Research Paper

The Effect of Superbrain Yoga Exercises on Cognitive Functions of Older Adults: A Randomized Controlled Clinical Trial

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ABSTRACT

Background: The prevalence of cognitive disorders among older individuals is considered to be one of the most significant and controversial health problems. This study was conducted to determine the effect of Superbrain yoga exercises on older adults' cognitive status.

Methods: This is a randomized controlled clinical trial conducted on 60 older adults who were referred to centers of comprehensive health services in Khaf City in 2020. The participants were selected by random allocation and randomly divided into two groups (30 people equally in both groups). The mini-mental status examination was used to assess cognitive status, which was completed at the beginning and end of the intervention. Subjects, after obtaining a score of 21 to 23 from the above questionnaire, were placed in two intervention and control groups. The intervention group performed superbrain yoga exercises three days a week for one month. Data analysis was done by SPSS software, version 20 software using independent t-test, and Kolmogorov-Smirnov, chi-square, and Mann-Whitney U tests.

Results: The mean score of the mini-mental status examination in the intervention group was higher than in the control group before the intervention (P=0.009). A comparison of the score of the mini-mental status examination after the intervention showed that the score of the intervention group was higher than the control group (P<0.001). Also, the comparison of the mean score of the groups after the intervention showed that the scores of the intervention group increased compared to before the intervention (P<0.001).

Conclusion: Superbrain yoga exercises have a positive effect on the cognitive status of older adults with mild cognitive impairment; thus, it is recommended to prevent cognitive disorders and improve the cognitive status of these people.

Keywords: Cognitive function, Elderly, Yoga

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1. Introduction

The cognitive disorder is one of the most important and controversial disorders among older adults and has different types [1]. According to the latest report of the World Aging Association, it is estimated that in 2030, 74.7 million people in the world will struggle with cognitive problems (weak information processing, learning, and poor attention and concentration) every 20 years, this figure will double. In Iran, about 600,000 people are suffering from this disorder, and in the next 20 years, 2,500,000 people will be affected [2].

Mild cognitive impairment (MCI) is an intermediate condition and a clinical syndrome between the normal cognitive status of old age and dementia, which provides an opportunity for early detection and prevention of Alzheimer's disease [3]. This type of aging-related memory disorder does not interfere with the individual's daily functioning to the extent that it interferes with their cognitive abilities or memory, but in any case, their daily functioning is weaker than normal [4]. As one of the clinical problems in older adults, MCI prevalence is growing. Studies have shown that in older adults with MCI, developing Alzheimer's disease increases by 10 to 30% per year, while in older adults without it, the annual dementia rate is 1 to 2% [5].

There is currently no definitive treatment for cognitive disorders; thus, it is better to use preventive interventions [6]. These preventive interventions are provided based on the guidelines of associations related to cognitive issues in various fields. For example, banning alcohol and smoking, avoiding inhaling polluted air, and managing and controlling chronic diseases, such as high blood pressure, diabetes, and obesity are among the interventions that can be useful. Also, following a Mediterranean diet, maintaining social contact with friends and acquaintances, observing sleep hygiene, and performing mind-stimulating interventions, such as solving mental games, visual puzzles, and Sudoku tables are among the effective measures to prevent the occurrence of cognitive disorders [7, 8].

One of the recently considered methods is yoga. Yoga is a physical-mental exercise that is related to physiological and psychological processes [9]. Its exercises are performed in both static and dynamic modes and focus on relaxation. Yoga includes meditation exercises, breathing regulation, and physical exercises [10]. The activity of neurotransmitters as the main inhibitor of the brain can be affected through yoga exercises [11]. Finally, yoga-based interventions are associated with improvements in cognition in healthy older adults [12].

According to studies, yoga is a therapeutic technique that does not require special technology and equipment and can be done almost at any time and place. As a result, it is cost-effective, and more importantly, the individuals can do it independently [13]. Superbrain yoga is a type of yoga, in which the main energy centers are the points of acupuncture. Superbrain yoga balances the body's energy levels for optimal brain function [14]. In mental and neurological disorders, energy is trapped in the lower chakras (the main points of acupuncture), thus preventing sufficient energy from being sent to the brain.

