

# Hearing trial in child education: association with health determinants

## Triagem auditiva na educação infantil: associação com determinantes de saúde

## Tamizaje auditivo en la educación infantil: asociación con determinantes de salud

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### **Abstract**

**Objective:** To describe the results of hearing screening in preschool children and verify association with socioeconomic aspects and health history. **Methods:** composite sample of 199 children. Data collection consisted of the application of a structured questionnaire of characterization of the Brazil Classification Criteria sample and the Transient Evoked Otoacoustic Emissions Exam. **Results:** The descriptive analysis of the participants' profile revealed similarity between the sexes and mean age of four years and eight months. In the auditory profile, it was observed that the majority presented a "pass" result in the otoacoustic emissions exam. Although there was no statistically significant result, the association between the results of otoacoustic emissions and socioeconomic data showed that the classification of the level of schooling of the predominant head of household was illiterate/elementary school 1 incomplete, classified in the socioeconomic level D/E of the Brazil Economic Classification Criterion, most had a family grant and few children had a health plan. The analysis of the "failure" results of otoacoustic emissions and the health history also didn't present significant result but revealed that of the children who presented this result, the

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SCGP Data collection, analysis and interpretation of data, writing and final approval of the version to be published. JMM Data collection and interpretation, and final approval of the version to be published. AJAC Conception and study design, data collection, data analysis and interpretation, writing, review and final approval of the version to be published. AGE Data collection, analysis and interpretation of data, writing, review and final approval of the version to be published. LMHFG Conception and design of the study, analysis and interpretation of the data, revision and final approval of the version to be published. SMAL Conception and design of the study, analysis and interpretation of data, writing, review and final approval of the version to be published.

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majority of those in charge answered that the student listens well, went to the doctor less than 12 months ago, doesn't use drugs and doesn't perform any kind of treatment. **Conclusion:** Most children presented a "pass" result in otoacoustic emissions and there were no associations with statistical significance between school auditory screening, socioeconomic aspects and health history.

**Keywords:** Speech, Language and Hearing Sciences; Hearing; Social class; Health profile; Child, Preschool; Child rearing.

### Resumo

**Objetivo:** Descrever os resultados da triagem auditiva em escolares da educação infantil e verificar associação com aspectos socioeconômicos e histórico de saúde. **Métodos:** Amostra composta por 199 crianças. A coleta de dados consistiu na aplicação de questionário estruturado de caracterização da amostra do Critério de Classificação Econômica Brasil e realização de exame de Emissões Otoacústicas Evocadas Transientes. **Resultados:** A análise descritiva do perfil dos participantes revelou semelhança entre os sexos e média de idade de quatro anos e oito meses. No perfil auditivo observou-se que a maioria apresentou resultado "passa" no exame de emissões otoacústicas. Apesar de não apresentar resultado com significância estatística, a associação entre resultado das emissões otoacústicas e dados socioeconômicos revelou que a classificação do grau de escolaridade do chefe de família predominante foi analfabeto/ ensino fundamental 1 incompleto, classificada no nível socioeconômico D/E do Critério de Classificação Econômica Brasil, a maioria possuía bolsa família e poucas crianças possuíam plano de saúde. A análise dos resultados "falha" das emissões otoacústicas e o histórico de saúde também não apresentaram resultado significativo, mas revelou que das crianças que apresentaram este resultado, a maioria dos responsáveis respondeu que o escolar ouve bem, foi ao médico há menos de 12 meses, não faz uso de medicamentos e não realiza algum tipo de tratamento. **Conclusões:** A maioria das crianças apresentou resultado "passa" nas emissões otoacústicas e não houve associações com significância estatística entre a triagem auditiva escolar, os aspectos socioeconômicos e histórico de saúde.

