




## Original Article

### Effect of Yoga on Memory in Elderly Women

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#### ABSTRACT

##### Article history

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**Introduction:** Cognitive impairment rate such as memory loss increases because of aging as a natural process. Based on the evidence, physical activity can lead to improved mental and cognitive function and also plays a preventive role against reducing cognitive function. the purpose of this study was to investigate the effect of yoga exercises on memory of elderly women.

**Methods:** This experimental study was a randomized, controlled clinical trial that was conducted in 2018. Two elderly day care centers in Yazd city, in central Iran were selected and randomly assigned to control and intervention groups. Then, according to the inclusion criteria, eligible people were selected from the centers and enrolled in the study. Participants were 58 elderly women who were assigned to control (n: 29) and intervention (n: 29) groups. Yoga exercises were held for 2 months (three 1-h sessions a week) for intervention group. The Wechsler Memory Scale was completed for both groups before and after the intervention. Data were analyzed by SPSS using descriptive and inferential statistics.

**Results:** The mean score of memory in the intervention group before intervention was  $77.7 \pm 17.8$  and after the intervention reached  $86.4 \pm 17.3$ , with a statistically significant difference ( $p < 0.05$ ), but in control group, no significant difference was observed. In the intervention group, mental control, logical and visual memory subscales increased significantly ( $p < 0.05$ ), but there was no significant difference in other subscales. There was no significant difference in any of the subscales in control group ( $p > 0.05$ ).

**Conclusion:** To improve the memory of the elderly, physical activity such as yoga exercise can be helpful. The elderly can routinely practice these exercises in elderly care centers.

**Keywords:** Memory, Yoga, Aged

#### Introduction

Aging is a period that is accompanied by spontaneous deteriorating, progressive, and gradual changes in most physiological organs and functions of the body, including impacts on long-term and short-term memory and changes in brain structure. With

increasing age in the elderly, misconception, decline in memory strength, misunderstanding, and confusion are more likely to occur. Cognitive impairment, such as memory loss, is a natural process in this age population (1). As the age increases, the concentration, number

and synthesis of neurotransmitter receptors (2) and the volume of white matter in the brain decreases (3). In fact, in many countries, decline in cognitive function in elderly people has become an important health care issue. If we cannot design effective preventive measures to prevent it from starting or progressing among the elderly, the number of people with mild cognitive impairment or even dementia will increase due to the rising population of the elderly (4). Based on evidence on pharmacological interventions, in addition to harmful side effects, drugs do not reduce cognitive impairment or progression towards dementia (5). However, various therapeutic approaches, such as psychotherapy interventions (6), cognitive exercises (7) and physical activity and exercise (8), are available to slow down age-related decline in cognitive function. Physical activity and exercise is one of the interventions that have recently drawn more attention.

As the aging population grows, the incidence of age-related cognitive disorders and interest in the role of physical activity and exercise in improving cognitive function of older people are increased (9). Yoga is referred to a set of physical exercises (Asanas), controlled breathing exercises (Pranayama) and relaxation and meditation exercises (Savasana) (10). According to the philosophy of yoga, mankind is rich in energy and happiness. Due to the constraints we create in our minds, we also create obstacles in the direction of these energies and cause illness and disorder in the body and mind. Yoga is a way to reach this source of internal energy, and therefore, this sport is one of the most important ways of preventing many diseases at this age (11). The close relationship between mind and body has long been clear, and yoga influences increasing quality of life and having general health by adjusting the cognitive, nervous, immune, and psychological systems, modulating the body's autonomic nervous system, increasing body resistance and physical stability, and modulating the immune system. Physical and breathing yoga exercises lead to muscle flexibility and strength and improve the function of the hormonal system, circulation and oxygen uptake. In addition, meditation and relaxation in the yoga stabilize the autonomic nervous system and, by controlling emotions, cause the person to feel healthy (12). Eyre et al. reported the improvement of memory function by examining the effect of yoga on memory in the elderly (13), and a study by Kasai et al. showed that Tai Chi improves the cognition of elderly women with mild cognitive impairment (14). Sharma et al. also reported the effect of yoga on cognitive improvement in depressed people (15). Irandoust also noted in his study that aerobic exercise and yoga had a positive effect on the overall memory and dynamic balance of elderly men (16). Given that very few studies have been conducted on the short-term effects of exercise on the memory of elderly people (17), most of the studies conducted abroad are in people with cognitive impairment and dementia, and in Iran, much of the research has been done on the impact of yoga exercise on the memory of age groups other than the elderly, and studies conducted on the elderly have investigated the effect of Pilates on memory, then the

purpose of this study was to investigate the effect of yoga exercise on memory of elderly women.