In 1997, reviewing the previous studies on the effect of yoga exercises on improving the balance of older adults showed that a moderate-intensity daily workout program of at least 30 minutes a day will help seniors maintain adequate levels of strength, balance, agility, and flexibility and also, exercises, such as yoga, which are done regularly can have positive effects on balance and some factors of physical fitness [15]. In 2020, the results of a systematic review study on yoga showed that interventions based on yoga can have positive effects on the cognitive dimensions of older adults [16].

Therefore, considering this background that the older adult population is increasing and cognitive problems will also increase in the same proportion, prevention is always better than cure. Geriatric nurses, caregivers, and centers related to older adults are the best factors to provide preventive services in all aspects of health and wellness, including the prevention of cognitive problems. Also, the role of prevention will be prominent when we know that suffering from cognitive problems in old age can pose a heavy burden for the individual, family, and society. On the other hand, despite the positive effects of yoga exercises on the cognitive performance of older adults, specific and limited studies have been conducted on superbrain yoga. It should also be kept in mind that even systematic review studies have recommended more studies in this area. Also, the cultural considerations and different geographical differences between Iran and Iranian older adults should be considered in accepting such an intervention. Therefore, considering the importance of the above issue and brain yoga as a cost-effective and low-complication preventive method, we decided to investigate the effect of superbrain yoga exercises on the cognitive functions of older adults referring to community health centers in Khaf City.

2. Methods

This study is a randomized controlled clinical trial that examined the effect of superbrain yoga on the cognitive function of older adults. The study population consisted of all people aged 60 to 75 years under the care of comprehensive health service centers in Khaf City in 2020. The choice of this age range is due to their more accessible health records and also considering that this group of people are young older adults, which reduces worry about limitations in performing superbrain yoga movements.

To determine the sample size, a pilot study was conducted on ten people from the samples of each group, and the cognitive performance score was determined before and after the intervention. Considering the test power of 80%, the confidence coefficient of 95%, and the mini-mental status examination (MMSE) mean score in the two studied groups and based on the formula for mean comparison, the sample size was estimated to be 27 people in each group; however, considering the 10% chance of dropout, 30 people were studied in each group. A demographic questionnaire and MMSE questionnaire were given randomly to 150 people referring to health centers. After completing the questionnaires, 60 people who had MCI (scoring 21 to 23 out of 30) were selected randomly and divided into two intervention and control groups by random allocation method (Figure 1). Random allocation of the samples was done using four permutation blocks. For this purpose, intervention group A and control group B were considered. Quadruple blocks included six AABB, ABAB, ABBA, BABA, BBAA, and BAAB blocks. A code from one to six was given to each of the blocks. Considering that the total sample size of this study was 60 people, blocks were selected 15 times using a table of random numbers. For blinding, the researcher who filled out the questionnaire before and after the intervention was not aware of the permuted blocks and random allocation that had been done before.

Inclusion criteria were the age of 60 to 75 years, literacy, having an MCI according to the results of the MMSE questionnaire, not using drugs for cognitive disorders, and completing the consent form to participate in the research. Exclusion criteria included not performing superbrain yoga regularly (exercise should be done regularly and daily, at least three times a week), acute physical illness during the period, the absence of two or

