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Original Article
Artigo Original

Effects of hearing and cognitive impairment in sentence recognition

Efeitos da perda auditiva e da cognição no reconhecimento de sentenças

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Keywords

Elderly Individual
Hearing Loss
Cognition
Speech Perception
Noise

ABSTRACT

Purpose: To evaluate the effects of hearing and cognitive impairment in sentence recognition in elderly people. **Methods**: The study included 30 elderly individuals divided into two groups: GI, with 17 elderly people without hearing loss and GII, with 13 elderly people with mild hearing loss. In order to evaluate their cognition, the Mini Mental State Examination (MMSE) was performed, whereas, for the evaluation of the auditory effects, the Portuguese Sentence List (PSL) was performed, in which the sentence recognition thresholds in silence (SRTS) and the signal-to-noise ratio (S/N) were researched. **Results**: In MMSE, there was a higher percent of individuals with alteration for GI group when compared with GII group. In both SRTS and S/N, the GI group presented lower thresholds when compared with the GII group for both ears. Regarding the cognitive aspects, no significant statistical difference between normal and altered groups was observed in the MMSE for SRTS and S/N for GI and GII in both ears. **Conclusion**: Mild hearing loss exerted influence on the sentence recognition in silence and in noise. On the other hand, the cognitive aspects did not interfere in speech recognition in both silence and noise.

Descritores

Idoso
Perda Auditiva
Cognição
Percepção da Fala
Ruído

RESUMO

Objetivo: Avaliar os efeitos da perda auditiva e da cognição no reconhecimento de sentenças em idosos. **Métodos**: Participaram do estudo 30 idosos distribuídos em dois grupos: GI- composto por 17 idosos sem perda auditiva e GII- composto por 13 idosos com perda auditiva de grau leve. Para avaliar a cognição, foi aplicado o Mini Exame do Estado Mental (MEEM) e, para analisar os efeitos auditivos, foi realizado o teste Listas de Sentenças em Português (LSP), no qual foi pesquisado o Limiar de Reconhecimento de Sentenças no Silêncio (LRSS) e a relação sinal/ruído (S/R). **Resultados**: No MEEM, houve um percentual maior de indivíduos com alteração no GI do que no GII. Tanto no LRSS quanto na relação S/R, o GI apresentou menores limiares do que o GII em ambas as orelhas. Em relação aos aspectos cognitivos, não houve diferença estatisticamente significante entre o grupo normal e alterado no MEEM com o LRSS e relação S/R dos grupos GI e GII de ambas as orelhas. **Conclusão**: A perda auditiva de grau leve exerceu influência no reconhecimento de sentenças no silêncio e no ruído. Já os aspectos cognitivos não interferiram no reconhecimento de fala tanto no silêncio quanto no ruído.

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INTRODUCTION

The process of population aging is a reality in Brazil and in the world and, as a consequence, it starts changing the perspective of life of people. Thus, it has become important to carry out studies on elderly individuals, in order to meet the new requirements and demands in terms of public health policies[1].

Aging causes different alterations in each individual, and it might be gradual for some people or faster for others. Although this process is not necessarily related to diseases and disabilities, these alterations are dependent on factors such as lifestyle, socioeconomic conditions and chronic diseases[2].

Among the alterations found in the elderly is presbycusis, which is the hearing loss due to aging and it becomes a common factor among elderly people[3]. The occurrence of the beginning of this loss is common after the fifth decade of life. It primarily affects the high frequencies of the cochlear system bilaterally and it also causes alterations in central auditory pathways, associated with aging, which results in losses in the recognition and perception of rapid alterations in speech, mainly in noisy environments[4].

In addition to the disorder in the auditory system, aging is also responsible for generating cognitive impairment. These aspects are decreased and they mainly affect memory and attention. These two factors (hearing loss and cognitive impairment) together, lead to impairment in word recognition and comprehension of sentences[5].

