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Artigo Original

Hearing function, perception of disability (handicap) and cognition in the elderly: a relation to be elucidated

Função auditiva, percepção da incapacidade e cognição em idosos: uma relação a elucidar

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Keywords

Elderly
Cognition
Cognitive Disorders
Auditory Perception
Hearing Loss

ABSTRACT

Purpose: To analyze auditory perception, hearing and cognition in the elderly referred for audiological evaluation and search for correlations between hearing and cognitive abilities. **Method:** An observational and descriptive study, carried out with 135 elderly people. The participants did the auditory (tonal audiometry, speech audiometry, immittance measures, HHIE Questionnaire - Hearing Handicap Inventory for the Elderly) and the cognitive (MMSE - Mini Mental State Examination) assessments. **Results:** There is a high prevalence of hearing complaints (91.85%) and hearing loss (91.85%) in the elderly referred for audiological assessment, but there was no relation between the degree of hearing loss ($p = 0.537$) and the auditory perception ($p = 0.930$) in relation to cognitive performance. **Conclusion:** In this study, the degree of hearing loss did not influence the cognitive performance of the elderly, and the auditory handicap perception did not differ between individuals with normal or altered cognition.

Descritores

Idosos
Cognição
Transtornos Cognitivos
Percepção Auditiva
Perda Auditiva

RESUMO

Objetivo: Analisar a percepção da incapacidade auditiva, a audição e a cognição em idosos encaminhados para avaliação audiológica e verificar a existência de correlação entre a audição e as habilidades cognitivas. **Método:** Estudo observacional e descritivo, realizado com 135 idosos. Os participantes realizaram a avaliação auditiva (Audiometria Tonal Limiar, Logoaudiometria, Imitanciometria) responderam a um inventário que avalia a percepção da incapacidade auditiva (questionário HHIE - *Hearing Handicap Inventory for the Elderly*) e foram submetidos a um rastreio cognitivo (teste Mini Exame do Estado Mental - MEEM). **Resultados:** Houve elevada prevalência de queixa auditiva e perda da audição nos idosos encaminhados para avaliação auditiva, mas não houve relação do grau da perda auditiva e da percepção da incapacidade auditiva em relação ao desempenho cognitivo. **Conclusão:** Neste estudo, o grau da perda auditiva não influenciou o desempenho cognitivo dos idosos, e a percepção da incapacidade auditiva não diferiu entre indivíduos com cognição normal ou alterada.

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INTRODUCTION

Brazil is currently in a process of demographic transition with an increase in the number of elderly people and an increase in life expectancy, raising the possibility of the appearance of health deficiencies that are common to the elderly. This requires the need for assistance for the elderly in order to maintain a good quality of life, as well as to prevent problems related to communication disorders.

The natural aging process, senescence, has an impact on all the sensory systems, including the auditory system. It is estimated that currently 30% of the elderly population has some degree of hearing loss[1]. This prevalence may be even higher, considering that with aging there is a progressive increase in the degree of hearing loss[2].

As with hearing, cognitive processes also change with aging, the most common being the reduction of attentional resources and short-term memory[3-5].

Cognition is associated with hearing and contributes to the processing and closure of auditory information, just as auditory processing can interfere with cognitive functions. The reduction in auditory acuity can accelerate the process of cognitive decline, due to the limitations that hearing loss brings, such as communication difficulties, social isolation and loss of independence[4,5].

Individuals with cognitive impairment also perform worse in auditory processing tasks, when compared to individuals with normal cognition[3,6]. However, in spite of the fact that some studies have explored the association between cognition and hearing, it is necessary to explore the underlying mechanisms in this process.

Pichora-Fuller et al.[5] who carried out various studies in the area, say the auditory function, understanding and communication depend on cognitive processing. And they state that the brain allows new information to be processed in the connection between the hearing and cognitive processing. According to the authors, the more cognitive resources the brain has access to, such as memory and language, the better the hearing and consequently communication. Pichora-Fuller also states that cognitive and social factors are predictive of successful hearing rehabilitation which includes the adaptation of hearing aids, auditory training, counseling and group care.

Considering that hearing loss and cognitive changes impair communication, interfere in the activities of daily living and in the social interaction of the elderly, this research sought to investigate the mental processes involved in hearing and to understand the existing integration between the perception of hearing impairment and cognition. The objectives of this study were to analyze the perception of hearing impairment, hearing and cognition in elderly people referred for audiological evaluation and to verify a probable correlation between auditory aspects and cognitive skills.

