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ORIGINAL ARTICLE

Sound pressure level generated by individual portable sound equipment[☆]

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External auditory canal;
Music;
Young adult

Abstract

Introduction: The use of Personal Digital Audio Players can cause hearing injuries, as the sound is generated directly in the ear canal. It is believed that different types of headphones can cause different amplifications, since they cause changes in the volume and resonance of the ear canal according to their depth.

Objective: This study aimed to determine the sound pressure to which young individuals are exposed when using Personal Digital Audio Players with two types of headphones: insertion earphones and anatomical insertion earphones

Materials and methods: This was an experimental study. The probe microphone measurements were made with different headphones in 54 ears (27 young individuals). The resonance peaks were also recorded.

Results: A statistically significant difference was observed between the evaluated headphones, showing that anatomical insertion earphones had higher levels of sound pressure than insertion earphones for all frequencies measured. There was no correlation between the resonance peak of the closed canal and the frequency where the highest sound pressure level was obtained. There was a significant difference between ears at some frequencies with the different headphones.

Conclusion: It was concluded that anatomical insertion earphones generate a higher sound pressure level than insertion earphones.

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PALAVRAS-CHAVE

Orelha externa;
Meato acústico externo;
Música;
Adulto jovem

Pressão sonora gerada por equipamentos sonoros portáteis individuais

Resumo

Introdução: O uso de equipamentos portáteis sonoros individuais pode ser um risco auditivo, pois o som é gerado diretamente no meato acústico externo. Acredita-se que fones diferentes proporcionam amplificações diferentes, pois causam variações de volume e de ressonância conforme suas inserções.

Objetivos: Verificar a pressão sonora a que jovens estão expostos quando fazem uso de equipamentos sonoros portáteis individuais com dois diferentes fones: de inserção e de inserção anatômico.

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Material e método: Trata-se de uma pesquisa experimental. Para tanto, foram feitas medições em 54 orelhas de 27 jovens com idades entre 18 e 30 anos, com os dois tipos de fones. Também foram registrados picos de ressonância da orelha externa com e sem fone.

Resultados: Observou-se que o fone de inserção anatômico apresenta aumento do nível de pressão sonora estatisticamente significativa em comparação com o fone de inserção para todas as frequências avaliadas. Não há uma correlação entre o novo pico de ressonância do meato fechado e a frequência na qual se obteve os maiores níveis de pressão sonora com o fone. Observou-se diferença estatisticamente significativa entre orelhas para algumas frequências com os diferentes fones.

Conclusão: o fone de inserção anatômico gera um maior nível de pressão sonora que o fone de inserção.

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Introduction

Hearing is a sensory system of vital importance for humans who live in a society immersed in sounds and based on oral communication.

It is increasingly observed that the auditory system is exposed to high sound pressure levels, mainly by the changes in societal habits, such as venues where the sound is amplified, the use of sound equipment in cars, and the use of individual portable sound equipment, among others. Young individuals who, in today's society do not know how to live in silence and consider amplified sounds to be common and normal, are the segment of the population most exposed to amplified sounds.¹

The technological revolution has greatly contributed to the acquisition of these new habits, launching new devices in the market that allow people to change their experiences. The technological developments that enable the amplification of sounds are a prime example. In the past, the radio was the only means of communication through which people learned the news. Over time this has evolved from portable radios so that today people can listen to the radio or to their favorite songs in any environment without affecting those around, as the sound comes from the the headphone and goes directly into the ear. This common attitude of listening to music at any time and any place characterizes the contemporary behavior.²

The technological revolution has been so comprehensive that it improved not only the equipment that allows for the transmission of sound signals, but also the the quality of the headphones, so that the signal suffers no distortion until it reaches the auditory system. However, the technological developments have also allowed many young individuals to listen to their sound equipment for long periods of time, at very high sound intensities, without considering whether this habit can harm the auditory system in the long term.

Many studies have shown that the use of individual portable sound equipment such as MP3 players and iPods can cause a reduction in the hearing thresholds of young individuals, as well as the early onset of auditory symptoms such as tinnitus and hearing problems.³⁻⁶

This concern affects everyone. Brazilian Law No. 11,291, of April 26, 2006,⁷ requires that manufacturers of individual portable sound equipment inform customers that hear-

ing impairment may occur if the equipment is used above 85 dB. Yet, more importantly than disclaimers in products, it is necessary that the users of these devices are aware of the risk they face.

The Brazilian Regulatory Standard 15 (RS 15),⁸ which addresses occupational medicine and safety, particularly the exposure of workers to noise, states that the maximum allowable daily noise exposure for exposure level of 85 dBA is eight hours. As an increase in sound intensity level occurs, the noise exposure time must decrease (for every 5 dB increase, time is halved). Additionally, according to RS 15, individuals exposed to noise of 85 dBA must wear personal protective equipment (PPE) to protect their hearing. However, individual portable sound equipment can easily reach higher levels.

Studies have shown that such devices can reach up to 130 dB, which is equivalent to the sound pressure level generated by a jackhammer. In context, the maximum allowed volume of 85 dB corresponds to 65% of the total equipment capacity. Based on these studies⁹ and others, which state that almost 90% of the assessed young individuals use their equipment at maximum capacity,⁶ it is possible to infer that these young individuals exceed the recommended sound pressure levels and can damage their hearing.

Santos and Couto,¹⁰ in their study of young individuals, observed that they use their equipment on average for 1.83 hours a day, at a mean volume of 70% of the total equipment capacity. However, this same study observed, through measurements with a probe microphone, that the average equipment can reach peaks of 100 dB.

Specifically regarding the use of individual portable sound equipment, a question must be raised: does the type of headphone used favors greater amplification of the sound generated by the device? The use of headphones means that young individuals are at greater risk of exposure to high sound pressure levels, considering that the phone is inside the individual's ear, further amplifying the sound. Additionally, the sound pressure level is inversely proportional to the volume of the external ear, which, due to its shape, functions as a resonance tube.¹¹

Therefore, the sound pressure levels that these devices emit, which are measured by decibelimeters, are actually higher when measured in the ear of the young individuals, near the tympanic membrane, as the ear canal amplifies the sound.¹²

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