

**UNIVERSIDADE FEDERAL DE MINAS GERAIS
FACULDADE DE MEDICINA
FONOAUDIOLOGIA**

**PADRÃO LINGUÍSTICO DE PESSOAS COM DECLÍNIO COGNITIVO E
PERDA AUDITIVA**

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**BELO HORIZONTE - MG
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Trabalho de conclusão de curso
apresentado para o Departamento de
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obtenção do título de Fonoaudióloga.
Área de concentração: Linguagem e audição

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RESUMO

Introdução: A perda auditiva (PA) na população idosa é altamente frequente, muitas vezes caracterizada como presbiacusia, que pode ser definida como a alteração progressiva da audição decorrente do envelhecimento natural do corpo, afetando com maior intensidade as frequências agudas¹. A PA não tratada é reconhecida como um dos principais fatores de risco modificáveis para o desenvolvimento de demência, estando associada a um aumento de aproximadamente 23% no risco de ocorrência dessas condições¹. Em relação a comunicação, a presença de declínio cognitivo e perda auditiva simultaneamente geram impacto significativo na distinção da fala no ruído, principalmente, e esta dificuldade é maior em comparação a indivíduos com comprometimento cognitivo, mas sem alterações na acuidade auditiva¹¹. **Métodos:** Estudo observacional, descritivo e transversal, com abordagem quantitativa, desenvolvido com o objetivo de investigar a relação entre perda auditiva e o desempenho cognitivo-linguístico em adultos. A amostra não probabilística foi composta por 53 participantes no total. Após aplicação dos critérios de exclusão e inclusão, foram selecionados 29 indivíduos com perda auditiva bilateral acima de 25dB, neurosensorial ou mista e com declínio cognitivo. Todas as análises foram realizadas no Python (versão 3.12.6), com apoio das bibliotecas pandas, numpy, scipy e statsmodels. Trabalho aprovado pelo Comitê de Ética em Pesquisa da UFMG, sob o nº 5.626.511 (CAAE: 60832022.4.0000.5149). **Resultados:** Houve correlações significativas entre o nível de escolaridade e o desempenho nas tarefas de leitura, escrita e repetição de palavras extensas, indicando que quanto maior a escolaridade melhor o desempenho (escolaridade × repetição: $p = 0,0002$; escolaridade × escrita: $p = 0,0008$; escolaridade × leitura: $p = 0,0052$). Não houve associação entre o grau de perda auditiva e as subtarefas de linguagem e fluência da ACE-R. Da mesma forma, as variáveis sexo e idade não apresentaram correlação significativa com nenhuma das medidas analisadas. A tarefa de compreensão semântica a partir de figuras apresentou correlação com o desempenho nas provas de memória e visuoespaciais do teste (compreensão semântica × memória: $p = 0,003$; compreensão semântica × visuoespaciais: $p = 0,014$), enquanto a tarefa de nomeação de figuras esteve relacionada com o desempenho total na prova de fluência ($p = 0,014$). **Conclusões:** Este trabalho reforçou a importância do

estudo como proteção das funções cognitivas. Também constatou que o padrão de fluência de indivíduos com perda auditiva e declínio cognitivo e a redução das habilidades lexicais, já esperadas no envelhecimento, afetam a capacidade de recuperação de palavras. Não houve relação significativa entre perda auditiva e o desempenho cognitivo-linguístico nesta amostra, apesar dos achados na literatura, o que pode ser justificado pelas limitações do estudo, como número amostral reduzido e desenho de estudo transversal.