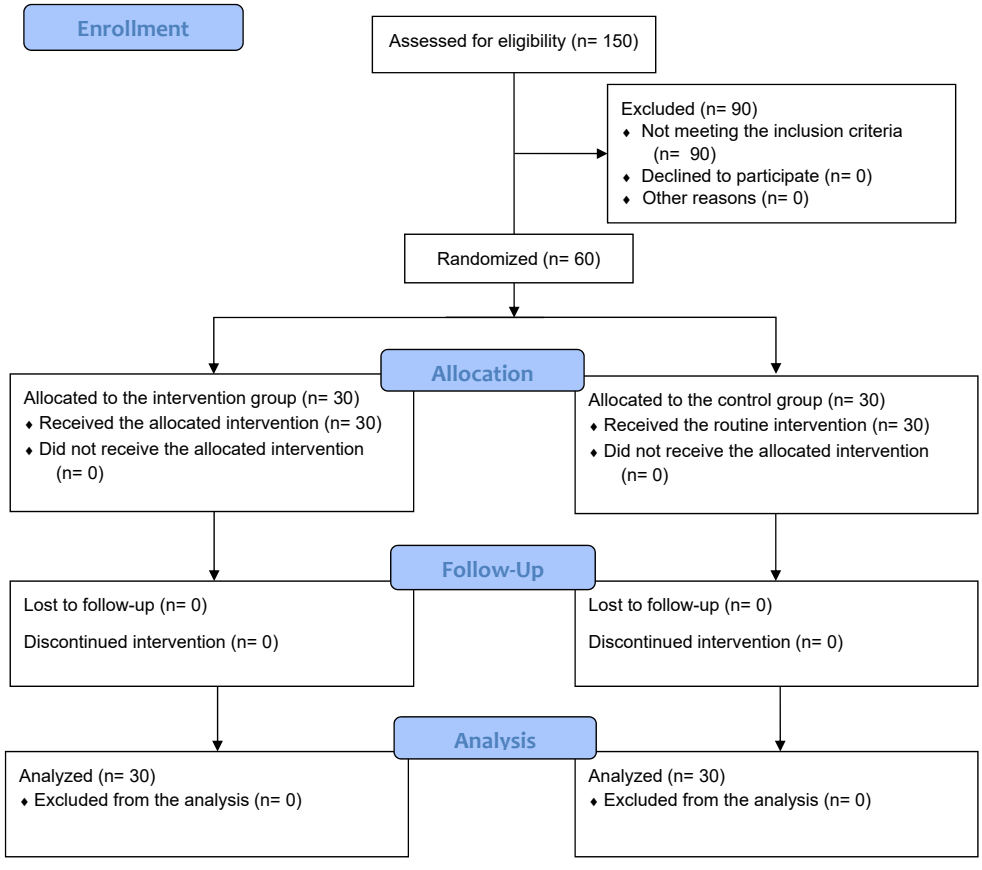

Figure 1. CONSORT diagram of the study

more sessions during the intervention, hospitalization, reluctance to continue cooperation at any stage of the research, and the death of the older adults.

After allocating the samples to two groups, the correct method of performing the superbrain yoga exercise was explained to the samples (intervention group). The method of exercising was three or four days a week for four weeks, and according to the conditions of COVID-19 and the vulnerability of the older adults, the intervention group was divided into six smaller groups. With full compliance with health protocols and social distance, training on how to perform superbrain yoga correctly in the first week (the first three sessions) was conducted in person (three days a week in the morning at 9 am) by the researcher in the community health centers of Khaf City.

According to previous studies in this study, the method of doing superbrain yoga was that people were facing east, legs were shoulder-width apart, and the tongue was attached to the palate. Then, the right earlobe was touched with the left hand and the left earlobe with the right hand. In the same body position, people performed 14 squats. They also inhaled while sitting and exhaled while standing [14, 17].

In the following weeks, the training was done virtually and by showing video clips and pamphlets. For the control group, the routine care of the community health centers, such as face-to-face and telephone consultations and answering the questions of the clients, was done. Then, at the end of one month after performing the superbrain yoga exercise in both the intervention and control groups, the MMSE questionnaire was completed again by the researcher. In addition, the follow-up of the samples in terms of correct performance of the superbrain yoga exercise was done by the researcher by phone call (three days a week) and in person.

The tools used in this study are explained below:

Demographic characteristics questionnaire

This questionnaire was created with the opinion of experts and professors in the field of geriatrics, which included age, gender, education level, marital status, financial status, job status, taking medicine status, and the history of background diseases.

Mini-mental status examination (MMSE) questionnaire

The standard MMSE questionnaire was used to assess cognitive status. It contains 11 questions with a total score of 30, including 16 scores on the memory and orientation subscale, five scores on the attention and focus subscale, eight scores on assessing linguistic production and comprehension, and one score on spatial visual ability. The maximum score is 30 points. A total score between 24 and 30 is a sign of cognitive health and a score of 23 or lower indicates cognitive impairment. A score of 21 to 23 indicates mild cognitive problems, a score of 10 to 20 indicates moderate cognitive disorders and a score below nine indicates severe cognitive disorders. The MMSE questionnaire was developed by Folstein et al. in 1975 and is the most common screening tool for cognitive disorders worldwide and has been translated into different languages and standardized in different cultures [18].

Following some modifications, Seyedian et al. tested the Persian version of the MMSE questionnaire on 30 people with dementia and 200 healthy people in Iran. In the mentioned research, they obtained Cronbach's alpha coefficient of 0.81, which indicates the validity and reliability of the Persian version of this tool [19].

In the sample selection process, the purpose and method of research were explained to the patients, and then they were invited to participate in the study, and the written and oral informed consent form was completed by them. Because the subjects had MCI, there was no concern about completing the informed consent form.

