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Impact of different sources of noise exposure on hearing impairment: A cross-sectional study

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ABSTRACT

Background: hearing loss and noise exposure may affect the population (adolescent) if left untreated it can result in significant implications for their life and future in terms of personal education and social welfare throughout life
Objective: To estimate the percentage of hearing impairment among a sample of the population in AL-Rusafa distract in Baghdad those exposed to a different source of noise and to detect some factors that are associated with hearing impairment.
Subjects and methods: The cross-sectional study was conducted at Al-Kindy Teaching Hospital (Speech and Hearing Center) in Al-Rusafa, Baghdad, on (February 18 -September 1, 2019), the sample population was conducted through a direct questionnaire or by audiological equipment (pure tone audiometer y) was used to assess the hearing level
Results: the number of samples taken in the study was 732 patients. And by type of hearing level and age, the age group above 18 years was the most vulnerable to hearing loss76.4%, and females were more likely to have hearing loss,59.3% and while males suffer from hearing loss by 40.6%. the percentage of those who use an earphone for less than two hours a day and suffering from hearing loss was 42.2%while those who use the earphone for more than two hours a day and suffer from hearing loss have the highest percentage was 57.7% also The study showed that who use headphones and earphones for more than 6 hours per week have a hearing loss by 56.9%, while those who use headphones and earphones less than 6 hours per week suffer from hearing loss by 32%the percentage of those who knew the dangers of headphones were 32.78%, which is lower compared to those who did not know it, and it was 67.21.
Conclusion: There are high risks to noise exposure especially in adolescents who use calling mobile phones for more than 2 hrs. /day. Those who use headphones and earphones for more than 6 hrs. /week suffer from hearing loss more than others, females are more prone to hearing loss than males.

Introduction

Hearing loss is defined as a certain level of hearing loss in one or both ears. Hearing loss is divided into categories according to the degree of hearing impairment. (1)

The most common categories of hearing loss classifications are a mild, moderate, severe, and profound hearing loss. Hearing loss is a natural consequence of aging, as our ability to hear decreases, and it is difficult for us to hear speech. Another cause that has the most impact is noise exposure. It can also be the result of living in a noisy

world. This noise can come from our work or voluntary exposure to noise, such as loud engines or loud music at concerts in clubs and discos, and stereo equipment- with or without the use of headphones. (2)

The increasing use of portable MP3 players leads to noise-induced hearing loss. There is also a temporary hearing loss resulting from a pathological injury, as it resolves with recovery from the disease. In most cases, hearing loss cannot be cured. Hearing loss is usually treated with hearing aids. (3)

There are three main types of hearing loss: sensorineural hearing loss, conductive hearing loss, and mixed hearing loss. the hearing loss can be sudden or asymmetric, hidden, bilateral, or unilateral resulting from damage to the fine hair cells in the inner ear and this is common with age. Symptoms are difficult to recognize and permanent hearing loss can be the result of exposure to a high level of noise. Hearing loss is identified through a hearing test. A hearing test consists of several different tests that, when done together, can determine whether or not you have a hearing loss and to what extent. A hearing test is performed by an audiologist using specialized equipment. (4)

Subjects having a hearing threshold of 25db and below were considered as normal hearing and those having a hearing threshold above 25db from the air conduction threshold level, the deaf-ness can be graded into several categories: <25db_Normal,26-40db_Mild hearing loss,41-60db_Moderate hearing loss,61-70db_Severe hearing loss,71-90db_Profound hearing loss,91db, and above_Total deafness. (5).