In view of the fact that one of the biggest problems of the elderly individual is understanding speech in noisy environments, one of the speech perception tests that can evaluate this complaint, in acoustically unfavorable environment, is the Portuguese Sentence List test (PSL)[6]. This test was the first one to use sentences in Brazilian Portuguese to evaluate these difficulties. It translates the real complaints faced by elderly people in their “hearing routine” and not understanding and it also makes an analysis of how the comprehension of the individual, both in quiet and in noise, is occurring.

The results of some research on noise with sentence tests have shown that hearing difficulties in noise occurs in several study groups, such as adults and elderly people, but they are more common when the individual is getting older, regardless of the preservation of peripheral hearing[7]. However, other studies have shown that in addition to the age of the individual, hearing loss causes great influence on speech intelligibility in comprehension tasks in noise[8,9].

Due to the lack of consensus among the previous studies and the lack of studies correlating the sentence recognition in quiet and in noise with the cognitive aspects, the aim of this study was to evaluate the effects of hearing and cognition loss in sentence recognition in elderly individuals.

METHOD

This study is an exploratory research with descriptive observational and cross-sectional approach with non-probabilistic convenience sample. It consisted of participants that were 60 years or older, they were participants of elderly groups who were invited to be volunteers in the study.

The procedures were initiated after the approval of the research project at the Human Research Ethics Committee under the CAAE protocol number 19806713.0.0000.0212. All individuals who were invited to participate in the research were also asked about their free and spontaneous participation and instructed on the procedures to be performed. After accepted, the individuals signed an Informed Consent Form (ICF) which authorized their voluntary participation in this research, which also contained all the procedures to be performed.

The sample consisted of elderly people, both males and females, from three different groups of elderly people who met the following eligibility criteria: being 60 years or older; being literate in Portuguese; not presenting evidence of neurological or psychiatric disorders; not presenting speech disorders; absence of conductive hearing loss; absence of cerumen or any foreign body that could hinder the visualization of the external auditory meatus; never worn any Personal Sound Amplification Product (PSAP).

At a first moment, the volunteers started to answer to an anamnesis and the Mini Mental State Examination (MMSE) [10], being considered the years of study of individuals to obtain the cut-off average and classify them as normal or abnormal in terms of cognitive aspects[11].

After, the basic audiological evaluation composed of Meatoscopy, Pure Tone Audiometry (PTA), Logoaudiometry and Immitanciometry.

From the result of PTA, the elderly people were divided into two groups (GI and GII) based on auditory thresholds, calculated by using the average of the sound frequencies of 500 to 4000 Hz of the audiogram[12]:

- GI – it was composed of elderly people without hearing loss, in other words, those ones with the average of sound frequencies of 500 to 4000 Hz less than or equal to 25 dBHL.
- GII – it was composed of elderly people with symmetrical bilateral sensorineural hearing loss, until moderate level (60 dBHL) in the average of frequencies of 500 to 4000 Hz[12].

To perform these procedures, it was used the two-channel audiometer, Interacoustic®, AC 40 model, supra-aural headphones TDH39, calibrated for evaluation by air conduction and bone vibrator to evaluate bone conduction. To perform the immitanciometry, it was used the immittanciometer AT 235 model - Interacoustic®, in which the tympanogram curve and stapedial acoustic reflex ipsilateral and contralateral was performed.

After the completion of the aforementioned reviews, individuals who were in accordance with the inclusion criteria were divided into GI and GII. Afterwards, the PSL[6] test was performed.

LSP consists of a book and a Compact Disc (CD), made up of eight lists of sentences in Brazilian Portuguese, a noise with speech spectrum and a pure tone calibration. For the presentation, the CD was inserted into a computer that remained attached to the audiometer.

Before starting the test, it was performed the calibration of the output channel of the sentences by using the pure tone present on the CD and it was also performed the calibration of noise in another CD, by using the noise itself as a reference. Each channel was calibrated with the aid of the VU-meter of the audiometer, and both the pure tone and noise were placed at zero.