## Methods

### *Study design and participants*

The present experimental study is a randomized, controlled clinical trial conducted in 2018. Required sample size was calculated at 58 (29 in intervention group, 29 in control group) according to the study of Marandi et al. (18), 95% confidence interval, 80% power, minimum difference of 2 units, and 20% attrition. Two elderly day care centers of Yazd were selected and randomly assigned to control and intervention groups. Then, according to inclusion criteria, 29 eligible elderly were selected from each center and enrolled in the study. Participants in control group were matched by BMI, education level and marital status with the intervention group.

Inclusion criteria were age of over 60 years, no physical problems such as pelvic replacement, Parkinson's disease, vertigo to the extent that the person could not perform the exercises, lack of taking any hypnotic drug during the past month, and the approval of the trusted physician for performing yoga exercises. Exclusion criteria were suffering from cognitive problems (Alzheimer's disease), development of progressive physical and mental problems during the exercise program, sensory problem (deafness), mental problem (mental retardation), absence in more than three sessions of exercises and transfer to another day care center. All the participants in both group completed the exercise program without any attrition.

### *Instrument*

The measurement instrument in this study was the Wechsler Memory Scale designed for assessing memory and learning abilities in the people aged 16-89 years. The scale consists of seven subscales: 1- personal awareness of personal and daily issues. 2. knowledge of time and location (orientation); 3) mental control; 4) logical memory; 5) repeating the figures forward and backward; 6) visual memory; and 7) associative learning. The raw score of the respondent is obtained by adding the sum of the seven subscales to the correction factor of age and memory. The reliability of this scale has been reported to be 0.81 (16).

### *Intervention program*

The intervention group participated in an 8-week exercise program (three 1-h sessions a week) under the supervision of an experienced yoga instructor (yoga exercises: warm-up, tensile and rotational movements, physical and breathing movements, and relaxation). This program is based on the protocol of Janizadeh, Badami and Torkan (Table 1) (19). All selected yoga exercises were adjusted to the elderly so that our participants could perform.

**Table 1. Selected yoga practice in intervention program**

Selected yoga exercises	Exercise steps	Time (minute)	Selected yoga poses
Stretching and rotating joints	Body warm-up	20	Bending the toes and stretching the ankles, rotating the ankles, bending the elbows, rotating the knees, bending the knees, rotating the knees, lifting the legs, hand punching, rotating the shin, bending the wrists, rotating the wrists, rotating the shoulders, moving the neck, twisting the abdomen, Savasana, reverse Savasana, shin lock position, simple screw position, twist of spinal propulsion, hand grinder, canoe, cat position, hand lifting position, palm position, palm movement position, back rotation position, back stretch position
Asanas: (standing up, strengthening the muscles of the arms, sides, and legs) Pranayama: Easy (normal), abdominal (diaphragmatic), chest, and clavicular breathing, moon-sun	Physical and breathing movements	35	
Savasana: Meditation mode	Relaxation and meditation	5	

### *Ethical considerations*

The present study's protocol, after being approved by the Ethics Committee of Shahid Sadoughi University of Medical Sciences (IR.SSU.SPH.REC.1396.45), was also registered as IRCT20190103042225N1 in the Iranian Registry Clinical Trial. Necessary coordination with the Organization of Welfare were also made. Potential participants were selected in the day elderly care centers. The meeting with the participants was held and before the intervention, the purpose and procedure of the study were explained to them by the researcher. The participants were assured that all information obtained from this study would be kept confidential and provided informed written consent for voluntary participation in the study.

### *Data analysis*

Data were entered into the SPSS. Descriptive data were analyzed by central tendency and dispersion, and inferential data by paired t-test and Wilcoxon test. Significance level ( $p$ ) was considered  $< 0.05$ .

### **Results**

In this study, 58 elderly women from Yazd's elderly day care centers participated and were assigned to control ( $n: 29$ ) and intervention ( $n: 29$ ) groups, with a minimum age of 60 and a maximum age of 89 (mean:  $68.76 \pm 7.24$ ) years. Comparing the two groups after the intervention showed, the mean of memory before the intervention was  $77.7 \pm 17.8$  and after the intervention reached  $86.4 \pm 17.3$ , with a statistically significant difference ( $p < 0.05$ ), but in control group, no significant difference was observed. In the intervention group, mental memory subscales logical memory and visual memory significantly increased ( $p \leq 0.05$ ), but there was no significant difference in other subscales. There was no significant difference in any of the subscales in the control group (Table 2).

