

The Effect of Brain Gym Exercises on Cognition among Geriatrics

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Abstract:

Background: Aging is a natural phenomenon which occurs at physical and cognitive level. Changes in cognition related to aging vary considerably among individuals and across domains of cognition. Brain Gym exercises are a simple series of exercises that can help the brain function better. **Methodology:** Study had 40 participants aged 65-75 years staying in PCMC and were divided in two groups. Group A did conventional exercises while Group B did Brain Gym exercises. Both groups took 6 weeks of intervention twice a week. Addenbrooke's cognitive assessment scale- ACE III and Cognitive timed up and go test were outcome measures used to assess cognition and cognitive dual task ability respectively. **Results:** ACE III Scale had difference in the pre and post measures between both the groups. The P value in ACE III Scale of Group A is 0.16 and that of Group B is 0.000. The P value in Cognitive timed up and Go test in Group A is 0.000 and that of Group B is 0.017. **Conclusion:** Six weeks of Brain Gym Exercises improves cognition among the elderly but not the cognitive dual task.

Key words: Aging, Cognition, Brain Gym, Cognitive dual task, ACE III, Timed up and Go

Introduction:

Physiological changes at cognitive level with aging is a natural phenomenon. Environmental factors and lifestyle influence the process of aging alongside with functional changes due to biological effect. The elderly experiences decrease in amount of physical and social activities because of these physiological and cognitive changes. Generally, decrease in physical strength begins to emerge as one gets old which may lead to falling, fatigue and decreased motor skill. In short, as physical strength is attached to the daily life performances of the elderly and plays an important role in onset of degenerative nervous disorders- Dementia, Alzheimer's bringing the need of exercise to the forefront to unravel health issues related to physical health and brain.[1]

Cognition is the process of identifying, selecting, interpreting, filtering, and using information that makes sense. The cognitive function itself is a conscious mental activity such as thinking, remembering, learning and using language.

Decreased cognitive function in the elderly such as often forgetting time, place, daily activities are often considered as a normal condition. This deterioration of cognitive function affects the quality of life in elderly population.[2]

Changes in cognition related to aging vary considerably among individuals and across domains of cognition. By their 6th decade, the majority experiences a decline in processing speed and working memory. Awareness of normal changes in an aging population is helpful when assessing patients concerned about memory. In general, an individual ability to keep attention to a single task is preserved into late life. Cognitive impairment and dementia are some of the major health concerns in the aging population.[3]

Awareness of normal changes is an aging population is helpful when assessing patients concerned about their memory. In general, an individual's ability to keep up attention to a single task is preserved into late life.

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Ability to perform tasks requiring divided attention or attention-switching tends to reduce. This has implications for driving, given the requirement to constantly switch one's attention in response to the environment and also the ability to sort relevant from irrelevant information.

Remote memory, Long Term Memory (factual information), and procedural memory (knowledge of skills and procedures) tend to stay intact with aging. Remembering (simple maintenance of data over a brief period of time) shows little change with aging. However, memory, which requires the manipulation of information in remembering, declines.

Exercise improves cardiovascular health and increases level of neurotrophic factor which improves brain health and results in better cognitive performance. Exercise prevent and reduces the chance of developing secondary conditions that arise from functional decline and physical disuse.[4]

Many studies showed positive effects of physical exercise in delaying or preventing conditions like dementia. Brain Gym exercises is a structured aerobic exercise involving head, eyes, and crossing movements of the extremities in order to stimulate both brain hemispheres. Donna Adriani *et al.* suggested that brain gym exercise sessions significantly increase plasma BDNF levels (Brain derived neurotrophic factor) in the elderly population.[5]

Brain Gym exercises are a simple series of exercises that can help the brain function better, making one sharper, smarter and confident. Brain Gym comprises very easy body movements which have been designed to coax the two hemispheres in brain to work in synchronization. Brain exercise aims to increase self-confidence, strengthen learning motivation, stimulate the left and right brain, relax the brain, and can improve cognitive function.[6]

Apparently, when the brain becomes balanced, our whole body responds, revitalizing the natural healing mechanism, restoring health and harmony. The average trajectory of cognitive ability over the last three to four decades of life is one of the most accelerating declines. Brain gym exercises is said to improve the executive functions which boosts the confidence and helps improve daily life in the elderly.[7]

This study will help to understand if this form of exercise helps to maintain or increase the cognitive function of the elderly. This will help in creating an exercise program as an effort to supply helpful program for improvement of cognitive function necessary for daily activities.