METHOD

Study design and ethical aspects

It is an observational and comparative study carried out with elderly people seen at the geriatric reference center Instituto Jenny de Andrade Faria, attached to the Hospital das Clínicas (University Hospital) of the Federal University of Minas Gerais, in the city of Belo Horizonte, Brazil. The study, as well as the informed consent form, were approved by the Research Ethics Committee of the responsible institution, opinion No. 1,602,017.

Case histories

The sample consisted of 135 elderly people, considering the sample calculation, defined because of the need for a minimum of 118 patients to obtain 80% of statistical force, with an accuracy of 12.5%, in estimating the prevalence of hearing loss, assuming that this parameter is 30% in the population[1].

All the elderly members of the study were referred to the Speech-Language Pathology Service for hearing assessment, after the elderly person's complaint or perception by the geriatric doctor.

The inclusion criteria adopted were: 60 years old or older and signing the Informed Consent Form. The following were excluded: individuals who failed to complete the assessment; the presence of psychiatric or neurological alterations that did not permit the tests to be done, disabling visual or auditory hypoacuity; conductive hearing loss, individuals with accumulation of earwax observed with meatoscopy in one or both ears. In the latter case, the participants were referred to the otorhinolaryngologist for evaluation and management.

Data collection procedures

Initially, a thorough anamnesis was performed to collect the following data: age, education, general health data and use of medication, the presence of hearing complaints and the side(s) affected, occupational history and aspects of hearing health, such as, previous history of infections, auditory trauma and ear surgery.

The perception of hearing impairment was assessed using the Hearing Handicap Inventory for the Elderly - Screening Version (HHIE - S)[7], questionnaire, with 10 questions, five of which on a social scale and five on an emotional scale. The questionnaire was read by the researcher who asked the elderly to attribute the best answer (yes, no, maybe) to the current perception of their hearing. For analysis, 4 points were given for each "yes" answer, 2 for each "no" and 0 for each "maybe". The results were stratified in three categories: no perception of handicap (0-8 points), mild to moderate perception (10-23 points) and significant perception (24-40 points).

The next procedure was the application of the Visual Faces Scale (Figure 1), in which the subject would choose a face that represents their current perception of hearing. For each face, a number from 1 to 5 was associated, 1 for "very bad hearing", 2 for "bad hearing", 3 for "average hearing", 4 "good hearing" and 5 "very good hearing".

All the subjects underwent a visual inspection of the external auditory canal to ensure conditions of integrity and that there was no obstruction of the external ear before the auditory exams were performed.

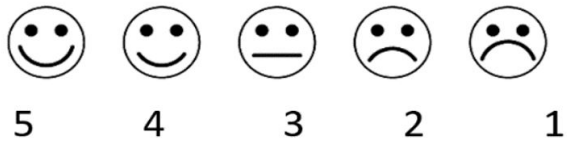


Figure 1. Scale of Faces

Pure-Tone Threshold Audiometry and Logoaudiometry were performed to assess hearing acuity in an acoustic booth with an *Interacoustics* audiometer (Assens, Denmark), model AD629b, with calibration according to ISO 8253-1. For audiometry, the audibility thresholds for pure tones were determined at frequencies of 250, 500, 1000, 2000, 3000, 4000, 6000 and 8000 Hz by air and at frequencies of 500,1000, 2000, 3000 and 4000 Hz via the bone (when the air threshold was equal to or greater than 25dBHL). The classification adopted was the one proposed by Biap (1997), defined from the average of the thresholds obtained at 500,1000, 2000 and 4000Hz.

Since the Biap recommendation has 10 classifications, to reduce the number of variables, these classifications were grouped into: normal hearing, mild hearing loss, moderate hearing loss (grade I and II), severe hearing loss (grade I, II, very severe grade I), very severe hearing loss (II, III, total).

In speech audiometry, the Speech Reception Threshold (SRT) and the Speech Recognition Percentage Index (SRPI) were determined from the repetition of 25 monosyllables, which were read by the researcher. The result was considered normal when a percentage of correct answers equal to or greater than 88% was obtained and altered when the percentage of correct answers was equal to or less than 84%.

