

Review Of The Literature On The Impact Of Music On Working Memory In Elderly People.

Fereshteh Bagheri

Department of Audiology, School of Rehabilitation Sciences, Babol University of Medical Sciences, Mazandaran, Iran.

Corresponding Author:

Fereshteh Bagheri, Department of Audiology, School of Rehabilitation Sciences, Babol University of Medical Sciences, Mazandaran, Iran.

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Abstract

Working memory in older persons is declining, which in turn causes a deterioration in cognitive abilities. Therefore, performing the best working memory restoration technique is crucial for older individuals' wellbeing. In this research, we review the effects of music on working memory in older individuals and discuss the function of working memory in the central auditory system. Using the search terms music, working memory, ageing, and central auditory processing disorder, researchers were able to find the articles that would make up this review by searching the databases PubMed, Scopus, and Google Scholar. Only articles written in the English language and published between the years 1981 and 2020 were included in the literature search. The majority of elderly persons have reduced abilities related to central auditory processing, such as speech in noise perception. A quick diagnosis It is crucial for older persons to practise music therapy and be aware of central auditory processing dysfunction.

Keywords:

Music, Working memory, Central Auditory Processing Disorder, Aging

Introduction

The number of senior individuals is rising worldwide, and ageing is becoming a more problematic condition for mental health [1]. In 2050, there will likely be 2.1 billion older individuals (those over the age of 60).

Our mission must be to research effective prevention and treatment protocols in order to create good living conditions and increase independence in old age [4-6]. Aging is associated with age-related changes in function of various parts of the body, such as the cognitive system, which lead to limited social activity, loneliness, and physical weakness [2,3].

Working memory (WM), whose function changes with ageing, is one of the major complaints in the ageing population related to memory

loss and a significant portion of issues in the memory system [7,8]. WM decline is a natural part of ageing and occurs in healthy older persons, therefore it is unrelated to having or not having a neurologic condition [9,10].

However, aged people with WM decline run the risk of acquiring neurodegenerative disorders like Alzheimer disease and moderate cognitive impairment (MCI) [11,12]. Although WM decrease in older adults who are in good health might have a detrimental impact on life performance and increasing reliance, these effects are much more pronounced in elderly people who have neurodegenerative diseases [13,14].

This study's objective is to Point out the significance of the WM's role in elderly people's daily activities and think about the best strategy for minimising the effects of WM capacity decline with age.

Method

103 possibly eligible articles out of 288 primary articles were examined. The databases of PubMed, Medline, Scopus, Google Scholar, and Scientific Information Database were searched for relevant articles using the search terms "music," "working memory," "ageing," and "central auditory processing dysfunction." We took into account aspects of working memory, such as ageing. English-language literature from the years 1981 to 2020 was the only literature that could be found. The procedure for choosing studies according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Conclusion

In tasks requiring core auditory processing, such as voice perception in noisy settings, musicians have demonstrated superior performance. And one of the abilities required for hearing speech over noise is working memory. As a result, this review can probably help us set up programmes to improve speech perception in older adults with central auditory processing disorders and also, evaluate the central auditory system such as SIN perception is very important in older adults. This is because working memory plays a key role in central auditory processing, and we also understand the positive effects of music on working memory.

References:

1. Weng, W., et al. The transfer effects of cognitive training on working memory among Chinese older adults with mild cognitive impairment: a randomized controlled trial. *Front Aging Neurosci* 11 (2019): 212.
2. Goghari, V. M., & Lawlor-Savage, L. Comparison of cognitive change after working memory training and logic and planning training in healthy older adults. *Front Aging Neurosci* 9 (2017): 39.

