



The Influence of Earphone Usage Behaviour on Ear Disorders

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Abstract

Is the use of earbuds linked to ear disorders? This research tries to find out. A proportional random sample method was used for the research. The main data and simple linear regression are used for descriptive statistics and statistical analysis of the findings. The habit of wearing earbuds has a negative impact on ear problems. Extended exposure to sound above 110 dB in loudness each day for more than 1 hour per day, along with extended earphone usage, may lead to impaired hearing. To minimize hearing loss, earphone use should be avoided if possible, and use should be limited to less than 1 hour a day, at lower volumes.

Introduction

Humans have five sensory organs, with the ear being one of them. The ear can receive sound waves or air waves, which are then transformed into electrical impulses and sent to the brain through the auditory nerves. The ear may also receive electromagnetic radiation. In addition to its function as a hearing instrument, the inner ear also serves as a sense of balance organ, which is referred to as the vestibulum.

The inner ear is responsible for two distinct functions: the cochlea, which is responsible for the sensation of hearing, and the semi-circular canal, which is responsible for maintaining balance (Daudet & Žak, 2020). Endolymph is found inside the membranous labyrinth, and it is generated by the stria vascularis and resorbed in the endolymphatic sac, which is located within the stria vascularis (Li et al., 2021). The helicotrema is the tip or crest of the cochlea, and it links the perilymph of the Scala tympani with the Scala vestibuli, forming a ring around the cochlea (Lim & Brichta, 2016; Parker et al., 2016).

The sound that is perceived by the human ear transforms from an acoustic signal that is mechanical to a signal that is sent to the brain via the auditory nerve after it is received by the ear. The process of hearing starts with the entrance of sound waves collected by the auricle into the inner ear via the external acoustic meatus (ear canal) (Saul et al., 2017).

Afterwards, the sound waves that have been recorded will cause the tympanic membrane of the ear to quiver. During normal hearing, sound is received in the form of vibrations on the tympanic membrane, which is in the frequency range of human hearing. Known as the acoustic field, these vibrations are caused by a variety of changes in air pressure caused by the sound source and transmitted to the surrounding medium as a consequence. After passing through the tympanic membrane, the vibration will cause the three ossicles to vibrate in response to the sound (malleus, incus, stapes).

In order for the basilar membrane to vibrate, the ossicles' vibrations must be communicated via the oval window, which moves the fluid in order for the basilar membrane to vibrate in response

to the resonance. The organ of Corti, which is composed of hair cells and is situated on the surface of the basilar membrane, is responsible for converting mechanical vibrations into electrical impulses (Dewey et al., 2019; Liu et al., 2017). Once the signals from the hair cells have been received by the nerve cells (afferents), they are passed on to the auditory nerve, which then transmits them to the cortex of the brain. The auditory stimuli are identified as auditory stimuli by the cerebral regions of hearing (Boardman's areas 41 and 42).

A variety of ear diseases may develop at any time and from any location, including both ear and hearing abnormalities that are either congenital or acquired (Cole & Flexer, 2019). There are a variety of factors that may contribute to ear problems, including the aging process, inheritance or genetics, viral illnesses, and head trauma as a result of exposure to high-frequency sound that is more than 20,000 hertz (damaged) over a prolonged length of time.

Increases in the usage of audio-visual and telecommunications technologies have led in the use of earphones, headsets, and headphones in order to listen to crisper sound or audio, particularly while listening to music (Jackson, 2018). This is true for both children and adolescents as well as adults. Because the distance between the sound source and the earphones is shorter when using in-ear earphones, the noise intensity of the music is higher than the noise intensity of the music when not using in-ear headphones at the same level. Furthermore, since earbuds in the ear cannot fully block out noise from the surrounding environment, when they are used, there is a propensity for someone to raise the volume of the music to a higher level (Mandel et al., 2016). Hearing loss may occur due to noise and the accompanying symptoms of ear diseases, which can include aches and pains, ringing in the ears, ear fullness and other symptoms that can interfere with and impair hearing function.

A sound source is any device that is capable of causing a disruption in the pattern of air molecules to be present in the environment (Volfson et al., 2020). The frequency of the vibration is responsible for determining the pitch of the sound (Alimuradov et al., 2019; Qin & Buehler, 2019). It is expected that the tone would increase in volume proportion to the frequency of the vibration. The human ear is capable of detecting sound waves with frequencies ranging from 20 to 20,000 hertz (Garstang & Kelley, 2017). When it comes to sound, the intensity or strength of a wave is determined by its amplitude, which is defined as the difference between regions of high pressure and areas of low pressure. The larger the amplitude, the louder the sound. Sound intensity is measured in decibels (db), which is a logarithmic measure of the intensity relative to the weakest sound that is still detectable to the ear (Hamill & Price, 2017). Decibels (db) are a unit of measurement for sound strength (hearing threshold).