To assess the conditions of the middle ear and the integrity of the acoustic nerve reflex arc, immittance testing (tympanometry and stapedial reflex investigation) was performed with an *Interacoustics* device (Assens, Denmark), model AT235h, in compliance with ISO 8253-1. To classify the tympanometric curves, the criterion proposed by Jerger (1970)[8] was used. The stapedial reflex was considered to be either present or absent.

For the cognitive screening, the Mini Mental State Examination[9] - MMSE was applied. This is a widely used scale for cognitive assessments. The analysis of the results used the different cutoff levels for each level of schooling as recommended by Bertolucci[10], considering as the cutoff value, 13 points for illiterate individuals, 18 points for low (1 to 4 incomplete years) and for average schooling (4 to 8 incomplete years) and 26 points for individuals with high schooling (8 years or more).

Statistical analysis

For the descriptive analysis of the qualitative variables, absolute and relative frequencies were used, while for the analysis of the quantitative variables, measures of position, central tendency and dispersion were used. For the comparative analysis between hearing and cognitive skills and between the degree of hearing loss and the perception of hearing impairment, the Chi-Square and Simulated Chi-Square tests were used, considering the $p < 0.05$ was considered statistically significant. The software used for the analyzes was R (version 3.4.1).

RESULTS

Most individuals (67.41%) were female, with a minimum age of 60 and a maximum age of 90 years, with an average age of 75.93 years. There was a predominance of individuals with low education (54.07%). For the general health status, a higher prevalence of Systemic Arterial Hypertension (SAH) was observed, which was present in 69.63% of the respondents. The rate of Depression was 34.81%, Dyslipidemia (DLP) was 29.63%, followed by Diabetes Mellitus (DM), with a prevalence of 22.22%. Polymorbidity was found in 14.07% of the elderly, while polypharmacy was present in 33.33%.

The history of hearing health showed 91.85% of respondents with hearing complaints, and in 95.20% of cases the complaint was referred to bilaterally. Tinnitus was reported by 58.52% of the individuals, and in almost all of them (58.23%), tinnitus is present in both ears. The difficulty in understanding speech was pointed out by most respondents (80.74%), however the complaint of hyperacusis was present in 31.11% of the individuals. Dizziness affects 51.11% of the individuals in this research. All clinical data, hearing complaints and demographic profile are described in Table 1.

Table 2 presents the results of the assessment of perception about hearing (Visual Scale of Faces), in which 42.22% of the individuals described hearing as “more or less” and 29.63% considered hearing as “good”. Considering the variable perception of hearing impairment, measured by the HHIE, 45.93% of the individuals had a perception of mild to moderate disability.

For the analysis of the audiometry results, only one ear (with a better threshold) was considered, considering that there were no differences between the ears in the statistical analysis. The analysis of the audiological evaluation revealed that 88.89% of the elderly have hearing impairment, with a predominance of moderate sensorineural hearing loss. Normal hearing was found in 11.11% of those surveyed, mixed hearing loss was present in 10.37%, while sensorineural hearing loss affects 78.52% of the elderly. In relation to laterality, 81.49% of the hearing losses found were bilateral and with a descending curve and in 68.42% of the cases the audiometric configuration was symmetrical. The percentage index of speech recognition (SRPI) showed alteration in 53.33% of the subjects. The “A” tympanometric curve was predominant (85.93%), followed by the As curve (14.07%). Acoustic reflexes were present in only 21.48% of the elderly.

With regard to cognition, 77.78% of the individuals performed normally in the MMSE test (Table 3). The mean of the total MMSE score was 22.82 with a standard deviation of 4.98, with 10 being the minimum and 30 the maximum.

Table 4 shows the comparison of hearing and SRPI with HHIE. The significant relation (p-value = 0.000) between the degree of hearing loss obtained by audiological evaluation and