The test was performed in an acoustic booth, with the use of earphones. Stimuli (speech and noise) are recorded on the CD in independent channels, which enables carrying out evaluations of speech recognition skills in quiet and in the presence of competitive noise.

The research was performed in each ear, and speech and noise stimuli were presented ipsilaterally.

All individuals received first training through the list 1A, which was used only for this purpose. The participants were instructed to repeat each presented sentence. From this list, only 20 sentences were used, five to the right ear training in silence, five to the left ear in silence, five to the right ear in noise and five to the left ear in noise.

The training helped to familiarize the elderly people with the test and also to determine the initial intensity in the thresholds would be surveyed in the next list. To facilitate the recognition of the first sentence of each list, in order to ensure the understanding of the test, the initial intensity of presentation of the sentences in silence for training was 10 to 20 dB above the Speech Recognition Threshold (SRT)[13].

In the test were, the sentences were first presented without the presence of competitive noise, in order to determine the Sentence Recognition Threshold in Silence (SRTS), then the sentences in the presence of competitive noise were presented to determine the Sentence Recognition Threshold in Noise (SRTN).

In all individuals, it was followed the same order of presentation of sentences, both in training and in the test. For the last one, it was used the list 1B to the right ear in silence, list 2B for the left ear in silence, list 3B to the right ear in noise and List 4B for the left ear in noise.

The noise was presented at fixed intensity of 65 dB SPL (A) with all participants and only the sentences had changes in intensity.

To obtain measures of the SRTS and SRTN, it was used the “sequential strategy, adaptive or ascending/descending”, which allows to determine the minimum level required for the individual to identify correctly about 50% of the presented sentences[14].

Thus, the application of the test consisted in presenting a sentence, in a particular initial intensity. If the individual answered correctly, the intensity of presentation of the next sentence was decreased. If the answer was incorrect, the intensity of the next sentence was increased, keeping the intensity of the noise when present. Intervals of 4 dB were used until the first change in the type of response and, from there, the intervals of presentation of the stimuli were 2 dB between themselves until the end of the list, as suggested by the literature[14,15]. A response was considered correct only when the individual repeated, without any mistake or omission all the presented sentence.

In the first work performed with earphones[13], the existence of a difference of 7 dB between the recording volume of the two signals in the CD was observed (speech and noise). Thus, the researchers performed a computerized spectrographic analysis of the recorded material on the CD, which showed that the sentences are recorded at an average intensity of 7 dB below the intensity of the noise, thus it was necessary to adopt the criterion of subtraction of 7 dB of speech values that were observed in the dial of the equipment.

During the test performance, the levels of presentation of each sentence levels were noted and, after the presentation of all the lists used in the test, it was performed the average of these values in each list, from the level of presentation on which occurred the first change on the type of response to the level of presentation of the last sentence of the list. Then, to obtain the SRTS, 7dB of the final value of the calculation were subtracted as described above, and the same was performed to obtain the SRTN expressed by the S/N ratio (signal/noise), which is the difference between the average intensity of presentation of the sentences and the noise.

Therefore, to calculate the S/N ratio, the average intensity calculated from the presented speech was subtracted from the intensity of the noise (65 dB SPL (A)).

For the statistical analysis, the Chi-Square Test, the Analysis of Variance Test (ANOVA) and the Pearson correlation were used.

It was considered the statistical significance level of $p<0.05$ (5%), and the results were significant, indicated by an asterisk (*).

RESULTS

The initial population of this study consisted of 39 individuals, being nine of them excluded for not presenting the inclusion criteria: two individuals had perforated tympanic membrane, one individual had mixed loss, four individuals had asymmetrical hearing loss, one had total bilateral earwax and one individual had already worn hearing aids previously.

Thus, the population of the study was composed of a total of 30 individuals, being 19 females and 11 males (p-value= 0.039*). The average age of the participants was 68.5 years, with a minimum of 60 and maximum of 88 years. In GI, the average age was 66.1 years and in GII, the average was 71.7 years, with a statistically significant difference (p-value = 0.028*).