According to data from the World Health Organization (WHO) on the number of people who suffer from hearing loss and deafness in 2000, there are 250 million (4.2 percent) of the world's population who suffer from hearing loss, with approximately half of them (75-140 million) living in Southeast Asia, which has a high prevalence of deafness. At 4.6 percent, this is a significant amount.

According to statistics collected in both developing and developed nations, adolescents and young adults aged 12 to 35 years are most vulnerable. 50 percent are exposed to loud noises at hazardous levels as a result of the use of personal audio devices, 40 percent are exposed to possibly harmful sounds at work, entertainment, and other locations, and 10 percent are exposed to potentially harmful sounds in other areas.

Sixty-three percent of respondents did not perceive the danger of using earbuds too often, whereas 36.7 percent of respondents did see the risk of using headphones too frequently, according to the findings.

Methods

The Analytical Descriptive technique was utilized in conjunction with an Ex Post Facto strategy in the design of this research. The information utilized in this research is derived from primary data obtained via the completion of questionnaires and direct examination.

The information in this research was derived from primary data collected via questionnaires and hearing examinations utilizing a tuning fork on the part of the participants who were tested. The questionnaire includes questions regarding the respondents' identities as well as a description of their behavior while using earbuds. The use of a tuning fork is used to assess whether or not there is a hearing impairment. It was also determined whether or not the usage of earphones had an impact on ear diseases by comparing the data collected from the questionnaire with the findings of the tuning fork examination.

The research data will be analyzed in two stages: first, a univariate analysis will be performed to answer the description of behavior and ear disorders associated with the use of earphones, and then a multivariate analysis will be performed to answer the description of behavior and ear disorders associated with the use of earphones. In this instance, a frequency distribution table will be used. A basic linear regression test was performed to examine the potential impact of the independent variable on the dependent variable in order to answer the hypothesis. Bivariate analysis was utilized to answer the hypothesis.

Results and Discussion

Overview of Earphone Usage Habits

From the frequency with which earphones are used in a day, the length of time with which earphones are used in a day, the high and low volume that is usually used when using earphones, and daily behavior that can be a trigger factor for ear disorders, the description of the respondent's behavior regarding the use of earphones in general can be deduced. When you use earbuds, you may develop the habit of wearing them while sleeping or laying down or in crowded areas, which may be hazardous to your health.

According to the findings of univariate data analysis, as many as 14 respondents (56 percent) have admitted to sometimes using headphones during lectures delivered through zoom. A total of eleven respondents (44 percent) report that they often use headphones while laying down or sleeping.

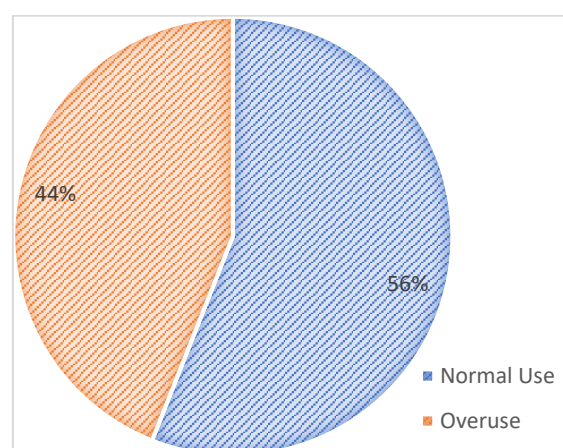


Figure 1. Earphone Use Behaviour Percentage

The practice of wearing earbuds to listen to audio in crowded settings has become commonplace. According to the study data collected from 23 research participants, 7 respondents (30.4 percent) admitted to sometimes listening to music via headphones in busy settings. It has been shown that using earphones during noisy conditions or in crowded places

increases the risk of hearing loss, with respondents frequently increasing the earphone volume in order to be able to enjoy the music or audio that is heard, increasing the likelihood that it will have a greater impact on the ears of those who have hearing loss. Among the 11 respondents (47.8 percent), earbuds are frequently used while listening to music or watching television.

According to the findings of the Univariate data analysis, the majority of respondents had been using earbuds for more than three years, with as many as 22 respondents having done so for more than three years (95.7 %). It is estimated that earphones are used on average 1-2 days a week, which falls into the category of low frequency of earphone use. According to the results of the survey, the total amount of time respondents use earphones per day is at most 1-2 hours per day with a frequency of 9 respondents (39.1%), compared to the period of using earphones for more than 3 hours, which has only 5 respondents (21.7 percent), and the number of respondents who use earphones for more than 2 hours has as many as 5 respondents (39.1%).

