



Reading Level of Hearing-Impaired Children in a Specialized Rehabilitation Center

Nível de Leitura de Crianças com Deficiência Auditiva de um Centro Especializado de Reabilitação

Nivel de lectura de niños con discapacidad auditiva de um Centro de Rehabilitación Especializado

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Abstract

Introduction: Children with hearing impairment need monitoring in the hearing health service in an expanded approach to comprehensive health care, which considers other dimensions of development, such as academic performance, in addition to audibility. **Objective:** To identify the level of reading comprehension of words and sentences of children with hearing impairment, hearing aid users at a Specialized Rehabilitation Center, correlating it with audibility, receptive vocabulary and the time of use of the hearing aid. **Method:** Sample composed of 18 children with hearing impairment fitted to individual electronic sound devices, between 8 and 12 years old, already literate, in regular school. The tests used were: for reading - “Sentence Comprehension-TELCS” Test, TDE-II School Performance Test (word reading) and for receptive vocabulary the Peabody-PPVT4. **Results:** The SII-Speech Intelligibility Index

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55dB and 65dB \geq 64% demonstrated a significant relationship with receptive vocabulary. The sentence reading and comprehension test showed a statistically significant relationship with SII 65dB \geq 64% and receptive vocabulary greater than 85. The consistency of device use did not demonstrate a relationship with any of the SII 55dB, SII 65dB, vocabulary, word reading and sentence reading. **Conclusion:** The reading assessment indicates that it is a relevant factor in the analysis of the development of children with hearing impairment, correlated with audibility and vocabulary factors.

Keywords: Reading; Hearing loss; Hearing aids; Vocabulary; Child.

Resumo

Introdução: Crianças com deficiência auditiva necessitam de acompanhamento no serviço de saúde auditiva em uma abordagem ampliada para o cuidado integral à saúde, que considere além da audibilidade outras dimensões do desenvolvimento, como é o caso do desempenho acadêmico. **Objetivo:** Identificar o nível de compreensão de leitura de vocábulos e sentenças de crianças com deficiência auditiva, usuárias de aparelhos de amplificação sonora individual de um Centro Especializado em Reabilitação correlacionando à audibilidade, vocabulário receptivo e o tempo de uso do AASI. **Método:** Amostra composta por 18 crianças com deficiência auditiva usuárias de dispositivos eletrônicos sonoros individuais, entre 8 e 12 anos, já alfabetizadas, em escola regular. Os testes utilizados foram: para leitura - Teste de “Compreensão de Sentenças -TELCS”, Teste de Desempenho Escolar TDE-II (leitura de palavras) e para o vocabulário receptivo o Peabody-PPVT4. **Resultados:** O SII-Índice de Inteligibilidade de Fala 55dB e 65dB \geq 64% demonstraram relação significativa com o vocabulário receptivo. O teste de leitura e compreensão de sentenças apresentou relação estatisticamente significativa com o SII 65dB \geq 64% e com o vocabulário receptivo maior que 85. A consistência do uso do aparelho não demonstrou relação com nenhum dos dados do SII 55dB, SII 65dB, vocabulário, leitura de palavras e leitura de sentenças. **Conclusão:** A avaliação de leitura indica ser um fator relevante na análise de desenvolvimento da criança com deficiência auditiva correlacionada aos fatores de audibilidade e vocabulário.

Palavras-chave: Leitura; Perda auditiva; Auxiliares de audição; Vocabulário; Criança.

Resumen

Introducción: Los niños con discapacidad auditiva necesitan seguimiento en el servicio de salud auditiva en un enfoque ampliado de atención integral en salud, que considere otras dimensiones del desarrollo, como el rendimiento académico, además de la audibilidad. **Objetivo:** Identificar el nivel de comprensión lectora de palabras y oraciones de niños con discapacidad auditiva, usuarios de dispositivos individuales de amplificación de sonido en un Centro de Rehabilitación Especializado, correlacionándolo con la audibilidad, el vocabulario receptivo y el tiempo de uso del audífono. **Método:** Muestra compuesta por 18 niños con discapacidad auditiva que utilizan dispositivos electrónicos de sonido individuales, entre 8 y 12 años, ya alfabetizados, en escuela regular. Las pruebas utilizadas fueron: para lectura - Test de “comprensión de oraciones -TELCS”, TDE-II School Performance Test (lectura de palabras) y para vocabulario receptivo el Peabody-PPVT4. **Resultados:** El Índice de Inteligibilidad del Habla SII 55dB y 65dB \geq 64% demostró una relación significativa con el vocabulario receptivo. La prueba de lectura y comprensión de oraciones mostró una relación estadísticamente significativa con SII 65dB \geq 64% y vocabulario receptivo mayor a 85. La consistencia en el uso del dispositivo no demostró relación con ninguna de las pruebas SII 55dB, SII 65dB, vocabulario, lectura de palabras y oraciones. **Conclusión:** La evaluación de la lectura indica que es un factor relevante en el análisis del desarrollo de niños con discapacidad auditiva, correlacionado con factores de audibilidad y vocabulario.

