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THE INFLUENCE OF NOISE ON CHILDREN'S HEARING LEVEL.

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ABSTRACT

The present study evaluated the hearing threshold level (HTL) in two groups of school children aged between 7-12 - living in a noisy (508 pupils) and in a quiet (522 pupils) district of the town. In order to point out the noise induced hearing loss, we eliminated the subjects with serous otitis media and genetic hearing loss, remaining for the study 435 and 442 pupils. From the noise assessments within the two school classrooms, results an equivalent level of 56.2 dBA and 46.6 dBA respectively. The increased HTL on high frequencies (7-13 dB in boys and 4-8 dB in girls) registered in pupils from noisy district, cannot be fully explained with the 10 dBA higher background noise level. The interwiev held among children showed that listening almost daily of loud rock music (80-101 dBA) has the most damaging effect on hearing, from leisure time activities. This activity was found in 68% and 35% of pupils from noisy and quiet district schools. In conclusion it is quite probable that even slight losses in indoor and outdoor environment such as todays classrooms with their high noise background level or noisy leisure time activities, may affect listening and learning procedures markedly.

INTRODUCTION

Until now systematic studies of the audiometric screening in pupils were not performed in Romania. In countries where such tests are applied children have been examinated at the age of 7, 11, 14 and even 15, by repeated investigations at 3-4 years intervals (1,2,3), in order to evaluate the dynamics of the hearing level.
The early identification of children with hearing loss facilitates the improvement of hearing capacity during the classes, playing the most important role in the instructional process.
Accordingly, we underline the significance of the follow-up studies that can reveal the modifications of hearing loss parameters by identifying the permanent or temporary loss, the improvement or decline of the previously recorded auditive thresholds.
Moreover, this audiometric screening has been demonstrated to be available in selecting the pupils for the admittance to the vocational schools; by repetead tests one can identify the subjects having a discreet hearing loss of sensorineural type and must avoid constantly the exposure to noise. In many cases, the pupils are advised to choose another profession.
Recently published studies revealed a relative high prevalence of sensorineural hearing loss at high frequencies (4,5) in young people aged 13-15, probably due to pop music (6, 7, 8).
Among other contributory factors one can consider shooting with airgun, motor sports, etc., but the pop and rock music have been the greatest influence upon the hearing level.
The present paper evaluates the hearing threshold level (HTL) in two groups of school pupils aged between 7 and 12; subjects in the first group live in a noisy central district whereas those in the second group reside in an outskirt with a lower noise pollution.

METHODS

The analysis of noise level within the classrooms were done using a Bruel - Kjaer 2203 type sonometer. The audiometric examinations were performed using a MA-30 clinical audiometer. The pure tone audiometry, was carried out in sound proof room, during the first hour of the curses, according to ISO normes.
The used audiometer tested the frequencies: 0.125; 0.250; 0.5; 1; 2; 3; 4; 6; and 8 kHz.
The studied groups comprised pupils from the noisy district (508 subjects) and pupils from a more silent outskirt (522 subjects). Pupils with genetic hearing loss (GHL) and those with serous otitis media (SOM), in antecedents were not included in the study remaining 435 and 442 pupils, respectively.
From the three etiologies contributing to the hearing loss we look into consideration only the noise induced hearing loss (NIHL).
The sources of noise exposure have been considered to be: a) the classroom; b) leisure time activities. Accordingly, measurements were done in order to evaluate the noise exposure in pupils. However, the sound level during leisure time activities can be identified only by collecting a great deal of data implying much time and a large participation.
Because of this, we applied a questionnaire aiming at demonstrating pupils'leisure time activities. This method monitorized the most important leisure time activities in the series of exposure to noise; each type of activity was furthermore, evaluated from the viewpoint of the noise intensity level. Maximal, minimal and mean values of noise intensity were registered for least 5 children's home.

RESULTS AND DISCUSSIONS

The noise intensity measurements within the classrooms were done as follows: a) during the holidays (no pupils inside), a.m., during the curses time period of day; b) during the school year by registering the speak noise, produced by teacher and pupils (normal school activity).
The results coming out from the circumstances in a) paragraph reflect the background noise level induced by the external pollution i.e the traffic that is the same noise inducing source for the two studied school.
The mean level of equivalent background noise for a daily school time interval in the two schools was 56.2 dBA for the central school and 46.6 dBA for outskirt school.One can observe a significant difference of 10 dBA.
The measurements performed within the frame of the b) paragraph showed a speak noise level/day/class non-significantly different for the two schools, as follows: at the central school these values were between 83.2-85.6 dBA whilst at the districtual school were between 83.5-85.5 dBA.
Data regarding the noise exposure during leisure time activities were collected, by means of the mentioned method (interview) illustrating the percentage of frequency for different activities performed by the pupils from the two schools (Table 1.).
One can observe that listening to the pop-rock music at high intensity loud speakers was the most favorite daily hobby of pupils from the two schools. However, at this type of exposure the central school pupils presented a frequence of almost twice, at against the outskirt children.
Accordingly, besides the background noise in the classrooms, which is more intense in the central school, the pupils are also exposed to the noise, resulted from listening daily for more than one hour loud pop-rock music (80-101 dBA).
Table 2 illustrates the mean age and number of subjects from the two schools, included in the study.