Overview of Ear Disorders Symptoms After Using Earphones

43.5% of those who constantly use earbuds regularly experience issues with ear discomfort after using them. Earphones usage that is frequent and utilizing high levels for extended time periods is likely to result in changes in humidity, discomfort from friction, or earwax being created owing to constant exposure to sounds. Twelve people (52.5%) reported hearing ringing in their ears (known as tinnitus) after they had used earbuds.

Hearing Disorders

The research found two different types of hearing loss from the ear after an earphone/tuning fork test. The first kind was from the sensors in the ear, and the second was from the communication with the other organs. Based on study by 23 respondents who use earbuds daily, almost half of the respondents (47.8% of those with sensorineural hearing loss) reported right ear hearing loss and a fifth of respondents (17.4% of those with sensorineural hearing loss) said their left ear hearing was affected.

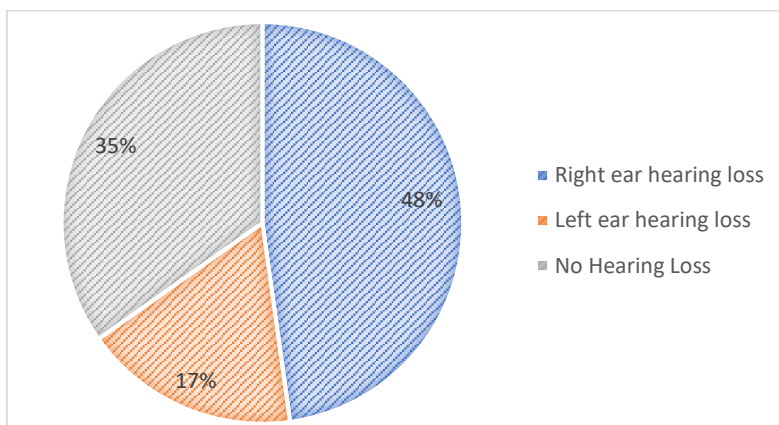


Figure 2. Hearing loss after earphone fork test percentage

Results of Bivariate Data Analysis

The Sig value is calculated based on the findings of data analysis in the Coefficients table, which shows the impact of the user's behavior while wearing headphones on ear diseases. On the tuning fork test, the significance level for ear problems is (P) significant = 0.003, which is lower than the significance level of 0.05 (P = 0.05). Painful ear disorder (otalgia) with Sig (P) = 0.003, which is less than the alpha significance threshold of 0.005, indicating that the condition is less common. Tinnitus is a ringing in the ears that has a Sig value (P) of 0.010, which is less than the alpha significance threshold of 0.005, which is 0.005. Otorrhoea ear

diseases have a Sig value (P) of 0.208, which is higher than the significance threshold of 0.005 and indicates that they are more common.

The Effect of Earphone Usage Behavior on Ear Disorders

Based on the findings of research into the relationship between knowledge and behavior regarding the use of earphones and ear disorders, the results of a simple linear regression test were obtained with a significant value less than 0.05 ($p = 0.003$), indicating that there is a relationship between knowledge and behavior regarding the use of earphones and ear disorders.

Earphone usage may cause damage to the auditory organ depending on the length of use, frequency of use, volume level utilized, ambient noise while using earphones, and the habitual behavior of using earphones every day, all of which can result in symptoms of ear diseases if not addressed. Using earbuds for an extended period of time, such as more than three years, may result in hearing loss (Portnuff, 2016). With the use of earphones, the intensity of the sound produced can reach 110 dB. Exposure to sound intensity levels greater than 110 dB per day for more than 1 hour per day can cause hearing loss. As the volume of sound produced increases, the duration of use as well as the frequency of use must be reduced.

When identifying hearing loss, this research used a tuning fork test; however, an audiometric test, which can assess a person's hearing threshold based on the amount of sound intensity, would be preferable in terms of determining the degree and kind of hearing loss. As a result, further study utilizing the equipment indicated above is required

Conclusion

In general, hearing loss may occur while using earbuds, with longer usage times, louder volumes, or other issues resulting in long-term damage. Long-term usage of earbuds leads to hearing loss after more than three years. Exposure to sounds with intensities higher than 110 dB every day for at least an hour will put people at risk of developing hearing problems; one should therefore limit the amount of loud music listened to each day by using headphones less often.

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