By 2050, the worlds geriatric population will rise to about 20%. The current population of geriatrics in India according to the 2011 census is about 8.6%. People ageing around the world is increasing dramatically. While France had about 150 years to adapt to a change from 10% to 20% countries like India have slightly more than 20 years to adapt to this change.[4-8] Thus, this study will prove beneficial to the society as a whole.

Thus, this study fetches an answer to whether brain gym exercises have an effect on cognitive function in elderly.

Methodology:

The study was conducted in PCMC area. 40 participants aged between 65 -75 years took part in study. Purposive sampling was done and study was conducted for 6 weeks. Participants who could ambulate without any assistive device and had diabetes and hypertension under control were the part of the study. Individuals who presented with any co morbidities or any acute illness that would affect training were excluded from the study. Also, the participants who had previously participated in Brain Gym sessions or took part in any other physical exercise or memory training program were excluded from the study.

Procedure:

Approval was obtained from ethical committee after which screening for subjects was done. The subjects were made to understand the purpose and outcome through the study. All their queries were answered. A well-informed consent for willingness to participate in the study was taken. 45 participants were screened for inclusion and exclusion criteria, of them 40 participants were divided into 2 groups of 20 participants each. The participants Group A was control group, it consisted of 7 male and 13 female with mean age of 69 ± 2.68 . Group B was Experimental group consisted of 11 male and 9 female with mean age of 67.1 ± 2.62 .

The exercise session for both the groups started with warm up and ended with cool down exercises. Group A was given conventional exercises and Group B was given Brain Gym Exercise Protocol. Warm up and cool down for both the groups were same. The sessions were conducted twice a week with a time duration of 30 minutes per session

Outcome measures were taken pre and post intervention in both groups.

WARM UP – Included of Walking in different directions, walking with long deliberate steps and walking with small deliberate steps, walking while raising knees and active joint movements.

COOL DOWN – consisted of general stretching exercises.

Group A was given conventional exercises and Group B was given Brain Gym Exercise Protocol. Warm up and cool down for both the groups were same.

GROUP A: Conventional Exercises:[6]

- A.Low impact aerobic exercise: Subjects were asked to perform low impact aerobic exercises.
- B.Bouncing A ball while activity: Subject were asked to bounce a ball while walking.
- C.Throwing a ball in the air while walking activity: Subjects were asked to throw a ball in air under supervision along with walking activity.
- D.Walking between cones in zig zag manner: Subjects were asked to walk in a zig-zag manner under supervision.
- E.Mild Jogging between cones: Cones were placed on the floor and mild jogging was performed by the participants.[6]

GROUP B: Brain Gym Exercises were as follows: [3, 6]

- A.Cross lateral walking in space: Place both your hands in front of you. Make 'L' shape along with your thumb and also the index finger. Join the thumb of one hand to the index finger of the other and the other way around. Now, keep on joining the fingers in the upward direction. Start slowly then increase speed as session's proceeds.
- B.Belly Breathing: Place your hands on your abdomen. Exhale through your mouth in short little puffs, as if you keeping a feather in the air, until your lungs feel empty. Now, inhale deeply, filling yourself sort of a balloon beneath your hand. Then slowly and fully exhale. Repeat deep breaths, establishing a natural rhythm, during the course of three or more breaths.
- C.The Calf Pump: Stand arm's length aloof from a

wall and place your hands shoulder width apart against it. Extend your left leg straight out behind you, that the ball of your foot is on the ground and your heel is off the ground. Your body is slanted at a 45-degree angle. Exhale while leaning forward against the wall, while also bending the right knee and pressing your left heel against the ground. Inhale and raise yourself back up, while raising the left heel. Repeat three or more times. Then alternate to the opposite leg and repeat.