### **Discussion**

The purpose of this study was to investigate the effect of yoga exercises on memory of elderly women. As our study showed, the intervention group experienced significant changes in memory, mental control, logical and visual

memory after intervention compared to before the intervention. However, there were no significant changes in general memory, orientation, figures repeating and associative learning.

There are many discussions about how physical activity affects memory, and the underlying mechanisms of intervention have not yet been adequately elucidated, but it is assumed that these effects will occur along with certain changes in the body. Human research is limited for ethical reasons, but many animal studies have been done on the underlying physical and mental changes that have demonstrated increased brain volume, angiogenesis, neurogenesis, and synaptogenesis. Colcombe et al. investigated the effect of synaptogenesis (increased synapses and neurotransmitters) on the human brain, and observed aerobic exercise affected the volume of gray matter in the brain (20). Kramer et al. argued that even relatively short exercises could increase the gray area of the brain in the upper extremity of the frontal temporal lobe and prevents reduce the size of the brain in aging (21). Other studies on angiogenesis showed that blood capillaries and blood flow increased in the brain, especially in the hippocampus, as a result of physical activity. Investigations on light and heavy exercises in adults show that more active people have denser and greater number of blood capillaries in the brain, confirmed by Bullitt et al. (22).

Besides, in people aged 65 and over with only at least two days of physical activity at their leisure, a positive, significant correlation with delayed development of Alzheimer's disease was reported (23). According to researchers, physical activity causes delay in age-related memory loss (24). Evidence suggests that physical activity can improve mental and cognitive functions in a person and also play a more pronounced preventive role against decline in cognitive function (25, 26). In fact, it can be argued that yoga exercises in the present study enhanced the formation of the brain, prevented deterioration of and improved memory in our participants due to the physiological and neurological effects of physical activity on the nervous system of the brain, neurotransmitters and the cerebral circulation system. In addition, because exercise and physical activity, especially yoga, which is related to mind and mental relaxation, can reduce distresses and worries, it can also improve memory and enhance learning in them.

**Table 2. Comparison of mean scores of memory scale and its subscales in control and intervention groups before and after intervention**

Variable	Group	Before intervention		After intervention		p-value
		mean $\pm$ standard deviation	median (interquartile range)	mean $\pm$ standard deviation	median (interquartile range)	
<b>Personal awareness</b>	Control	3.2 $\pm$ 1.3	3 (2)	3.2 $\pm$ 1.6	3 (3)	0.6
	Intervention	3.4 $\pm$ 1.6	4 (2)	3.4 $\pm$ 1.5	4 (3)	0.9
<b>Orientation</b>	Control	4 $\pm$ 0.9	4 (2)	4.1 $\pm$ 1	4 (1)	0.6
	Intervention	3.8 $\pm$ 1.1	4 (2)	3.7 $\pm$ 1.1	4 (2)	0.7
<b>Mental control</b>	Control	4 $\pm$ 2.5	5 (4)	4.2 $\pm$ 2.5	4 (4)	0.5
	Intervention	2.9 $\pm$ 2.4	3 (4.5)	4.3 $\pm$ 2.2	4 (3.5)	0.00*
<b>Logical memory</b>	Control	4.3 $\pm$ 2.4	4.5 (3.8)	4.4 $\pm$ 2.4	4.5 (3)	0.8
	Intervention	4.2 $\pm$ 3	4.5 (4)	5.1 $\pm$ 2.3	5.5 (3.5)	0.01*
<b>Repeating figures</b>	Control	4.5 $\pm$ 3	6 (5.5)	4.8 $\pm$ 2.7	6 (5)	0.2
	Intervention	4.6 $\pm$ 3.1	4 (5)	5.3 $\pm$ 2.8	7 (4.5)	0.1
<b>Visual memory</b>	Control	4.1 $\pm$ 3.8	3 (7)	4 $\pm$ 3.2	3 (6)	0.5
	Intervention	4.1 $\pm$ 3.8	3 (8)	6.4 $\pm$ 3	6 (3.5)	0.00*
<b>Associative learning</b>	Control	11.3 $\pm$ 3.6	12 (4.5)	10.6 $\pm$ 3.1	11 (4.8)	0.09
	Intervention	10.5 $\pm$ 4.7	11 (8.3)	11.4 $\pm$ 4.4	11.5 (5.5)	0.2
<b>Memory</b>	Control	80.3 $\pm$ 15.8	79 (28)	79.9 $\pm$ 15.9	80 (29)	0.7
	Intervention	77.7 $\pm$ 17.8	74 (25)	86.4 $\pm$ 17.3	86 (23)	0.00*

