

SCHOOL-AGE HEARING SCREENING: IDENTIFICATION OF HEARING IMPAIRMENTS IN FIRST GRADE STUDENTS

Triagem auditiva escolar: identificação de alterações auditivas em crianças do primeiro ano do ensino fundamental

Daiane Tamanini⁽¹⁾, Natália Ramos⁽¹⁾, Louise Varela Dutra⁽¹⁾, Humberto José Chisté Bassanesi⁽¹⁾

ABSTRACT

Purpose: to characterize the audiological profile of students in the first year of municipal elementary schools in Caxias do Sul-RS, investigating and identifying the occurrence of hearing impairment in this population, by electroacoustic measurements. **Methods:** cross-sectional, prospective, descriptive and quantitative study of 391 students from first year of municipal elementary schools in Caxias do Sul-RS. Students were submitted to four audiological procedures in School Hearing Screening: Meatoscopy, Transient Evoked Otoacoustic Emissions, Otoacoustic Emissions - Distortion Product and Tympanometry. Furthermore, those responsible for the children answered a questionnaire relating to development and the otological history of each child. The students who had some hearing impairment in hearing screening were referred for evaluation otorhinolaryngological and/or complete audiological evaluation at a reference center in the same city. **Results:** of the 782 ears evaluated, 85,4% in the examinations were normal and 14,6% shown some kind of change. In Meatoscopy, it was found that 6,3% of the ears showed alterations. 94,8% ears have passed the Transient Evoked Otoacoustic Emissions and 95,8% the Otoacoustic Emissions - Distortion Product. In Tympanometry, the curve predominant was type A, followed by type C. Referrals were made to 14,6% of students. **Conclusion:** the population of this study was composed mostly by male schoolchildren, with six years of age. Of the 782 ears evaluated, 85,4% had normal test findings and 14,6% showed some kind of change.

KEYWORDS: Hearing; Triage; Students; Otoacoustic Emissions, Spontaneous; Acoustic Impedance Tests

■ INTRODUCTION

Normal hearing is one of the essential factors for the individual's good psychosocial development. The integrity of this sense depends on the proper functioning of the external, middle and inner ear. Furthermore, it is important in all stages of life, not only for the development of auditory abilities, which are essential for oral language acquisition, but also for verbal comprehension, reading and writing acquisition, and for a good learning and academic performance¹⁻³.

The hearing loss has a significant impact on the individual and the society. The problem is even

greater for children, since normal hearing is the main source for the acquisition of language, speech and cognitive abilities⁴. On younger age groups, even a slight alteration of the hearing threshold can impair the learning and comprehension of speech, the development of social abilities and the self-image⁵.

The impact of hearing loss on learning begins on the first years of school life; however, many children with mild hearing loss will only present considerable learning difficulties in third grade. This difficulty may be due to changes in language complexity, the smaller number of visual cues, the greater need for linked auditory information and evocation, in addition to the loss in the development of prerequisite abilities in earlier grades⁶.

Hearing screening is understood as a simple, fast and low-cost process that is able to identify individuals more likely to have alterations on the

⁽¹⁾ Faculdade Nossa Senhora de Fátima, Caxias do Sul, RS, Brasil.

Conflict of interest: non-existent

tested function. Failing this test, the individual should be referred to more complex diagnostic procedures. In short, the hearing screening has the aim to identify individuals with hearing impairments in order to refer them for otorhinolaryngological assessment and a complete audiological evaluation^{7,8}. The Hearing Screening Programs have been demonstrating their relevance as the primary means for early detection of hearing loss in children. Up until now, the Programs performed in schools have been offered mainly as local initiatives in places such as the United States, Australia, China and a few European countries⁹. In Brazil, they are not yet part of the routine in most schools.

Public Health Policies recommend, in addition to the Neonatal Hearing Screening Program, the School-age Hearing Screening, in order to early diagnose hearing loss and perform the necessary interventions as early as possible¹. Among the tests used in different screening programs, the hearing assessment can be performed by using objective tests, such as the Otoacoustic Emissions (OAE) and the Tympanometry, which are both fast, non-invasive and reliable tests, thus representing an ideal test profile^{10,11}.

