Psychological Studies
Vol.20, No.4, Winter 2025, Serial No.77
Submitted Date:2024-05-22 Accepted Date:2024-11-18
Pages: 25-39
DOI: 10.22051/psy.2024.47147.2958
https://psychstudies.alzahra.ac.ir/article_8153.html

Research paper

The Effectiveness of Transcranial Direct Current Stimulation and Multi-Component Cognitive Stimulation Programs on Cognitive Functions and Quality of Life in Elderly

Moslemi, Bakhtiar [1]; Chalabianloo, Gholamreza [*2]

1. Psychology Department, Humanitarian and Psychology Faculty, Azerbaijan Shahid Madani University, Tabriz, Iran. Email: Dr.moslemib@gmail.com
2. Corresponding Author: Associate Prof. in Neuroscience, Psychology Department, Azerbaijan Shahid Madani University, Tabriz, Iran. Email:Chalabianloo@azaruniv.ac.ir

Abstract

This research aimed to determine the effectiveness of two types of intervention on cognitive functions and quality of life in the elderly. The research method was semi-experimental with a pre-test-post-test design, follow-up with a control group. The statistical population was all elderly people living in Tabriz in 2023. A number of 90 elderly people over 60 years of age were selected by purposive sampling method and randomly placed in three groups of tDCS and multi-component cognitive stimulation program and control group. Intervention programs were used for three months. The CANTAB test and QOL-SF 36 questionnaire was applied. The results of data analysis with repeated measurements showed that tDCS and multi-component program improved the cognitive function and quality of life of the elderly, which can be suggested to use such programs to improve the cognitive function of the elderly.

Keywords: Cognitive function, elderly, multi-component cognitive program, tDCS, quality of life.

Introduction

Aging is a natural course and one of the stages of development, which is accompanied by special physical, psychological and social changes (Haywood & Getchell, 2021). With the decline of cognitive functions over time, the elderly are gradually unable to perform personal daily activities and become dependent on others (Ebrahimi et al., 2019). Some studies have reported the effect of neuropsychological interventions in the treatment of positive cognitive actions and concluded that with tDCS can be improved functions such as working memory, attention, and executive functions (Kazinka et al., 2024). In fact, that during the aging process, the physiology of all body systems, especially the nervous system, suffers a decrease in performance, and psychologically and socially isolated, so a solution to reduce problems cognitive and improvement of the existing condition in the elderly and provided cognitive and physical rehabilitation in them. Neurocognitive approaches such as tDCS and mobile programs based on cognitive stimulation have been effective. the current research hypothesis was:

-the tDCS and multi-component cognitive stimulation program are effective on elderlies' cognitive functions and quality of life

Method

The method was a quasi-experimental study with pre-test, post-test design, follow-up with a control group. The target population in the present study was all the elderly who lived in Tabriz in 2023. A number of 90 elderly people over 60 years of age were selected by purposive sampling method, based on the inclusion and exclusion criteria and randomly placed in three groups, the first group was the tDCS group, the second group was a multi-component cognitive stimulation program and the third was the control group. For the first experimental group, 20 sessions of 20 minutes were performed every other day, for two months. For the second experimental group, the multi-component cognitive stimulation program was implemented for three months. The control group did not receive any intervention. Data were analyzed using repeated measures analysis of variance and Bonferroni's post hoc test.

Tools

The CANTAB, a computerized test battery targeting multiple neuropsychological function, is suitable for cross-cultural comparison (De luca et al., 2003). The CANTAB to assess the cognitive domains of Attention, Working Memory, Decision, and social recognition in elderly was used. The reliability of this test for elderly people is 0.85 in the current study.

Quality of life SF-36: It was designed by War and Shelbourne (1992) and its reliability is confirmed (α=0.83). This questionnaire evaluated 8 different areas of health. In this study, Cronbach's alpha for the total score was 0.81.

Transcranial direct current stimulation: This method is one of the non-invasive treatments that is established to stimulate the activity of neurons in the brain based on the ability of the magnetic field to pass through the skull and brain membranes and as a result induce electric current in the brain tissue (Majdi et al., 2022).

Multi-component cognitive stimulation program: It is a software program based on the android system that is installed on a smartphone. In this software, several cognitive components are emphasized, including: cognitive activities, social interactions, physical activity and self-management. Clients reported their progress to the researcher by daily implementation of the program and its feedback in the software through online reports.

Results

Data analysis showed that the experimental and control groups were not significantly different in variables of age, gender, education, and married status (p=0.745). The mean and standard deviation are shown in Table 1. The results of the Shapiro-Wilk's test confirmed the normality of the data distribution. The results of Levin's test also showed that the variance between groups in pre-test, post-test and follow-up is equal in cognitive function and quality of life. The results of the in-box test that the equality condition of the variance-covariance matrix is also met. Also, the findings show that the hypothesis of sphericity is maintained in the variable of cognitive function ($p<0.06$; $\chi2=3.58$) and quality of life ($p<0.08$; $\chi2=2.62$).