- D.Earth Buttons: Rest 2 fingers of one hand under your lower lip. Place the heel of the opposite hand on your navel together with your finger pointing downwards. Breathe deeply as you observe the floor. Move only your eyes, looking gradually from the ground to the ceiling, then down again. Repeat this for three or more breaths, as the entire body and eyes relax. This helps in stimulating the brain and relieves mental fatigue. It also helps to boost your ability to target on near objects.
- E.The Grounder: Stand together with your legs a bit but less than one leg-length apart. Point your left foot straight prior to you: point your right foot towards the right. Now bending your right knee as you exhale, keep the left knee straight. Your body should face squarely to the front. Do the movement over three or more complete breaths, then repeat facing the alternative directions.
- F.Lazy Eights: Extend one arm straight out in front of you with the thumb pointing towards the ceiling. In the air, smoothly and slowly trace the form of an outsized figure of 8 on its side. As you draw the eight, concentrate your eyes on the thumb, keeping your head upright, face forward and moving only slightly. Start tracing your eight beginning at your eye level. Move your arm up and over to the left, around and back to centre, then to the other side.
- G.Neck Rolls: While breathing in deeply, relax your shoulders and drop your head forward. Close your eyes while slowly and simply rolling your head from side to side. At any point of tension, relax your head while making small circles along with your nose and breathing fully. Do three or more complete sets.
- H.Positive Points: Above the centre of each eyebrow and halfway to the hairline, you may find a small indentation. Lightly place 3 fingers of both hands on each of these indentations. Close your eyes and hold the points lightly, pulling the forehead slightly taught, during the course of six to ten complete breaths.

I. Space Buttons: Rest two fingers above your upper lip. Place your other hand, pointing downward, on your lower back, together with your fingertips touching the tailbone. Breathe deeply as you look towards the ceiling. Gradually lower your gaze to the ground, then 20 look up at the ceiling again. Repeat three or more times as your eyes and also the remainder of your body relaxes.



Step Up & Down



Obstacle walking



Jogging



Bouncing a ball while

Results:

Table 1: Pre and Post mean values and standard deviations of Outcome measures in group A and group B.

Outcome measures	Group	Pre-intervention	Post intervention	Testused	p Value
ACE III	A	88.2 ± 1.91	87.6 ± 1.46	WST	0.16
	B	88.35 ± 1.38	93.25 ± 0.94	WST	0.000
COGNITIVE TUG	A	13.2 ± 1.20	12.55 ± 1.35	WST	0.000
	B	13 ± 1.92	12.45 ± 1.46	WST	0.017
		Difference of Mean			
ACE III	A	1.5 ± 1	-	MWT	0.000
	B	4.9 ± 1.13	-	MWT	
COGNITIVE TUG	A	0.65 ± 0.7	-	MWT	0.26
	B	0.9 ± 0.53	-	MWT	

* WST = Wilcoxon Signed Rank Test, *MWT = Mann-Whitney Rank Sum Test

Discussion:

The purpose of the study was to compare Traditional exercises and Brain Gym Exercises among elderly.

The table.1 show the pre and post results of the effect of conventional exercises and brain gym exercises within the group. The Wilcoxon Signed Test was applied. With the ACE III Scale in Group A, the data was not statistically significant while in Group B, the data is highly significant. With the cognitive timed up and go test in Group A as well as in Group B the data is not statistically significant.

From the data give in Table 1, we found out that cognition assessed through ACE III Scale had differences in the pre and post measures between both the groups. The mean of score in ACE III Scale of Group A pre and post are as follows: 88.2 ± 1.91 and 87.6 ± 1.46 while that of Group B pre and post are 88.35 ± 1.38 and 93.25 ± 0.94. Clinically the Brain Gym Exercises group performed better in the ACE III Scale. It was seen that cognition showed significant increase post intervention in the Brian Gym Exercises group. This positive effect of exercise on cognition has been related to an increment of hippocampal volume (a structure which is sensitive to exercise induced change via neurogenesis and cell proliferation) and level of Brain derived neurotrophic factor (involved in cell growth and survival and memory promotion).[9] The regular performance of Brain Gym exercises results in stimulation and integration of different parts of the brain, especially the corpus callosum, which in the long term, makes communication between the two hemispheres faster and in a more integrated form for high level reasoning (Dennison, 1985).[9]

Apparently when the brain becomes balanced, our whole body responds, revitalising the natural healing mechanism, restoring health and harmony. We used the cognitive time up and go test to measure the effect of training on dual task. From the data given in Table 3, we found out that the cognitive training did not have a significant effect on the dual task scores of both the groups. The cognitive training groups also showed improvements in cognitive performance during the dual-task test, however improved performance only reached significance after the complete 12-week intervention, and the size of the improvements were less than half the size in each condition than that found in the combined exercise and cognition training group (David A. Reichlen, 2020).[10, 11]

