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Original articles

Habits and hearing complaints of teenagers users of personal stereos

Hábitos e queixas auditivas de adolescentes usuários de estéreos pessoais

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ABSTRACT

Purpose: to characterize the habits and hearing complaints of teenagers with normal hearing users of personal stereos and connect them with the activity of the medial olivocochlear system.

Methods: 21 subjects were assessed (between 12 and 19 years) with normal hearing. They answered a closed questionnaire concerning the auditory behavior and complaining of tinnitus and accomplished hearing evaluation: Audiometry, immittance, transient evoked otoacoustic emissions and Suppression Effect.

Results: all participants of the study get exposed to music, the most them less than two daily hours. It was observed the presence of the suppression effect in the right ear in 66,67% and in the left ear in 61,90% of teenagers. Was not found significant association among the presence of the suppression effect between the ears, the genders, times daily noise exposure and absence of suppression effect. The sample of the teenagers reported having tinnitus, these, most reported tinnitus in both ears. Had significant association between the daily noise exposure and the presence of tinnitus and between the absence of the suppression effect of right ear and the presence of tinnitus.

Conclusion: all the teenagers researched reported listen to music every day, the most them less than two hours per day. The most of teenagers presented suppression effect. The tinnitus complaint can be associated with the absence of suppression effect in the right ear. In addition, like longer the time of sound exposure longer also the presence of tinnitus complaint in these adolescents.

Keywords: Audiology; Adolescent; Music; Habits; Tinnitus; Risk Factors

RESUMO

Objetivo: caracterizar os hábitos e queixas auditivas de adolescentes normoouvintes, usuários de estéreos pessoais e relacioná-los com a atividade do sistema olivococlear medial.

Métodos: foram avaliados 21 indivíduos, com idades entre 12 e 19 anos, com audição normal. Todos responderam a um questionário fechado referente ao comportamento auditivo e a queixa de zumbido e realizaram avaliação audiológica: Audiometria, Imitanciometria, Emissões Otoacústicas Evocadas Transientes e Efeito de Supressão.

Resultados: todos os participantes do estudo ficam expostos à música, a maioria, menos de duas horas diárias. Observou-se a presença do efeito de supressão na orelha direita em 66,67% e na esquerda em 61,90% dos adolescentes. Não foi encontrada associação significante entre a presença do efeito de supressão entre as orelhas, os gêneros e entre tempos de exposição sonora diária e ausência do efeito de supressão. Parte da amostra dos adolescentes referiu ter zumbido, destes, a maioria referiu zumbido em ambas as orelhas. Houve associação significante entre a exposição sonora diária e a presença de zumbido e entre a ausência do efeito de supressão da orelha direita e a presença de zumbido.

Conclusão: os adolescentes pesquisados referiram ouvir música diariamente, menos de duas horas diárias. A maioria apresentou efeito de supressão. Houve associação entre queixa de zumbido e ausência do efeito de supressão na orelha direita. Além disso, quanto maior o tempo de exposição sonora maior também a presença de queixa de zumbido nestes adolescentes.

Descritores: Audiologia; Adolescente; Música; Hábitos; Zumbido; Fatores de Risco

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INTRODUCTION

Equipments such as portable stereo devices are popular among young people ant they are frequently used for many hours during the day, with high sound pressure levels[1,2]. This abusive use with high duration, intensity and/or frequency of exposure to music may lead to auditory function disorders[3-6] and it may cause severe consequences to life quality[7].

The occurrence of auditory symptoms such as hypoacusis, ear fullness or dizziness and tinnitus after using personal stereos may suggest higher risks to young people's hearing[5,6,8]. It indicates a relationship among these symptoms and the habit of using personal stereos[5].

However, youths do not seem to be worried about the harmful effects of intense sounds. It becomes clear when it is considered their attitudes in varied situations of sound exposure[9,10], thus, it is important to perform researches about teenagers personal stereo users[11,12].

A symptom which is associated with improper sound exposure is tinnitus[3]. It is considered a perception by individuals of sounds or noise with no external sound source[8] and it may occur after neuroplastic alterations in the peripheral auditory pathways and, mainly, central, which may appear through peripheral injuries[13].