In relation to the years of study, the overall average of the population was 10.4 years, with a minimum of one year and maximum of 21 years of study. In GI, the average years of study was 11.35 years and the GII, the average was 9.08 years, however, there was no statistically significant difference (p-value = 0.249).

In relation to the auditory features, 17 individuals were part of the GI and 13 individuals were part of the GII. The average of the hearing thresholds of 500 to 4000 Hz in GI was 17.12 dB, and, in GII was 35.91 dB.

In Table 1, it will be presented the analysis between the MMSE and the hearing of the studied individuals.

After analyzing Table 1, it was found that there was no statistically significant difference between the presence of hearing loss and MMSE scores between GI and GII.

Tables 2 and 3, you can see the average values of the SRTS and S / N ratio, respectively, of individuals belonging to the GI and GII, according to the right ear (RE) and the left ear (OE).

In Table 2, we observed a statistically significant difference between groups for the SRTS both OD as in OE, and the GI showed better LRSS than GII.

Table 3 shows that there was also a statistically significant difference between groups in the S / N ratio. You can observe lower thresholds in GI to GII in both ears.

By correlating the SRTS and the S / N ratio with age, there was no statistically significant difference in GI in both ears: SRTS OD (p-value = 0.266), SRTS OE (p-value = 0.998), S / R OD (p-value = 0.656) and S / R OE (p-value = 0.837). In the GII, there was a statistically significant difference only for the SRTS, OD (p-value = 0.004*) and OE (p-value = 0.015*). The S / N ratio, there was no difference: OD (p-value = 0.554) and OS (p = 0.233).

In Tables 4 and 5 shows the values found in the SRTS and S / N ratio in both ears, according to the MMSE performance of individuals of GI and GII.

From the analysis of Tables 4 and 5, it is possible to observe that there was no statistically significant difference between the groups classified as normal and altered MMSE with regard to the SRTS values and S / N ratio in both the OD and in OE.

Table 1. Distribution of GI and GII according to the classification of MMSE

		GI		GII		Total		P-value[1]
		N	%	N	%	N	%	
MMSE	Normal	10	59%	8	62%	18	60%	0.880
	Altered	7	41%	5	38%	12	40%	

[1] Chi-Square Test
Caption: N: absolute number of individuals; MMSE: Mini Mental State Examination

Table 2. Descriptive values (dB HL) of SRTS of RE and LE of GI and GII

		Mean	Median	Standard Deviation	Q1	Q3	N	CI	P-value[1]
SRTS RE	GI	13.50	13.00	4.35	10.33	14.88	17	2.07	<0.001*
	GII	28.27	23.00	11.14	20.85	32.55	13	6.06	
SRTS LE	GI	9.87	10.00	5.58	5.28	12.00	17	2.65	<0.001*
	GII	26.79	24.00	10.83	20.28	27.42	13	5.89	

* Statistically significant results; [1] ANOVA Test
Caption: Q1: first quartile; Q3: third quartile; N: absolute number of individuals; CI: confidence interval; RE: right ear; LE: left ear; SRTS: Sentence Recognition Threshold in Silence

Table 3. Descriptive values (dB HL) of S/N ratio of RE and LE of GI and GII

		Mean	Median	Standard Deviation	Q1	Q3	N	CI	P-value[1]
S/N RE	GI	-4.04	-4.23	2.57	-5.56	-1.56	17	1.22	0.003*
	GII	-1.21	-1.00	1.99	-2.00	-0.12	13	1.08	
S/N LE	GI	-5.13	-5.56	3.28	-7.45	-3.78	17	1.56	0.006*
	GII	-1.72	-2.34	2.87	-3.34	-1.00	13	1.56	

* Statistically significant results; [1] ANOVA Test
Caption: Q1: first quartile; Q3: third quartile; N: absolute number of individuals; CI: confidence interval; RE: right ear; LE: left ear; S/N: sound/noise ratio

