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HEARING LOSS AT 4KHz IN SCHOOL AGE CHILDREN IN JORDAN; A PILOT STUDY

Mohammed Tawalbeh[*] & Kholood Kaabneh[@]

[*]MD, FRCS, Jordanian Board, [@]Audiological Scientist, Dip. ENT and Audiology Department, King Hussein Medical Centre, Amman; JORDAN.

Summary

Pure tone screening audiometry was carried out on 400 school children at three different ages, 10,13 and 15 years old during the period 1998-1999. The results showed that the dip at 4KHz (>20dB) was found in 50 (12.5%) of the study sample, 35 boys (8.7%) and 15 (3.8%) girls. The 4KHz dip was unilateral in 42 children (10%) and bilateral in 8 children (2.5%). The number of children with 4KHz dip increased with age. At the age of 15 years, it was found in 17(4.2%) boys and 7(1.7%) girls, two or more frequencies were affected in 5 and hearing thresholds of 40 dB and worse were found in 7 of the children. The results clearly indicate that noise pollution is one of the causes of hearing loss among school age children. Therefore, it is recommended to implement a hearing conservation programme at school.

Introduction

Hearing loss due to noise pollution is well known in the modern society. In children, most hearing losses are of the conductive type, also sensorineural type due to congenital problem is common. A great number of sensorineural losses are probably induced by noise and can be disclosed by the audiometric pattern, the majority in the high frequency and specially the 4KHz dip.

It is well known that school children can be exposed to high levels of noise, both the continuous and the impulse type. These noise levels are often of sufficient magnitude to cause considerable noise damage to hearing.

The aim of this study is to explore the character and the frequency of the 4KHz dip in school children and to investigate the causes of noise in different age groups of children. However, it has not been our aim to give full evidence as to whether the 4KHz dip is caused by noise mainly.

Correspondence to:
Dr. Mohammed Tawalbeh
P.O. Box. 2129
Zarqa, JORDAN.

Material and Methods

Pure tone screening audiometry was carried out on 400 school children at three different ages 10, 13 and 15 years old during the period 1998-1999, using

Madsen portable audiometer fitted with TDH-39 earphones and calibrated according to ISO standards. The study was done in three private schools in western Amman. The screening was performed at 20 dB HL with frequency range between 0.25-8KHz, with a particular emphasis at 4KHz. The test was done in a quiet room. Children who failed two or more frequencies underwent a pure tone threshold audiogram and were referred for otological and auodiological evaluation. Children who failed the 4KHz frequency only, also had a threshold audiogram at the above frequencies. Children with a 4KHz dip greater than 40dB were also referred to otological and audiological evaluation. The school children with a 4KHz dip >20 dB were questioned particularly about possible exposure to noise.

Results

Four hundred school children were screened for hearing loss. Of these children, 50 (12.5%) had a 4KHz dip>20 dB. Table I shows sex distribution, age levels and frequency distribution of the dip. In this group, the majority were boys, 35 (8.7%) and only 15 (3.8%) were girls.

Table I. Distribution of age and sex

Age level	Total no.	Boys		Girls		Total	
		No.	%	No.	%	No.	%
10y	120	8	2	3	0.8	11	2.7
13y	130	10	2.5	5	1.3	15	3.8
15y	150	17	4.2	7	1.7	24	6
Total	400	35	8.7	15	3.8	50	12.5

Table II shows that unilateral dips were more frequent and were found in 37, bilateral in 13 of the children. The frequency of the dip increased with age in both sexes, and at the 15-year level, 10% boys and 3% girls were affected. The 4KHz dip also increased in magnitude at this age level, which can be seen in Table III (a+b). Twenty children had a dip > 40dB (5%) and 15 children had a hearing loss >20 dB, not only at 4KHz but also a hearing loss >20 dB at additional frequencies (3.7%).

Table II. Distribution of age, unilateral and bilateral losses

Age level	Total no.	Unilateral		Bilateral		Total	
		No.	%	No.	%	No.	%
10y	120	8	2	3	0.7	11	2.7
13y	130	11	2.8	4	1	15	3.8
15y	150	18	4.5	6	1.5	24	6
Total	400	37	9.3	13	3.2	50	12.5

Table III (a). 4KHz dip>40dB, age and sex distribution

Age	No. of boys	No. of girls	Total
10y	4	1	4
13y	4	2	6
15y	7	3	10
Total	14	6	20

Table III (b). 4KHz dip>20dB, age and sex distribution

Age	No. of boys	No. of girls	Total
10y	3	0	3
13y	4	1	5
15y	5	2	7
Total	12	3	15

In 33 (66%) out of 50 children with the 4KHz dip the main causes of noise could be established. Musical instrument including personal amplification system, shooting and treasure areas were main causes of noise. The 4KHz dip was increased with age and the boys were more affected than girls.