Palavras-chave: Declínio cognitivo; Perda Auditiva; Linguagem; Cognição

ABSTRACT

Introduction: Hearing loss (HL) in the elderly population is highly prevalent and is often characterized as presbycusis, which can be defined as the progressive alteration of hearing resulting from the natural aging process, affecting high frequencies more intensely¹. Untreated HL is recognized as one of the main modifiable risk factors for the development of dementia, being associated with an approximate 23% increase in the risk of such conditions¹. Regarding communication, the simultaneous presence of cognitive decline and hearing loss has a significant impact on speech-in-noise perception, in particular, and this difficulty is greater compared to individuals with cognitive impairment but without changes in auditory acuity¹¹. **Methods:** This is an observational, descriptive, and cross-sectional study with a quantitative approach, developed to investigate the relationship between hearing loss and cognitive-linguistic performance in adults. The non-probabilistic sample consisted of a total of 53 participants. After applying the inclusion and exclusion criteria, 29 individuals with bilateral hearing loss above 25 dB, either sensorineural or mixed, and with cognitive decline were selected. All analyses were performed using Python (version 3.12.6), with support from the libraries pandas, numpy, scipy, and statsmodels. The study was approved by the UFMG Research Ethics Committee, under no. 5.626.511 (CAAE: 60832022.4.0000.5149). **Results:** Significant correlations were found between the level of education and performance in reading, writing, and long-word repetition tasks, indicating that higher education levels were associated with better performance (schooling × repetition: $p = 0.0002$; schooling × writing: $p = 0.0008$; schooling × reading: $p = 0.0052$). There was no association between the degree of hearing loss and the ACE-R language and fluency subtests. Similarly, the variables sex and age did not show significant correlations with any of the analyzed measures. The semantic comprehension task using figures correlated with performance on the memory and visuospatial tests (semantic comprehension × memory: $p = 0.003$; semantic comprehension × visuospatial: $p = 0.014$), while the picture-naming task was related to total performance on the fluency test ($p = 0.014$). **Conclusions:** This study reinforced the importance of the educational level as a protective factor for cognitive functions. It also found that the fluency patterns of individuals with hearing loss and cognitive

decline, as well as the reduction in lexical abilities already expected with aging, affect word retrieval ability. There was no significant relationship between hearing loss and cognitive-linguistic performance in this sample, despite the findings in the literature, which may be explained by the study's limitations, such as the small sample size and cross-sectional design.

Keywords: Cognitive decline; Hearing loss; Language; Cognition

8. REFERÊNCIAS

1. Chern A, Golub JS. Age-related Hearing Loss and Dementia. *Alzheimer Disease & Associated Disorders* [Internet]. 2019 Jul;33(3):1. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7749722/>
2. Santos IB dos, Moraes EA de, Lacerda A, Guarinello AC. Fatores que interferem na participação social de idosos com perda auditiva. *Research, Society and Development*. 2022 Sep 22;11(12):e510111234860.
3. Gale SA, Acar D, Daffner KR. Dementia. *The American Journal of Medicine*. 2018 Feb 6;131(10):1161–9.
4. Mueller KD, Hermann B, Mecollari J, Turkstra LS. Connected speech and language in mild cognitive impairment and Alzheimer's disease: A review of picture description tasks. *Journal of Clinical and Experimental Neuropsychology*. 2018 Apr 19;40(9):917–39.
5. Bott NT, Radke A, Stephens ML, Kramer JH. Frontotemporal dementia: diagnosis, deficits and management. *Neurodegenerative Disease Management* [Internet]. 2014 Dec;4(6):439–54. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4824317/>
6. Gorno-Tempini ML, Hillis AE, Weintraub S, Kertesz A, Mendez M, Cappa SF, et al. Classification of primary progressive aphasia and its variants. *Neurology*. 2011 Feb 16;76(11):1006–14.
7. Yamada Y, Shinkawa K, Nemoto M, Ota M, Nemoto K, Arai T. Speech and language characteristics differentiate Alzheimer's disease and dementia with Lewy bodies. *Alzheimer's & Dementia: Diagnosis, Assessment & Disease Monitoring*. 2022 Jan;14(1).
8. Sparrow K, Lind C, van Steenbrugge W. Gesture, communication, and adult acquired hearing loss. *Journal of Communication Disorders* [Internet]. 2020 Sep 1;87:106030. Available from: <https://www.sciencedirect.com/science/article/pii/S0021992420300988#bib0725>