Table 4. Descriptive values (dB HL) of SRTS according to performance on MMSE in individuals of GI and GII

MMSE			Mean	Median	Standard Deviation	CV	Min	Max	N	CI	P-value[1]
SRTS RE	GI	Altered	13.00	12.66	3.17	24%	9.4	18.9	7	2.35	0.707
		Normal	13.84	13.22	5.16	37%	4.9	22.3	10	3.20	
	GII	Altered	31.39	25.00	14.31	46%	21.3	56.0	5	12.54	0.449
		Normal	26.33	21.48	9.19	35%	18.5	43.4	8	6.37	
SRTS LE	GI	Altered	11.24	10.00	6.23	55%	4.1	20.3	7	4.61	0.414
		Normal	8.92	9.01	5.19	58%	0.0	18.4	10	3.22	
	GII	Altered	32.53	25.14	15.71	48%	18.0	58.0	5	13.77	0.137
		Normal	23.21	21.50	4.68	20%	18.6	32.5	8	3.24	

[1] ANOVA Test
Caption: CV: coefficient of variation; Min: minimum; Max: maximum; N: absolute number of individuals; CI: confidence interval; MMSE: Mini Mental State Examination; SRTS: Sentence Recognition Threshold in Silence; RE: right ear; LE: left ear

Table 5. Descriptive values (dB HL) of S/N ratio according to the performance in MMSE in the individuals of GI and GII

MMSE			Mean	Median	Standard Deviation	CV	Min	Max	N	CI	P-value¹
S/N RE	GI	Altered	-4.62	-4.23	2.55	-55%	-8.8	-1.6	7	1.89	0.450
		Normal	-3.63	-4.51	2.64	-73%	-7.6	0.0	10	1.64	
	GII	Altered	-0.88	-0.12	1.45	-165%	-3.3	0.2	5	1.27	0.649
		Normal	-1.43	-1.25	2.34	-164%	-5.6	2.7	8	1.62	
S/N LE	GI	Altered	-4.72	-4.67	4.12	-87%	-10.3	1.7	7	3.05	0.678
		Normal	-5.42	-5.78	2.75	-51%	-9.2	-0.1	10	1.71	
	GII	Altered	-0.17	1.22	4.14	-2433%	-5.6	4.3	5	3.62	0.128
		Normal	-2.69	-2.67	1.24	-46%	-5.0	-1.0	8	0.86	

¹ ANOVA Test

Caption: CV: coefficient of variation; Min: minimum; Max: maximum; N: absolute number of individuals; CI: confidence interval; MMSE: Mini Mental State Examination; S/N: sound/noise ratio; RE: right ear; LE: left ear

DISCUSSION

From the features that were analyzed in the population of the study, it was observed that in relation to gender, there were a great number of female participants, which led to a statistically significant difference between the two genders.

One of the reasons that can lead to an increase of the participation in studies by women is the fact that they have greater health concerns than men, and the fact that they are the majority to attend the elderly groups and have greater longevity[3,16].

With regard to the years of study of this population, it was observed that there is a significant number of elderly people with high levels of education, which is not common in most of the studies that are carried out with elderly people in public institutions, where the average is usually between primary or until four years of study[16,17].

The fact that the present research provides an average of years of study in higher elderly population can be justified since the sample was collected from individuals who are still working or belonging to elderly groups with involvement with higher education institutions.

Regarding the hearing threshold of the population of the study, it could be verified that the average of the elderly individuals of GII represented a mild hearing loss. This may be justified due to the fact that presbycusis have its start in the high frequencies and, finally, in mid and low frequencies[4], which contributes to the classification of hearing threshold is within the normal range or mild hearing loss, when the classification used in this study (500 to 4000 Hz) is taken into account.