Palabras clave: Lectura; Pérdida de la audición; Audífonos; Vocabulario; Niño.

Introduction

Hearing is responsible for capturing sound stimuli, making it essential for the acquisition and development of oral language. Therefore, auditory sensory deprivation impacts the individual's communication, especially when preceding the period of language acquisition, compromising their global development, learning and quality of life.

Pediatric audiological diagnosis and early intervention result in fewer negative impacts on the child's long-term development. Children who receive intervention before six months of age using electronic devices are more likely to develop age-appropriate language skills when compared to children who receive intervention later. Studies state that children with early diagnosis also have better results in developing reading and communication skills.^{1-2,3,4,5}

The fitting of electronic devices becomes essential for the audibility of speech sounds, ensuring better conditions for the child's oral language and cognitive development, associated with family adherence and participation⁶. To ensure that the user receives speech sounds with quality and without discomfort, it is necessary to measure the speech intelligibility index (SII), which describes the audibility and intelligibility of speech sounds, measuring the proportion of audible speech information, through the calculation carried out by the verification equipment of the individual sound amplification device⁷⁻⁸.

The literature states that the consistent use of hearing aids makes it possible to achieve good audibility, promoting better conditions for the development of auditory, language, social and academic skills⁹⁻¹⁰.

Another study identified that subjects with good use of electronic devices who performed poorly on vocabulary tests and, consequently, on reading tests, were subjects with low SII. In the same study, subjects with a low average daily hearing aid use performed well in vocabulary and reading, but all subjects had mild or moderate hearing loss, with SII 65 dB amplified above 75%¹¹. A survey showed that children with moderate hearing loss have 65 minutes less use of the device, and those with mild hearing loss have 178 minutes less, when compared to hearing losses of higher degrees¹².

Monitoring the development of children diagnosed with hearing loss is recommended by the scientific community⁷⁻¹³⁻¹⁴. Hearing and language skills are used as a parameter for the development of children with hearing impairment in rehabilitation services. Such results have provided evidence about the importance of neonatal hearing screening and early intervention, as studies indicate that children who started intervention earlier show improvements at school age in terms of language, reading, social communication and academic achievement⁵⁻¹⁵.

Children with hearing impairment suffer in relation to distance, noise, and less access to speech sounds, since much of their learning is a consequence of incidental listening, when conversations in the environment are not directed to them, which serves as the main input for acquiring receptive vocabulary¹⁶⁻¹⁷.

Studies that consider the SII value to be 55 dB demonstrate greater fragility in the subjects' speech perception. Pereira et al.¹⁸ carried out a study with lists of meaning and meaningless words, observing a worsening in the speech perception performance of the group with the worst intelligibility, that is, low SII, while subjects with better audibility, good SII, showed greater variation in the hours of hearing aid use, although with evident individual variation.

Nonetheless, speech perception ability and audibility are not predictive of good reading levels¹⁹. The variable most strongly associated with the outcome of a good reading level is global linguistic competence¹⁹. However, verbal oral language skills are a better predictor of skills in the initial literacy process for children using cochlear implants than for hearing children, suggesting that this process does not depend solely on linguistic competence²⁰. Likewise, reading competence also contributes to better language development and vocabulary acquisition, thus increasing the exposure of children with hearing loss to the linguistic content of their environment. Macedo et al.¹¹, in a study with children with hearing impairment, concluded that children who presented better results in the receptive vocabulary test also achieved better reading performance, confirming the relationship between them.