The OAE were first observed and described by Kemp¹², who defined them as the release of sound energy originated in the cochlea, which propagates through the middle ear until it reaches the external auditory canal (EAC). He proved that they are present in all normally functioning ears and are not detected when the pure-tone thresholds are above 20-30 dB. According to the author, the measurement of OAEs is an objective, non-invasive and fast procedure, applicable in non-soundproofed facilities and possible to be performed with all age groups. Its use is recommended for hearing screening in school-age children, since it is proved to be an objective test that allows the evaluation of cochlear function³.

The tympanometry is an electroacoustic test that contributes to the identification of middle ear alterations by investigating the integrity of the tympanic-ossicular system. This low-cost, fast and simple procedure is the method of choice for differentiating among the middle ear conditions that may affect individuals in all age groups, especially in school age, when most hearing impairments are due to middle ear alterations^{13,14}.

Due to the fact that many children have no access to any sort of hearing evaluation before school age, the School-age Hearing Screening is

an important instrument for early identification of hearing impairments¹⁵. It provides the possibility to offer greater attention to children's auditory health and, especially, to the diagnosis of hearing loss and early intervention in this population. The detection of hearing loss in school-age children is essential. The later the hearing loss is detected, the greater will be the difficulties. Early diagnosis allows the referral to specialists, who will act to provide rehabilitation and prevention of children's cognitive, social, emotional and communicative alterations.

Therefore, this study had the aim to characterize the audiological profile of first grade students from municipal elementary schools in Caxias do Sul-RS, Brazil, by using electroacoustic measures to investigate and identify the occurrence of hearing impairments in this population.

■ METHODS

This study was approved by the Research Ethics Committee of the Associação Cultural e Científica Virvi Ramos (Cultural and Scientific Association Virvi Ramos), under protocol number 183.613. The study was conducted after approval of the Municipal Department of Education of Caxias do Sul – RS, Brazil (document number 728/2012).

Three hundred and ninety one school-age children were screened in this prospective descriptive quantitative cross-sectional study. The subjects were male and female students with ages between six and nine years, enrolled in the first grade of nine municipal elementary schools in Caxias do Sul-RS, which were randomly selected to include all four regions of the city and different socioeconomic levels.

The following inclusion criteria were considered: to be attending the first grade of elementary school in one of the municipal schools selected for this study, and to have the Free and Informed Consent signed by the student's legal guardian. Subjects that had presented a previous otologic alteration referred to in the questionnaire and/or those who had been diagnosed with permanent hearing loss were excluded from the sample.

The Free and Informed Consent was sent to the family through the students' agenda book, along with a questionnaire specially adapted for this study^{3,16} (Figure 1). The questionnaire included 11 multiple choice questions, which were objective and easy to understand. The questions regarded each child's development and otologic history.

PRE-HEARING SCREENING QUESTIONNAIRE	
Name: _____	Date: ____/____/____
Age: _____	DOB ____/____/____ Phone number: (____) _____
School: _____	Class: _____
<ol style="list-style-type: none"> 1. Did your child ever have a hearing evaluation? (<input type="checkbox"/>) Yes (<input type="checkbox"/>) No 2. Do you think your child hears well? (<input type="checkbox"/>) Yes (<input type="checkbox"/>) No 3. Does your child seem to hear better on some days rather than others? (<input type="checkbox"/>) Yes (<input type="checkbox"/>) No 4. Does anyone in the family present hearing impairments? (<input type="checkbox"/>) Yes (<input type="checkbox"/>) No 5. Was there any complication during pregnancy or birth? (<input type="checkbox"/>) Yes (<input type="checkbox"/>) No If yes, which one? _____ 6. Did your child ever have ear infections of any other ear problems? (<input type="checkbox"/>) Yes (<input type="checkbox"/>) No If yes, which one? _____ 7. Did your child ever have any ear surgery? (<input type="checkbox"/>) Yes (<input type="checkbox"/>) No 8. Does your child use cotton swabs to clean his/her ears? (<input type="checkbox"/>) Yes (<input type="checkbox"/>) No 9. Does your child have any health problem? (<input type="checkbox"/>) Yes (<input type="checkbox"/>) No If yes, which one? _____ 10. Does your child present learning difficulties in school? (<input type="checkbox"/>) Yes (<input type="checkbox"/>) No 11. Does your child present language or speech problems? (<input type="checkbox"/>) Yes (<input type="checkbox"/>) No 	

Adapted from Guerra-Silva³ and Lacerda¹⁶.