Table 1. Frequency of leisure time activities for the pupiles from studied schools.

Noisy leisure time activities	Frequency (school from noisy district / school from quiet district)				
	Never %	1-5 times per year %	6-12 times per year %	every other week %	several times weekly or daily %
Firecrackers	25/48	60/50	14/2	0/0	0/0
Pop-rock music headphones	56/94	8/2	2/0	15/1	19/3
Pop-rock music, loud speakers	3/40	7/6	10/9	12/10	68/35
Active musician	93/100	0/0	0/0	0/0	7/0
Pop-rock concerts	48/62	52/38	0/0	0/0	0/0
Discotheques, parties	19/12	48/11	18/7	15/10	0/0
Noisy work after school	93/81	3/7	4/12	0/0	0/0

Pairs of pupils were age and sex matched in order to eliminate the errors that would appear generated by these criteria. Dates regarding the number of pairs, sex and age of pupils from the two schools was included in Table 3.

Table 2. Number of pupils and mean age of the studied groups.

Examinated groups	Nr. of pupils	Age of group	
		mean	SD*
Noisy district school	435	9.49	1.68
Quiet district school	442	9.60	1.72

*SD - standard deviation

Table 3. Number of pairs, sex and mean age of pupils from the two schools.

Number of pupil pairs from the two schools	Sex	Age	
		mean	SD*
208	girls	9.45	1.71
197	boys	9.55	1.66

*SD - standard deviation

No statistically significant differences were found between girls and boys regarding the age of pairs.

Figure 1 represents the mean hearing threshold of girl and boy pairs from the two schools. One can observe that the mean values of the hearing threshold recorded in pupils from the central school was higher as compared to the pupils from the outskirt school. The differences were statistically significant at 4, 6 and 8 kHz for the two groups. Moreover, there is a significant increase of the boys auditive threshold, in comparison with that registered in girls but only at the central school. In accordance with the literature referring to adult population, the boys are more vulnerable to noise effect during the childhood.

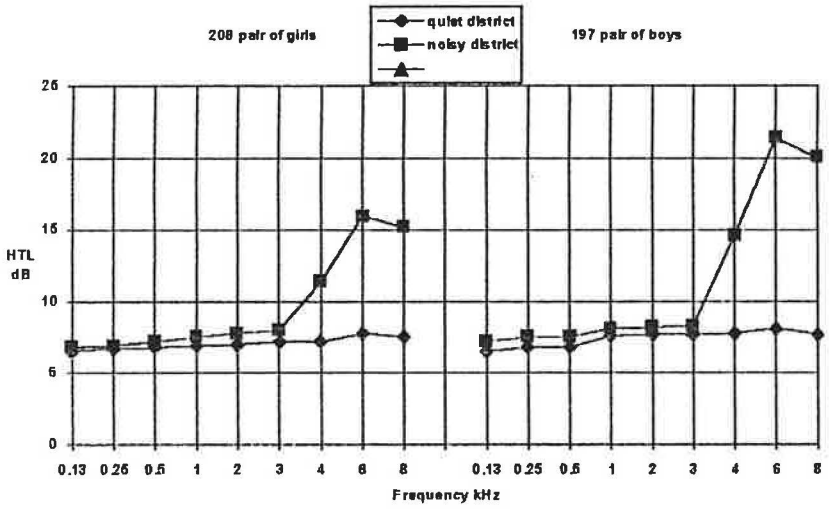

Figure 1. Hearing threshold levels for pupils from a quiet and from a noisy district (girls and boys).

In conclusion, it is quite probable that even slight losses in indoor and outdoor environment such as todays classrooms with their high noise background levels or noisy leisure time activities may affect listening and learning procedures markedly. We believe that the decreased HTL on high frequencies in pupils from noisy district was caused by the higher background noise level from classrooms and the greather percentage of noisy leisure time activities , especially the listening of pop-rock music with loud speakers at loud levels. The hearing level on high frequencies is bigger in boys than in girls, boys having more agressive and noisier leisure pastimes.

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