Nevertheless, there are few studies related to tinnitus in this age group, because children and teenagers usually do not refer such complaint. It is important to highlight that tinnitus may cause concentration, sleep and learning interference, becoming an important symptom to be investigated, because it is common in this population[3]. According to a recent study, as longer is the time of headsets use, higher is the tinnitus occurrence[6]. Besides, another study observed that people with tinnitus may present alteration of medial olivocochlear tract function, observed through lower otoacoustic emissions suppression[14].

Through the suppression effect, it is evidenced normal operation of the medial olivocochlear (MOC) system, after otoacoustic emissions amplitude reduction, when applied noise against or ipsilaterally the examined ear. Such phenomenon occurs because of the medial olivocochlear tract fibers, in synapse with exterior ciliated cells, occurring, thus, reduction of basilar membrane movement[15].

Thus, researching the MOC system operation in teenagers may be effective to obtain the relationship between hearing and auditory habits and exposure type of these subjects. Besides, the lack of emissions in these young individuals may express cochlear impairments, which can be detected even before this impairment becomes clinically evident[11].

Taking into account that teenagers are part of a group which is exposed to high levels of sound intensity, habits which are considered as risky to auditory health, and also observing that there are not many studies about this age group, this study had the purpose of characterizing auditory habits and complaints of normal hearing teenagers, users of personal stereos, and relating them with the medial olivocochlear system activity.

METHODS

This is a prospective, quantitative, descriptive and comparative study, with the purpose of investigating a possible association between auditory habits and complaints of teenagers, users of personal stereos, and the absence of suppression effect. The research is connected to the project *DISTÚRBIOS DE AUDIÇÃO: AVALIAÇÃO E INTERVENÇÃO* (AUDITORY DISORDERS: EVALUATION AND INTERVENTION), registered in the Research Ethics Committee from Federal University of Santa Maria (UFSM), number 5765712.3.0000.5346.

The participants were selected from municipal schools in Cerro Branco, RS, Brazil. After information about procedures, al parents signed the Informed Consent, according to the standard 196/96 by the National Commission for Ethics in Research (CONEP/1996). In this term there were procedures, risks and benefits, responsibility commitment about eventual damage, identity confidentiality assurance, as well as research declaration of consent and participation.

The selected study subjects were teenagers from 7th and 8th municipal school grades who agreed in participating in this research, with the following inclusion criteria: cognitive skills to respond the evaluations, audibility thresholds compatible with normal hearing, meatoscopy with no alterations, absence of middle ear and TEOAEs present in both ears. All subject who did not present the inclusion criteria were not part of the study.

It was performed visual inspection of the external acoustic meatus, hearing screening and impedance test. For external acoustic meatus visual inspection, it was used an otoscope *Heine mini 3000®.* The hearing screening was performed through auditory thresholds research airway in frequencies from 250Hz to 8 kHz with audiometer by Interecoustics, model AD229E in silent environment. To perform the immitance measures, it was used the middle ear analyzer INTERACOUSTIC

AZ7, with phone TDH-39 and MX-41 cushion, with probe tone from 220Hz to 70dBNA and ISO standard calibration 389-1991. As normal hearers were considered the subjects with thresholds up to 25 dB, classified according to the World Health Organization[16], and type A tympanogram in both ears[17]. The teenagers who presented any type or degree of hearing alteration were excluded from the research and submitted to complementary treatments.

The number of screened teenagers was 23, from three municipal schools from Cerro Branco who accepted to participate in the research. From them, two subjects were excluded from the research because of audiological alteration. The study final sample consisted of 21 teenagers, all right-handed.

All subjects were submitted to the TEOAEs register and analysis test with the equipment OtoRead, by Interacoustics. The used pass/fail criteria were the ones described in the equipment protocol: click stimulus; 83 dBNPS intensity; number of tested frequency ranges: six (from 1500Hz to 4000Hz). The "pass" result was considered when the emissions presented signal/noise relation of 4 dB in at least three frequency ranges.

