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Effects of headphones on hearing acuity of students of Ahmadu Bello University, Zaria, Nigeria

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ABSTRACT

Hearing is one of the five senses; it is a complex process of picking up sound and attaching meaning to it. Exposure to loud noise can lead to hearing impairment. Personal audio electronics such as MP3 players, iPods and other music devices today can produce sounds up to 120 decibels, equivalent to a sound level at a rock concert. This study was designed to investigate the effects of headphones on the hearing acuity of students of Ahmadu Bello University, Zaria, Nigeria. To achieve this aim, male and female students of the university within the ages of 19-31 were used. A total of 96 students both male and female were divided into two groups, A and B, each group comprising of 48 subjects. Group A (study group), comprised of students who are users of headphones, while group B (control group) comprised of students who are non-users of headphones. Questionnaires were administered to check indices such as their age, sex, history of hearing impairment, frequency and duration of usage of head phones and so on. The results obtained from this study showed that there was a significant increase ($p<0.05$) in the hearing threshold in the left ear of 18.75 ± 5.58 when compared to control group (8.19 ± 3.19). There was also a significant increase ($p<0.05$) in the hearing threshold in the right ear of 20.26 ± 5.47 in the study group when compared to control group (8.45 ± 3.33). It can be concluded that there was a decrease in the hearing acuity of users of headphones. It is therefore advisable to avoid or minimize the duration of exposure to direct noise source which may to lead to early onset of hearing impairment.

Key words: Headphones, hearing acuity, audiometric test, hearing impairment, noise.

INTRODUCTION

Sound is a very significant aspect in the relationship between environment and man, which has improved survival of man in evolution [1]. Noise can be defined as an unwanted and unpleasant sound. Sound is formed when objects vibrate, resulting in a minute variation in surrounding atmospheric pressure called sound pressure [2]. The human ear is fully developed at birth and responds to sound that are faint as well as sounds that are very loud. Hearing impairment is a growing problem and can occur in all ages, it could be caused due to repetitive exposure to sound or external noise [3]. As hearing decreases naturally with age, a minor hearing loss caused by noise at young age can become a greater problem later in life. On a daily basis, people are exposed to harmful noise in their environment, such as the sounds from television, traffic, construction sites, radio and other industrial appliances. Normally these

sounds are heard at safe levels that do not affect their hearing. However, when people are exposed to harmful noises that are too loud of for prolonged duration, hair cells in the inner ear can be damaged, causing noise-induced hearing loss (NIHL). Noise-induced hearing loss can be caused by one time exposure to an intense impulse or burst of sound, such as an alarm or to loud noise over an extended period of time [4]. Due to loud music and a generally noisy environment, young people in the United States have a rate of impaired hearing 2.5 times greater than their parents and grandparents, with an estimated 50 million individuals with impaired hearing estimated in 2050 [5]. The hair cells are small sensory cells in the inner ear that converts sound energy into electrical signals that travel to the auditory processing centers in the brain. Once damaged, the hair cells cannot grow back [6]. With this increase in the rate at which people use headphones, there is need to evaluate the adverse effect of long term usage of headphones on the hearing acuity of users of headphones and to check if there is a difference in the hearing acuity between sexes. This study was designed to investigate the effects of headphones on the hearing acuity of students of Ahmadu Bello University, Zaria, Nigeria.

MATERIALS AND METHODS

Materials used

Portable amplivox audiometer (Model name: Peters; Serial number: 279062-67), audiogram, earphones, and questionnaires.

Study location and population

The study was carried out in the Human Physiology laboratory of the Ahmadu Bello University, Zaria, Nigeria. A total of ninety six (96) subjects of both males and females were recruited for the study, all of whom were students of the Ahmadu Bello University, Zaria, Nigeria.

Data collection and technique

A random sampling technique was employed in selecting the subjects; they were all within the age range of 19-31. Questionnaire was administered to ascertain the suitability of the volunteers for the research study. A total of ninety six (96) subjects were employed for the study. The subjects were assigned into two groups as follows: Group A which comprised of forty eight (48) users of headphones formed the study group, while Group B comprised of forty eight (48) non-users of headphones and served as the control group. Questionnaire containing information such as sex, age, history of hearing problem, duration of headphones use, the sound level at which they enjoy using their headphones and which ear they prefer to use the headphone was administered before the commencement of the audiometric test. Those with history of hearing problem were excluded from this study to reduce the effect of temporary threshold shift to its barest minimum.