Children with hearing impairment at school, especially at the beginning of literacy, may present reading difficulties and different levels of vocabulary knowledge¹¹ and, for this reason, learning or



reading skills must be considered during audiological monitoring in hearing health services.

Reading skills may be related to increased vocabulary; This assumption is based on the premise that reading development can have significant results when the individual is exposed to new words²¹.

Wass et al.²² concluded that the receptive vocabulary of 29 children between 11 and 12 years old, with hearing loss who used cochlear implants, was a strong predictor of reading comprehension and that demographic factors such as parents' education were significant. Finally, they also highlighted that factors such as age at the first or second implant and speech perception were not determinants, in other words, they did not obtain significant correlations with any reading measure. Lund²³ in his meta-analysis, which included vocabulary research in children with cochlear implants, found that in implanted children the vocabulary is below that of their hearing peers. Considers that discrepancies between the results of this meta-analysis and other studies may be the result of the research methodology. Many studies reporting that children with cochlear implants can achieve the same vocabulary level as hearing children use a normative test sample as a comparison group, which does not allow for control of important variables such as nonverbal cognition and socioeconomic status.

The complexity of the relationship between oral language, receptive vocabulary and reading is evident and, consequently, the relevance of using tests that can assess children's reading and writing skills during their school learning²⁴⁻²⁵. The use of standardized tests for children can help the therapist and other professionals in the best way forward, providing better therapeutic strategies for the intervention process, making it more suitable for each one.

In this sense, the research aims to deepen knowledge about reading for children with hearing impairment.

Objective

To identify the level of reading comprehension of words and sentences of children with hearing impairment, hearing aids users at a Rehabilitation Center, correlating to audibility, receptive vocabulary, and the time of use of the hearing aid.

Method

The research is a quantitative descriptive study, approved under process number 5.441.206 by the University's Research Ethics Committee. Parents and guardians who agreed to participate in the study were informed, both verbally and in writing, about the research and then signed the informed consent form.

It was carried out in a hearing health service in the state of São Paulo, a Specialized Rehabilitation Center - CER II. The subjects who participated in the research were invited based on the service's regular audiological monitoring schedule on the days when the researcher was present. The inclusion criteria were children with hearing impairment, users of hearing aids and/or CI (cochlear implants) of both sexes, aged between 8 and 12 years old, users of oral language as their main form of communication, who attended regular schools.

Data were collected from the medical records of subjects scheduled for audiological follow-up: full name, sex, age, age at audiological diagnosis, age at first hearing aid and/or CI fitting, audiometric thresholds from 500 Hz to 8 kHz of both ears, value of the SII at 65 dB and 55 dB with and without hearing aids, region of residence, periodicity of speech therapy, history of consistency in hearing aid use, child's education level and parents' or responsible.

On the day of the consultation, children who met the research criteria were surveyed to carry out tests with the aim of identifying each subject's reading and writing level. Parents reported whether or not the child was literate, subjects who did not yet know how to read were excluded from the study. Data from children who were not yet able to take the research tests because they were not literate were not used for the analysis of this study.

For the subjects participating in the research, audiological data from exams carried out up to a maximum of six months before the research was collected were used; filling out the data sheet and script of the parents' socioeconomic and educational level³⁰.

Vocabulary and reading assessment

The entire assessment was carried out in a bright and quiet room with a table and chairs. For receptive vocabulary, a tablet was used to demonstrate the images from the Peabody-PPVT4 test. To assess reading, the Sentence Comprehension

test (TELCS) and the word reading session of the School Performance Test-TDE II were used.

Analysis

The statistical analysis was initially with descriptive measures: mean, median, minimum, and maximum values, standard deviation, absolute and relative frequencies (percentage), in addition to graphs.

For inferential analysis used with the aim of confirming or refuting evidence found in the descriptive analysis, Fisher's Exact tests or their extension were used.

In all conclusions obtained through inferential analyses, an alpha significance level of 5% was used. The data were entered into Excel spreadsheets

for adequate information storage and statistical analyzes were performed using the IBM-SPSS Statistics version program²⁴.

Results

The sample selected in this research was made up of 18 children with an average age of 10.6 years, ranging from 8 to 12 years, hearing aid users and one with CI.

