

The effect of Presbycusis-related Tinnitus among older adults with Alzheimer's Disease

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Keywords: Auditory system, Alzheimer's disease, Tinnitus, Presbycusis

By definition, Age-related hearing loss (ARHL) or Presbycusis is the organic and physiological changes that happen in the auditory system with increasing age above 65 years old. One of the features of impairment of auditory system functions is tinnitus. Both of them (Presbycusis and tinnitus) are essential risk factor for Alzheimer's disease.

Because of negative effects of Presbycusis and tinnitus on the speech perception in elderly people, a significant number of individuals with Alzheimer's disease have language problems in some stage of disease. Because in auditory processing there is a direct connection between auditory discrimination, memory, and interpretation of spoken word and tinnitus disturbed attention and memory in elderly people. It is important that we start treatment and use of hearing aid among older adults with Alzheimer's disease and complain of Presbycusis and tinnitus. The population of older adults is growing in the world and knowing about the problems in this population could help to increase the health and life style of the elderly (Zhang, Yu, & Ruan, 2020).

Tinnitus is a frequent trouble that can be occurred in any ages but it often happens in the elderly (Zhang et al., 2020).

Tinnitus is the perception of sound in one ear, or two ears or inside the head without any external source (Gibrin, Ciquinato, Gonçalves, Marchiori, & Marchiori, 2019). There are many reasons of tinnitus that can be caused by impairment in the peripheral auditory system or central auditory system (Zhang et al., 2020). Tinnitus may occur as a side effect of some disease such as anemia, high or low blood pressure. One of the most prevalent reasons of tinnitus is presbycusis (Terao et al., 2011).

Presbycusis or age-related hearing loss is common form of hearing loss among older adults (Seimetz et al., 2016). Presbycusis is a progressive and symmetrical sensory neural high frequency hearing loss (Bagheri, Borhaninejad, & Rashedi, 2018). Presbycusis has many psychosocial effects that affect quality of life in older adults. They often do not participate in communication because of their difficulties with speech perception especially in noisy environment (Adams, Gordon-Hickey, Morlas, & Moore, 2012).

Tinnitus has several negative effects on mood and mental health. One of the most serious difficulties that tinnitus caused is sleep disturbance. Several studies demonstrated that stress, anxiety and depression are common situation often occur together with insomnia (Acar, Yurekli, Babademez, Karabulut, & Karasen, 2011; Ferreira, Ramos Júnior, & Mendes, 2009; Gibrin, Melo, & Marchiori, 2013; Haider et al., 2017; Martines et al., 2010; Negrila-Mezei, Enache, & Sarafoleanu, 2011).

There is an interconnected between tinnitus and sleep disturbance in one hand, between tinnitus and stress in the other hand (as demonstrated in Figure 1).

Stress increases the free radicals' level that induced oxidative stress situation in the body. Various studies have been shown oxidative stress is a main risk factor for Alzheimer's disease (Bagheri & Rashedi,

2020; Baldeiras et al., 2010; Cervellati et al., 2013; Nunomura et al., 2006; Perry et al., 2008). Alzheimer's disease is a common type of Dementia that lead to cognitive decline in older adults (Bagheri, Rezaei, & Rashedi, 2018). So designing treatment protocols with the aim of decline the oxidative stress level through improve of sleep problems and decrease of stress or depression in older adults with tinnitus could have positive effects on the brain.



Figure 1. Connection of events *

* This is a theory based on changes after tinnitus.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for profit sectors.

Conflict of interest:

The author declared no conflict of interest.

References:

Acar, B., Yurekli, M. F., Babademez, M. A., Karabulut, H., & Karasen, R. M. (2011). Effects of hearing aids on cognitive functions and depressive signs in elderly people. *Archives of gerontology and geriatrics*, 52(3), 250-252.

Adams, E. M., Gordon-Hickey, S., Morlas, H., & Moore, R. (2012). Effect of rate-alteration on speech perception in noise in older adults

with normal hearing and hearing impairment. *American Journal of Audiology*.

Bagheri, F., Borhaninejad, V., & Rashedi, V. (2018). Alzheimer's disease and Hearing Loss among older adults: A literature review. *International Journal of Psychology and Behavioral Sciences*, 8(5), 77-80.

