

## THE IMPACT OF BRAIN VITALITY GYM ON COGNITIVE PERFORMANCE AND FITNESS LEVEL IN OLDER ADULTS WITH DEMENTIA: A PRELIMINARY STUDY

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### Abstract

Dementia is a common disease caused by decreases in memory and cognitive functions that could impact the quality of life of the elderly. This experiment aims to demonstrate and evaluate effects of the Brain Vitality Gym (BVG) training program for older adults with dementia. Nine elderly participants aged over 60 years with mild dementia are recruited to participate in the study. The training is held for a month and administered three times a week with 45-60 minutes each session. The participants' cognitive functions and physical fitness were assessed and tested using the Mini-Mental Status Examination (called by MMSE) and the 8-foot up-and-go (8FUGT) test. The MMSE is used to measure attention and memory functions, whereas the 8FUGT test is used to measure agility. The data are analysed using GraphPad Prism 8.0.2. After a month of BVG treatment, the results indicate an increase of MMSE and 8FUGT scores significantly among the participants. The BVG significantly improves the participant's cognitive performance and fitness levels. The findings suggest that BVG has a positive impact on improving cognitive performance and fitness in older adults with dementia.

Keywords: Brain vitality gym, Dementia, Fitness, Older adults.

## 1. Introduction

Globally, around 50 million people have dementia, with approximately 60% living in low- and middle-income countries (LMIC). The incidence of dementia in the world is predicted to reach 82 million in 2030 and 152 million in 2050, of which 60% is suffered by residents of third world countries [1, 2]. It has a massive impact on the individual and the community because it reduces the quality of life of elderly individuals [3]. While body functions are essential for the elderly in doing activities of daily life (ADL) [4], older adults diagnosed with dementia symptoms have problems performing daily tasks and making them unable to continue to live independently longer without treatments [5, 6]. Dementia affects the mobility, gait, endurance, strength, and balance of the lower extremities (body functions and body structure) of the patients [7].

Although dementia cannot be cured, the consequences can be controlled [8]. Various strategies to prevent early dementia have been investigated. Lifestyle modifications, such as exercise, diet, stress management, and immunomodulatory therapy, have been shown to reduce the risk of dementia [9]. Studies in groups of older adults and individuals with cognitive impairments experienced cognitive function improvements after undergoing programmed physical exercise [10, 11]. Physical activity is a sequence of systematic movements carried out for a specific purpose, where muscle activity can impact circulation adaptation and the integration of neurons that can influence cognition [12]. For example, aerobic and resistance exercises provide a beneficial effect on cognition [11, 13]. Effects of cognitive improvement after exercise programmed allegedly associated with increased levels of Brain-derived Neurotrophic Factor (BDNF) and hippocampal volume in the brain. BDNF is considered important in regulating synaptic plasticity, neurogenesis, and neuron survival. The Hippocampal structure is sensitive to changes caused by exercise through neurogenesis and cell proliferation [14].

Besides, aerobic exercise in the elderly can improve brain health by decreasing brain tissue damage and increased brain volume. When aerobic exercise is given simultaneously as the brain gym, it will have a more optimal effect [15]. Currently, studies about the relationship between aerobic exercise with improvements in cognitive function are still limited. Therefore, an investigation is needed to evaluate the effect of exercise in older adults with dementia.

This study investigates the Brain Vitality Gym (BVG) training program impact on the elder with dementia in term of their cognitive function, coordination, and agility.

## 2. Methodology

This study employs a quasi-experimental pre-post experimental non-randomized controlled design. It uses the 8 Foot Up-and-Go Test (FUGT) [16]. Participants undergo brain vitality gym (BVG) training three times a week for a month.

### 2.1. Ethics statement

This study follows the guidelines based on reference provided by the Helsinki Statement regarding the use of biomedical research for humans (18th Medical Assembly, 1964; revised 1983 in Italy and 1989 in Hong Kong) at the international level, and the Arrangement for Preservation of Human Rights and Dignity

concerning Biological and Medical Applications (IR1999; B.O.E. 251, 1999) at the national level. The ethics committee approves study No. 070/1534/V-2019/BPKP, and written informed consent is provided by all participants.

## **2.1. Participants**

Participants are older adults with dementia who live in the community. The inclusion criteria are older adults over 60 years old categorized with mild cognitive impairment (score between 18-23 based on the Mini-Mental Status Examination (MMSE)) and independent ambulation. Adults having any comorbidities or acute illnesses and previously participated in similar training sessions, physical exercises, or memory training programs are excluded. From eighty participants, only nine elderly participants are selected based on the inclusion criteria.

## **2.2. Procedure**

Participants were explained about the purpose of the study and signed informed consent for those who agreed. Participants' demographic data, including age, gender, weight, height, and test results, were recorded. Before the pre-test, we perform a warm-up with the participants.

## **2.3. 8-Foot-and-go-test (8FUGT)**

The equipment required is a stopwatch, straight back or folding chair (about 17 inches/44 cm high), cone marker, measuring tape, and area clear of obstacles.

The test was done by placing the chair in position of next to a wall (for safety), and we put the marker 8 feet from the chair. The path between the chair and the tag must be clear. The subject starts in fully seated, hands resting on the knees and feet flat on the ground. The timing was begun when the command "Go" was given. Then, the subject must stand and walk (with no running) as quickly as possible (and safely) to and around the cone and returns to the chair to sit down. The timing was stopped when the subject had been sat. The test was performed twice for each subject.

For scoring, we took participants' best time taken of the two trails to the nearest 1/10th second and the data was recorded.