Clinical Neurology And Neurosurgery Research

3. Nittrouer, S., et al. Verbal working memory in older adults: The roles of phonological capacities and processing speed. *J Speech Lang Hear Res* 59. 6 (2016): 1520-1532.
4. Degé, F., & Kerkovius, K. The effects of drumming on working memory in older adults. *Ann N Y Acad Sci* 1423 (2018): 242-250.
5. Teixeira-Santos, A. C., et al. Reviewing working memory training gains in healthy older adults: A meta-analytic review of transfer for cognitive outcomes. *Neurosci Biobehav Rev* (2019): 163-177.
6. Weicker, J., et al. WOME: Theory-based working memory training—A placebocontrolled, double-blind evaluation in older adults. *Front Aging Neurosci* 10 (2018): 247.
7. Fournet, N., et al. Evaluating short-term and working memory in older adults: French normative data. *Aging Ment Health* 16. 7 (2012): 922-930.
8. Lugtmeijer, S., et al. A comparison of visual working memory and episodic memory performance in younger and older adults. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn* 26.3 (2019): 387-406.
9. Di Rosa, E., et al. Reward motivation and neurostimulation interact to improve working memory performance in healthy older adults: A simultaneous tDCSfNIRS study. *Neuroimage* 202 (2019): 116062.
10. Reinhart, R. M., & Nguyen, J. A. Working memory revived in older adults by synchronizing rhythmic brain circuits. *Nat Neurosci* 22. 5 (2019): 820-827.
11. Filbey, F. M., et al. Failing compensatory mechanisms during working memory in older apolipoprotein E-ε4 healthy adults. *Brain Imaging Behav* 4. 2 (2010):177-188.
12. Yang, H.-L., et al. (2019). Development and effectiveness of virtual interactive working memory training for older people with mild cognitive impairment: a single-blind randomised controlled trial. *Age Ageing* 48. 4 (2019): 519-525.
13. Kirova, A.-M., et al. Working memory and executive function decline across normal aging, mild cognitive impairment, and Alzheimer's disease. *BioMed Res Int* (2015): 748212.
14. Nissim, N. R., et al. Effects of transcranial direct current stimulation paired with cognitive training on functional connectivity of the working memory network in older adults. *Front Aging Neurosci* 11 (2019): 340.
15. Saliassi, E., et al. Neural correlates associated with successful working memory performance in older adults as revealed by spatial ICA. *PloS one* 9. 6 (2014): e99250.
16. Fostick, L., & Revah, H. Dyslexia as a multi-deficit disorder: Working memory and auditory temporal processing. *Acta Psychol* 183 (2018): 19-28.
17. Leenders, M. P., et al. Diminished alpha lateralization during working memory but not during attentional cueing in older adults. *Cereb Cortex* 28 (2018): 21-32.
18. Ballesteros, S., et al. Effects of video game training on measures of selective attention and working memory in older adults: results from a randomized controlled trial. *Front Aging Neurosci* 9 (2017): 354.
19. Mičić, S., et al. The Impact of Working Memory Training on Cognitive Abilities in Older Adults: The role of Cognitive Reserve. *Curr Aging Sci* 13 (2020): 52-61.
20. Vaqué-Alcázar, L., et al. Functional and structural correlates of working memory performance and stability in healthy older adults. *Brain Struct Funct* 225 (2020): 375-386.
21. Borella, E., et al. Working memory training for healthy older adults: the role of individual characteristics in explaining short- and long-term gains. *Front Hum Neurosci* 11(2017): 99.
22. Woods, S. P., et al. Spontaneous strategy use protects against visual working memory deficits in older adults infected with HIV. *Arch Clin Neuropsychol* 25. 8 (2010): 724-733.
23. Avila, R. T., et al. (2015). Working memory and cognitive flexibility mediates visuoconstructional abilities in older adults with heterogeneous cognitive ability. *J Int Neuropsychol Soc* 21. 5 (2015): 392-398.
24. Nissim, N. R., et al. (2017). Frontal structural neural correlates of working memory performance in older adults. *Front Aging Neurosci* 8 (2017): 328.
25. McAvinue, L. P., et al. An evaluation of a working memory training scheme in older adults. *Front Aging Neurosci* 5 (2013): 20.
26. Brown, L. A., et al (2012). Processing speed and visuospatial executive function predict visual working memory ability in older adults. *Exp Aging Res* 38 (2012): 1-19.
27. Curtis, A. F., et al. Improving visual spatial working memory in younger and older adults: effects of cross-modal cues. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn* 26(2019): 24-43.
28. Zinke, K., et al. (2014). Working memory training and transfer in older adults: effects of age, baseline performance, and training gains. *Dev Psychol* 50 (2014): 304-315.
29. Nicholls, L. A. B., & English, B. Multimodal coding and strategic approach in young and older adults' visual working memory per-