As for tinnitus, it has become widespread recently, reaching 10-15% of the developed world, so it is temporary and chronic can be caused by noise and the use of mobile phones or handheld devices or High blood pressure or both, and most of the tinnitus is one-sided with ac-companying dizziness in some cases, especially for people who use mobile phones for an average of 10 minutes per day, as well as those who use phones in both ears for four years or more (6)

Research has shown that low-level radiofrequency affects the structural and functional properties of the cell membrane. Chronic exposure to radiofrequency may lead to tumor gene-sis by inhibiting cellular apoptosis and affecting DNA directly. There has been concern about an increased risk of acoustic neuroma and other brain tumors after prolonged exposure to mobile phones, but there is no conclusive evidence yet. Several studies failed to demonstrate any noticeable effect on auditory function after brief exposure to electromagnetic radiation. (7)

Hearing loss is a major public health concern, there have been some studies suggesting a relationship between hearing loss and tinnitus and mobile phone and exposure to radiofrequency electromagnetic fields (RF-EMF)from it have been associated with symptoms in some studies, but the studies have shortcomings and their findings are inconsistent so there have been no large cross-sectional epidemiological studies of a representative sample of the entire country population investigating this possible association The prevalence of chronic tinnitus is increasing and is currently around 10 to 15% in the developed world, say the authors. There are currently few treatment options. They suggest that there is a plausible explanation for a potential link between mobile phones and tinnitus as the cochlea and the auditory pathway directly absorb a considerable amount of energy emitted by a mobile. so The aim of the study is the effect of some noise factors and family history and the extent of exposure to the noise influence, taking into consideration the age and gender of the hearing impaired patients were taken in the study.

Subject and Methods

Study design and duration: a cross-sectional descriptive study with analytic elements was carried out during the period from18 February 2019 to 1 September 2019, three days per week.

Study setting: the data was collected in the AL-Kindy speech and hearing center, AL-Kindy teaching Hospital, Al-Rusafa, Baghdad, Iraq.

Study subject: convenient sample 732 who accept to participate in this study and available at time of data collection including both genders.

Data collection tool: the questionnaire consisted of two parts. The first one consist of age, gender, using a mobile phone, using headphone, earphone, and parents wearing a hearing aid, the second one depends on some questions like if they have tinnitus and knowledge about the risk of the increased volume of headphone and if they need to increase tv volume, ask people to repeat themselves and using the headphone for one year at least

Inclusion criteria: patients included in the study was those with hearing loss attending the above-mentioned centers divided into two age groups, patients younger than 18 years old and patients 18years old or older

Exclusion criteria: patients who refused to participate in this study.

Ethical approval: the proposal of this study was made according to the regulations and ethical considerations from the scientific and ethical committee at Al-Kindy teaching hospital (speech and hearing center) agreement from all participants involved in the study was also taken. Verbal consent: was taken from each participant after explaining the aim of the study, or from parents of children enrolled in the study, and all data were kept confidential during all stages of the work

Data collection procedure: our target population was from patients attending our center (hearing and speech center) Al-Kindy teaching during the studied period who were (aged>or< 18) of both gender with a questionnaire designed by the investigator was used for data collection, data was collected by direct interview and by audiological assessment, pure tone audiometric test

Audio-metric measurement: pure tone audiometric testing was conducted using an audiometer, all audiometric testing was performed under the supervision of an audiologist. Only air conduction threshold was measured, supra auricular headphone was used in the soundproof room it used a single pure tone of 1-2 seconds. the lowest level at which the subject responded to50%of of pure tone stimuli showed good test. The frequency ranges tested were 0.5,1,2,3,4and 6khz. We de-fined hearing loss as pure tone averages of frequencies at 0.5,1,2 and 4khz at a threshold of a> or = 40-decibel hearing level in the ear with worse hearing

Acoustic reflex and auditory brain stem response also can be used to know the hearing level mainly in children and patients with special needs.

Results

The cross-sectional study was conducted at Al-Kindy Teaching Hospital (Speech and Hearing Center) in Al-Rusafa, Baghdad, on (18 February -1 September 2019) and after collecting the results, they were entered in Table 1. (mild to moderate and normal tinnitus).