## **2.4. Mini-mental status examination (MMSE)**

As for the MMSE, we ask the participants to answer some questions or to do some activities. The one-point score is given if the participants could answer a question correctly or perform an activity appropriately. The score interpretation is based on severity, namely severe cognitive impairment (with score of 0-17); mild cognitive impairment (with score of 18-23); and no cognitive impairment (with score of 24-30) [17].

## **2.5. Statistical analysis**

The data was analysed by Wilcoxon matched-pairs signed-rank test supported using a software (GraphPad Prism 8.0.2).

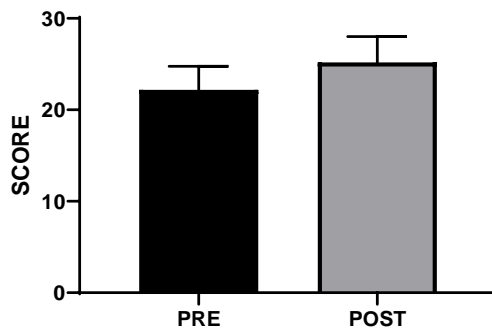
**3. Results and Discussions**

Based on MMSE screening, nine people are categorized as having a mild cognitive impairment (score between 18-23). The nine participants are observed during the period of assessment. The participants' characteristics are presented in Table 1.

**Table 1. Characteristic of the participants with mild dementia.**

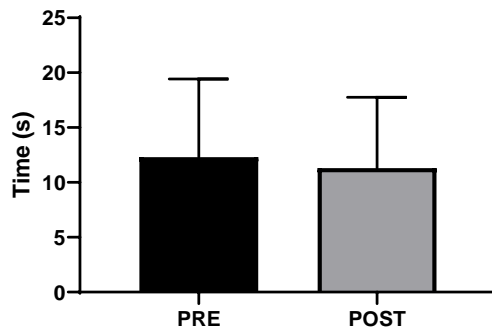
Age	Male	Female
60-69	1	3
70-79	1	3
80-89	-	1
MMSE score	21 ± 2.828	21.714 ± 1.496

From Table 1, It is found that the participants are seven females and two males with an average MMSE score of 21±2.828 in males and 21,714±1,496 in females. As seen in Fig.1, there is a significant increase in MMSE scores of participants before and after the BVG is given (p-value = 0.0313).



**Fig. 1. The MMSE score rate, before and after giving 12-times-BVG treatment.**

Likewise, in the results of 8FUGT, the data shows in Fig. 2. The value of p = 0.0938 indicates that the scores of 8FUGT increase significantly among the participants after one-month BVG treatment is given.



**Fig. 2. The average score of 8FUGT, before and after given 12-times-BVG treatment.**

#### **4. Discussion**

The experimental results indicate that the brain vitality gym affects cognitive function seen from the value of MMSE in the elderly who have mild cognitive impairment. This result has in line with the theory about physical activity that positively influences cognitive function in adults. The improvement indicated by some parameters, i.e., simple reaction time, working memory, and response accuracy [18, 19]. Physical exercise can also help individuals with moderate cognitive impairment and delay progression to dementia by improving verbal and spatial memory [20].

Another study using Aerobic and Cognitive Exercise (ACES) for six months has shown positive changes in cognitive function [21]. A recent meta-analysis shows that dementia patients who do aerobic exercise specifically or in combination with non-aerobic exercise are proven to have improved cognitive abilities and functions [22]. Another study suggested that a physical activity program can slow down cognitive decline and improve walking quality in older adults with dementia [23]. Regular physical activity may represent a potential and important protective factor in preventing dementia and cognitive decline in the elderly [24].

There was a substantial effect in older adults with severe cognitive impairment who did long-term consistent aerobic exercise demonstrated through increased functional mobility, cognitive function, and behaviour [14]. However, differences in individuals who experience cognitive decline in the elderly imply that damage to the brain area and cognitive function is common in the ageing process [25]. A review conducted by Park and Cohen [13] shows that providing exercise programs for older adults with dementia is beneficial for functional improvements in individuals' quality of life, including overall cognitive function and behavioural and psychological symptoms. Positive results of exercise interventions on cognitive abilities are often accompanied by increased individual activities in their daily lives.

8FUGT is a type of tests in the Senior Fitness Test which aims to measure and test agility, speed and balance while moving, especially in older adults [26, 27]. A recent study shows a significant improvement in agility using 8FUGT in older people with mild cognitive impairment. Falls are often experienced by the elderly due to poor balance. One of the precautions that can be taken to reduce or prevent falls is through physiotherapy. Dementia itself alters mobility, endurance, strength, and balance of the lower extremities (bodily functions and body structure). The body functions are essential for the elderly in doing activities in daily life (ADL).

Disruption of these functions ultimately results in decreasing quality of life and level of participation. Although dementia cannot be cured, the consequences can be controlled [8]. Programmed training is expected to positively affect mobility, lower extremity strength, balance, and endurance to improve ADL performance in older people with dementia. Other studies reveal that exercise can treat mild to moderate depression and its response in primary therapy, such as antidepressant drugs and cognitive behavioural therapy [28]. Several studies have proven that exercise is beneficial for various chronic diseases [29]. Under these conditions, physical activity can transform the chronic pro-inflammatory state to an anti-inflammatory state in both the peripheral and central nervous system at the molecular level [30, 31].

## 5. Conclusions

This study provides new hope for preventing cognitive decline in older adults with dementia. Through an active ageing program, doing BVG exercise regularly has shown to positively impact both cognitive improvement and fitness levels of older adults, particularly in terms of cognitive function and agility. By participating in this program, it is expected that elderly dementia may experience improvement in their quality of life. Furthermore, these findings can develop a more productive brain vitality exercise model to improve brain performance in older adults, especially those with decreased cognitive function.

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