Regarding the presence of hearing loss, it could be seen that it occurred in 13 elderly individuals, which corresponds to 43.3% of the total participants, which shows that most of the elderly people did not show hearing loss, even though these individuals were randomly selected. These data are opposing to other research[18], which found a higher percentage of elderly individuals with hearing loss. However, another performed study showed a greater number of elderly people with hearing within normal limits or with mild hearing loss[19].

It is believed that the fact that a greater number of individuals with normal hearing are present in this study may be explained due to the classification that was used for the level of hearing loss, which considered only high and medium frequencies. Another reason that can be taken into consideration is the fact that the participants did not have noise exposure history or hearing loss in the family, which are factors that may contribute to the acceleration of presbycusis[20].

In Table 1, it was verified that 12 individuals (40%) of the studied population showed changes in MMSE and 18 individuals (60%) presented a number of correct answers within the expected for their years of study. However, when comparing this result between GI and GII, there was no statistical significance, that is, hearing loss did not affect the cognitive performance of these individuals. It is believed that this fact was due to the mild hearing loss, since other studies with greater losses found some kind of correlation between cognition with hearing loss[19,21].

Furthermore, it is noteworthy that the MMSE is widely used for cognitive screening[11], however, as it is a brief cognitive evaluation test, it may present some limitations to detect mild cognitive declines.

This result differs from another study that found 52% of individuals with change in MMSE in a sample of 50 elderly people with hearing loss[21]. However, it should be taken into consideration that this study was performed with elderly people with severe sensorineural hearing loss, which may have increased the percentage of individuals altered in the cognitive aspects, different from this present research that elderly patients with mild sensorineural hearing loss were included.

A study carried out with 28 individuals revealed a percentage of 39.3% of individuals affected by cognitive changes[22], but this percentage is the result of a group of 11 (39.3%) illiterate individuals, 15 (53.6%) individuals with one to four years of study and two individuals (7.1%) who had five to eight years of study, which differs from the current research, we found a percentage close to this, but a group with high education (10.4 years). On the other hand, a study of 60 elderly people, with the use of MMSE and the Alzheimer's Disease Assessment Scale (ADAS-Cog), found that the majority of the sample (61.7%) presented cognitive changes mainly in MMSE[23].

Regarding the relationship between cognition with hearing loss, the current study showed different results of a study[19] that evaluated cognitive performance in elderly people with MMSE and it found a correlation between the presence of hearing loss and abnormal results of MMSE, since the individuals with mild sensorineural hearing loss presented better cognitive performance than those ones with moderate and severe levels. The same occurred in a study that used the Digit Symbol Substitution Test (DSST) to evaluate cognitive factors, in which it was found an association between hearing loss and cognitive decline, highlighting that this fact was evident in losses with greater levels[24].

However, this study is in agreement with a study that was carried out with 60 elderly patients in which no correlation was found between hearing loss and cognition[23]. However, this study evaluated individuals with moderate and moderately severe hearing loss.

It could be observed through these studies that there is no consensus on the correlation or not between hearing loss and changes of cognitive functions, but it should be taken into account that these studies evaluated cognition with different tests and used different levels of hearing loss. The sample size of the groups of this present study may also have contributed to these results.

In SRTS (Table 2), it was found that GI presented lower thresholds than the ones found for GII bilaterally, in other words, individuals without hearing loss have a lower threshold for recognition of sentences in silence than individuals with hearing loss.

A study performed with normal hearing adults that measured SRTS by using earphones concluded that the average LRSS was 6.20 dB NA, in a population where the average of pure tone thresholds of 500, 1000 and 2000 Hz was 7, 22 dB HL[25]. This result is better than that one found in the current study, but it should be taken into account that it was performed with elderly individuals with normal hearing only for the average frequency of 500 to 4000 Hz, since this study was performed with adults with normal hearing at frequencies of 250 to 8000 Hz. Even though, it is possible to affirm that the average LRSS in the elderly group (GI), in the current study, is consistent with the average of the thresholds of 500, 1000 and 2000Hz, including better performance in SRTS due to the fact that sentences provide acoustic and linguistic clues with meaning, which helps the comprehension.