**Palavras-chave:** Fonoaudiologia; Audição; Classe social; Perfil de saúde; Pré-escolar; Educação infantil.

### Resumen

**Objetivo:** Describir los resultados del tamizaje auditivo en escolares de la educación infantil y verificar asociación con aspectos socioeconómicos e histórico de salud. **Métodos:** Muestra compuesta por 199 niños. La recolección de datos consistió en aplicación de cuestionario estructurado de caracterización de muestra del Criterio de Clasificación Económica Brasil y realización examen de Emisiones Otoacústicas Evocadas Transientes. **Resultados:** El perfil de participantes reveló similitud entre los sexos y media de edad de cuatro años y ocho meses. En perfil auditivo se observó que mayoría presentó resultado "pasa" en examen de emisiones otoacústicas. A pesar de no presentar resultados con significancia estadística, la asociación entre resultado de las emisiones otoacústicas y datos socioeconómicos reveló clasificación del grado de escolaridad del jefe de familia fue analfabeto / enseñanza fundamental 1 incompleta, clasificadas en el nivel socioeconómico D / E del Criterio de escolaridad La clasificación Económica Brasil, la mayoría poseía beca familiar y pocos niños tenían plan de salud. El análisis de los resultados "falla" de las emisiones otoacústicas y el historial de salud tampoco presentaron un resultado significativo, pero reveló que de los niños que presentaron este resultado, la mayoría de los responsables respondió que el escolar oye bien, fue al médico hace menos de 12 meses, no hace uso de medicamentos y no realiza algún tipo de tratamiento. **Conclusión:** La mayoría de los niños presentaron resultado "pasa" en las emisiones otoacústicas y no hubo asociaciones con significancia estadística entre la clasificación auditiva escolar los aspectos socioeconómicos e histórico de salud.

**Palabras claves:** Fonoaudiología; Audición; Clase social; Perfil de salud; pré-escolar; Crianza del niño

## Introduction

The literature indicates that health is due to a set of conditions that involves social, emotional, economic, cultural, biological, ecological and political aspects<sup>1</sup>.

Demographic, socioeconomic and cultural changes have been factors that interfere in the concept of health. Such aspects may constitute protection or vulnerability in the overall development process of the individual, especially in the life cycle of childhood, interfering in its overall development or in more specific aspects, such as language and hearing, essential for communicative development<sup>1-3</sup>.

It should be emphasized that the development of hearing is related to the biological capacity and the environment in which the individual lives. The innate biological aspect refers to the set of organic structures present at birth<sup>1,4</sup>. The peripheral auditory system (external ear, middle and inner ear), which leads the sound to the auditory pathways, transforms the sound wave into electrical energy, which will soon be interpreted by the structures of the central auditory nervous system<sup>1,4</sup>. Therefore, it is essential to have acoustic quality in the environment in which they live, whether family or school, because these experiences are related to the auditory behavior of children<sup>1</sup>. In this way, a stimulating and interactive environment for the development of the individual is of extreme importance.

In addition, hearing plays an important role in the acquisition and development of oral language, which is indispensable for social interaction<sup>2,3,5</sup>. Thus, there will be a greater probability of improving aspects of expressive and receptive language, literacy, academic performance, and emotional and social development if there is early detection and intervention of hearing loss in children.

Socioeconomic and demographic conditions are determining factors in the health and disease process in the various life cycles<sup>1</sup>. In this way, understanding the influence of living conditions on auditory screening becomes an important point in research in the field of speech therapy. It is necessary to understand if the interference of socioeconomic factors can have association in the result of auditory tests.

In relation to auditory screening, another important factor is the child's health history<sup>1</sup>, since the study of clinical conditions and access to health

services may present data that will contribute to the understanding of the hearing screening result.

It is worth noting that the early detection of hearing loss is extremely important for children, since it can provide intervention in time, avoiding or minimizing its consequences, such as language disorders (oral and written) and changes in communicative and social behavior<sup>3-5</sup>.

Therefore, the present study aims to describe the results of hearing screening in preschool children and verify the association with socioeconomic aspects and health history.

## Methods

This is a cross-sectional observational study with probabilistic sample stratified by school and age group, carried out in five Municipal Units of Early Childhood Education (MUECE) of Northern Region of Belo Horizonte, Minas Gerais.

This study was approved by the Ethics Committee in Research of the institution under the CAAE opinion n<sup>o</sup>: 19409413.5.0000.5149. All those responsible for the children who participated in the study signed the Free and Informed Consent Term (FICT).

In the study, 199 children aged between four and six years old, 11 months and 29 days, who signed the FICT, answered more than 70% of the structured questionnaire characterizing the sample and the Brazilian Economic Classification Criterion (BECC)<sup>6</sup>. Children with neurological, cognitive and ventilatory changes were excluded from the study.