This study could help us explain why the effect of cognition on dual task was not significant after 6 weeks of training. This is why there was no effect in our study on dual task. The differences could have appeared with longer training sessions, increased frequency and longer duration of study. The effect of Brain Gym Exercises on cognition was found to be significant (From the data given in Table 4). A study by Sidiarto *et al* concluded that mentally healthy older populations may experience 28 significant improvements in different cognitive functions after the Brain Gym practice.[12] Drabben Thiemann *et al.* (2002)[13] reported beneficial effects of using Brain Gym on people who had been diagnosed with dementia, and Yagüez *et al.* (2011) [14] found that there were significant improvements in sustained attention and visual memory in people with Alzheimer's type dementia after applying this therapy. Also, another study found benefits of applying the brain gym exercise program once per week for only 6 weeks in healthy elderly individuals.[14] Some studies suggest the use of physical training along with brain gym exercises to improve cognition in the elderly.

This study suggests that brain gym for 10 minutes and physical activity with the frequency of three times a week affects in improving the quality of life in the elderly. Neva J. K., *et al*[13] 2014 in their study concluded that exercise programs that are structured, individualized, higher intensity, longer

duration, and multicomponent show promising results for preserving cognitive performance in older adults. This area should be studied to find out if physical training along with brain gym exercises has more significant improvement in the cognition of the elderly than just with brain gym exercises. Considering the Cognitive Time Up and Go scale, the difference in the pre and post values within the groups gave the following results: Group A had the mean score of 0.65 ± 0.57 and B had the mean score of 0.9 ± 0.53 . With the *p* value of 0.26, this data accepts the null hypothesis that none of the groups had significant changes in the Cognition with the values obtained by the Cognitive Time Up and Go Test. Dual Task training improves cognition significantly in the elderly, this has been recorded by various studies. Another study concludes that Dual-task interventions improved both balance performance and working memory, but more so if cognitive performance was specifically trained along with resistance training.[15]

Many studies report an improvement in the cognitive function by dual task training in elderly even with those with neurodegenerative disorders.[16-19] Another study concluded that that motor control in aging is influenced by executive control and have implications for theories of cognitive training and transfer, results in the training group showed significant improvements in body sway during single-support balance and centre of gravity alignment during double-support dynamic balance.[20] Researches on effect of exercise training on elderly persons with cognitive impairment and dementia also suggests that exercise training increases physical function, cognitive function and positive behaviour.[21]

Thus, Brain Gym exercises Improves self-awareness, situational insight, clarity of thought, impulse control and improved general physical coordination. It improves the provision of oxygen to the whole body. It relaxes the central nervous system and increases your energy levels. It can help improve the reading and speaking abilities. Improves concentration, attention, comprehension and allows you to affix in activities more fully.

This increases comprehension, immediate memory, self-expression and organisational skills. This integrates both visual fields, improves balance and co-ordination. Many people report better vision after this exercise. Enhances breathing and relaxation of vocal cords (for more resonant speech).[23-26] Helps every kind of verbalising or thinking. It also points disperses the “fight or flight” reflex. Touching these points allows more rational response to stressful situations. Holding these points helps to improve attention, focus, motivation and intuition for decision making.[27-30]

In a nutshell, Brain Gym Exercises improves the cognitive function in the elderly. It is also effective in elderly with cognitive disorder. A lot of work is still going on in this field. The ultimate mechanism may be increment in the hippocampal volume and level of brain derived neurotrophic factor resulting in enhancement of the cognitive function. Hence, it is clear that Brain Gym Exercises is an innovative, feasible, safe, promising, patient directed treatment which can prove to be an important adjunct in preventing the cognitive decline in the elderly.

Conclusion:

The study concludes that six weeks of Brain Gym Exercises improves cognition among the elderly but not the cognitive dual task.

Clinical implications:

This study can be used to create awareness among the geriatrics about the possible benefits of Brain Gym Exercises in the daily regime in elderly individuals thus improving the cognition.

This study can also be used in planning a programme from late adulthood itself so that cognitive impairments can be prevented in later life, thereby improving the quality of life of the elderly.

Conflict of Interest: None

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