Figure 1 – Pre-hearing screening questionnaire

The hearing screening was performed in quiet rooms, where students were submitted to four audiological procedures: meatoscopy, Transient Evoked Otoacoustic Emissions (TEOAE), Distortion Product Otoacoustic Emissions (DPOAE), and tympanometry.

The HEINE MINI 3000 diagnostic otoscope was used for the meatoscopy, which was the first procedure performed. This procedure had the aim to evaluate whether the students' EAC presented suitable conditions for the other tests, as well as to verify the presence of excessive cerumen or foreign body. The students that presented no alterations in the EAC were submitted to the other procedures of the School-age Hearing Screening. When alterations were observed, the student was referred to a prescheduled otorhinolaryngological evaluation at the Centro de Saúde Clélia Manfro - Unidade Auditiva (Health Center Clélia Manfro – Auditory

Unit) (CSCM – UA) – a reference center for medium complexity otorhinolaryngological and audiological care of the Unified Health System (SUS) in Caxias do Sul-RS, Brazil – on a different day from the hearing screening, and unlike the usual flow. Students were reassessed on the same date and place, after the otorhinolaryngological evaluation and conduct.

After the EAC inspection, the students without alterations were submitted to the TEOAE and DPOAE tests, as well as the tympanometry. The Maico ERO-SCAN™ portable automatic equipment was used for the TEOAE and DPOAE, and the Interacoustics MT-10 portable immittance meter, for the tympanometry, the. All equipments were calibrated according to the standards and guidelines recommended by the manufacturers.

For the TEOAE, the results that presented amplitude values equal or superior to -12 dB and signal-to-noise ratio equal or superior to 4 dB

in at least three of the tested frequencies were considered normal (“pass” criteria). For the DPOAE, it was considered normal (“pass”) the results that presented amplitude equal or superior to 6 dB in at least three of the frequencies tested. These criteria were used according to the manufacturer’s suggestion.

The classification proposed by Jerger¹⁷ was used to analyze the values of tympanometric curves. Students who presented types A, C, Ad and As curves and satisfactory results on the TEOAE and DPOAE were considered “pass”. Those who presented type B curve in at least one ear were considered “fail”, and referred for complete audiological evaluation, in order to confirm the presence of middle ear alterations.

Students who presented no alterations in the meatoscopy but failed the OAE and/or the tympanometry were referred for audiological diagnosis at the CSCM – UA using Pure-Tone Air- and Bone-Conduction Audiometry, speech audiometry (using the Maico MA 41 audiometer), immittance measures (using the Interacoustics AT 235 automatic immittance meter), TEOAE and DPOAE (using the ERO-SCAN™).

For better elucidation, a flowchart of the performed procedures from the school-age hearing screening to the students’ final audiological conduct is presented in Figure 2.

Immediately after getting the audiological diagnosis, the caregivers of the students that presented alterations in the audiological evaluation received a referral for otorhinolaryngological evaluation.

The test for equality of two proportions and the chi-square test were used to analyze the results. For some results, it was necessary to use the Yates’ Correction, since the chi-square test presented significant results, but with a frequency below or equal to five cases. A significance level of 0.05 (5%) was adopted, with 95% confidence intervals.