Table 1 shows the profile of the children included in relation to age, degree of loss, SII 55 dB and SII 65 dB, length of time using hearing aids in the better ear, speech therapy, family socioeconomic class, school year, type of school and mother's education.

Table 1. Distribution of the general profile of children (n=18)

Total (n=18)	Description	N	%
Children age (years)	8	1	5.60%
	9	1	5.60%
	10	5	27.80%
	11	9	50.00%
	12	2	11.10%
Children age (years)	N		
	Media	10.6	
	Median	11	
	Minimum-maximum	8.0-12.0	
Degree of hearing loss of the better ear	Standard deviation	1	
	Mild	3	16.70%
	Moderate	10	55.50%
	Severe	3	16.70%
SII 55dB	Profund	2	11.10%
	≥ 64%	12	66.70%
	< 64%	6	33.30%
SII 65dB	≥ 64%	15	83.30%
	< 64%	3	16.70%
Datalogging of the better ear HA	≥ 8 hours	11	61.10%
	< 8 hours	7	38.90%
Speech therapy	Yes	5	27.80%
	No	13	72.20%
Socioeconomic class	A, B1 ou B2	6	33.30%
	C1, C2, D ou E	12	66.70%
School type	Private	7	38.90%
	Public	11	61.10%
School year	5º ou 6º	16	88.90%
	3º ou 4º	2	11.10%
Mother's education	Incomplete elementary II	3	16.70%
	Complete elementary II – incomplete High School	3	16.70%
	Complete High School to College	12	66.70%

The 18 children had hearing loss, 72.2% of which were mild and moderate, and 83.3% had SII 65 dB greater than or equal to 64%. In relation to the average number of hours of daily use of hearing aids, 11 (61.1%) used the device for eight hours or more and 7 (38.9%) children used it for less than eight hours. Only 5 (27.8%) of the 18 children were receiving speech therapy at the time of research data collection.

Of the total number of children who participated as research subjects, 6 (33.3%) families belonged to socioeconomic classes A, B1 or B2 and

the rest of them, 12 (66.7%) children belonged to classes C1, C2, D or E.

All children were attending elementary school, 7 (38.9%) in private schools and 11 (61.1%) in public schools. In relation to the school year, 16 (88.9%) children were in the 5th/6th year of elementary school and only 2 (11.1%) were in the 3rd/4th year.

Regarding the level of education of the mothers of these children, we noticed that more than half, 12 (66.7%), had completed secondary education to higher education.

Table 2. Distribution of children's performance, according to vocabulary-peabody standard score, word reading - TDE and reading comprehension - TELCS (n=18).

Category	Classification	n (18)	%
Vocabulary - Peabody Standard Score	≥ 85 (-1dp)	13	72.2%
	< 85 (-1dp)	5	27.8%
Reading of words - TDE	within or above expectation	9	50.0%
	under expectation	9	50.0%
Reading Comprehension - TELCS	superior/above average/average	13	72.2%
	disorder/difficulty	5	27.8%

As we can see in Table 2, a little more than half of the children presented a result in the vocabulary test greater than or equal to 85 points or -1dp (72.2%) and the result in the reading compre-

hension test was superior/above average/ average (72.2%). Exactly half of the children performed at or above expectations on the word reading test.

Table 3. Distribution of hearing aid usage time in the better ear (n=18).

	Datalogging of better ear				Total (n=18)	P	
	≥ 8 hours (n=11)		< 8 hours (n=7)				
SII 55dB ≥ 64%	6	54.5%	6	85.7%	12	66.7%	0.316 ^a
SII 55dB < 64%	5	45.5%	1	14.3%	6	33.3%	
SII 65dB ≥ 64%	8	72.7%	7	100.0%	15	83.3%	0.245 ^a
SII 65dB < 64%	3	27.3%	-	-	3	16.7%	

^a Exact of Fisher

In this research, possible relationships between the performance of the tests applied and the children's audiological characteristics were

investigated. Table 3 presents the distribution of hearing aid usage time in the better ear according to the SII classification at 55 dB and 65 dB.

Table 4. Distribution of performance in the vocabulary test - Peabody Standard Score according to SII 55 dB and SII 65 dB and time using the hearing aid in the better ear (n=18).