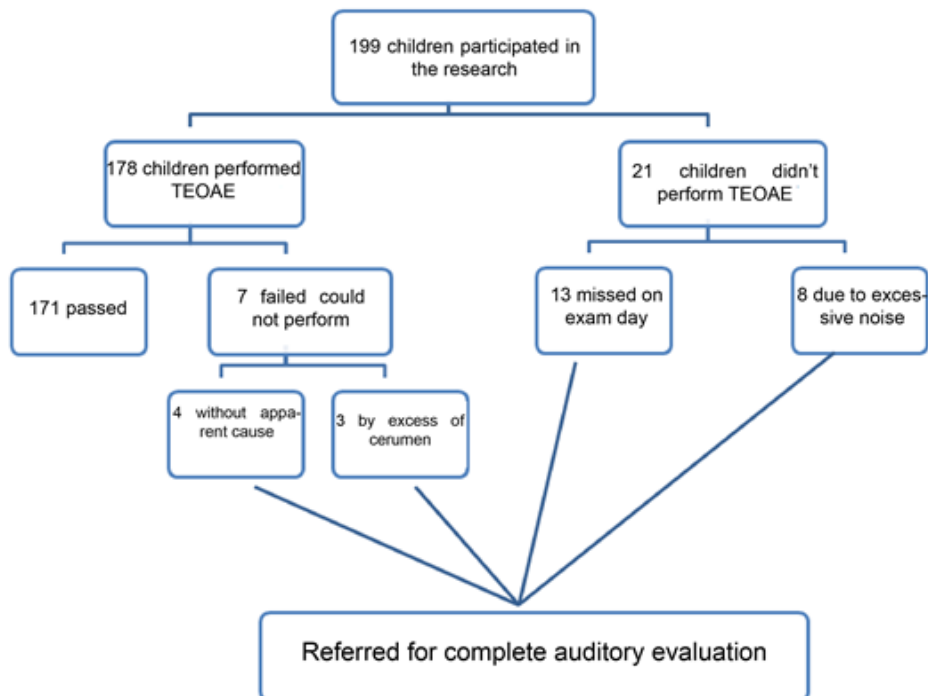
To calculate the sample size, a prevalence of 20% was used and a sample error of 5% and a 95% confidence interval were also considered. Considering the criteria presented, it was estimated the sampling based on a population of 466 eligible children regularly enrolled in 2013, based on the five MUECE and selected age groups. Considering the exclusion criteria, the final sample consisted of 199 children.

The procedures used to collect data included the application of a questionnaire characterizing the BECC sample and Transient Evoked Otoacoustic Emissions (TEOAE). The application of the questionnaire took the form of an interview with parents or guardians without the participation of the child. It should be noted that the application of the questionnaire and the evaluation of the children were carried out in a room provided by the school.

The sample characterization questionnaire, which includes identification, socioeconomic-demographic data and health profile, was structured and elaborated by the researchers and applied individually to the parents or guardians of the children. Through it, the following thematic axes were investigated: sociodemographic profile and health history. The sociodemographic profile consisted of questions related to age, gender, length of stay in school, age and profession of parents, and the number of siblings the child has. On the other hand, health history addressed issues related to current or previous health care, continuous use of medication, perception of the person responsible for hearing the child and possession of health plans. In order to evaluate the socioeconomic/demographic level, the BECC was used, whose sole purpose is to evaluate the purchasing power of a group of consumers, abandoning the pretension of classifying the population in terms of social classes, dividing the market into economic class<sup>6</sup>. The questionnaire consists of questions about possession of items, degree of education of the head of household and family income<sup>6</sup>.

In order to evaluate the hearing, the meatoscopy was performed, initially, through the Mikatos Mini Otoscope, in order to identify in the students the presence of impacting cerumen or foreign body in the External Acoustic Meatus (EAM). Subsequently, Transient Evoked Otoacoustic Emissions (TEOAE) was performed, which is a non-invasive, fast, objective, sensitive procedure for the detection of mild to profound hearing loss, uni or bilateral, and was performed by speech therapist in a room with control of noise, provided by MUECE. The TEOAE were performed with stimuli in non-linear clicks at 80 dBNPS. Emissions were recorded with AuDX I equipment, Bio-logic brand, calibrated on July 6, 2012. In the examination the parameters analyzed were: a) reproducibility greater than or equal to 70%; b) the signal-to-noise ratio greater than or equal to 6 dB; and c) probe stability equal to or greater than 95%.