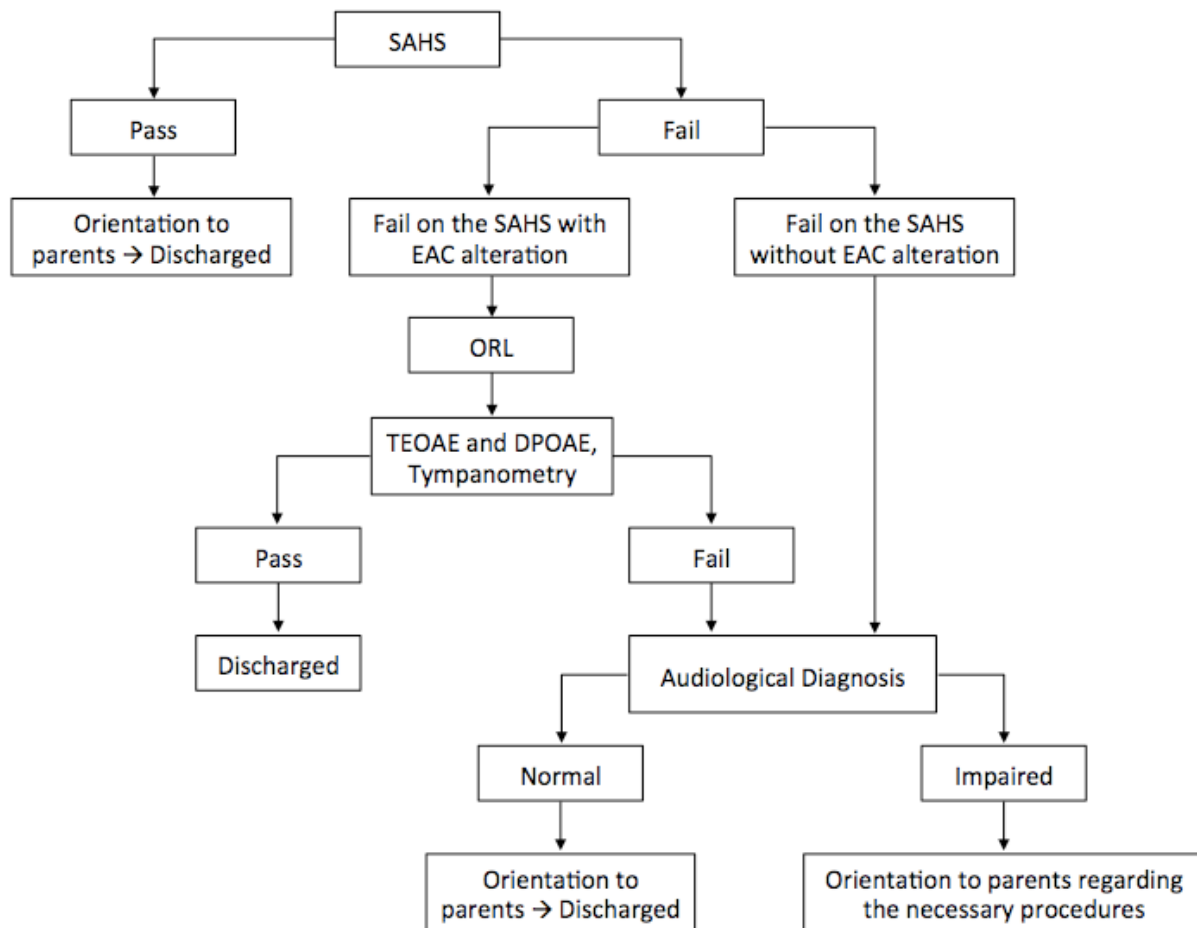
■ RESULTS

A total of 391 school-age children were screened for hearing impairments, 208 male (53.2%) and 183 female (46.8%). From these subjects, 288 (73.7%) were six, 101 (25.8%) were seven, and two (0.5%) were nine years old. All of them were submitted to four audiological procedures in both ears, hence 782 ears were assessed.

From the 782 ears, 85.4% presented normal results on the audiological procedures (meatoscopy, TEOAE, DPOAE, and tympanometry), and 14.6% presented some kind of deficit. The results obtained in each procedure are described next. It is worth mentioning that, for this, all ears were considered (both right and left).

In the meatoscopy, 733 (93.7%) ears presented no alterations, and 49 (6.3%) did. Excessive cerumen was the most common alteration observed.

All students with alterations in the meatoscopy were referred to the otorhinolaryngologist (Figure 2) and submitted to the hearing screening after medical conduct. Table 1 presents the pass/fail results on the TEOAE and DPOAE by ear, considering those that did not present alterations in the meatoscopy and those that were assessed after medical conduct regarding EAC alterations.



Note – SAHS: School-age Hearing Screening; EAC: External Auditory Canal; ORL: Otorhinolaryngologist; TEOAE: Transient-Evoked Otoacoustic Emissions; DPOAE: Distortion Product Otoacoustic Emissions.

