

# Variation of Induced Pure Tone Audiometry of Hidden Hearing Loss in Music Player Users

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## Abstract

Hearing acuity has been estimated in 277 university students of Georgia. 150 from, were regular music player employers while remainder 127 have been not utilized habitually any local music device and constituted thus the control group. Ages of individuals in both sample collections fell in the range of 18-25 years. Auditory thresholds were measured monaurally by the pure tone audiometer within the band of 1-12-kHz frequencies. The overall time of the player service was different among individual admirers while only a restricted number used to listen to the music more than 8 hours per day. At the principal speech frequency link, 1-6 kHz, the thresholds in player music consumers did not differ from those in non-consumers. At 8 and, especially, 12 kHz, however, the player music fans possessed greater thresholds. High-frequency hearing disorders did not display any persistent dependence upon everyday music listening lengths. The process of hearing disturbances along with a group-systematic character seemed thus to own an individual-sensitive quality also. When analyzing the personal data, the gender bearing trend was revealed furthermore: high-frequency threshold elevations appeared in somewhat greater rate in female than in male consumers. Systematic audiometrical inspection of personal music player followers is recommended for an in-time disclosure of a hearing disorder and an immediate start then of corresponding treatment and preventive means. The hearing testing has to include high tone frequencies, 12 kHz, e.g.

**Keywords:** personal music player users; acoustic trauma; frequencies; gender factor; prevention of hearing lo.

## 1. Introduction

Music players are rather popular in the world around. The maximal sound intensity in players reaches 100-120 dB [1, 3]. The users mostly use the devices in the noisy environments: when walking through the streets, when transporting over, etc. In such situations the outer noise level approximates conventionally to 90 dB [2].

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To follow the applied melody, the music intensity in players should thus exceed 90 dB that appearing harmful for delicate inner-ear structures [4, 5]

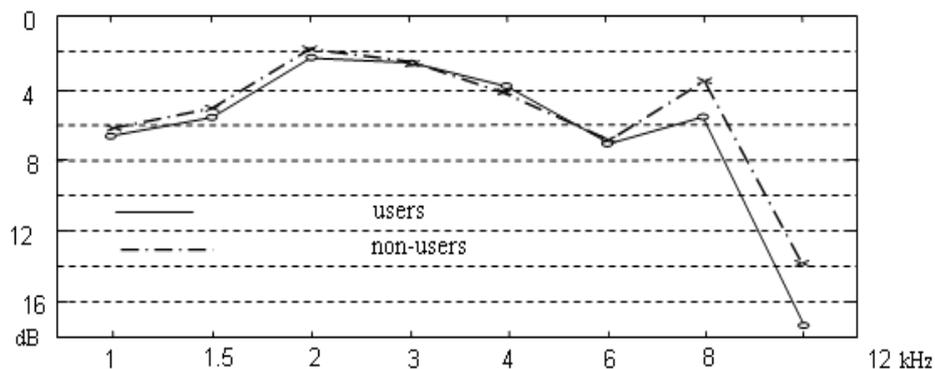
## 2. Materials and Methods

The influence of the player music on the hearing function has been estimated in the present study. 277 students of the higher education establishments participated in the project. The age of inspected individuals fell within the range of 18-25 years. 174 from the tested subjects were females and 103 were males. 150 participants, 141 females and 49 males, were music player fans while 127 individuals, 73 females and 54 males, were apart from the regular music player users and constituted thus the control sample

Potential participants of the research underwent initially otoscopy. If finding cerumen or any outer- and middle-ear pathology, the subject was not included in the study. Individuals filled then the particular questionnaire. The subjects were excluded from the sample if indicating the history of auditory trauma, and/or of the use of ototoxic drugs, and/or of a family history of a hearing loss at early ages. Special attention was given to the duration of the music player usage: how many years, how many days, and how many hours per day are involved the participants in music habits.

Hearing thresholds were determined in a soundproof chamber. The pure-tone audiometry was conducted by GCI-16 Audiometer. Hearing acuity indices were determined monaurally at 1-, 2-, 3-, 4-, 6-, 8-, and 12-kHz frequencies.