For the emission results, the TEOAE Final Total classification was used, with the result “passing” being attributed to children with a presence of response in both ears (figure 1).



Caption: EOAT = Transient Evoked Otoacoustic Emissions

**Figure 1.** Flowchart of the TEOAE.

Of the 199 children who participated in the study, 21 did not perform TEOAE due to excessive noise at the time of the examination or because they had missed the scheduled day. Thus, the total number of children who took the TEOAE was 178.

In the event of failure or failure to complete TEOAE due to lack on the day of the exam or due to excessive noise during the test, the children were referred for complete auditory evaluation in the public health network of Belo Horizonte.

The complete auditory evaluation, which consists of the Conditional Tonal Audiometry exam in which it is possible to evaluate the child's hearing level, as well as the acoustic immittance measures that allow to identify and classify middle ear alterations. All the exams were performed in health network of Belo Horizonte.

After the collection, the data were entered in a database and checked. Subsequently a descriptive analysis of the variables was performed by means of absolute and relative frequency distribution of the categorical variables and by measures of central tendency and dispersion of the continuous variables. Fisher's exact test was used to evaluate the factors associated with Otoacoustic Emissions. The analysis were performed in software R - version 3.1.3.

## Results

The characteristics of the 199 children who participated in the research (Table 1) revealed that there were similar proportions between male (50.8%) and female (49.2%), and that the mean age is four years and eight months old. The family profile revealed that the majority of mothers were

between 30 and 40 years old (54.3%), that most heads of families had incomplete high school education (47.8%), which most had monthly family income of two or more minimum salaries (74.6%) and did not receive a family grant (61.1%).

As to the auditory profile of the children who participated in the study (Table 2), it can be observed that of the 178 students who took the exam, 96.1% presented a "pass" result in the total final TEOAE and a 3.9% "failed" result.

In the analysis of association between the results of Total Final Evoked Otoacoustic Emissions and socioeconomic data (Table 3), it is verified that of the children who presented "failure" results in the total final TEOAE, the grade of schooling of the head of household was illiterate/elementary school 1 (1<sup>st</sup> to 5<sup>th</sup> year) incomplete (11%), classified in the D/E level of the BECC (15.4%), had a family grant (5.9 %) and only 1.5% of the children had health insurance. None of the associations presented a statistically significant result.

The analysis of the absolute values of the results of the Transient Evoked Otoacoustic Emissions Failure total final result and the health history (Table 4) revealed that of the seven children who presented this result, the majority of those in charge answered that the student listens well (5), does not treat for any disease (6), went to the doctor for the last time less than 12 months (4), does not use medications (7) and does not perform any type of treatment (speech therapy, physiotherapy, occupational therapy, psychology and other specialists). The analysis of the association between the results of Transient Evoked Otoacoustic Emissions Final and health history did not present a statistically significant result.

**Table 1.** General characteristics of the evaluated children and their families

	<b>N</b>	<b>%</b>
<b>Child's Gender</b>		
Female	98	49,2
Male	101	50,8
Total	199	100,0
<b>Age of the child</b>		
4 years old	64	32,2
5 years old	119	59,8
6 years old	16	8,0
<b>MUECE</b>		
MUECE -1	56	28,1
MUECE -2	36	18,1
MUECE -3	32	16,1
MUECE -4	23	11,6
MUECE - 5	52	26,1
Total	199	100,0
<b>MUECE Time</b>		
12 months	31	15,6
18 months	9	4,5
24 months	75	37,7
Over 30 months	84	42,2
Total	199	100,0
<b>Age of the mother</b>		
20 to 30 years old	69	34,7
30 to 40 years old	108	54,3
40 to 50 years old	20	10,1
Over 50 years old	2	1,0
Total	199	100,0
<b>Degree of schooling of head of household</b>		
Illiterate / Fundamental 1 incomplete	20	10,1
Fundamental 1 complete / Fundamental 2 incomplete	43	21,6
Fundamental 2 complete / Incomplete Medium	46	23,1
Middle Full / Incomplete Superior	84	42,2
Graduated	6	3,0
Total	199	100,0
<b>Monthly family income</b>		
Less than one minimum wage	8	4,2
A minimum wage	40	21,2
Two minimum wages	72	38,1
Three minimum wages	21	11,1
Four minimum wages	29	15,3
Above five minimum wages	19	10,1
Total	189	100,0
<b>Family grant</b>		
Yes	77	38,9
No	121	61,1
Total	198	100,0