Table 1. Demographic, clinical and auditory profile of the elderly

Variables		N	%
Sex	Female	91	67.41%
	Male	44	32.59%
Education	Illiterate	21	15.56%
	Low education level	73	54.07%
	Average schooling	15	11.11%
	High Schooling	26	19.26%
Depression	Yes	47	34.81%
	No	88	65.19%
SAH	Yes	94	69.63%
	No	41	30.37%
DM	Yes	30	22.22%
	No	105	77.78%
DLP	Yes	40	29.63%
	No	95	70.37%
B12 deficiency	Yes	7	5.19%
	No	128	94.81%
Polymorbidity	Yes	19	14.07%
	No	116	85.93%
Polypharmacy	Yes	45	33.33%
	No	90	66.67%
Hearing complaint	Yes	124	91.85%
	No	11	8.15%
Hearing complaint side	RE	4	3.20%
	LE	two	1.60%
	Both	119	95.20%
Worst Side	RE	28	22.40%
	LE	39	31.20%
	Ears same	58	46.40%
Family history	Yes	8	5.93%
	No	127	94.07%
History of occupational noise	Yes	32	23.70%
	No	103	76.30%
Past Infection	Yes	6	4.44%
	No	129	95.56%
Buzz	Yes	79	58.52%
	No	56	41.48%
Tinnitus Location	RE	10	12.66%
	LE	14	17.72%
	Both ears	46	58.23%
	Head	9	11.39%
Difficulty understanding speech	Yes	109	80.74%
	No	26	19.26%
Discomfort with intense noise	Yes	42	31.11%
	No	93	68.89%
Dizziness	Yes	69	51.11%
	No	66	48.89%

Caption: N = number; SAH = Systemic arterial hypertension; DM = Diabetes Mellitus; DLP = Dyslipidemia; RE = right ear; LE = left ear

Table 2. Handicap Perception/hearing disability and in elderly

Variables		N	%
HHIE	No perception of handicap	44	32.59%
	Mild to moderate perception	62	45.93%
	Meaningful perception	29	21.48%
Faces Scale	Lousy	9	6.67%
	Bad	15	11.11%
	Average	57	42.22%
	Good	40	29.63%
	Excellent	14	10.37%

Caption: N = number; HHIE = *Hearing Handicap Inventory for the Elderly*

Table 3. Description of hearing and cognition of the elderly referred for audiological evaluation

Variables		N	%
Hearing	Normal Hearing	15	11.11%
	Mild Hearing Loss	41	30.37%
	Moderate HL	67	49.63%
	Severe HL	8	93%
	Very severe HL	4	2.96%
Laterality	Unilateral	10	7.40%
	Bilateral	110	81.49%
	NA	15	11.11%
Settings	Downward	110	81.49%
	Horizontal	25	18.51%
Symmetry Curve	Symmetrical	93	68.42%
	Asymmetric	42	31.58%
SRPI	Changed	72	53.33%
	Normal	63	46.67%
MEEM	Changed	30	22.22%
	Normal	105	77.78%

Caption: N = number; HL = Hearing loss; SRPI = Speech Recognition Percentage Index; MMSE = Mini Mental State Examination; NA = Not Applicable

the perception of hearing impairment in HHIE stands out, with the highest percentage of individuals with mild hearing loss not showing perception of handicap/impairment (50.00%), while the highest proportion of individuals with moderate hearing loss had mild to moderate perception (69.35%) and significant perception of their handicap (44.83%).

There was a significant relationship (p-value = 0.000) between SRPI and HHIE, since the proportion of individuals who had normal SRPI and had no perception of handicap was higher (72.23%) in relation to individuals who had their SRPI changed, while the percentage of individuals who presented altered SRPI and who had mild to moderate perception (64.52%) or significant perception of handicap (68.97%) was higher in relation to individuals with normal SRPI.

Table 5 shows the comparison of the variables of interest in relation to the MMSE. It is observed that there was no significant relationship (p-value> 0.050) in the degree of hearing loss and in the perception of hearing impairment in relation to cognitive performance.

Figure 2 shows the results of audiometry and the HHIE questionnaire in individuals with normal and altered MMSE.

Table 4. Comparison of SRPI and hearing with the perception of the auditory handicap