Figure 2 – Flowchart of the procedures, from the school-age hearing screening to the final audiological conduct

Table 1 – Distribution of pass/fail results on the transient evoked otoacoustic emissions and on the distortion product otoacoustic emissions

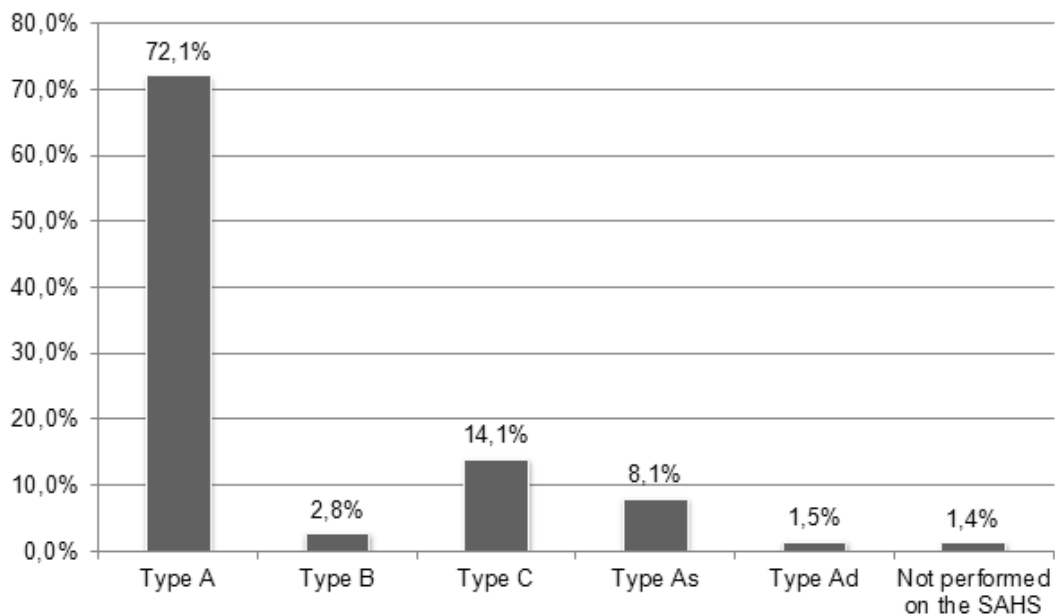
Test	Fail		Pass		P-value
	N	%	N	%	
TEOAE	41	5.2%	741	94.8%	<0.001
DPOAE	33	4.2%	749	95.8%	<0.001

Note – TEOAE: Transient-Evoked Otoacoustic Emissions; DPOAE: Distortion Product Otoacoustic Emissions; N: number of subjects. Test for Equality of Two Proportions; P-value <0.05.

The results obtained on the tympanometry are presented in Figure 3. Type A were the most common curve type found in this test, followed by type C.

From the students who presented alterations in any of the hearing screening procedures, 37 (9.5%)

– or 49 ears – were referred for otorhinolaryngological assessment, and 21 (5.4%) for audiological diagnosis. From these, conductive hearing loss was detected in 14 (66.7%), while three (14.3%) presented normal hearing, as shown in Table 2.



Note – SAHS: School-age Hearing Screening.
 Test for Equality of Two Proportions; P-value <0.05.

Figure 3 – Distribution of the types of tympanometric curves

Table 2 – Distribution of audiological diagnosis

Audiological diagnosis	N	%	P-value
Normal	3	14.3%	<0.001
Conductive hearing loss	14	66.7%	Ref.
Mixed hearing loss	1	4.8%	<0.001
Did not attend	3	14.3%	<0.001

Note – N: Number of subjects.
 Test for Equality of Two Proportions; P-value <0.05.

Table 3 shows the values regarding the conduct adopted after all assessments. Fifteen (3.8%) students presented alterations in the audiological diagnosis and were referred to otorhinolaryngological assessment.

Caregivers’ responses to the questionnaire applied before the hearing screening are presented in Table 4.

Table 3 – Distribution of audiological conduct

Conduct	N	%	P-value
Discharged	366	93.6%	Ref.
Referred to ORL assessment	15	3.8%	<0.001
Did not attend	10	2.6%	<0.001

Note – ORL assessment: Otorhinolaryngological assessment; N: Number of subjects.
Test for Equality of Two Proportions; P-value <0.05.