Legend: N = Number of individuals, varies according to missing answers; MUECE = Municipal Unit of Early Childhood Education; Fundamental 1 = 1st to 5th year; Fundamental 2 = 6 to 9 years old

**Table 2.** Characteristics of the children's auditory profile

	<b>N</b>	<b>%</b>
<b>TEOAE Right Ear</b>		
Passed	172	96,6
Failed	6	3,4
Total	178	100,0
<b>TEOAE Left Ear</b>		
Passed	171	96,1
Failed	7	3,9
Total	178	100,0
<b>TEOAE Total Final</b>		
Passed	171	96,1
Failed	7	3,9
Total	178	100,0
<b>Complete hearing evaluation</b>		
Yes	3	1,7
No	175	98,3
Total	178	100,0

Legend: N = Number of individuals, varies according to missing answers; TEOAE = Transient Evoked Otoacoustic Emissions

**Table 3.** Univariate analysis of the association between the auditory profile and socioeconomic data

<b>Variables</b>	<b>Total Final Otoacoustic Emissions</b>			<b>Value-p</b>
	<b>Passed N(%)</b>	<b>Failed N(%)</b>	<b>Total N(%)</b>	
<b>Child's gender</b>				
Female	82(95,3)	4(4,7)	86(100)	0, 7131
Male	89(96,7)	3(3,3)	92(100)	
<b>Age of child</b>				
4 years old	58(98,3)	1(1,7)	59(100)	0, 6492
5 years old	101(59,3)	6(5,6)	107(100)	
6 years old	12(100)	0(0,0)	12(100)	
<b>Degree of schooling of head of household</b>				
Illiterate / Fundamental 1 incomplete	16(89)	2(11)	18(100)	0, 5598
Fundamental 1 complete/Fundamental 2 incomplete	36(97)	1(3)	37(100)	
Fundamental 2 complete/ Incomplete Medium	41(98)	1(2)	42(100)	
Middle Full / Incomplete Superior	73(96)	3(4)	76(100)	
Graduated	5(100)	0(0,0)	5(100)	
<b>BECC</b>				
B	58(98,3)	1(1,7)	59(100)	0, 09316
C	102(92,3)	4(3,8)	106(100)	
D/E	11(84,6)	2(15,4)	13(100)	
<b>Family grant</b>				
Yes	64(94,1)	4(5,9)	68(100)	0, 431
No	106(97,2)	3(2,8)	109(100)	
<b>Has a health plan</b>				
Yes	66(98,5)	1(1,5)	67(100)	1,00
No	104(94,5)	6(5,5)	110(100)	

Fisher's exact test

Legend: N = Number of individuals, varies according to missing answers; ECCB = Economic Classification Criteria Brazil; Fundamental 1 = 1st to 5th year; Fundamental 2 = 6 to 9 years old.

