphones (supra-aural type).

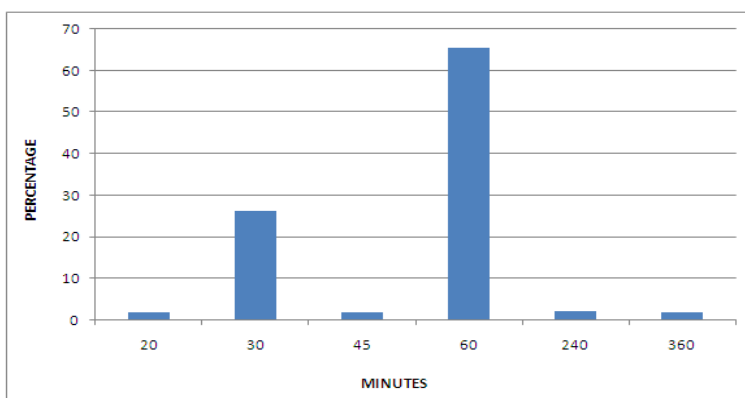


Figure-3. Graph showing duration of listening to music per day.

Out of the 61 subjects, 40 students (65.57%) used ear phones for 60 minutes per day. In addition, 16 students (26.22%) used it for 30 minutes per day. Two students (2%) used it for 240 minutes per day (Fig -3).

Table-3.Years of usage.

Years	Number	Percentage (%)
0-1	6	9.83
1-3	1	1.63
3-5	3	4.91
5-7	24	39.34
>7	27	44.26

The overall usage period of earphones was more than 7 years in 27 students (44.26%). It ranged from 5 to 7 years in 24 students (39.34%), 0 to 1 year in 6 students (9.83%) and 3 to 5 years in 3 students (4.91%)(Table – 3).

Table-4.Correlation of the variables.

	Duration/day(mins)	Years of usage	Loudness
RIGHT EAR LFA	0.016	0.061	0.408
RIGHT EAR HFA	0.11	0.101	0.579
LEFT EAR LFA	0.153	0.006	0.432
LEFT EAR HFA	0.084	0.036	0.436

Table-5.Pearsons Correlation.

0 to 0.2	0.2 to .4	0.4 to .6	0.6 to .8	0.8 to 1.
poor correlation	fair correlation	good correlation	Very good correlation	excellent correlation

In our study, the variables duration and years of usage has a poor correlation, whereas loudness shows a good correlation (TABLE - 4, TABLE – 5).

IV. Discussion

Hearing loss is associated with difficulties in daily life. Children and adults with hearing loss may have limited social activities, have a reduced quality of life or develop psychological problems including feelings of isolation and exclusion as well as depression and cognitive disorders.⁵

Noise exposure is an important risk factor for hearing loss. Although exposure may be involuntary, many individuals are exposed voluntarily to noise, including people who listen to music using personal music players. An important consequence is difficulty in understanding speech, leading to fatigue and anxiety in attending social activities occurring in noisy settings.⁶

Personal listening devices (PLDs) allow users to listen to music uninterrupted for prolonged periods and at levels that may pose a risk for hearing loss. Ear phones are the more common modality used by music listeners⁷ as is also found in our study (81.4%), thus putting them in the higher risk group.

The present study investigated the prevalence and magnitude of NIHL in students to understand the risk of hearing damage from PLDs. Our study showed that the hearing loss occurred in 36.06% (22 of 61) of

subjects following long-term use of PLDs. The test group showed higher threshold of hearing when compared with the control group which is similar to the result of the study done by Penget al.⁸ Also, hearing threshold is higher in the presence of external noise. When we compared the effect of variables, it was found that “loudness” has good correlation. Similar result was obtained in a study done by Gupta et al on the college students of Delhi in which 23% complained of transient decreased hearing after exposure to loud music. 83.8% knew that loud sound has harmful effect on hearing but still only 2.7% used protection device.⁹ Similar result was also found in a study done by Kumar et al which showed a positive correlation between output levels and auditory measures suggesting that listening to music through PMPs at higher intensities may cause subtle pre-clinical damage to the auditory system and over the years such behaviour may be hazardous to hearing.⁹ Although duration of PLD usage has a poor correlation, it can be a contributing factor for NIHL due to PLD exposure. This revealed that the risk of damage to hearing is increased as the duration of noise exposure lasts longer which was also true in the study done by Penget al.⁸ In their study, the hearing thresholds in the 3 to 8 kHz frequency range were significantly increased in the PLD listeners. The frequency range of the increased thresholds became broad as the exposure duration was increased. Impaired hearing was detected in 14.1% of ears. In a study done on the Korean adolescents, significant elevations of hearing threshold were observed in those who had used portable music players for over 5 years and in those who had used earphones.¹⁰ Current study reveals that the loudness of PLDs has a stronger impact on hearing and duration of PLD usage has a milder impact.

In a study conducted to measure the frequency of hearing loss in a sample of teenagers in Mexico City, it showed hearing loss in 21% of students. The main hearing loss-related risk factor was exposure to recreational noise.¹¹ In a study done on young adults using mobile phones in the University of Ibadan, Nigeria, 22.2% of students and 28% staff had some evidence of hearing impairment.¹²

In a study done by Hegde et al to find out the effect of mobile phones on hearing, it was observed that there was a minimal hearing loss of 5-15 dB in those exposed to mobile phone usage of more than 2 hours per day.¹³

V. Conclusion

Portable music players can have a deleterious effect on hearing threshold. Long term use of PLDs can impair hearing function. But more than the duration of exposure to music, it is the loudness factor which is showing harmful effect on hearing. Finally, we suggest that users of PLDs should sensibly control the loudness so as to avoid developing NIHL.

Annexure - 1

Name: _____ Age: _____ Sex: _____

1. Duration of listening to music per day (minutes) --- _____
2. Presence of external noise --- Yes / No
3. Years of usage of ear phones --- Number of years _____
4. Loudness out of a scale of 10. --- _____

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