	Vocabulary Standard Score				Total (n=18)	P	
	≥ 85 (n=13)		< 85 (n=5)				
SII 55dB ≥ 64%	11	84.6%	1	20.0%	12	66.7%	0.022 ^a
SII 55dB < 64%	2	15.4%	4	80.0%	6	33.3%	
SII 65dB ≥ 64%	13	100.0%	2	40.0%	15	83.3%	0.012 ^a
SII 65dB < 64%	-	-	3	60.0%	3	16.7%	
Datalogging of better ear ≥ 8 hours	6	46.2%	5	100.0%	11	61.1%	0.101 ^a
Datalogging of better ear < 8 hours	7	53.8%	-	-	7	38.9%	

^a Exact of Fisher

The time of use in the best ear did not show any significance related to performance at SII 55 dB (p=0.316), equally at SII 65 dB (p=0.245).

Table 4 shows the children's performance in the vocabulary test (Peabody Standard Score version 4) according to the classification of SII 55 dB and SII 65 dB and the number of hours of hearing aid use in the better ear. It was possible to observe significant relationships.

The data in Table 4 demonstrate that children with SII 55 dB ≥ 64% are more frequent among those with receptive vocabulary results ≥ 85 (84.6%) when compared to the group of children with receptive vocabulary results < 85 (20.0%) (p=0.022). It can also be observed that the group of

children with SII 65 dB ≥ 64% are more frequent among those with a receptive vocabulary test result ≥ 85 (100.0%) when compared to the group of children with a receptive vocabulary test result < 85 (40.0%) (p=0.012). The length of time using the hearing aid in the better ear did not show statistical significance related to performance in the receptive vocabulary test (p=0.101).

According to Table 5, the children's classification in the reading comprehension test - TELCS was related to the SII 65 dB (p=0.012) and the receptive vocabulary test - Peabody Standard Score (p=0.008).

Table 5. Distribution of reading comprehension tests - TELCS and receptive vocabulary - Peabody Standard Score, in relation to SII 55 dB and SII 65 dB, time using hearing aids in the better ear and mother's education (n=18).

	TELCS				Total (n=18)	P	
	above/above average/ average (n=13)		disorder/ difficulty (n=5)				
SII 55 dB							
≥ 64%	10	76.9%	2	40.0%	12	66.7%	0.268 ^a
< 64%	3	23.1%	3	60.0%	6	33.3%	
SII 65 dB							
≥ 64%	13	100.0%	2	40.0%	15	83.3%	0.012 ^a
< 64%	-	-	3	60.0%	3	16.7%	
Vocabulary - Peabody Std Score							
≥ 85	12	92.3%	1	20.0%	13	72.2%	0.008 ^a
< 85	1	7.7%	4	80.0%	5	27.8%	
Datalogging of better ear							
≥ 8 hours	7	53.8%	4	80.0%	11	61.1%	0.596 ^a
< 8 hours	6	46.2%	1	20.0%	7	38.9%	
Mother's education							
Illiterate to elementary II incomplete	1	7.7%	2	40.0%	3	16.7%	0.176 ^b
Elementary II complete to high school incomplete	2	15.4%	1	20.0%	3	16.7%	
Complete High school to College	10	76.9%	2	40.0%	12	66.7%	

^a Exact of Fisher, ^b Extension of Exact of Fisher

The results shown in Table 5 showed statistical significance in the group of children with SII 65 dB $\geq 64\%$, which are more frequent among those with reading comprehension results (TELCS) higher/above average/average (100.0%), when compared to the group of children with reading comprehension results (TELCS) as a disorder/difficulty (40.0%). It can be observed that the group of children with results on the receptive vocabulary test (Peabody Standard Score) ≥ 85 is more frequent

among those with results on the reading comprehension test (TELCS) superior/above average/average (92.3 %), when compared to the group of children with a result in the reading comprehension test (TELCS) as a disorder/difficulty (20.0%).

The reading comprehension result classification (TELCS) was not related to SII 55 dB ($p=0.268$), time of use in the better ear ($p=0.596$) and mother's education ($p=0.176$).

Table 6. Distribution of word reading tests (TDE), receptive vocabulary (Peabody Standard Score), SII 55 dB and SII 65 dB, time using hearing aids in the better ear and mother's education (n=18).