9. Nirmalasari O, Mamo SK, Nieman CL, Simpson A, Zimmerman J, Nowrangi MA, et al. Age-related hearing loss in older adults with cognitive impairment. *International Psychogeriatrics*. 2016 Sep 22;29(1):115–21.
10. Hopper T, Slaughter SE, Hodgetts B, Ostevik A, Ickert C. Hearing Loss and Cognitive-Communication Test Performance of Long-Term Care Residents With Dementia: Effects of Amplification. *Journal of Speech, Language, and Hearing Research*. 2016 Dec;59(6):1533–42.
11. Guthrie DM, Davidson JGS, Williams N, Campos J, Hunter K, Mick P, et al. Combined impairments in vision, hearing and cognition are associated with greater levels of functional and communication difficulties than cognitive impairment alone: Analysis of interRAI data for home care and long-term care recipients in Ontario. Bowen M, editor. *PLOS ONE*. 2018 Feb 15;13(2):e0192971.
12. Bott A, Meyer C, Hickson L, Pachana NA. Can adults living with dementia complete pure-tone audiometry? A systematic review. *International Journal of Audiology*. 2019 Jan 21;58(4):185–92.
13. Carvalho VA, Barbosa MT, Caramelli P. Brazilian Version of the Addenbrooke Cognitive Examination-revised in the Diagnosis of Mild Alzheimer Disease. *Cognitive and Behavioral Neurology*. 2010 Mar;23(1):8–13.
14. Amaral-Carvalho V, Caramelli P. Normative Data for Healthy Middle-Aged and Elderly Performance on the Addenbrooke Cognitive Examination-Revised. *Cognitive And Behavioral Neurology*. 2012 Jun;25(2):72–6.
15. Spearman, C. The proof and measurement of association between two things. *The American Journal of Psychology*. 1904;15(1):72-101.
16. Mann, H. B., Whitney, D. R. On a test of whether one of two random variables is stochastically larger than the other. *Annals of Mathematical Statistics*. 1947;18(1):50-60.
17. Kruskal, W. H., Wallis, W. A. Use of ranks in one-criterion variance analysis. *Journal of the American Statistical Association*. 1952;47(260):583-621.
18. Holm, S. A simple sequentially rejective multiple test procedure. *Scandinavian Journal of Statistics*. 1979;6(2):65-70.

19. Arora S, Patten SB, Mallo SC, Lojo-Seoane C, Felpete A, Facal-Mayo D, et al. The influence of education in predicting conversion from Subjective cognitive decline (SCD) to objective cognitive impairment: A systematic review and meta-analysis. *Ageing Research Reviews* [Internet]. 2024 Sep 5;101:102487. Available from:
<https://www.sciencedirect.com/science/article/pii/S1568163724003052>
20. Howard KA, Massimo L, Griffin SF, Gagnon RJ, Zhang L, Rennert L. Systematic examination of methodological inconsistency in operationalizing cognitive reserve and its impact on identifying predictors of late-life cognition. *BMC Geriatrics*. 2023 Sep 9;23(1).
21. del Ser T, Valeriano-Lorenzo E, Jáñez-Escalada L, Ávila-Villanueva M, Frades B, Zea MA, et al. Dimensions of cognitive reserve and their predictive power of cognitive performance and decline in the elderly. *Frontiers in Dementia*. 2023 Aug 31;2.
22. Diniz BS de O, Volpe FM, Tavares AR. Nível educacional e idade no desempenho no Miniexame do Estado Mental em idosos residentes na comunidade. *Archives of Clinical Psychiatry (São Paulo)*. 2007;34(1):13–7.
23. Borelli WV, Leotti VB, Strelow MZ, Fagundes Chaves ML, Castilhos RM. Preventable Risk Factors for Dementia: Population Attributable Fractions in a Brazilian Population-Based Study. *SSRN Electronic Journal* [Internet]. 2021 [cited 2022 Jul 26]; Available from:
<https://www.thelancet.com/action/showPdf?pii=S2667-193X%2822%2900073-4>
24. **Instituto Brasileiro de Geografia e Estatística (IBGE)**. Censo Demográfico 2022: alfabetização – resultados do universo. Rio de Janeiro: IBGE; 2024. 54 p. (ISSN 0104-3145). Disponível em:
<https://biblioteca.ibge.gov.br/visualizacao/periodicos/>
25. Zhong T, Li S, Liu P, Wang Y, Chen L. The impact of education and occupation on cognitive impairment: a cross-sectional study in China. *Frontiers in Aging Neuroscience*. 2024 Jul 11;16.