Table 4 – Distribution of responses to the pre-screening questionnaire

Question		N	%	P-value
1. Did your child ever have a hearing evaluation?	Yes	67	17.1%	<0.001
	No	322	82.4%	Ref.
	NR	2	0.5%	<0.001
2. Do you think your child hears well?	Yes	352	90.0%	Ref.
	No	36	9.2%	<0.001
	NR	3	0.8%	<0.001
3. Does your child seem to hear better on some days rather than others?	Yes	102	26.1%	<0.001
	No	278	71.1%	Ref.
	NR	11	2.8%	<0.001
4. Does anyone in the family present hearing impairments?	Yes	126	32.2%	<0.001
	No	262	67.0%	Ref.
	NR	3	0.8%	<0.001
5. Was there any complication during pregnancy or birth?	Yes	50	12.8%	<0.001
	No	338	86.4%	Ref.
	NR	3	0.8%	<0.001
6. Did your child ever have ear infections of any other ear problems?	Yes	146	37.3%	<0.001
	No	245	62.7%	
7. Did your child ever have any ear surgery?	Yes	6	1.5%	<0.001
	No	385	98.5%	
8. Does your child use cotton swabs to clean his/her ears?	Yes	263	67.3%	Ref.
	No	125	32.0%	<0.001
	NR	3	0.8%	<0.001
9. Does your child have any health problem?	Yes	80	20.5%	<0.001
	No	310	79.3%	Ref.
	NR	1	0.3%	<0.001
10. Does your child present learning difficulties in school?	Yes	46	11.8%	<0.001
	No	345	88.2%	
11. Does your child present language or speech problems?	Yes	76	19.4%	<0.001
	No	315	80.6%	

Note – NR: Did not respond; N: Number of subjects.
Test for Equality of Two Proportions; P-value <0.05.

When the questionnaire results were compared to the outcome on the four procedures included in the hearing screening, there were significant associations between the question “Do you think your child hears well?” and all the hearing screening tests. In 92% of the cases where the caregiver declared that the child had good hearing no alterations were

found on the EAC inspection and the child passed the TEOAE, the DPOAE and the tympanometry. In the cases where the caregiver declared to suspect that the child did not hear well, 23% had alterations on the meatoscopy, 27% failed the TEOAE and the DPOAE, and 32% failed the tympanometry.

Table 5 shows that the TEOAE was also significantly associated with the questions “Do you think

your child hears well?” and “Did your child ever have ear infections of other ear problems?”.

Table 5 – Association between transient-evoked otoacoustic emissions and the pre-screening questionnaire

TEOAE		Fail		Pass		Total		P-value	Yates
		N	%	N	%	N	%		
1. Did your child ever have a hearing evaluation?	No	22	79%	617	83%	639	83%	0.493	
	Yes	6	21%	122	17%	128	17%		
2. Do you think your child hears well?	No	8	27%	60	8%	68	9%	<0.001	
	Yes	22	73%	675	92%	697	91%		
3. Does your child seem to hear better on some days rather than others?	No	18	60%	531	74%	549	73%	0.093	
	Yes	12	40%	188	26%	200	27%		
4. Does anyone in the family present hearing impairments?	No	21	70%	496	67%	517	68%	0.773	
	Yes	9	30%	239	33%	248	32%		
5. Was there any complication during pregnancy or birth?	No	26	87%	641	87%	667	87%	0.930	
	Yes	4	13%	94	13%	98	13%		
6. Did your child ever have ear infections of any other ear problems?	No	13	43%	472	64%	485	63%	0.024	
	Yes	17	57%	269	36%	286	37%		
7. Did your child ever have any ear surgery?	No	28	93%	733	99%	761	99%	0.008	0.067
	Yes	2	7%	8	1%	10	1%		
8. Does your child use cotton swabs to clean his/her ears?	No	12	40%	232	32%	244	32%	0.331	
	Yes	18	60%	503	68%	521	68%		
9. Does your child have any health problem?	No	26	87%	586	79%	612	80%	0.326	
	Yes	4	13%	153	21%	157	20%		
10. Does your child present learning difficulties in school?	No	30	100%	651	88%	681	88%	0.042	0.082
	Yes	0	0%	90	12%	90	12%		
11. Does your child present language or speech problems?	No	25	83%	596	80%	621	81%	0,694	
	Yes	5	17%	145	20%	150	19%		

Note – N: Number of subjects. Chi-Square test and Yates' Correction. P-value <0.05.

■ **DISCUSSION**

Four distinct procedures were selected for this study in order to provide a full evaluation in the school-age hearing screening, examining from the EAC to the integrity and functionality of the outer hair cells in the cochlea, and considering that the early detection of hearing losses that may interfere in the process of learning, reading and writing of school-age children is indispensable. The early identification and rehabilitation of hearing impairments provide great benefits for the child¹⁸, besides reducing the linguistic, educational and psychosocial consequences. Hence, it is consensus that the hearing assessment and monitoring should not

be carried out only in newborns, but also during the first years of school life.