Table 1. Average and standard deviation of cognitive function and quality of life in three groups

Variable	group	Pre test		Post test		Follow up	
		M	SD	M	SD	M	SD
Cognitive function	tDCS	69.25	6.72	80.94	7.06	80.11	6.46
	Multi-component app	70.75	6.45	81.83	6.27	80.62	5.78
	control	70.33	5.79	71.49	5.88	71.74	5.52
Quality of life	tDCS	70.45	5.87	80.94	6.14	79.73	6.49
	Multi-component app	68.74	6.45	81.83	6.55	81.14	5.89
	control	69.13	6.34	71.42	7.39	70.82	6.75

Based on the results of variance analysis with repeated measurements (Table 2), experimental and control groups are significantly different from each other in terms of cognitive performance and quality of life in the three stages of pre-test, post-test and follow-up.

Table 2. Results of analysis of variance with repeated measurement with intra-group and inter-group variable factors of cognitive function and quality of life.

Variable	Source		SS	Df	MS	F	P	Eta
Cognitive function	Intra-group	Time	69.42	1	69.42	26.76	0.001	0.53
		Group	42.16	2	42.16	9.55	0.001	0.45
	Inter-group	Time group	74.67	2	74.67	10.97	0.001	0.35
Quality of Life	Intra-group	Time	2176.95	1	2176.95	87.44	0.001	0.66
		Group	1162.49	2	1162.49	47.22	0.001	0.57
	Intra-group	Time group	3251.62	2	3251.62	17.65	0.001	0.44

Discussion and Conclusion

The tDCS over the dorsolateral prefrontal cortex (DLPFC) of the elderly causes increased activity, brain arousal and increased regional blood flow in the brain, which causes processing of cognitive processes and improvement of executive functions, memory, attention, decision-making and social cognition. With the improvement of cognitive functions in the elderly, they feel empowered, independent and more self-confident. This feeling and ability will improve the way of life and improve the quality of life of the elderly. The multi-component program of cognitive stimulation by stimulating cognitive components, physical activity, social interactions and self-management in the elderly on a daily basis causes multi-faceted rehabilitation in cognitive, behavioral, physical functions, social interactions and delays in the reduction of cognitive ability, which subsequently, positive behavioral changes in lifestyle. Therefore, it is suggested to use these interventions in rehabilitation and home care centers for the elderly to improve their cognitive function and quality of life. For improvement of

limitations of this study, it is suggested that in future researches, sampling methods with less error and a wide population should be used.

References

Beck, A. T., Steer, R. A. & Brown, G. K. (1996). *Manual for Beck depression inventory-II*. San Antonio, TX: Psychological Corporation https://psycnet.apa.org/doi/10.1037/t00742-000

Berking, M., & Whitley, B. (2014). Development of the "affect regulation training" (ART) program. *Affect Regulation Training: A Practitioners' Manual*, 53-65. https://doi.org/10.1007/978-1-4939-1022-9_6

Clary, H. M. M., Giambarberi, L., Floyd, W. N., & Hamberger, M. J. (2023). Afraid to go out: Poor quality of life with phobic anxiety in a large cross-sectional adult epilepsy center sample. *Epilepsy Research*, 1(2), 1-10. https://doi.org/10.1016/j.eplepsyres.2023.107092

Ertan, D., Aybek, S., LaFrance Jr, W. C., Kanemoto, K., Tarrada, A., Maillard, L., & Hingray, C. (2022). Functional (psychogenic non-epileptic/dissociative) seizures: why and how? *Journal of Neurology, Neurosurgery& Psychiatry*, *93*(2), 144-157. http://dx.doi.org/10.1136/jnnp-2021-326708

Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioral Assessment*, *26*(1), 41-54. https://psycnet.apa.org/doi/10.1023/B:JOBA.0000007455.08539.94

Hayes, S. C., Strosahl, K. D., &Wilson, K.G. (2016). *Acceptance and commitment therapy: The process and practice of mindful change*. Second Edition. New York: Guilford Press https://psycnet.apa.org/record/2012-00755-000

Sadeghnezhad, H., Teimory, S., & Amiri, M. (2020). Effectiveness of acceptance and commitment therapy on emotion regulation in epileptic patients. *Social Determinants of Health*, *6*(1), 37-37. https://doi.org/10.22037/sdh.v6i1.34990

Wenjie, H. A. N., Youtian, Z. H. O. U., Zhensheng, L. I., Jianjie, K. A. N. G., & Bingmei, D. E. N. G. (2024). Risk factors of depression and anxiety in epilepsy patients and their relationship with quality of life HAN Wenjie. *Journal of Practical Medicine/Shiyong Yixue Zazhi*, *40*(4), 1-10. https://openurl.ebsco.com

Acknowledgments

All the participants (people with epilepsy) who answered the research questions and participated in the treatment sessions are greatly thanked and appreciated.

Funding

This research did not receive any financial support.

Conflicts of interest

Authors found no conflict of interests.