\*  $p \leq 0.05$ 

Besides, in people aged 65 and over with only at least two days of physical activity at their leisure, a positive, significant correlation with delayed development of Alzheimer's disease was reported (23). According to researchers, physical activity causes delay in age-related memory loss (24). Evidence suggests that physical activity can improve mental and cognitive functions in a person and also play a more pronounced preventive role against decline in cognitive function (25, 26). In fact, it can be argued that yoga exercises in the present study enhanced the formation of the brain, prevented deterioration of and improved memory in our participants due to the physiological and neurological effects of physical activity on the nervous system of the brain, neurotransmitters and the cerebral circulation system. In addition, because exercise and physical activity, especially yoga, which is related to mind and mental relaxation, can reduce distresses and worries, it can also improve memory and enhance learning in them.

The results of this study are comparable to those of the study by Brenes et al. which reported the positive effect of yoga exercise on the memory of patients with mild cognitive impairment and dementia (27). A study by Eyre et al. examined the role of yoga in improving the memory of people over the age of 55, concluding that yoga interventions are useful for improving cognitive function in the elderly (13). The study of Joolaei et al. also suggested the positive effect of Pilates on the memory of the elderly (28). Brooks et al. in their study of aerobic exercise (cycling), on the students' long-term and short-term memory in ten minutes, observed there was no significant difference between the control and test groups. The difference in the type of participant, the type of aerobic activity, duration and measurement tool can explain the inconsistency in the findings of the present study and other studies (29).

## Conclusion

Elderly people are more predisposed to psychological problems due to the problems of this period. Attention should be directed to this age group. As it has been observed, most researches in the field of exercise, physical activity and memory of elderly people have shown positive effects as in the current study, yoga had a positive effect in improving the memory of the elderly. Therefore, it can be a good idea that the elderly, as a group at day care centers and even at home individually, do these exercises as one of the non-pharmacological psychological approaches, along with other methods, to reduce mental health problems.

## Study limitations

Some of the limitations of this study include lack of access to men because all the participants were from women's elderly day care centers. The study was conducted only in two elderly day care centers in Yazd, and it was not possible to randomize each participant. It is necessary to consider the above considerations in applying the results.

## Conflict of interest

The authors of this article declare no conflicts of interest.

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### Authors' contributions

All authors contributed to the design of the study; SB collected the data; AD analyzed the data; SB drafted the manuscript; AAV reviewed the draft; and all authors read and approved the final version of the manuscript.