The cerumen is a natural event, normally expelled from the EAC and, usually, asymptomatic. However, if excessive, it may cause complications such as the hearing loss¹⁹. In the present study, the most observed alteration in the meatoscopy was excessive cerumen, which is reported in literature as one of the most frequent causes of alterations in preschool and school-age children¹. Recent studies have found that the presence of excessive cerumen in the EAC was the most common alteration found in students²⁰⁻²², which complies with the results in this study. However, in other researches^{10,11,23,24}, there the prevalence of excessive cerumen was a higher than in this study.

The OAE has been revealing an important applicability to perform hearing screenings, as it is a quick, effective and viable method²⁵. Nevertheless, the results of these screenings are frequently influenced by the presence of middle ear abnormalities. The OAE have been shown as effective measures to identify these alterations, as well as moderate or more severe degrees of cochlear hearing loss²⁶.

The frequency of fail results in the OAE found in literature diverges from the observed in the present study. Performing the screening with 744 preschool students using the TEOAE, authors found a failure rate of 5.5%²⁵. Another study performed the TEOAE in 93 school-age students, finding a failure rate of 25.8%²⁷. Authors who performed the DPOAE in 105 children found that 5.37% presented alterations²⁸. DPOAE was also performed in 846 children from another study, in which 96% of the subjects passed the hearing screening²⁹, similar to the data found in the present study.

In a research that used similar methods to the present study, analyzing the tests by ear, it was found 818 (90.6%) pass and 84 (9.4%) fail results in the TEOAE. The DPOAE was performed in the same ears, and obtained 849 (94.0%) pass and 53 (6.0%) fail results¹⁰. These data corroborate the present study, once it was found a greater number of pass in the DPOAE than in the TEOAE. This may be due to the fact that the TEOAE are registered in nearly 98% of people with hearing thresholds of up to 25 dBHL, while the DPOAE can be detected in practically 100% of the individuals with normal hearing thresholds or better than 45 dBHL. Hence, the DPOAE does not detect mild cochlear hearing losses^{30,31}.

Furthermore, the literature reports variations between 11.6 and 37.8% of hearing impairments found in the school-age hearing screening^{11,32,33}. Authors recommend that the TEOAE are always used along with the tympanometry, thus providing a more significant interpretation and allowing the detection of hearing impairments with middle ear alterations^{26,27,34,35}.

The tympanometry is a quick and objective test designed to evaluate the functional integrity of the tympanic-ossicular system^{7,36}, and that has been broadly used in hearing screening programs for precisely identifying conductive alterations. Like in this study, other authors have also observed the predominance of type A curves^{37,38}, followed by type C, when performing the tympanometry in the school-age hearing screening^{2,7,22,27}. The occurrence of 26.5% of types B, C, As and Ad tympanometric curves in this study's population, which may be related to middle ear and/or auditory tube alterations, infers that the findings were compatible with

the types of hearing loss (conductive and mixed) found in the school-age children referred for audiological diagnosis.

Any alteration found in the school-age hearing screening requires an appropriate referral for full audiological evaluation, in order to provide more complete and definitive tests. The hearing screening will only bring benefits for the student if the results that are outside the normal range are confirmed and the appropriate intervention is performed after that³⁵.

Conductive hearing loss, which is more frequent in the months of fall and winter due to the weather, may be considered the most common cause of fail results in the school-age hearing screening^{32,35}. It is worth emphasizing that the data collection for the present study was performed in these seasons. This type of hearing impairment is the most reported fail in the school-age hearing screening, both in national and international literature^{10,22,32,38}.

The combination of procedures to identify children with hearing impairments is recommended because children often fail only one of them⁶. Performing the TEOAE along with the DPOAE³, as well as the tympanometry and the full audiological evaluation after the school-age hearing screening, in cases where referral is needed, is important to avoid false positive results, since some students referred for audiological diagnosis in this study presented normal hearing.