	Reading of words (TDE)				Total (n=18)		P
	Within or above expected (n=9)		Under expected (n=9)				
SII 55 dB							
$\geq 64\%$	6	66.7%	6	66.7%	12	66.7%	$>0.999^a$
$< 64\%$	3	33.3%	3	33.3%	6	33.3%	
SII 65 dB							
$\geq 64\%$	9	100.0%	6	66.7%	15	83.3%	0.206 ^a
$< 64\%$	-	-	3	33.3%	3	16.7%	
Vocabulary - Peabody Standard Score							
≥ 85	8	88.9%	5	55.6%	13	72.2%	0.294 ^a
< 85	1	11.1%	4	44.4%	5	27.8%	
Datalogging of better ear							
≥ 8 horas	4	44.4%	7	77.8%	11	61.1%	0.335 ^a
< 8 horas	5	55.6%	2	22.2%	7	38.9%	
Mother's education							
Illiterate to elementary II incomplete	1	11.1%	2	22.2%	3	16.7%	$>0.999^b$
Elementary II complete to incomplete High school	2	22.2%	1	11.1%	3	16.7%	
Complete High school to College	6	66.7%	6	66.7%	12	66.7%	

^a Exact of Fisher, ^bExtension of Exact of Fisher

Finally, as summarized in Table 6, it was not possible to confirm a significant relationship between the performance of the word reading test (TDE) and SII 55 dB ($p>0.999$), SII 65 dB ($p=0.206$), receptive vocabulary test (Peabody Standard Score) ($p=0.294$), time using hearing aids in the better ear ($p=0.335$) and mother's education ($p>0.999$).

Discussion

The group of children who participated in this study is mostly children with mild to moderate sensorineural loss, with an SII of 65 dB above 64% (83.30%). All were users of electronic devices and

were considered literate by their parents to be able to participate in the research. There were 12 girls and six boys, aged between eight and 12 years, who attended regular school (public or private), between the 3rd and 6th school year, with most of the sample being in the 5th or 6th year.

The objective of the research was to identify the level of reading comprehension of words and sentences of children with hearing impairment, users of individual sound amplification devices at a Rehabilitation Center, correlating it with audibility, receptive vocabulary, and the time of use of the hearing aid. For this, audiological data from medical records was used and receptive vocabu-

lary, decoding and reading comprehension tests were applied.

The subjects considered to have consistently used the electronic device were those who had an average daily use greater than or equal to eight hours (61.1%). The length of time using the hearing aid did not show a statistically significant relationship with the SII value, whether with a value of 55 or 65 dB. However, according to Walker et al.²⁶ and Booyesen et al.¹², it is common to find children with minor hearing losses who use the device less and, consequently, children with greater hearing losses use the devices for more hours daily. In this study, although there was no statistical significance, the seven children who had the shortest daily use of the device had mild to moderate hearing losses, which means that these children have more access to speech sounds at shorter distances and in quiet environments, more easily. The quantification of audibility for speech sounds and the consistency of device use in its relationship with audibility have been widely discussed. McCreery & Walker¹⁰ suggest the use of an algorithm to better characterize the relationship between audibility and consistency of use, considering that, even without the device, children with mild and moderate losses still have audibility for speech sounds.

It is worth mentioning that one of the inclusion criteria for subjects for this research was being literate. The subjects who were unable to participate in the research for this reason were not analyzed, but it would be essential to analyze the audibility and school characteristics of these subjects. The study group is a group of subjects mostly (SII 65 dB \geq 64% - 83.3%) with audibility that allows understanding of oral language in quiet environments and at a shorter distance.

The receptive vocabulary test also did not show a significant relationship with the hours of hearing aid/CI use in the sample studied, in contrast to Novaes et al.⁶, who demonstrated a statistical relationship with consistency of use and language skills. The number of children with mild and moderate audibility losses for speech sounds even without a device probably led to the result of this research, considering that there is a tendency to consider the SII 65dB without a device to consider the consistency of use¹⁰. The study by Scarebello et al.²⁷ carried out with children with CI, showed that the time of use of the device positively influenced the oral language performance of the implanted

children. The same conclusion is presented by Walker et al.²⁷, that the use of devices has a direct influence on the vocabulary of children with hearing loss. For Nittrouer²⁸, verbal oral language skills are a better predictor of skills in the initial literacy process for children using cochlear implants than for hearing children, suggesting that this process does not depend solely on linguistic competence.