Then, it was researched the suppression effect, using noise contralateral stimulation generated by the audiometer, through headsets, intensity of 60 dBNA. The TEOAEs supression calculation was performed through the subtraction of the TEOAEs response level without contralateral acoustic stimulation from the TEOAEs response with contralateral acoustic stimulation. Positive values indicated presence of TEOAEs suppression and negative values or zero indicated suppression absence. The suppression effect analysis was performed in Response, which was calculated through geometric average of all frequency ranges tested by ear, in each individual. It was considered the presence of TEOAEs suppression effect when the responses averages with and without contralateral stimulation was greater than or equal to 1 dBNPS[18].

It was performed the application of a closed questionnaire, regarding auditory behavior and complaints about tinnitus. After the questionnaire responses, it was observed the following variables: number of daily hours of music exposure, presence of tinnitus and where there was tinnitus. After responding the questionnaire and performing the auditory evaluations, it was raised study hypotheses and, then, it was performed statistical analysis.

The data was tabulated and statistically analyzed. For all the variables, the frequency tables were calculated. To analyze the association between the presence of suppression effect between genders and ears, and the association between the presence of tinnitus and the presence of suppression effect, it was used the Chi-Squared Test. For the association between time of daily sound exposure and presence of suppression effect and the association between presence of tinnitus and time of daily sound exposure, it was used the non-parametric Mann-Whitney U Test (for both independent samples). The considered significance level was 5%, indicating significant difference among the evaluated variables.

RESULTS

The studied teenagers are between 12 and 19 years old. Most of them are 13 years old (23.80%), followed by 12 years (19.04%) and 14 years old (19.04%). All 21 subjects (100%) referred they listen to music, 47.62% (n=10) referred music exposure for less than two hours a day, 19.05% (n=4) of them referred music exposure from two to three hours a day and 33.33% (n-7) of them referred music exposure from three to four hours a day.

About the presence of suppression effect, in the right ear 66.67% (n=14) of the subjects presented suppression effect and 33.33% (n=7) did not present the effect. In the left ear, 61.90% (n=13) of the teenagers presented suppression effect and 38.10% (n=8) did not present such effect.

In the comparison between the ears, it was not found difference between the presence of suppression effect in the right and left ear. It proves that the ears are independent (p=0.075).

In relation to gender, 57.14% (n=12) of the researched subjects are female and 42.86% (n=9) are male. When it was performed the analysis of suppression effect presence in relation to male and female subjects, it was not found difference between the groups, as for the right ear (p=1.00) as for the left ear (p=0.19). About the right ear, as for male, as for female, 66.67% (n=14) of the subjects presented suppression effect. In relation to the left ear, 53.85% (n=7) of the male teenagers presented suppression effect and 46.15% (n=6) of the female teenagers presented suppression effect.

There was no association between time of daily exposure and absence of suppression effect in both ears (Table 1).

In relation to the presence of tinnitus, 33.33% (n=7) of the teenagers reported presence of tinnitus. From them, 28.57% (n-14) reported tinnitus in both ears and only 4.76% (n=1) reported tinnitus in the right ear. There was not any report of tinnitus only in the left ear.

About the difference between time of daily sound exposure and presence of tinnitus, it is observed that the longer is the time of music exposure, the greater is the presence of tinnitus (Table 2).

The association between suppression effect and complaint of tinnitus occurred only in the right ear (Table 3).

Table 1. Relationship between daily noise exposure and absence of suppression effect in both ears

SUPPRESSION EFFECT	SOUND EXPOSURE						P value
	Less than 2 hours		From 2 to 3 hours		From 3 to 4 hours		
	%	n	%	n	%	n	
RE Absent	28.57	2	14.29	1	57.14	4	0.13
RE Present	57.14	8	21.43	3	21.43	3	
LE Absent	50.00	4	25.00	2	25.00	2	0.69
LE Present	46.15	6	15.38	2	38.46	5	

*Statistically significant values (p≤0.05) – *Mann-Whitney's* U Test
Legend: RE = right ear; LE = left ear; N = number of subjects; % = percentage in relation to the number of subjects.