Table 1: distribution of patients by hearing levels in Al-Rusafa Baghdad city

Hearing condition	Number	%
Normal hearing tinnitus (-)	519	71
Hearing loss (mild-moderate) tinnitus (+)	72	9.8
(moderate)hearing loss tinnitus (-)	51	7
Normal hearing tinnitus (+)	90	12.2
Total	732	100

The results of Table 1 show that the number of patients taken in the study is 732 patients, of which 519 patients were normal hearing with a percentage of 71%, while 72 patients were hearing loss with tinnitus with a percentage of 9.8%. The percentage of hearing loss with tinnitus and the percentage of hearing loss without tinnitus was 7%, and normal hearing with tinnitus was 12.2 %. And in the study was taking distributed the female and male distribution of patients by type of hearing level age it shown in table 2.

Table 2:the distribution of patients by type of hearing level, age and gender

	Hearing loss tinnitus (+) mild-moderate No. %	Hearing loss tinnitus (-) moderate-severe No.%	Normal hearing tinnitus (+) No. %	Normal hearing tinnitus (-) No. %	Total No. %
Age: >18	52 72.2	42 82.4	68 75.6	209 40.3	371 50.7
<18	20 27.8	9 17.6	22 24.4	310 59.7	361 49.3
Gender: Male	29 40.2	21 41.2	62 68.9	304 58.6	416 56.8
female	43 59.8	30 59.8	28 31.1	215 41.4	316 43.2
Total	72 9.8%	51 7%	90 12.2	519 71%	732 100%

Table 2 shows that there is a significant correlation between age and type of hearing level, where the study took two age groups above 18years and less than 18 years, with a percentage (50.7%, 49.3%, respectively). The results showed that the age group over 18 years is the most Prone to hearing loss due to noise and the effect of sound waves emitted from the mobile phone through earphones, and this is innocent due to the impact of the dangerous age changes, which is the adolescence period and the change of sex hormones and growth hormone to reach the physical stage towards puberty, where the adolescent tendencies to learn a lot of information and be affected by sounds and music The loudness of the fluctuation of hormones causes a feeling of fear and comfort when leaving the variable mark by using earphones to avoid influence, criticism or interference with privacy. The research also showed that females are more susceptible to hearing loss. They are observed to have hearing loss with tinnitus and hearing loss without tinnitus (59.8% and 58.8%) respectively while males have hearing loss with tinnitus and hearing loss without tinnitus (40.2% and 41.2%) as well as hearing loss with or not tinnitus.

Table 3: percentages of patients in the study, according to the duration of their use of earphones and headphones (hour/day) and their effect on the level of hearing. and its relationship with age and gender

Patients criteria		No hearing loss no. %	Hearing loss no. %	Total no.
Used using earphones per day	<2hrs/day	220 36.12	52 42.27	342 46.72
	>2hrs/day	389 63.87	71 57.72	460 62.82
Patients in years	>18	277 45.5	94 76.4	371 50.6
	<18	332 54.5	29 23.6	361 49.3
gender	Male	366 60	50 40.6	416 57.8
	female	243 40.0	73 59.4	316 43.1
Using head phone & ear pods	<6hrs/week	409 67.15	53 32.4	462 63.11
	>6hrs/week	200 32.84	70 56.9	270 37.9

Table 3 shows that the percentage of those who use the earphones for two hours a day is the lowest, with 42.2% suffering from hearing loss, while 63.8% had normal hearing. As for those who use the earphones for more than two hours a day and they suffer from hearing loss, it was the highest rate was 57.7%, 36.1% had normal hearing. The study also showed that 18-year-old or more suffer from hearing loss was 67%, But 45.5% of them have normal hearing, which, so in females increase in aging is more likely to suffer from hearing loss, the study also showed that hearing impairment was more in females than males at 59.3%, 40%, respectively. The study also showed that those who use headphones and earphones for more than 6 hours per week were suffering from hearing loss by 56.9%, while those who use headphones and earphones for less than 6 hours per week have hearing loss which is the lowest rate by 32%.