The children's performance in the receptive vocabulary test showed a statistically significant relationship with SII values 55 and 65 dB, that is, the greater audibility, the better performance in the receptive vocabulary test, with a deviation \geq 85 (-1dp). Unlike what was observed in this study, Deperon et al.¹ did not find a significant relationship between SII 65 dB and vocabulary. However, Macedo et al.¹¹ and Stiles et al.²⁹ are in agreement with the results obtained in this study, that is, that receptive vocabulary is influenced by audibility, reinforcing that SII is a strong predictor for vocabulary performance. Lund²³ considers that discrepancies between results are due to different research methodologies. Many studies report that children with cochlear implants can reach the same vocabulary level as hearing children²⁸ and use a normative sample of the test as a comparison group, which does not allow the control of important variables such as non-verbal cognition and socioeconomic status.

The performance of children in the sentence reading test (TELCS), who presented superior/above average and average performance, had a statistically significant relationship with the SII of 65 dB \geq 64%, that is, the individuals who showed greater audibility, They also performed better in the reading test, which corroborates Macedo et al.¹¹, who concluded in their study that children with an SII of 65 dB, considered good, also demonstrated better reading performance than those with a lower SII.

Children with superior/above average or average performance in the reading sentence comprehension test also had better vocabulary (-1sd), showing a statistically significant relationship ($p=0.008$). Wass et al.²² state that vocabulary is a great predictor of reading comprehension in children using CI. The study by Walker et al.²⁶ makes a comparison of children with mild hearing loss and hearing children and concludes that children with hearing loss did not show significant differences in

terms of increased vocabulary and reading, when compared to hearing children.

The inferential analysis of the time of use of the device, SII 55 dB and mother's education, did not show a statistical relationship with the children's performance in the reading comprehension tests (TELCS), unlike Wass et al.²², who demonstrated that education of parents showed a significant correlation in children's reading.

The school performance test, word reading subtest, showed no relationship with SII 55 dB and SII 65 dB, and showed no relationship with device use. Pinheiro et al.²⁴, using the same test (School Performance Test – TDE) to evaluate implanted children, showed that the children presented lower performance in word reading.

The receptive vocabulary test was also unrelated to the word reading test; 55% of the subjects who presented a deviation ≥ 85 (-1 sd) performed below expected in the TDEII word reading test, different from the sentence compression reading test (TELCS), which had a significant relationship with the receptive vocabulary test - PPVT. These data corroborate the study by Guimarães and Mousinho³⁰, despite having been carried out with hearing children.

Unlike the data observed in this study, Luccas, Chiari and Goullart²⁵, in a study carried out with hearing-impaired children from regular schools, demonstrated that the subjects were able to read words better than sentences. These data can be justified by the relationship between the time taken in the word reading test, as in the TDEII the time and number of correct answers are calculated to obtain the individual's percentile. It can be assumed that some children need more time to be able to read the words, which does not mean that they are not below expectations. So that we could analyze the difference in results found in the two types of tests, it would be important to include the analysis of time in relation to the performance of the requested tasks. Policies for the inclusion of children with hearing impairment in regular schools and specialized educational services provide for the possibility of different wordings or changes in time for taking tests, always with the function of developing and organizing pedagogical and accessibility resources that eliminate barriers to student participation in the classroom.

Conclusion

Children with SII 65 dB $\geq 64\%$ performed better in the receptive vocabulary test, showing that audibility in the researched group was correlated with receptive vocabulary.

- The reading and sentence comprehension test showed a statistical relationship with receptive vocabulary and audibility, suggesting that children with superior, above average, and average performance in the reading test, have good audibility and performance > 85 (-1sdp) in the test vocabulary.
- The Word Reading test was not related to any of the factors analyzed in this study.
- The consistency of hearing aid/CI use did not demonstrate a statistical relationship with receptive vocabulary, reading comprehension and audibility with aids, probably because audibility without aids was not considered in this work.

It is important to highlight that the target group of the study had a small number of subjects and most children had mild to moderate hearing loss, with better audibility. We suggest that for a future study, subjects who are not literate have their audiological and vocabulary data analyzed so that other hypotheses can be raised.

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