26. Rojas C, Rizzo B, San Martín M, Guerra E. Lexical Access Restrictions after the Age of 80. *Brain Sciences* [Internet]. 2023 Sep 19 [cited 2023 Nov 29];13(9):1343. Available from: <https://pubmed.ncbi.nlm.nih.gov/37759944/>
27. Schubert AL, Hagemann D, Löffler C, Frischkorn GT. Disentangling the Effects of Processing Speed on the Association between Age Differences and Fluid Intelligence. *Journal of Intelligence*. 2019 Dec 25;8(1):1.
28. Petriglia F, Gasparotto G, D'Ortenzio S, Gabbatore I, Marini A. Assessing lexical diversity and informativeness across the adult lifespan: A comprehensive investigation. *Research Methods in Applied Linguistics*. 2025 Dec;4(3):100276.
29. Quaranta D, Marra C, Vita MG, Guido Gainotti. Different Markers of Semantic–Lexical Impairment Allow One to Obtain Different Information on the Conversion from MCI to AD: A Narrative Review of an Ongoing Research Program. *Brain Sciences*. 2024 Nov 8;14(11):1128–8.
30. Ding J, Zhang Y, Liang P, Li X. Modulation of working memory capacity on predictive processing during language comprehension. *Language Cognition and Neuroscience*. 2023 May 23;38(8):1133–52.
31. Savarimuthu A, Ponniah RJ. A Slip Between the Brain and the Lip: Working Memory and Cognitive-Communication Disorders. *Journal of Psycholinguistic Research*. 2023 Apr 6;52.
32. Wu W, Hoffman P. Age differences in the neural processing of semantics, within and beyond the core semantic network. *Neurobiology of Aging*. 2023 Jul 25;131:88–105.
33. Fichman HC, Fernandes CS, Nitrini R, Lourenço RA, Paradela EM de P, Carthery-Goulart MT, et al. Age and educational level effects on the performance of normal elderly on category verbal fluency tasks. *Dementia & Neuropsychologia*. 2009 Mar;3(1):49–54.
34. Machado TH, Fichman HC, Santos EL, Carvalho VA, Fialho PP, Koenig AM, et al. Normative data for healthy elderly on the phonemic verbal fluency task - FAS. *Dementia & Neuropsychologia*. 2009 Mar;3(1):55–60.

35. Wang HF, Zhang W, Rolls ET, Li Y, Wang L, Ma YH, et al. Hearing impairment is associated with cognitive decline, brain atrophy and tau pathology. *eBioMedicine*. 2022 Dec;86(104336):104336.
36. Shechter Shvartzman L, Lavie L, Banai K. Speech Perception in Older Adults: An Interplay of Hearing, Cognition, and Learning? *Frontiers in Psychology*. 2022 Feb 17;13.
37. L Lodeiro-Fernández, Maseda A, L Lorenzo-López, N Cibeira, Millán-Calenti JC, J Leira, et al. Is there a relationship between hearing loss and language impairment in patients with dementia? A systematic review. *Archives of Gerontology and Geriatrics*. 2025 Jul 7;137:105948–8.
38. Elmer S, Frei V, Ockelmann J, Giroud N. Breaking down the ear-brain dichotomy: the effects of age-related hearing loss on the cortical language system. *NeuroImage*. 2025 Nov;322:121563.
39. Manuella Lech Cantuaria, Ellen Raben Pedersen, Frans Boch Waldorff, Wermuth L, Kjeld Møller Pedersen, Aslak Harbo Poulsen, et al. Hearing Loss, Hearing Aid Use, and Risk of Dementia in Older Adults. *JAMA otolaryngology-- head & neck surgery*. 2024 Jan 4;150(2).