Clinical Neurology And Neurosurgery Research

- formance. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn* 27(2020): 83-113.
30. Pliatsikas, C., et al. Working memory in older adults declines with age, but is modulated by sex and education. *Q J Exp Psychol (Hove)* 72. 6 (2019): 1308-1327.
 31. Bugg, J. M., et al. Physical activity moderates time-of-day differences in older adults' working memory performance. *Exp Aging Res* 32. 4 (2006): 431-446.
 32. Osaka, M., et al. Verbal to visual code switching improves working memory in older adults: an fMRI study. *Front Hum Neurosci* 6 (2012): 24.
 33. Andiel, C., & Liu, L. Working memory and older adults: Implications for occupational therapy. *Am J Occup* 49. 7 (1995): 681-686.
 34. Borella, E., et al. (2010). Working memory training in older adults: evidence of transfer and maintenance effects. *Psychol Aging* 25. 4 (2010): 767.
 35. Brehmer, Y., et al. Working-memory training in younger and older adults: training gains, transfer, and maintenance. *Front Hum Neurosci* 6 (2012): 63.
 36. Brum, P. S., et al. Working memory training format in older adults: individual versus group sessions. *Aging Clin Exp Res* 32. 11 (2020): 2357-2366.
 37. Gamboz, N., et al. The role of switching, inhibition and working memory in older adults' performance in the Wisconsin Card Sorting Test. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn* 16. 3 (2009): 260-284.
 38. Hara, Y., & Naveh-Benjamin, M. (2015). The role of reduced working memory storage and processing resources in the associative memory deficit of older adults: simulation studies with younger adults. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn* 22. 2 (2015): 129-154.
 39. Borella, E., et al. Are age-related differences between young and older adults in an affective working memory test sensitive to the music effects? *Front Aging Neurosci* 6 (2014): 298.
 40. Gerhardsson, A., et al. Positivity effect and working memory performance remains intact in older adults after sleep deprivation. *Front Psychol* 10 (2019): 605. *Journal of Neurology & Neurophysiology* 2020, Vol.11, Issue 7, 509. Bagheri F.4
 41. López-Higes, R., et al. Efficacy of cognitive training in older adults with and without subjective cognitive decline is associated with inhibition efficiency and working memory span, not with cognitive reserve. *Front Aging Neurosci* 10 (2018): 23.
 42. Thurm, F., et al. Comparing effects of reward anticipation on working memory in younger and older adults. *Front. Psychol* 9 (2018): 2318.
 43. Gilchrist, A. L., et al. Working memory capacity for spoken sentences decreases with adult ageing: Recall of fewer but not smaller chunks in older adults. *Memory* 16. 7 (2008): 773-787.
 44. Goral, M., et al. The contribution of set switching and working memory to sentence processing in older adults. *Exp Aging Res* 37. 5 (2011): 516-538.
 45. Insel, K., et al. Executive function, working memory, and medication adherence among older adults. *J Gerontol* 61. 2 (2006): P102-P107.
 46. Heinzel, S., et al. Working memory training improvements and gains in nontrained cognitive tasks in young and older adults. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn* 21. 2 (2014): 146-173.
 47. Berryhill, M. E., & Jones, K. T. tDCS selectively improves working memory in older adults with more education. *Neurosci Lett* 521. 2 (2012): 148-151.
 48. Boller, B., et al. Relationships between years of education, regional grey matter volumes, and working memory-related brain activity in healthy older adults. *Brain Imaging Behav* 11. 2 (2017): 304-317.
 49. Heinzel, S., et al. Working memory load-dependent brain response predicts behavioral training gains in older adults. *J Neurosci* 34. 4 (2014): 1224-1233.
 50. Salami, A., et al. Neurocognitive profiles of older adults with working-memory dysfunction. *Cereb Cortex* 28. 7 (2018): 2525-2539.
 51. Salat, D. H., et al. Greater orbital prefrontal volume selectively predicts worse working memory performance in older adults. *Cereb Cortex* 12. 5 (2002): 494-505.
 52. Kawagoe, T., et al. Brain activation during visual working memory correlates with behavioral mobility performance in older adults. *Front Aging Neurosci* 7 (2015): 186.
 53. Rizio, A. A., & Diaz, M. T. Language, aging, and cognition: Frontal aslant tract and superior longitudinal fasciculus contribute to working memory performance in older adults. *Neuroreport*, 27. 9 (2016): 689.
 54. Heinzel, S., et al. Transfer effects to a multimodal dual-task after working memory training and associated neural correlates in older adults—a pilot study. *Front Hum Neurosci* 11(2017): 85.