Table 4: percentages of patients taken in the study that suffer from tinnitus, the percentage of exposure to the sounds of television and headphones, and their knowledge of its risks

Hearing Questionnaire	answer	no.	%
tinnitus	Yes	162	22.2
	no	570	77.8
Need to raise TV volume	Yes	410	56.1
	no	322	43.9
Need to asked people to repeat themselves	Yes	392	53.5
	no	340	46.4
Head phones used for 1year at least	Yes	400	54.6
	no	332	45.3
know about risk of increase volume of head phone	Yes	240	32.8
	no	492	67.2

Table 4 shows that those who need to increase the volume of the television, at a rate of 56.1%, while those who don't need to increase the television volume are 43.9%. And those who wear headphones for one year at least, at a rate of 54.6%, while the participant who wears headphones for less than one year are 45.3%. The table also shows that the percentage of those who know the dangers of headphones was 32.8%, which is lower compared to those who don't know at a rate of 67.2%.

Discussion

The current study disclosed that patients above18 years old have more influence by tinnitus and these results differed from what Mnaather, Asaad Adil et al (8) came up with, as he confirmed that the young age group less than 18 years is the most vulnerable to the influence by noise, while we agreed with the results of the same researcher, as females were more susceptible to the influence of noise and hearing loss with the presence of tinnitus. From males, I think that hormonal changes from the rise of estrogen, progesterone, and other hormones are more effective in females than males and he studies agrees with Herrera, Sarah, et al (9)and Goncalves CL et al(10) and Hodgetts WE et al(11). the advancing age is more prone to hearing loss due to increased exposure to noise, so there is an aging process that affects the level of hearing, therefore, the severity of hearing loss will increase with increasing age and cumulative exposure we agree with Clercq, Carlijn M P Le et al(12)

The results in the study agree with Torre, P.3rd et al (13), Mohammadpoorasl, Asghar et al(14) which suggested that the most commonly used earphones by the students were small and portable devices, such as ear pods and supra-aural earphones, which directly entered the ear canal that have a significant effect on the development of hearing loss.

The study agreed with Shafique, Muhammad Asim et al (2) who confirmed in their study that excessive use of mobile phones increased the net tone threshold associated with the duration of use. Use of more than 5 years with more than 60 minutes per day can cause adverse effects on human hearing results were consistent with Carlijn M.P.Le Clercq et al (12), Kumar A et al (17) the researcher's opinion although the researcher's findings were that 1 in 7 children between the ages of 9 and 11 years showed high-frequency clefts and/or HFHL. They also have a binary weakness. This HI already exists before exposure to known noise hazards, such as club attendance and subscription, and may have life-long consequences for the researcher's young age group, suggesting a need for early education on the risks of PMP use in young children and adolescents, the researcher's Which found The results showed that the sound pressure levels of either the first volume step or the maximum volume step were not the same for the different the most important symptom associated with the use of headphones is tinnitus and an increased need for a high volume of television that affects ears and cause permanent hearing loss and increases the need for hearing aid, T smartphone models and genres of music, which means that the risk volume sign and its output levels should be unified across the devices for their users. In addition, the risk volume steps proposed by the latest smartphone models are high enough to cause noise-induced hearing loss if their users habitually listen to music at those levels so we agree with Lacerda ABM et al (18).

The most common symptom associated with the use of headphones is tinnitus and the need for raising TV to increase the need for hearing aid, our results agreed with Figueiredo et al (19), similar results were reported in another study regarding the knowledge about risk for using a high volume of a headphone that affect hearing level shown that 32.78% of patients knew that there is a risk while 67.2% did not know that risk (20).

Conclusion

There are high risks to noise exposure especially in adolescents who use calling mobile phones for more than 2 hrs. /day. Those who use headphones and earphones for more than 6 hrs. /week suffer from hearing loss more than others, females are more prone to hearing loss than males

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Conflict of Interest

No conflict of interest.

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