Bagheri, F., & Rashedi, V. (2020). Simultaneous exposure to noise and carbon monoxide increases the risk of Alzheimer's disease: a literature review. *Medical Gas Research*, 10(2), 85.

Bagheri, F., Rezaei, M., & Rashedi, V. (2018). Auditory training among older adults with Alzheimer disease and central auditory processing disorder. *Avicenna Journal of Neuro Psycho Physiology*, 5(4), 147-150.

Baldeiras, I., Santana, I., Proenca, M. T., Garrucho, M. H., Pascoal, R., Rodrigues, A., . . . Oliveira, C. R. (2010). Oxidative damage and progression to Alzheimer's disease in patients with mild cognitive impairment. *Journal of Alzheimer's disease*, 21(4), 1165-1177.

Cervellati, C., Cremonini, E., Bosi, C., Magon, S., Zurlo, A., M Bergamini, C., & Zuliani, G. (2013). Systemic oxidative stress in older patients with mild cognitive impairment or late onset Alzheimer's disease. *Current Alzheimer Research*, 10(4), 365-372.

Ferreira, L. M. d. B. M., Ramos Júnior, A. N., & Mendes, E. P. (2009). Characterization of tinnitus in the elderly and its possible related disorders. *Revista Brasileira de Otorrinolaringologia*, 75(2), 245-248.

Gibrin, P. C. D., Ciquinato, D. S. d. A., Gonçalves, I. C., Marchiori, V. d. M., & Marchiori, L. L. d. M. (2019). Tinnitus and its relationship with anxiety and depression in the elderly: a systematic review. *Revista CEFAC*, 21(4).

Gibrin, P. C. D., Melo, J. J., & Marchiori, L. L. d. M. (2013). *Prevalence of tinnitus complaints and probable association with hearing loss, diabetes mellitus and hypertension in elderly*. Paper presented at the CoDAS.

Haider, H. F., Flook, M., Aparicio, M., Ribeiro, D., Antunes, M., Szczepek, A. J., . . . Caria, H. (2017). Biomarkers of presbycusis and tinnitus in a Portuguese older population. *Frontiers in aging neuroscience*, 9, 346.

Martines, F., Bentivegna, D., Di Piazza, F., Martines, E., Sciacca, V., & Martinciglio, G. (2010). Investigation of tinnitus patients in Italy: clinical and audiological characteristics. *International Journal of Otolaryngology*, 2010.

Negrila-Mezei, A., Enache, R., & Sarafoleanu, C. (2011). Tinnitus in elderly population: clinic correlations and impact upon QoL. *Journal of Medicine and Life*, 4(4), 412.

Nunomura, A., Castellani, R. J., Zhu, X., Moreira, P. I., Perry, G., & Smith, M. A. (2006). Involvement of oxidative stress in Alzheimer disease. *Journal of neuropathology & experimental neurology*, 65(7), 631-641.

Perry, G., Moreira, P. I., Santos, M. S., Oliveira, C. R., Shenk, J. C., Nunomura, A., . . . Zhu, X. (2008). Alzheimer disease and the role of free radicals in the pathogenesis of the disease. *CNS & Neurological Disorders-Drug Targets (Formerly Current Drug Targets-CNS & Neurological Disorders)*, 7(1), 3-10.

Seimetz, B. M., Teixeira, A. R., Rosito, L. P. S., Flores, L. S., Pappen, C. H., & Dall'igna, C. (2016). Pitch and loudness tinnitus in individuals with presbycusis. *International archives of otorhinolaryngology*, 20(04), 321-326.

Terao, K., Cureoglu, S., Schachern, P. A., Morita, N., Nomiya, S., Deroee, A. F., . . . Paparella, M. M. (2011). Cochlear changes in presbycusis with tinnitus. *American journal of otolaryngology*, 32(3), 215-220.

Zhang, W., Yu, Z., & Ruan, Q. (2020). Presbycusis-Related Tinnitus and Cognitive Impairment: Gender Differences and Common Mechanisms *Multiple Chronic Conditions-Overview and Management of Chronic Disease Clusters*: IntechOpen.