Clinical Neurology And Neurosurgery Research

55. Hakun, J. G., & Johnson, N. F. Dynamic range of frontoparietal functional modulation is associated with working memory capacity limitations in older adults. *Brain Cogn* 118 (2017): 128-136.
56. Heinzel, S., et al. Prefrontal-parietal effective connectivity during working memory in older adults. *Neurobiol Aging* 57 (2017): 18-27.
57. Heinzel, S., et al. Neural correlates of training and transfer effects in working memory in older adults. *NeuroImage* 134 (2016): 236-249.
58. Nagel, I. E. et al. Load modulation of BOLD response and connectivity predicts working memory performance in younger and older adults. *J Cogn Neurosci* 23. 8 (2011): 2030-2045.
59. Oren, N., et al. Neural patterns underlying the effect of negative distractors on working memory in older adults. *Neurobiol Aging* 53 (2017): 93-102.
60. Moossavi, A., et al. The relation between working memory capacity and auditory lateralization in children with auditory processing disorders. *Int J Pediatr Otorhinolaryngol* 78. 11 (2014): 1981-1986.
61. Lotfi, Y., et al. Relation between working memory capacity and auditory stream segregation in children with auditory processing disorder. *Iran J Med Sci* 41. 2 (2016): 110.
62. Rodríguez-Aranda, C., et al. Association between executive functions, working memory, and manual dexterity in young and healthy older adults: an exploratory study. *Percept Mot Skills* 122(2016): 165-192.
63. Ehrlich, M.-F., et al. Working-memory capacity and reading comprehension in young and older adults. *Psychol Res* 56. 2 (1994): 110-115.
64. Ganzer, C. A., et al. Associations between working memory, health literacy, and recall of the signs of stroke among older adults. *J Neurosci Nurs* 44. 5 (2012): 236-243.
65. Bagheri, F., et al. Auditory Training Among Older Adults with Alzheimer disease and Central Auditory Processing Disorder. *Avicenna J Neuro Psycho Physio* 5. 4(2018).
66. Bauer, E., et al. Performance level and cortical atrophy modulate the neural response to increasing working memory load in younger and older adults. *Front Aging Neurosci* 10 (2018): 265.
67. Toril, P., et al. Video game training enhances visuospatial working memory and episodic memory in older adults. *Front Hum Neurosci* 10 (2016): 206.
68. Bo, J., Jennett, S., & Seidler, R. Differential working memory correlates for implicit sequence performance in young and older adults. *Exp Brain Res* 221. 4 (2012): 467-477.
69. Guye, S., & Von Bastian, C. C. Working memory training in older adults: Bayesian evidence supporting the absence of transfer. *Psychol Aging* 32. 8 (2017): 732.
70. Werkle-Bergner, M., et al. Inter-individual performance differences in younger and older adults differentially relate to amplitude modulations and phase stability of oscillations controlling working memory contents. *NeuroImage* 60(2012): 71-82.
71. Basak, C., & O'Connell, M. A. To switch or not to switch: Role of cognitive control in working memory training in older adults. *Front Psychol* 7 (2016): 230.
72. Verhaeghen, P., et al. Resolving age-related differences in working memory: Equating perception and attention makes older adults remember as well as younger adults. *Exp Aging Res* 45. 2 (2019): 120-134.
73. Hayes, M. G., et al. Working memory and the strategic control of attention in older and younger adults. *J Gerontol B Psychol Sci Soc Sci* 68. 2 (2013): 176-183.
74. Janse, E., & Jesse, A. Working memory affects older adults' use of context in spoken-word recognition. *Q J Exp Psychol (Hove)* 67. 9 (2014): 1842-1862.
75. Nagaraj, N. K. Working memory and speech comprehension in older adults with hearing impairment. *J Speech Lang Hear Res* 60. 10 (2017): 2949-2964.
76. Wayne, R. V., et al. Working memory training and speech in noise comprehension in older adults. *Front Aging Neurosci* 8 (2016): 49.
77. Clapp, W. C., et al. Deficit in switching between functional brain networks underlies the impact of multitasking on working memory in older adults. *PNAS* 17 (2011): 7212-7217.
78. Pelegrina, S., et al. Similarity-based interference in a working memory numerical updating task. *Exp Psychol* 59. 4 (2012): 183-189.
79. Gilchrist, A. L., et al. Retrospective cues based on object features improve visual working memory performance in older adults. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn* 23. 2 (2016): 184-195.
80. Jones, K. T., et al. Longitudinal neurostimulation in older adults improves working memory. *PloS one* 10. 4 (2015): e0121904.