Statistical methods

The study data were analyzed using SPSS software, version 20. The chi-square test was applied to determine the homogeneity of qualitative demographic variables in the two groups. The Kolmogorov-Smirnov test was used to assess the normality of quantitative data in each group. An independent t-test was used to compare the variables that had a normal distribution in the two study groups, and the Mann-Whitney nonparametric test was used for the variables without normal distribution. The significance level was considered less than 0.05.

3. Results

The normality of quantitative variables, including age, weight, and cognitive impairment score before and after the intervention in each group was evaluated by the Kolmogorov-Smirnov test. The age had a normal distribution in both groups. However, cognitive impairment did not have a normal distribution before and after the intervention. Therefore, non-parametric tests were used to analyze the data related to this variable (Table 1).

Comparing the intervention group with the control group in terms of gender showed that there was no statistically significant difference between the two groups (P=0.718). Also, there was no statistically significant difference in the two groups in terms of marital status (P=0.105), education level (P=0.939), financial status (P=1), job status (P=0.272), taking medicine (P=1), background diseases (P=0.252), and age (P=0.4) (Table 1).

According to Table 1, all demographic variables were statistically homogeneous and did not have statistically significant differences.

The results showed that the MMSE score before the intervention was 21.53±0.77 in the control group and 22.13±0.89 in the intervention group. The MMSE mean score in the intervention group was higher than the control group and the two groups were significantly different (P=0.009) before the intervention (Table 2). Also, the results showed that the MMSE score after the intervention was 21.03±1.69 in the control group and 24.33±0.78 in the intervention group. Comparison of the MMSE score of the samples after the intervention using the Mann-Whitney U test showed that the MMSE score of the intervention group was higher than the control group and the two groups were significantly different (P<0.001) (Table 2). The comparison of the difference in the MMSE mean score after the intervention was 1.34±0.5 in the control group and 2.2±1.34 in the intervention group, and the results of statistical analysis showed that there was a significant difference between the two groups (P<0.001) (Table 2). Thus, in the intervention group, the MMSE score increased after the intervention compared to before the intervention.

Table 1. Comparison of demographic characteristics of the two groups

Characteristics		No. (%)		P
		Intervention	Control	
Gender	Male	25(83.3)	26(86.6)	0.718*
	Female	5(16.6)	4(13.3)	
Marital status	Single	2(6.6)	5(16.6)	0.105*
	Married	28(93.3)	25(83.3)	
Education level	Primary school	14(46.6)	14(46.6)	0.939*
	High school	8(26.6)	9(30.0)	
	University	8(26.6)	7(23.3)	
Financial status	Adequate	28(93.3)	28(93.3)	1**
	Inadequate	2(6.6)	2(6.6)	
Job status	Housewife	5(16.6)	5(16.6)	0.272*
	Retired	17(56.6)	20(66.6)	
	Employed	8(26.6)	5(16.6)	
Taking medicine	No	9(30.0)	9(30.0)	1*
	Yes	21(70.0)	21(70.0)	
Background disease	No	6(20.0)	11(36.7)	0.252**
	Yes	24(80.0)	19(63.3)	
Age (y)		63.53±3.11	64.26±3.57	0.4^

*The results of the chi-square test, **The results of the Fisher's exact test, ^Independent sample t-test.

Table 2. Comparison of MMSE questionnaire score before and after the intervention in the two groups

MMSE Score	Mean±SD		Mann-Whitney U Test
	Intervention	Control	
Before	22.13±0.89	21.53±0.77	Z=-2.6 P=0.009
After	24.33±0.78	21.03±1.69	Z=-5.3 P<0.001
Comparison of the mean difference of MMSE score	2.2±1.34	1.34±0.5	Z=-5.5 P<0.001

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4. Discussion

Based on the findings, there was a statistically significant difference in the MMSE score between the control and intervention groups so that the results indicated the positive effect of superbrain yoga in the intervention group compared to the control group.

Basically, the extensive interventions prevented the occurrence of cognitive disorders in all age groups. Older adults who are potentially at risk for these disorders may be good candidates for these interventions. It seems that interventions, such as superbrain yoga, even if they do not benefit older adults, do not harm them either. Therefore, the implementation of such interventions provides a two-way opportunity. First, the function of such interventions can be measured in different societies, especially older adults, and then, if there are positive consequences, it can be recognized as a scientific but formal and practical intervention. In the present study, superbrain yoga played a key role in improving the cognitive status of the assessed people.