The significant relationship between some of the answers from caregivers and the procedures performed in the school-age hearing screening demonstrates that it is possible to associate the use questionnaires along with other tests in hearing screenings. The authors from a study that had the aim to analyze the effectiveness of a low-cost screening instrument concluded that questionnaires may be used to classify children as having normal hearing or hearing loss. Furthermore, they pointed out that developing low-cost strategies can help in caring for children with hearing impairments in developing countries. Therefore, it is necessary to establish and adopt procedures with lower expenses, such as screenings and/or questionnaires, which are accessible to needy areas and allow the identification of groups of children at risk for hearing loss³⁹.

It has been reported in literature that hearing loss can be noticed by some of the students' behavior, such as: frequently asking to repeat sentences, turning the head towards the speaker, higher or lower intensity in speech, demonstrating effort in trying to listen, looking at and concentrating on the teacher's lips, being inattentive in classroom debates, preferring social isolation, being passive or tense, easily getting tired, no effort in demonstrating capacity, presenting learning difficulties¹.

Caregivers often do not notice the hearing difficulty of the child. It is not uncommon to detect the hearing loss only in school, through the school-age hearing screening and the observation of the student's behavior. Many children that get to school-age without a hearing loss diagnose are wrongly classified as inattentive, hyperactive, with poor academic performance, difficult to adjust to school, among other things, while the actual problem is an undiagnosed hearing loss²⁴.

The prevalence of 14.6% of hearing alterations found in this sample evidences the need to intensify the implementation of programs for prevention and early diagnosis of hearing impairments. The school-age hearing screening has been shown as an effective and accessible mean of identifying impairments that were not diagnosed until school-age, as well as those developed during this period, fulfilling its objective to minimize the difficulties and losses due to hearing deficits.

Therefore, the regular hearing screening of children during their school years would guarantee that they were affected by hearing loss or other preventable alterations. Information in this study demonstrate the importance of prioritizing the identification and early treatment of hearing impairments.

■ CONCLUSION

The sample of this study was composed mostly by male school-age children with six years of age. From the 782 ears evaluated, 85.4% had normal results on the hearing screening and 14.6% showed alterations. From these, 5.8% had absence of responses in the TEOAE, and 4.2% in the DPOAE. The predominant tympanometric curve was type A, followed by type C. The most common alteration found in the students referred for audiological diagnose was the conductive hearing loss.

RESUMO

Objetivo: caracterizar o perfil audiológico de escolares do primeiro ano do Ensino Fundamental da rede municipal da cidade de Caxias do Sul-RS, investigando e identificando a ocorrência de alterações auditivas nesta população, por meio de medidas eletroacústicas. **Métodos:** estudo transversal, prospectivo, descritivo e quantitativo de 391 escolares do primeiro ano do Ensino Fundamental de escolas municipais da cidade de Caxias do Sul-RS. Os estudantes foram submetidos a quatro procedimentos audiológicos na Triagem Auditiva Escolar: Meatoscopia, Emissões Otoacústicas Evocadas por Estímulo Transiente, Emissões Otoacústicas - Produto de Distorção e Timpanometria. Além disso, os responsáveis pelas crianças responderam a um questionário com perguntas referentes ao desenvolvimento e aos antecedentes otológicos de cada criança. Os escolares que apresentaram alguma alteração auditiva na Triagem Auditiva foram encaminhados para avaliação otorrinolaringológica e/ou avaliação audiológica completa. **Resultados:** das 782 orelhas avaliadas, 85,4% apresentaram normalidade nos exames realizados e 14,6% demonstraram algum tipo de alteração. Na Meatoscopia, verificou-se que 6,3% das orelhas apresentaram alterações. Passaram nas Emissões Otoacústicas Evocadas por Estímulo Transiente 94,8% das orelhas e nas Emissões Otoacústicas - Produto de Distorção 95,8%. Na Timpanometria, a curva predominante foi a tipo A, seguida pela tipo C. Foram realizados encaminhamentos para 14,6% dos escolares. **Conclusão:** a população desse estudo foi composta, em sua maioria, por escolares do gênero masculino, com seis anos de idade. Das 782 orelhas avaliadas, 85,4% apresentaram normalidade nos exames realizados e 14,6% demonstraram algum tipo de alteração.

DESCRITORES: Audição; Triagem; Estudantes; Emissões Otoacústicas Espontâneas; Testes de Impedância Acústica

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Mailing address:

Natália Ramos

Rua Alexandre Fleming, 454

Caxias do Sul – RS – Brasil

CEP: 95041-520

E-mail: taia.ramos@yahoo.com.br