**Table 4.** Univariate analysis of the association between auditory profile and health history

Variables	Total Final Otoacoustic Emissions			Value-p
	Passed N(%)	Failed N(%)	Total N(%)	
<b>The child hears well</b>				
Yes	157(96,9)	5(3,1)	162(100)	0,122*
No	14(87,5)	2(12,5)	16(100)	
<b>Treatment for any disease</b>				
Yes	31(96,9)	1(3,1)	32(100)	1,00*
No	140(95,9)	6(4,1)	146(100)	
<b>Last time the child went to the doctor</b>				
A month ago	57(95)	3(5)	60(100)	1,00*
Less than 12 months	92(95,8)	4(4,2)	96(100)	
Between 12 and 24 months	17(100)	0(0,0)	17(100)	
More than 24 months	1(100)	0(0,0)	1(100)	
Do not remember	4(100)	0(0,0)	4(100)	
<b>Use of medication</b>				
Yes	19(100)	0(0,0)	19(100)	1,00*
No	151(95,6)	7(4,4)	158(100)	
<b>Treatment with a doctor</b>				
Yes	34(97,1)	1(2,9)	35(100)	1,00*
No	136(95,8)	6(4,2)	142(100)	
I do not know	1(100)	0(0,0)	1(100)	
<b>Treatment with speech therapist currently</b>				
Yes	1(100)	0(0,0)	1(100)	1,00*
No	170(96)	7(4)	177(100)	
<b>Previous speech therapist treatment</b>				
Yes	3(100)	0(0,0)	3(100)	1,00*
No	167(96,5)	6(3,5)	173(100)	
I do not know	1(50)	1(50)	2(100)	
<b>Physiotherapist Treatment</b>				
Yes	1(100)	0(0,0)	1(100)	1,00*
No	170(96)	7(4)	177(100)	
<b>Occupational Therapist Treatment</b>				
Yes	2(100)	0(0,0)	2(100)	1,00*
No	169(96)	7(4)	176(100)	
<b>Treatment with Psychologist</b>				
Yes	3(100)	0(0,0)	3(100)	1,00*
No	168(96)	7(4)	175(100)	
<b>Other Specialists</b>				
Yes	2(100)	0(0,0)	2(100)	1,00*
No	169(96)	7(4)	176(100)	

Fisher's exact test

Legend: N = Number of individuals, varies according to missing answers

## Discussion

The present study evidenced that the occurrence of the result in the final total TEOAE was greater than a “failure” result, which was already expected, since the study was conducted in MUECE with children without hearing complaints and considered by teachers with normal social hearing<sup>8</sup>, that is, with adequate hearing for different environments for the purpose of communication. These findings corroborate previous<sup>2,4,9,10</sup> studies that used OAE and pure tone audiometry

as screening in students, aged between three and 12 years old.

With regard to such studies, it is worth considering a research carried out in Caxias do Sul/RS<sup>9</sup> with 391 students, in the age group of six to nine years old, in which the majority presented a “pass” result in the emissions. Another study<sup>10</sup>, conducted in Rio de Janeiro/RJ, with 431 students and a more extensive age group (one to 12 years old) than the present research, showed that more than 90% of the sample presented a “pass” result in the emissions.

It is also worth mentioning, among the studies corroborated by the present research, those who used pure tone audiometry such as school auditory



screening<sup>2,4</sup>. One of them, conducted in Pernambuco<sup>4</sup> with 127 children aged 6 to 12 years old, revealed that more than 80.0% had hearing within the norms of normality. A similar result was found in another study<sup>2</sup> carried out at a philanthropic institution in the city of Campo Grande/MS, with a sample of 100 children aged 6 to 12 years old. It was verified that 90.4% of the students presented hearing results within the standards normality in the two ears tested.

Although in these studies most of the children presented a “pass” result in the examinations, the percentage of children with possible hearing loss should be considered, since, even if the value was small, the impairments to the quality of life and learning of these children will be great, especially with regard to language development.

These data corroborate studies carried out with children who presented some degree of hearing loss, revealing that such an alteration in an early period of development can affect communicative, social learning and quality of life skills<sup>11,12</sup>. In addition, the possibility of frustration of the child by not understanding the context, which can cause major problems, such as behavioral and cognitive changes.

According to the Brazilian Institute of Geography and Statistics (IBGE)<sup>14</sup>, 1.3% of the population in Brazil, aged between zero and 14, has hearing impairment. Comparing the states of the Southeastern Region, Minas Gerais is the second with the greatest population with some hearing difficulties (26.0%)<sup>14</sup>.

The present study revealed that of the children who presented a failed TEOAE, the majority belonged to the age group of five years old. In this context, it is necessary to remember that the age group of five years old must be auditively controlled, since it is the initial phase of literacy, learning and linguistic acquisition<sup>4,10</sup>.