Similarly, in the signal/noise ratio (Table 3), it is possible to observe a better response in GI in comparison to GII, in other words, the more negative the S/N ratio, the better the sentence recognition in the noise of these individuals.

Hearing loss is a major contributor to the difficulties in speech understanding[26], which is evident in the present study, in which the relationship between the groups with and without hearing loss showed statistically significant differences in both ears when it comes to sentence recognition in the presence of competitive noise.

In the study carried out to estimate reference values in SRTN with normal hearing adults, they used earphones and found that the average value found in S/N ratio was -5.29 dB HL, and a S/N ratio from -3.03 to -7.55 dB HL indicates a good performance in speech recognition in noise[25]. By comparing these values with those ones found in this study, it was found that all elderly people of GI are within normal limits, different from the individuals of GII, who presented a worse performance.

The present study is in agreement with a research carried out with a group of adults with normal hearing and adults and elderly people with hearing loss at high frequencies, which evaluated the effect of hearing loss and age in speech recognition in noise, and they verified that both age and hearing loss contribute to poor performance in speech recognition with noise[8].

Peripheral hearing loss caused by aging is one of the factors that contribute to the difficulty in understanding speech, mainly because it starts at high frequencies, which leads to greater difficulty in understanding because high frequencies are responsible for the intelligibility of consonants, which reduces the speech recognition performance. Another relevant factor is the changes because of the age in the central auditory nervous system, which can cause a slowness of signal transmission of speech and, consequently, there is a distorted perception of speech[4]. It should be noted that this fact in the current study, in which the GII consisted of elderly people who are older than the individuals of GI. Age was another factor that influenced the SRTS responses in both ears.

On the other hand, in relation to the influence of the cognitive aspects of speech recognition, it could be observed in Tables 4 and 5 that individuals of GI presented lower thresholds for sentence recognition in silence and better S/N ratio. However, this difference was not statistically significant, that is, the change in the cognitive system did not interfere in speech recognition in quiet and in noise, regardless of the individual presenting hearing loss or not.

The current study corroborates other research comparing individuals with cognitive impairment and individuals with normal cognition and found no difference between groups for the speech recognition, both in silence and in noise[27]. However other studies have said that cognition can interfere in recognition of sentences in noise[15,28].

A good cognitive performance may contribute to the good performance in speech recognition task, but these skills are generally in decline in the elderly individuals, which may impair their understanding of speech especially in noisy environments. Thus, it is evident the importance of evaluating the speech recognition in the elderly people by using sentences and not isolated words, due to the increased number of phonemic cues offered by the sentences and the temporal processing that is slowed in elderly people that affect their comprehension[29].

A study carried out with elderly people found that these individual present greater difficulties in understanding speech in noise when compared to younger individuals. The level of hearing loss was also significant in this study, because the greater the loss, the more difficult to recognize speech in noise. The authors also stated that the changes in cognitive function as a consequence of aging contribute to the difficulty of understanding speech in the presence of noise[30].

The SRTS values and S/N ratio in GI, both with or without cognitive impairment, are adequate, unlike the GII in which they are changed.

Thus, through the findings of this study it is possible to conclude that the presence of mild hearing loss influenced the sentence recognition in quiet and in noise.

It is suggested that further research might be carried out with different levels of hearing loss and with different evaluating tests for cognitive analysis in order to occur further clarification of the correlations among the variables addressed in this study.

CONCLUSION

A mild hearing loss exerted a significant influence on the sentence recognition in quiet and in noise. In relation to the effects of cognition, it was found that it did not influence the recognition of speech in quiet and in noise.

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Author contributions

MB performed this work as the topic Final work for the undergraduation. She was responsible for the collection, analysis and interpretation of data, in the study idealization and writing of the article; MMCP participated as the supervisor, in the study idealization, analysis and interpretation of data and writing of the article.