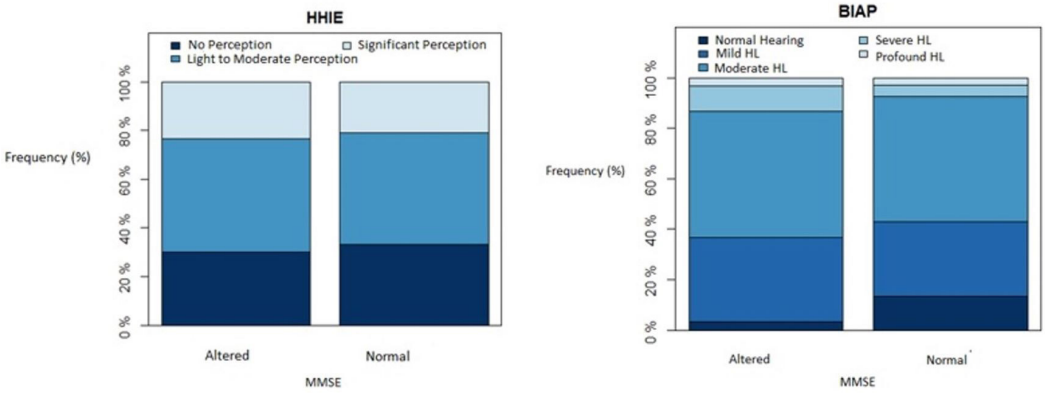
Variables\HHIE		No perception of handicap		Mild to moderate perception		Meaningful perception		P-value
		N	%	N	%	N	%	
Hearing	Normal Hearing	9	20.45%	4	6.45%	2	6.90%	0.000[2]
	Mild Hearing Loss	22	50.00%	12	19.35%	7	24.14%	
	Moderate HL	11	25.00%	43	69.35%	13	44.83%	
	Severe HL	2	4.55%	2	3.23%	4	13.79%	
	Very severe HL	0	0.00%	1	1.61%	3	10.34%	
SRPI	Changed	12	27.27%	40	64.52%	20	68.97%	0.000[1]
	Normal	32	72.73%	22	35.48%	9	31.03%	

[1]Qui-square; [2]Simulated chi-square
Caption: N = number; HL = Hearing loss; SRPI = Speech Recognition Percentage Index; HHIE = *Hearing Handicap Inventory for the Elderly*

Table 5. Correlation of hearing and auditory perception with cognitive performance

Variables\MEEM - Category		Changed		Normal		P-value
		N	%	N	%	
Hearing	Normal Hearing	1	3.30%	14	13.30%	0.537[1]
	Mild Hearing Loss	10	33.30%	31	29.50%	
	Moderate HL	15	50.00%	52	49.50%	
	Severe HL	3	10.00%	5	4.80%	
	Very severe HL	1	3.30%	3	2.90%	
HHIE	No perception of handicap	9	30.00%	35	33.30%	0.930[2]
	Mild to moderate perception	14	46.70%	48	45.70%	
	Meaningful perception	7	23.30%	22	21.00%	

N = number; MMSE = Mini Mental State Exam; HL = Hearing loss; HHIE = *Hearing Handicap Inventory for the Elderly* [1]Qui-square; [2]Simulated Chi-square



Caption: HHIE = Hearing Handicap Inventory for the Elderly; MMSE = Mini Mental State Examination; BIAP = Bureau International d'Audio Phonologie; HL = Hearing loss
Figure 2. Bar graph of the comparison of the audiometry result and HHIE in relation to the MMSE

DISCUSSION

The hearing complaint in the elderly referred was widely reported in this study: 91.85%, of the individuals. This agrees with the study of other authors who found a prevalence of hearing complaint of 79.5% among the elderly referred for audiological evaluation[11]. In studies carried out with the general Brazilian population, the complaint of hearing loss varies from 25.7% to 45.3% in the population over 60 years old[1,12,13]. Self-reported hearing difficulties have a significant incidence both in the elderly referred to a specialized service and in the elderly in the general population, demonstrating the importance of hearing health for this population that perceives the decline and has a reduction in auditory perception in the aging process.

Even in individuals with normal peripheral hearing, the hearing complaint may be present. This can be explained by the complex processing of auditory information, which depends not only on sensory transduction, but also on central auditory processing. The complaint of difficulty in understanding speech was frequent in the participants of this research, explaining the changes that aging brings to the processing of auditory information.

The Costi[13] study evaluated elderly participants in a social project and found that hearing complaints (45.3%) were less than the complaints of difficulty in understanding speech (56.9%), that is, some elderly people, despite feeling that there was no decline in auditory acuity, they had difficulty in understanding speech. According to the study by Bruckmann[14], in the elderly, even a mild hearing loss has a significant influence on speech recognition. The complaint of difficulty in understanding speech

can be better understood in the elderly due to its functional impact on day-to-day life and also due to the fact that hearing comprehension depends on other complex mechanisms that also undergo changes with aging, such as auditory processing, attention and memory.