In addition, it was observed that of the seven children that failed, or with whom it was not possible to perform final total TEOAE, three were due to total or partial obstruction of the external acoustic meatus due to cerumen, three due to conductive changes and one attended the complementary auditory examination, being thus not able to be accompanied in its course in the health system.

Cerumen is produced in the external acoustic meatus by the ceruminous glands and by hair of the external third of the auditory canal that also produce

glandular secretions<sup>15,16</sup>. Produced and disposed of under normal conditions, cerumen is a healthy, beneficial phenomenon and has important functions such as lubricating the ear canal and protecting the tympanic membrane against ingress of water, dust, insects and other harmful particles<sup>16,17</sup>. In some cases the excessive production of this secretion may occur, causing total or partial obstruction of the external acoustic meatus. Such obstruction can be due to the inadequate use of flexible rods at the time of cleaning or because there is a chronic inflammatory process in the region<sup>16</sup>.

Obstruction of the auditory canal reduces hearing ability, and causes a variety of symptoms, including itching, pain, tinnitus, dizziness, and increased risk of infection<sup>15,17</sup>. With regard to hearing loss, compacted cerumen prevents sound waves from reaching the middle ear, reducing the transmission of sound and, consequently, hearing capacity, characterized by aural fullness and reversible conductive change<sup>9,16</sup>. Such loss is proportional to the degree of obstruction of the external acoustic meatus<sup>15</sup>, the total obstruction by wax plug, first affects the high frequencies, with loss of sensitivity of 40 dB, causing difficulty in the perception of the acute sounds, besides some discomfort<sup>15,16</sup>. The auditory alteration occurs mainly at the 6000 and 8000 Hz thresholds, worsening hearing, on average, 6 to 10 dB<sup>15,16</sup>. The obstruction in the External Acoustic Meatus (EAM) caused by a wax plug can have a great impact on school-age children, as such alteration can cause problems in receptive and expressive language beyond literacy and academic performance<sup>9,18</sup>.

All children who presented with auditory alterations and who did not attend to perform an evaluation on the day of the exam or who could not perform the evaluation due to excessive cerumen were referred for the complete auditory evaluation, but only three attended for such evaluation. In addition, an active search was carried out for these children who did not take TEOAE, but there was also no success. For these reasons, there is a certain difficulty of parental adherence in the research. A national study<sup>19</sup> conducted at the Faculty of Medical Sciences of UNICAMP with mothers of the Universal Neonatal Hearing Screening (UNHS) program, in which the majority (68.3%) did not return to the conclusion of the screening, revealed that the probability of no return of mothers are related to absence of partners, number of

children, attendance at prenatal consultations and low schooling. Another study<sup>20</sup> carried out with 105 children from a day care center in the interior of São Paulo revealed that the difficulty of adherence may be related to socioeconomic-cultural factors.

Of the three children who underwent complete auditory evaluation, it was observed that tonal audiometry was within the normal range, but two children presented tympanometric alterations with predominance of type B and C curves. The type B curve is identified in cases where there is fluid in the middle ear, and the type C curve occurs in cases of tubal dysfunction<sup>21</sup>. These findings are closely related to otitis media which is a highly prevalent disease in childhood and corroborate other studies<sup>2,4,9,18,21</sup>. A study<sup>21</sup> carried out with 134 School Auditory Triage protocols for children aged six to eight years old, attending a school linked to the School Health Program, located in the city of Porto Alegre / RS, revealed that most of the students had tympanometric curve type A, followed by the curves of type C, Ar and B, respectively. Another study<sup>18</sup> carried out at the Municipal School of Early Childhood Education, in the interior of São Paulo, with vulnerable population, used tympanometric screening in 112 preschoolers, aged from four years old to five years old and 11 months, and found a higher failure rate (63,4%) in the population. The study also reveals that this fact can be explained by the risk factors that the population was exposed to (climatic variations, socioeconomic level and recurrent rhinorrhea).

The present study revealed that of the seven children who failed in the total final TEOAE, the level of education of the head of the family who was predominant was illiterate / elementary school 1 (1st to 5th year) incomplete, but this finding did not influence the results obtained. A national study corroborates this finding<sup>4</sup>. Research carried out in the city of Vitória de Santo Antão / PE conducted auditory screening in 106 elementary students and revealed that of the 21 children who did not pass the evaluation, the majority of the parents or guardians (52.4%) had a reduced educational background schooling (no schooling - kindergarten - elementary school), but this finding did not influence the results obtained. On the other hand, a research<sup>22</sup> conducted in the form of self-perception interview with adults to verify the association between socioeconomic factors and speech-language disorders showed an

association between low schooling and hearing complaints.