Table 2. Occurrence of tinnitus in relation to daily sound exposure

SOUND EXPOSURE HOURS/DAY	TINNITUS			
	NO		YES	
	%	n	%	n
Less than 2 hours	100.00	10	0.00	0
From 2 to 3 hours	25.00	1	75.00	3
From 3 to 4 hours	42.86	3	57.14	4
P value	0.008*			

*Statistically significant values (p≤0.05) – *Mann-Whitney's* U Test
Legend: N = number of subjects; % = percentage in relation to the number of subjects.

Table 3. Occurrence of Suppression Effect in both ears in relation to presence of tinnitus

SUPPRESSION EFFECT	TINNITUS				P value
	NO		YES		
	%	n	%	n	
RE Absent	28.57	2	71.43	5	0.009*
RE Present	85.71	12	14.29	2	
LE Absent	62.50	5	37.50	3	0.75
LE Present	69.23	9	30.77	4	

* Statistically significant values (p≤0.05) – Chi-Squared Test (p<0.05)
Legend: RE = right ear; LE = left ear; N = number of subjects; % = percentage in relation to the number of subjects.

DISCUSSION

Teenagers, according to recent studies, have demonstrated harmful habits and behavior considered as improper to hearing health[19]. Such habits are explained in relation to adolescence concepts and usual association with high music[20].

In another study[10], a larger part of the researched teenagers did not demonstrated concerns about the possibility of hearing loss caused by the use of personal stereos. Among these subjects, a considerable number reported hearing personal stereo for three or more hours a day. The authors observed that this is probably

the group with the greatest risk to acquire hearing loss[10]. The present research found similar data, as some teenagers referred music exposure for three to four hours a day.

A recent study observed that a considerable number of teenagers referred exposure to high levels of sound pressure, using personal stereos for a longer period[6].

In the present study it was researched the decrease in the levels of TEOAEs responses magnitude in the presence of contralateral acoustic stimulation. It shows that the contralateral noise produced TEOAEs suppression effect, which is related to the action of the efferent auditory system, according to the data by other authors[21]. It was evidenced in the present study, in most teenagers, as in the right as in the left ear. This results are similar to other studies[22,23] which also found suppression effect in a considerable part of the sample, which consisted of normal hearing individuals.

The absence of OAEs suppression effect, evidenced by the increase of the OAEs amplitude, suggests medial olivocochlear system alteration 23. This dysfunction may occur in the presence of partially injured outer hair cells, when the inner hair cells are working well, without altering the audiometric thresholds[24]. Such absence occurred in the researched individuals, evidencing the importance of researching teenagers' hearing, even when they do not refer auditory symptoms or complaints, because there are risks factors in this age group and there are other facts related to this absence of suppression factor. For instance, there is disorder on school performance[25], considering the importance of medial olivocochlear system integrity for learning.

Foi evidenciado que não há diferença quanto à presença do efeito de supressão entre a orelha direita e a orelha esquerda, corroborando com estudo recente[26].

Quanto a diferença entre os gêneros e a presença do efeito de supressão, o estudo atual corrobora com estudo semelhante, no qual não foi observada associação entre os gêneros no efeito de supressão das EOAs[27].

Já em relação à ausência do efeito de supressão e o tempo de exposição sonora referida pelos adolescentes não foi encontrada diferença neste estudo, o que pode ser explicado pelo pequeno tamanho da amostra e considerando também o fato da mensuração do tempo da exposição ser subjetivo, pois os adolescentes podem não indicar a real resposta.

A exposição a intensidades elevadas pode tornar-se prejudicial ao ouvido, pois considerando que não se tem uma regulamentação para exposição sonora em atividades de lazer, pode-se levar em conta dados do Ministério do Trabalho, que estabeleceu uma Norma Regulamentadora nº 15 (NR 15) que determina limites de tolerância de 85 a 115 dB (A). A partir da primeira intensidade, verifica-se que a cada aumento de 5 dB (A) o tempo máximo diário de exposição deve ser reduzido à metade[28].