Clinical Neurology And Neurosurgery Research

81. Oberlin, L. E., et al. White matter microstructure mediates the relationship between cardiorespiratory fitness and spatial working memory in older adults. *NeuroImage* 131 (2016): 91-101.
82. Rast, P. (2011). Verbal knowledge, working memory, and processing speed as predictors of verbal learning in older adults. *Dev Psychol* 47. 5 (2011): 1490.
83. Arciniega, H., et al. Frontoparietal tDCS benefits visual working memory in older adults with low working memory capacity. *Front Aging Neurosci.* 10 (2018): 57.
84. Feld, J. E., & Sommers, M. S. Lipreading, processing speed, and working memory in younger and older adults. *J Speech Lang Hear Res* 2009.
85. Truong, L., & Yang, L. (2014). Friend or foe? Decoding the facilitative and disruptive effects of emotion on working memory in younger and older adults. *Front Psycho* 5 (2014): 94.
86. McCabe, J., & Hartman, M. (2008). Working memory for item and temporal information in younger and older adults. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn* 15. 5 (2008): 574-600.
87. Magimairaj, B. M., & Nagaraj, N. K. Working memory and auditory processing in school-age children. *LANG SPEECH HEAR SER* 49. 3 (2018): 409-423.
88. Baldwin, C. L., & Ash, I. K. Impact of sensory acuity on auditory working memory span in young and older adults. *Psychol Aging* 26 (2011): 85.
89. Doherty, K. A., & Desjardins, J. L. The benefit of amplification on auditory working memory function in middle-aged and young-older hearing impaired adults. *Front Psychol* 6 (2015): 721.
90. Frtusova, J. B., & Phillips, N. A. The auditory-visual speech benefit on working memory in older adults with hearing impairment. *Front Psychol* 7 (2016): 490.
91. Bagheri, F., et al. Alzheimer's Disease and Hearing Loss among Older Adults: A Literature Review. *JPBS* 8. 5 (2018): 77-80. *Journal of Neurology & Neurophysiology* 2020, Vol.11, Issue 7, 509. Bagheri F. 5
92. Frtusova, J. B., et al. ERP evidence that auditory-visual speech facilitates working memory in younger and older adults. *Psychol Aging* 28. 2 (2013): 481.
93. James, P. J., et al. Working memory predicts semantic comprehension in dichotic listening in older adults. *Cognition* 133 (2014): 32-42.
94. Huntley, J., et al. Adaptive working memory strategy training in early Alzheimer's disease: randomised controlled trial. *Br J Psychiatry* 210 (2017): 61-66.
95. Borella, E., et al. Is working memory training in older adults sensitive to music? *Psychol Res* 83. 6 (2019): 1107-1123.
96. Tumuluri, I., et al. Effectiveness of music therapy on focused attention, working memory and stress in Type 2 diabetes: An exploratory study. *Int J Yoga* 10. 3 (2017): 167.
97. Lee, S.-M., et al. Music application alleviates short-term memory impairments through increasing cell proliferation in the hippocampus of valproic acid-induced autistic rat pups. *J Exerc Rehabil* 12. 3 (2016): 148. Cite this article: Temitope SA&Musa VM. Effect of Bromelain on BDNF level and memory deficit following intra-medial forebrain bundle
98. Bergman Nutley, S., et al. Music practice is associated with development of working memory during childhood and adolescence. *Front Hum Neurosci* 7 (2014): 926.
99. Hyer, L., et al. Cognitive training program to improve working memory in older adults with MCI. *Clin Gerontol* 39. 5 (2016): 410-427.
100. Kuschpel, M. S., et al. Differential effects of wakeful rest, music and video game playing on working memory performance in the n-back task. *Front Psychol* 6 (2015): 1683.
101. Lehmann, J. A., & Seufert, T. The influence of background music on learning in the light of different theoretical perspectives and the role of working memory capacity. *Front Psychol* 8 (2017): 1902.
102. Särkämö, T., et al. Cognitive, emotional, and social benefits of regular musical activities in early dementia: randomized controlled study. *Gerontologist* 54. 4 (2014): 634-650.
103. Sakamoto, M., et al. Comparing the effects of different individualized music interventions for elderly individuals with severe dementia. *Int Psychogeriatr* 25. 5 (2013) : 775-784.