Tinnitus and dizziness are common complaints with aging and, as in this study, they are reported in the literature, with a prevalence of 55,1% of tinnitus and 53,1% of dizziness[15]. When compared to this study, complaints of tinnitus and dizziness are similar, which may be explained by the sample of this first study. They were elderly people who had recently being adapting to hearing aids. In a second study carried out with elderly people also referred for audiological evaluation, there was a predominance of tinnitus (75.2%) and dizziness (58.6%)[11] and a third[16] found that the most prevalent complaint in the elderly is tinnitus, with or without dizziness, ranging from 39.1 to 29.9% respectively. Tinnitus, besides being a prevalent complaint in the elderly, deserves attention because it interferes with hearing and cognitive performance given that it influences attention skills, concentration and the emotional aspects of the individual.

Hyperacusis was less prevalent in this study. It is not widely studied in the elderly.

Auditory perception and disability

A cross-sectional study[17] with 1162 subjects over 65 years old, examined how the elderly perceive hearing by asking the question "How well can you hear?". Individuals would classify their hearing as "good", "very good", "normal", "poor" and "very poor." Most elderly people rated their hearing as "good" or "very good", and only 37% rated it as "normal", "poor" or "very poor" which would be equivalent ratings "average", "bad" or "very bad" used in this research through the Faces Scale. The Lopez-Torres[17] study was carried out with elderly members of the general population which may explain a lower perception. In this research, 60% of the elderly perceive hearing as "more or less", "bad" or "very bad".

The literature points to a correlation between audiometry and the result of HHIE[15,18-20]. Our study agreed with the findings of the literature, when it found that elderly people with mild hearing loss are associated with the absence of perception of hearing impairment, while elderly people with a moderate hearing loss perceive their hearing impairment. This is significant and it may be inferred that the perception and restriction of hearing participation can be predictors for hearing loss in the elderly. In general, the elderly show good agreement between the perception of the handicap and hearing, which contributes to clinical practice demonstrating that the questionnaire on the perception of the handicap can be used in the routine of audiological evaluation, helping in the diagnostic process of hearing changes.

Self-perception is influenced by individual, cultural and social aspects. A cohort study in Singapore considered HHIE to be a poor predictor of hearing loss in the elderly, and the authors believe that the study results may be explained by cultural issues, considering that many elderly people in the research went through times of war and consequently tended to minimize their difficulties and disabilities[21].

In this study, there was also an association between HHIE and the results of the SRPI, indicating that elderly people with worse speech recognition have a greater perception of hearing impairment ($p = 0.000$). There is a clear relationship between speech recognition and the perception of hearing impairment - that is, the worse the speech recognition or the greater difficulty in understanding speech, the worse the disability perception score. This is an interesting association, as good speech understanding is indicative of good hearing, which may not necessarily be related to the audiogram. Especially in sensorineural hearing loss, there is a decline in speech recognition that does not depend only on the degree of audibility. Thus, the difficulty in understanding speech significantly impacts the perception of hearing ability, which may be explained by the consequences that this brings in terms of autonomy, activities and the social participation of the elderly.

Hearing

Hearing loss frequency among the elderly of outpatient clinics is variable in the literature studies of 34,7% 94,4%[2,4,11,13,14,20-22]. A recent study[23] that also used the Biap classification, found a prevalence of 68% of hearing loss in elderly people referred for audiological evaluation. For the type of hearing loss, other studies point to a higher incidence of sensorineural impairment[2,18,23] and symmetrical hearing[2,4,18,23] with a descending audiometric curve[2,4,18,23], corroborating the results of this study, characterizing the hearing loss associated with aging, known as presbycusis. There is an increase in the degree of hearing loss according to age[2,20-22].

In studies carried out in Brazil[16,23], the mean SRPI was 80% or less, showing the difficulty in understanding speech among the elderly. In our study most of the subjects had an altered SDT, that is, with values equal or lower than 84%, and may be explained by the survey sample, made up of elderly people referred for hearing evaluation and most of which had a hearing loss, which was also found in another study[19]. In the study by Sanchez et al.[24] most elderly people presented percentages above 88% for the recognition of monosyllables. The justification for this difference can be explained by the methodological designs, considering that the studies that found greater impairment of the SRPI analyzed elderly people with hearing complaints and with a higher prevalence of hearing loss in their samples.

Cognition and hearing

The change in the MMSE was found in 22.22% of the individuals in this study. This agrees with the result of another study that found an altered MMSE in 28% of the elderly[23]. The mean of the MMSE was 22.82 points, not differing from the average found in other studies[23,25]. Another study[26] found an even worse performance in the test with increasing age.