Audiometric assessment

The audiometer was used for this study. Instructions were given to the subjects concerning the test procedure and the subjects were required to indicate whether he or she can hear or not a certain sound. The sound level was increased from a very low to high level. The headphones were connected to the audiometer which produced pure tones at specific frequencies as a calibrated knob is tuned. The knob is calibrated in Decibels (dB) ranging from -10 to 110dB. Earphones were fitted carefully over the ears and the test was then carried out on each ear. Firstly, a threshold test was undertaken in which each ear is subjected to sound at a frequency of 125Hz at varying levels of intensity ranging from low to high and high to low. The procedure was repeated several times so that an average threshold can be derived for the test. Following this pre-check, both ears were tested through a range of frequencies (usually 125, 250, 500, 1000, 4000 and 8000 Hz) and hearing loss recorded on an audiogram for each frequency via a series of sound exposures.

Statistical analysis

The data obtained from this study were expressed as mean ± SEM and analyzed using student t-test. Post hoc test and Pearson's correlation coefficient (r) was used to determine to determine the correlation between parameters. Differences between the mean ± SEM of the study and control groups were considered significant at $p< 0.05$.

Table1: Effects of Headphones on Hearing Acuity of students of Ahmadu Bello University, Zaria.

Parameters	Sex	Study group (48)	Control group (48)
Hearing acuity of the right ear	Male	17.04±5.89 [a]	8.53±3.28
	Female	20.78±4.53 [a]	7.87±3.14
Hearing acuity of the left ear	Male	19.33±5.52 [a]	8.64±3.31
	Female	21.73±5.33 [a]	8.23±3.40

Values are statistically significant when compared to control group at [a] $p<0.05$, while ns=not significant.

RESULTS AND DISCUSSION

The result obtained from this study showed a statistically significant increase ($p < 0.05$) in the hearing acuity of the right and left ears of male headphones users from 8.53 ± 3.28 and 8.64 ± 3.31 in the control groups to 17.04 ± 5.89 and 19.33 ± 5.52 in the study groups when compared. This indicate that the use of headphones had an effect on the hearing acuity of the study group and their hearing acuity fell within the range of mild hearing loss and this could be due to decreased sensitivity of the hair cells of the ear. On the other hand, the hearing acuity of the right and left ears of the female headphones users recorded a statistically significant increase ($p<0.05$) from 7.87 ± 3.14 and 8.23 ± 3.40 in the control groups to 21.73 ± 5.33 and 20.78 ± 4.53 in the study groups when compared. Our present findings disagrees with the study of Krishnamurti and Grandjean [7] who showed that hearing acuity and auditory function did not alter after exposure to loud music and exercise and also that hearing acuity and auditory function in young women do not change after short-term exposure to moderate-intensity exercise and loud music. Wallace *et al*., [8] reported that hearing acuity of anesthesiologists was worse than the general population. They also recorded that inability of the anesthesiologists to hear alarms occurred only with alarms with frequencies of 4,000Hz or greater. Abdel-Aziz *et al*., [9] also reported that chronic exposure to sound of air plane engine which is about 150dB impacts adversely on hearing and is a risk factor in airport workers. Young people endanger their hearing voluntarily, through the abuse of headphones and this can lead to the early onset of deafness in such people. The degree of hearing loss an individual may suffer depends on the intensity of the sound and the duration of exposure to such sound. Some models of modern players allow one to listen to the music with the volume of about 105dB. Sound at 85dB and below is considered to be safe. If one is exposed to sounds greater than 90 dB for an average of eight hours per day without hearing protection, hearing loss may likely result. Once damage to hearing occurs it cannot be repaired, but reducing or avoiding too loud sound can prevent any further damage to hearing.

CONCLUSION

In conclusion, our present study showed that the male and female head phone users recorded an increased hearing acuity, and this may lead to early onset of hearing loss or deafness. Therefore, it is recommended that an over the ear type of headphone should be used, rather than the ear plug type and better still, a noise cancelling type of headphone should be used.

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