The program *IMB SPSS Statistics 20* was applied for the quantitative processing of obtained results. The primary data analyses, e.g. revealing of ratios and estimation of mean values, were descriptive. The comparison

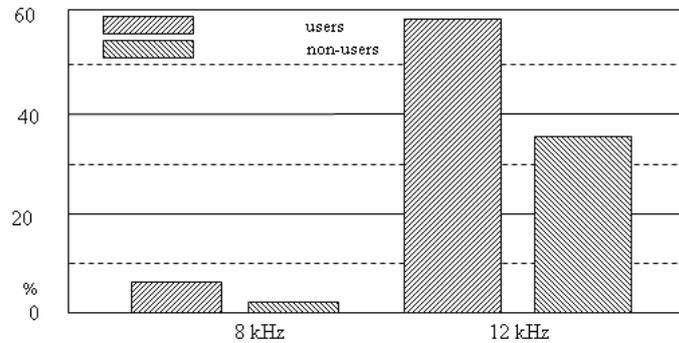


**Figure 1:** Auditory thresholds in personal music player users and non-users at 1-12-kHz frequencies.

of the test vs. the control intergroup categorical variables was performed utilizing the *Person Chi-Square Test*.

### 3. Results

Auditory threshold values of music player users and non-users were estimated at 1-12-kHz frequency band (Fig. 1). No difference was found at 1-6-kHz frequencies. At higher frequencies, 8 and 12 kHz, the thresholds in periaural player music users regularly exceeded those in non-users (Figs. 1 and 2).



**Figure 2:** Incidences auditory threshold augmentation at 8- and 12 kHz frequencies of music player users and non-users.

At 8 kHz the mean difference approximated to 2 dB while at 12 kHz to 4 dB. The latter disparity was statistically significant ( $p < 0.001$ ). The systematic usage of player music can lead thus to high-frequency hearing impairments. From the overall number of 277 inspected individuals, the impaired hearing at 12-kHz frequency was the case in 101. From those, 80 subjects belonged to the test subgroup of the music player fans while 21 only to the control one, 79.2% and 20.8%, respectively ( $p < 0.001$ ). Within the inspected generation, the increase in auditory thresholds at high sound frequencies did not display any dependence upon the age of music player users: the incidences of high-frequency hearing worsening in age groups of 18-20 and 21-25 years appeared rather similar.

From the overall number of the 80 music player users, demonstrating an increase in auditory thresholds at 12-kHz frequency, in 54 individuals it occurred unilaterally while in 26 bilaterally. The threshold augmentation appeared thus twice as much unilaterally than bilaterally: 67.3% and 32.7% of cases, respectively. The hearing threshold augmentation at high auditory frequencies failed to correlate with duration of music player listening. The threshold augmentation at 12-kHz frequency was detected somewhat more frequently in users involved in music player more than 6 hours per day, 54.2% (Fig. 4). On the other hand, the impairment incidence was greater in individuals rarely, 1-2 hours, than more intensively, 3-6 hours, being engaged in everyday music: 48.6% and 40.7%, respectively.

The incidences of auditory threshold augmentation at high auditory frequencies in the control subgroup were lower in females than in males: 12% and 22%, respectively (Fig. 3). In the test subgroup, on the opposite, the rate of high-frequency impairment in females exceeded that in males: 55% and 49%, respectively. The ears of

females appeared thus more sensitive to the music player effects than those of males.

#### **4. Conclusions**

The following conclusions were reached considering the results of the study:

- (1) At conventional speech frequencies the hearing thresholds in music player users are within the normal limits and statistically are not differed thus from those in non-users.
- (2) The hearing thresholds in music player users are increased at high sound frequencies, at 8 and 12 kHz, in particular.
- (3) Augmentation of hearing thresholds in music player users at high auditory frequencies are not correlated with everyday lengths of the player usage and bear thus more individual-personal rather than systemic-group character.
- (4) The effects of music listening on a hearing function possess gender specific character: high-frequency hearing loss due to systematic music listening has more regular character in female than in male music player users.

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