The association between the degree of hearing loss and MMSE is supported by some authors, who claim that

elderly individuals with a greater hearing loss had a worse cognitive performance[4,6,25]. Other studies have also shown an association between auditory and cognitive skills[3,5,6,16,19,27-29]. In a cohort study that monitored 3,075 elderly people over six years, it was found that elderly individuals with hearing loss have a rate of cognitive decline of 30 to 40% and an increased risk for cognitive impairment, when compared with individuals with normal hearing[28]. This same author argues that this association is due to social isolation and reduced cognitive load that may be a consequence of hearing loss in the elderly[28].

Disagreeing with the above, this study did not find an association between hearing loss and performance on the Mini Mental State Examination. Other studies corroborate this finding[12,14,15,30]. A recent piece of research, despite not finding a correlation between audiometry and MMSE, points to an association between SRPI and MMSE, and the subjects with a lower SRPI value also had a lower score on the cognitive test[15]. This result can be explained by the difficulty in processing verbal information and reduced attention that can be found in individuals with a cognitive decline. This study also did not find a correlation between the perception of hearing impairment and cognition. The hypothesis that individuals with impaired cognition would have worse auditory self-perception has not been confirmed. Other studies point to the relation of speech tests with cognitive skills[3,4], strengthening the hypothesis that the test of speech recognition can assist in identifying possible cases of cognitive decline in the elderly.

A survey also analyzed the results of HHIE and MMSE in the elderly, but by collecting data from medical records and hearing aid users, points out that the adaptation of hearing aids in the elderly improves auditory perception and the MMSE score[15]. However, the study did not correlate the results of the two instruments. The study by Camargo[18], which also used HHIE in its methods, concluded that the perception of hearing disability is greater in individuals with hearing loss who do not use hearing aids. Lessa[6] argues that even elderly people with a worse cognitive performance show an improvement in hearing skills after 3 months of adaptation to a hearing aid, showing that hearing aids and hearing training can stimulate neural plasticity. The study by Volter et al.[30] did not find a direct relation of adaptation of the cochlear implant with improved cognitive tests, but found improved autonomy, quality of life and improvement of executive functions. Therefore, it is possible to infer that hearing rehabilitation through adaptation of hearing aids or cochlear implant when indicated will positively influence hearing self-perception, participation and the cognitive skills of the elderly.

The limitations found in this study are because there was only one cognitive test, the MMSE, that does cognitive screening and from which it is not possible to obtain detailed data on cognition. The non-association between the result of the SRPI and MMSE can be considered a limitation, given that the complaint of difficulty in understanding speech was very prevalent among the respondents in this research. In addition to the above limitations, the descriptive study does not make it possible to define causal evidence and has less analytical power. As a positive aspect of the study, it is possible to highlight the "n" used in the sample that considered the sample calculation for a specific population, showing the methodological rigor.

It is extremely important to carry out more research that can analyze the integration between hearing, perception of hearing impairment and cognition, as well as to verify the relationship between auditory processing and cognition, considering that cognitive functioning depends on a complex process.

In clinical practice, it is necessary to be careful to address complaints and cognitive skills to the elderly with hearing complaints. Also, doctors who diagnose cognitive impairment and dementia need to collect information about hearing, guaranteeing the qualification and comprehensiveness of care and informing new discussions about the interfaces between cognition and hearing in the elderly.

CONCLUSION

It is believed that this study helped to inform the relation between hearing function, perception of disability and cognition in the elderly. However, it is a field of knowledge in which there is still much to explore and that needs new investigations. We concluded from this research that the frequency of hearing complaints and hearing loss in elderly people who were referred was high, with a greater predominance of sensorineural, bilateral and symmetrical hearing loss. For the perception of hearing impairment, most of the elderly have a fair self-perception about their hearing, with a mild to moderate handicap index, and the assessment of cognition was altered in a minority of the elderly in this study. Also, the study pointed out that the degree of hearing loss did not influence the cognitive performance of the elderly, and the perception of hearing impairment did not differ between individuals with normal or impaired cognition.

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Author contributions

KCSB participated in the planning of the research project, bibliographic research and review, search and selection of participants, collection and analysis of data and exams, preparation of tables, writing of the article; LMR bibliographic research, data analysis and exams, orientation and writing of the article; EABC orientation and writing of the article.