It is worth mentioning, also, a research carried out in Bauru/SP, from a training course for parents of children with hearing impairment that pointed out the higher level of schooling of the parents was related to the best use of the information that was exposed in the course<sup>23</sup>. This reveals that the level of education of the parents or guardians can contribute to the understanding of hearing complaints and to a greater incentive for the search for prevention and treatment.

In the present research, the Brazilian Economic Classification Criterion was the one that showed greater proximity to associate to the result of the emissions failure, that is, although no statistical significance was evidenced among the variables, it is inferred that in larger samples, such association may occur. International literature<sup>17,24</sup> reveals an association between socioeconomic level and hearing loss. A study<sup>17</sup> of 101 preschool children in Nigeria, aged four to six years old, found that the majority of children who had hearing loss were in the low socioeconomic status. Another study<sup>24</sup> conducted in China's urban and rural areas, with 616,940 children aged zero to 17 years old, found that hearing loss can be explained by low socioeconomic status, poor education and inadequate medical care. The research also indicated that vulnerable socioeconomic status may affect the participation of families in health promotion and prevention programs<sup>24</sup>.

Another important issue that should be considered in the present research, because it defines the socioeconomic level of the students is related to the family grant program, created with the objective of benefiting families living in poverty<sup>25</sup>. This variable was also not associated with statistical significance with the emission failure, nor were studies in the literature associating such variables.

Based on the findings of the present study, the auditory screening was necessary in students, especially those in the age of acquisition and development of the language, since the detection and early intervention of the auditory alterations are associated with better results in the development of the language (oral and written)<sup>9,10</sup>.

Previous study<sup>4</sup> points out that although auditory evaluation is guaranteed and obligatory for newborns (Law n° 12,303, of August 2, 2010<sup>26</sup>) by examining Otoacoustic Emissions in hospitals

and maternities, the same does not occur in school age. This fact reveals the need for optimization of auditory screening programs in students for the detection and prevention of auditory alterations<sup>9</sup>.

Some studies<sup>4,9,27</sup> have demonstrated that the use of OAE is an excellent evaluation for hearing screening in students. A specific study conducted with 846 children aged 0 to 10 years old, attended at three clinics funded by the federal government of the United States<sup>27</sup>, aimed to evaluate the effectiveness of the implementation of school-based hearing screening based on the use of OAE. The researchers concluded that the use of OAE was satisfactory for hearing screening in students.

The accomplishment of the present study was important to demonstrate that OAE is a good option to perform auditory screening in students, since it is a fast, non-invasive and objective exam. However, the use of OAE is more efficient for school auditory screening when associated with the immitanciometry exam, and the evaluation of the middle ear is essential for better results<sup>10,21</sup>. Such assessments are extremely important, because children are at the age of language development and the early detection and intervention of hearing loss would minimize the consequences of language disorders.

Although the present study did not show an association with statistical significance between hearing loss and socioeconomic level, it was possible to observe the need to guarantee the analysis of such indicators. In addition, it reflects the importance of promoting actions that contribute to the knowledge of the parents or responsible of the students about the importance of hearing in the process of learning and communication, and that guarantees greater adhesion to actions of promotion and prevention of health. Although the present research is a probabilistic sample study, this reflects the reality of only five MUECE, which does not allow the generalization of the results found for other contexts or populations, therefore their data should be used with caution.

## Conclusion

Based on the analysis of the results obtained in this study, it was concluded that the majority of the children presented “pass” results in TEOAE and there were no associations with statistical significance between the auditory school screening socioeconomic aspects and health history. In

addition, of the children who were referred for the complete auditory evaluation only three attended.

There were gaps in the research area that related hearing, childhood and social determinants of health. Thus, it is necessary to elaborate other researches with the objective of associating the auditory screening of schoolchildren with the quality of life and its socioeconomic factors in order to contribute to other actions of prevention and health promotion in the school environment.

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