Discussion

The investigation revealed a considerable number of school children

(12.5%) with a loss of audiotry sensitivity >20 dB in high frequency range around 4KHz. This loss is of the sensorineural type and increased with age both in magnitude and in frequency range (Table III a+b). This increase is more frequent in boys. It has been established both in animals and in man that this type of loss is primarily caused by noise. We, therefore, assume that noise is a major contributing factor to permanent damage to the inner ear also in school children. It is also known that boys are more exposed to noise and the higher incidence of the 4KHz loss supports this statement. Noise induced causes damage to the inner ear occurs over a wide frequency range with a particular effects around 3,4, 6HKz and above (Fausti et al, 1981)[1] and (Axelsson et al, 1981)[2]. It is also important to ask a question whether children are more susceptible than adults to high level of sounds (Mills, 1975, 1978)[3,4].

In this study the causes of noise varied and were both of the continuous and impluse type (Nilsson and Arlington, 1980)[5].

This study shows that noise exposure occurs often and has a considerable damage effect on the inner ears of school children. This is probably also very serious for their hearing ability as even minor auditory losses may affect the acquisition of speech, language and listening attitudes and these are important in school performance and education.

Hearing damage in the early years and during the school period is also considerable threat to future hearing ability, as further hearing losses during adult age and presbycusis add up to a very serious handicap in communication.

Noise control programme is recommended to reduce the noise damage to the inner ear and also further studies are recommended.

Conclusion

Pure tone screening of 400 school children at the age levels 10,13 and 15 years was performed. Hearing loss >20dB at 4KHz was found in 12.5%. This impairment occurred more often with increasing age and was considerably more common in boys than in girls, especially at higher age.

The frequency range involved around 4KHz and the degree of loss increased also with age. It is assume that this hearing impairment at 4KHz was mainly caused by noise. The most frequent causes of noise damage were found in personal musical instruments, leisure places and shooting.

Due to a serious and irreparable damage to hearing in a considerable number of children, it is important to institute a noise and hearing control programme with a complete information and prophylactic advice.

The value of this information shows that further studies are recommended to reduce the possibility of noise damage to the inner ear in children.

References

1.Faustic SA, Erickson DA, Frey RH, Rappaport BZ. The effects of impulsive noise upon human hearing sensitivity. Scand Sudiol 1981; 10, 21.

2.Axelsson A, Jerson T, Lindburge U, Lindgren F. Early noise induced hearing loss in teenage boys. Scand Audiol 1981; 10(2): 91-96.

3.Mills JH. Noise and children, a review of literature. J Acoust Soc Am 1975; 58, 767.

4.Mills JH. Effects of noise on young and old people, 1978, in noise and audiology (ed D. Lipscomb). University Park Press, Baltimore.

5.Nilsson P, Arlinger S. International symposium on effects of impulse noise on hearing. Scand Audiol 1980, Suppl 12.

6.Babisch W, Ising H. Music listening habits of adolesce-

nts. With reference to disc-othek exposure. HNO 1994; 42(8): 466-69.

7. Dolen Tr, Ades HW, Bredberg G, Neff WD. Inner ear damage hearing loss after exposure to tones of high intensity. Acta Otolaryngol 1975; 80,343.
8. Falk S, Cook RO, Haseman JK, Sanders GM. Noise induce inner ear damage in newborn and adult Guinea pigs. Laryngoscope 1974; 84, 444.
9. Hellstrom PA, Dengerink HA, Axelssom A. Noise levels from toys and recreational articles for children and teenagers. Br J Audiol 1992; 26(5): 267-70.
10. Ising H. Endangering of hearing due to loud music. Soz Praventivmed 1996; 41(5): 327-28.
11. Murai K. Investigation of the 4HKZ dip by detailed audiometry. Ann Otol Rhinol Laryngol 1997; 106(5): 408-13.
12. Rytzner B, Rytzner C. Schoolchildren and noise. The 4KHz din-tone screening in 14391 schoolchildren. Scand Audiol 1981; 10(4): 213-16.