Superbrain yoga probably improved the MMSE score in the intervention group by engaging and stimulating important brain centers that are responsible for memory, learning, and concentration. Superbrain yoga causes such an effect by activating alpha brain waves [13]. Reaching such a result is not far from the mind and it seems that this study was able to provide a specific answer to the main research question. However, we will continue the discussion by referring to other studies.

In line with the findings of this study, Thomas et al. conducted a comparative study entitled "The effect of superbrain yoga and aerobic exercise on cognitive functions among medical students in Bangalore, India". They showed that superbrain yoga had a positive effect on attention control and components of working memory. The effect was more prominent on working memory than attention control in the superbrain yoga group compared with the group that performed simple squats [17]. Although this study used the intervention exactly as used in the present study the studied samples were people other than older adults. However, taking into account the different conditions of the older adults and the possibility of them not accepting such interventions, the results were similar.

Eskandarnejad et al. studied the effect of aerobic exercise on neural networks of attention and working memory. The results showed that working memory in the experimental group increased significantly compared to the control group, which was consistent with the results of our study [20]. In this study, the same discussion of non-older adults' samples is discussed. In addition, they measured the impact of aerobic sports intervention other than yoga on memory performance and other aspects, which is also different from the present study. Considering that yoga is also a sport, this study was similar to the present study. In addition, Alivand et al. reviewed the effect of exercise on memory enhancement. The results showed that exercise, as a non-invasive method, can improve memory and learning ability. These effects are associated with cellular and molecular changes in the brain structure, which is consistent with the results of our study [21].

Hariprasad et al. found that yoga positively influenced the cognitive function of older adults. They confirmed that yoga is useful for improving cognitive function in older adults, which is consistent with the results of our study [22]. Indeed, this study is also in line with the current study, but it should be noted that superbrain yoga is considered a special, different, and of course, new method, which forms the difference between the current study and the mentioned study.

As stated, all the mentioned studies were in line with the results of this research. Some of the studies assessed

old adults and some assessed others. However, the results of the interventions were positive and did not differ from each other. The current research was conducted with a relatively new concept of "superbrain yoga" in a group with a special characteristic of "cognitive problems". Therefore, our research can be distinguished from previous studies.

Considering the positive role of superbrain yoga in improving the cognitive status of older adults, teaching and explaining the benefits of this method to caregivers and people connected to them can provide the basis for its implementation. Geriatric nurses, healthcare providers, and even families can play an important role in improving and preventing the occurrence of cognitive disorders as a non-pharmacological treatment by providing this method to older adults and monitoring its implementation. In addition, even this method can be part of the routine services provided in health centers to older adults.

The research team recommends that this new method, superbrain yoga, be investigated in more studies with different designs and age groups.

Limitations of the study

The outbreak of COVID-19 caused older adults to enter the study with fear and anxiety to prevent contracting this disease. Therefore, in the first session, the participants were assured about following the health protocols during the study, and a part of the intervention training was provided to the participants in the form of a pamphlet. We also tried to homogenize the two groups in terms of background variables by random allocation. However, it seems that certain conditions and restrictions can be considered in future studies for conditions, such as having hearing aids, glasses, etc. Also, to check the continuity of the effect of this intervention, it is necessary to include follow-up periods in the next studies.

5. Conclusion

Superbrain yoga exercises have a positive effect on the cognitive status of older adults with MCI; thus, it is recommended to prevent and improve the cognitive status of these people. Geriatric nurses can also use this method as nursing care for people with such characteristics.

Ethical Considerations

Compliance with ethical guidelines

This research was approved in the session of the ethics committee of Gonabad University of Medical Sciences, on October 20 2020 (Code: IR.GMU.REC.1399.084). The study was conducted in accordance with the ethical principles provided by the Declaration of Helsinki and the guidelines of the Iranian Ministry of Health and Medical Education.

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Authors' contributions

Conceptualization: Azadeh Derayat and Leila Sadeghmoghadam; Methodology: Mahmood Reza Mottaghy and Tahereh Baloochi Beydokhti; Investigation: Azadeh Derayat and Mahmood Reza Mottaghy; Software: Tahereh Baloochi Beydokhti; Writing and editing: Saeed Khayat Kakhki and Azadeh Derayat; Supervision: Leila Sadeghmoghadam.

Conflict of interest

The authors declared no conflict of interest.

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