Levando-se em conta também que mesmo que períodos curtos de exposição a diversos tipos de ruído e intensidade sonora elevada, assim como o encontrado no presente estudo, não levem à perda auditiva permanente, os danos da exposição crônica são cumulativos[29]. Estudos mostram esta relação entre o aumento das patologias em função dos hábitos nocivos frequentes nesta faixa etária[19].

No presente estudo, foi encontrada queixa de zumbido nos adolescentes. Em estudo realizado com crianças, o zumbido também foi referenciado[3]. Um estudo realizado com estudantes universitários também evidenciou a queixa de zumbido por parte dos sujeitos avaliados. Além disso, os universitários não tinham conhecimento de que o zumbido pode ser um sinal de alerta precoce para a exposição a níveis de pressão sonora elevados[10]. Pode-se inferir com os estudos supracitados que o zumbido pode estar presente desde a infância e a busca por fatores intervenientes faz-se necessária para elucidar formas alternativas de tratamento e prevenção deste sinal/sintoma auditivo.

Em relação à queixa de onde percebe o zumbido diário, a maioria dos adolescentes com zumbido referiu ouvi-lo em ambas as orelhas, corroborando com o estudo semelhante[30] em que foi relatado, no seu grupo de estudo, que a maioria dos sujeitos apresentava a queixa de zumbido de forma bilateral.

Foi observado que a incidência de zumbido apresenta diferença em relação aos fatores tempo de exposição sonora medidos em horas diárias, ou seja, quanto maior o tempo de exposição sonora referida maior a ocorrência de queixa de zumbido. Já em estudo recente não foi encontrada esta relação na população estudada[8].

Esta relação também foi estudada recentemente, porém na análise da comparação entre queixa de zumbido e tempo de uso de fones de ouvido, considerou-se a variável "anos de exposição". As autoras também verificaram que, quanto maior o tempo de uso de fones de ouvido, maior a ocorrência de zumbido[6].

Deve-se ressaltar que a presença de queixa de zumbido é mais alta entre crianças com distúrbios otológicos ou história de exposição a sons muito intensos[31], o que mostra a relação encontrada no presente estudo, pois os adolescentes mais expostos foram os que apresentaram a maior ocorrência da queixa de zumbido.

O presente estudo encontrou diferença entre a ausência do efeito de supressão na orelha direita e a presença de zumbido, o que corrobora com outro estudo recente[32], mas segundo estes autores o funcionamento assimétrico do trato olivococlear medial pode alterar a análise dos resultados e esta é uma variável que deve ser controlada.

Esta diferença entre a ausência do efeito de supressão na orelha direita e a presença de zumbido pode ser explicada, pensando que o SOCM, por meio do trato olivococlear medial, modula os movimentos das CCE e uma disfunção neste sistema seria capaz de gerar zumbido, enfatizando o aparente vínculo entre eles[32]. Entretanto, em outro estudo realizado[23] foi encontrado que o efeito de supressão das EOATs e os graus de zumbido não apresentaram associação em indivíduos normoouvintes com queixas de zumbido e hiperacusia.

O desenvolvimento de pesquisas e conhecimentos detalhados sobre a fisiologia e a anatomia da via auditiva eferente, especificamente do sistema olivococlear medial, pode levar a um melhor entendimento de como os hábitos de exposição auditiva de adolescentes podem lesar este sistema. Acrescenta-se ainda que estes achados poderiam orientar o desenvolvimento de ações de saúde pública nesta população jovem.

CONCLUSÃO

Todos os adolescentes pesquisados referiram ouvir música diariamente, sendo que a maioria referiu exposição à música por tempo inferior a duas horas diárias.

A maioria dos adolescentes apresentou efeito de supressão, não ocorrendo diferença entre a presença do mesmo em relação às orelhas e ao gênero.

Também não foi encontrada associação entre os adolescentes que apresentam maior tempo de exposição sonora diária com a ausência do efeito de supressão, em ambas as orelhas.

Quanto a presença de zumbido, foi encontrada tal queixa em um terço dos adolescentes pesquisados, mostrando a associação com a ausência do efeito de supressão na orelha direita. Além disso, quanto maior o tempo de exposição sonora maior à presença de queixa de zumbido nestes adolescentes.

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