### References

- Potter P, Perry G. Basic nursing: theory and practice. 7th ed. Philadelphia: Mosby; 2007.
- Chen J-F. Adenosine receptor control of cognition in normal and disease. *International Review of Neurobiology*. 2014; 119: 257-307.
- Sexton CE, Walhovd KB, Storsve AB, Tamnes CK, Westlye LT, Johansen-Berg H, et al. Accelerated changes in white matter microstructure during aging: a longitudinal diffusion tensor imaging study. *The Journal of Neuroscience*. 2014; 34(46): 15425-36.
- Pressley JC, Trott C, Tang M, Durkin M, Stern Y. Dementia in community-dwelling elderly patients: A comparison of survey data, medicare claims, cognitive screening, reported symptoms, and activity limitations. *Journal of Clinical Epidemiology*. 2003; 56(9): 896-905.
- Farina N, Isaac MG, Clark AR, Rusted J, Tabet N. Vitamin E for Alzheimer's dementia and mild cognitive impairment. *The Cochrane Database of Systematic Reviews*. 2012; 11: 1-31.
- Simon SS, Cordás TA, Bottino CM. Cognitive behavioral therapies in older adults with depression and cognitive deficits: a systematic review. *International Journal of Geriatric Psychiatry*. 2015; 30(3): 223-33.
- Barnes DE, Yaffe K, Belfor N, Jagust WJ, DeCarli C, Reed BR, et al. Computer-based cognitive training for mild cognitive impairment: results from a pilot randomized, controlled trial. *Alzheimer Disease and Associated Disorders*. 2009; 23(3): 205-10.
- Kelly ME, Loughrey D, Lawlor BA, Robertson IH, Walsh C, Brennan S. The impact of exercise on the cognitive functioning of healthy older adults: a systematic review and meta-analysis. *Ageing Research Reviews*. 2014; 16: 12-31.
- Monteiro-Junior RS, da Silva Figueiredo LF, Maciel-Pinheiro PT, Abud ELR, Braga AEMM, Barca ML, et al. Acute effects of exergames on cognitive function of institutionalized older persons: a single-blinded, randomized and controlled pilot study. *Ageing Clinical and Experimental Research*. 2017; 29(3): 387-94.
- Villien F, Yu M, Barthélémy P, Jammes Y. Training to yoga respiration selectively increases respiratory sensation in healthy man. *Respiratory Physiology & Neurobiology*. 2005; 146(1): 85-96.
- Khalsa SBS. Treatment of chronic insomnia with yoga: a preliminary study with sleep-wake diaries. *Applied Psychophysiology and Biofeedback*. 2004; 29(4): 269-78.
- Parshad O. Role of yoga in stress management. *The West Indian Medical Journal*. 2004; 53(3): 191-4.
- Eyre HA, Acevedo B, Yang H, Siddarth P, Van Dyk K, Ercoli L, et al. Changes in neural connectivity and memory following a yoga intervention for older adults: a pilot study. *Journal of Alzheimer's Disease*. 2016; 52(2): 673-84.
- Kasai JYT, Busse AL, Magaldi RM, Soci MA, Rosa PDM, Curiati JAE, et al. Effects of Tai Chi Chuan on cognition of elderly women with mild cognitive impairment. *Einstein (São Paulo)*. 2010; 8(1): 40-5.
- Sharma V, Das S, Mondal S, Goswami U, Gandhi A. Effect of Sahaj Yoga on neuro-cognitive functions in patients suffering from major depression. *Indian Journal of Physiology and Pharmacology*. 2005; 50(4): 375-83.
- Irاندoust K, Taheri M, Seghatoleslami A. Comparing the effectiveness of water-based exercises and Yoga on memory and dynamic balance of elder people. *Development and Motor Learning*. 2015; 6(4): 463-73. [Persian]
- Hsieh S-S, Chang Y-K, Hung T-M, Fang C-L. The effects of acute resistance exercise on young and older males' working memory. *Psychology of Sport and Exercise*. 2016; 22: 286-93.
- Marandi SM, Rezayat F, Esfarjani F, Rezaei Z. The effect of "Tai Chi" exercise on depression, quality of sleep and some of physiological factors in elderly, living in Nursing Home. *Scientific Journals Management system*. 2013; 11(5): 51-61. [Persian]
- Janizadeh E, Badami R, Torkan A. A comparison of the effectiveness of yoga and lavender on symptoms of depression in elderly women. *Journal of Research in Behavioural Sciences*. 2016; 14(4): 421-7. [Persian]
- Colcombe SJ, Erickson KI, Raz N, Webb AG, Cohen NJ, McAuley E, et al. Aerobic fitness reduces brain tissue loss in aging humans. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*. 2003; 58(2): 176-80.
- Kramer AF, Erickson KI, Colcombe SJ. Exercise, cognition, and the aging brain. *Journal of Applied Physiology*. 2006; 101(4): 1237-42.
- Bullitt E, Rahman F, Smith J, Kim E, Zeng D, Katz L, et al. The effect of exercise on the cerebral vasculature of healthy aged subjects as visualized by MR angiography. *American Journal of Neuroradiology*. 2009; 30(10): 1857-63.
- Stroth S, Hille K, Spitzer M, Reinhardt R. Aerobic endurance exercise benefits memory and affect in young adults. *Neuropsychological Rehabilitation*. 2009; 19(2): 223-43.
- Laurin D, Verreault R, Lindsay J, MacPherson K, Rockwood K. Physical activity and risk of cognitive impairment and dementia in elderly persons. *Archives of Neurology*. 2001; 58(3): 498-504.
- Liu-Ambrose T, Nagamatsu LS, Graf P, Beattie BL, Ashe MC, Handy TC. Resistance training and executive functions: a 12-month randomized controlled trial. *Archives of Internal Medicine*. 2010; 170(2): 170-8.

26. Erickson KL, Kramer AF. Aerobic exercise effects on cognitive and neural plasticity in older adults. *British Journal of Sports Medicine*. 2009; 43(1): 22-4.

27. Brenes GA, Sohl S, Wells RE, Befus D, Campos CL, Danhauer SC. The Effects of Yoga on Patients with Mild Cognitive Impairment and Dementia: A Scoping Review. *The American Journal of Geriatric Psychiatry*. 2018; 27(2): 188-97.

28. Joolaei N, Bagherli J, Sanatkaran A. The effects of regular pilates exercise on long-term and short-term memory of the elderly. *Journal of Aging Psychology*. 2017; 3(2): 147-57. [Persian]

29. Brooks H, Landry K, Malas K, Rihal N, Umhoefer H. The Effects of Moderate Aerobic Activity on Short-Term and Long-Term Memory. *Journal of Arts & Social Sciences*. 2015;20(1):1-16.