

# Effect of a dual task exercise program on physical fitness in people with dementia

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## ABSTRACT

### Background:

Older people experience a progressive loss of cognitive and physiological functions, comprehending cognitive impairments and loss of functional motricity. It is estimated that by 2050 the number of people with dementia will reach 131.5 million worldwide. Apart from deficits in cognition and behaviour, people with dementia are at increased deficits in balance, gait, and movement coordination, leading to an elevated risk of falls. Exercise improves cognitive and physical functions and is an important contributor to functional independence. The aim of this study was to determine the effect of a tailored dual task exercise program in physical fitness of people with dementia.

### Methods:

The cross-sectional study included older people  $\geq 65$  years of age. 36 nursing home residents (mean 79.36 years) from both genders participated in this study; all participants have mild cognitive impairment according to the Mini Mental State Examination. All participants were offered a six-month, individually tailored exercise program. Physical fitness was evaluated at the beginning and end of the trial, using the Rikli & Jones Test. Statistical analyses were conducted with the statistical software SPSS.

### Results:

A general improvement in all tests from the pre-test to the post-test was found. Significant differences were found to dynamic balance test, superior strength, flexion of arms, sitting and walk 2.44m and flexibility test ( $P < 0.05$ ).

### Conclusion:

This trial of a tailored dual task exercise intervention presents preliminary evidence that this intervention can improve physical fitness in older people with dementia, which can decrease the prevalence of falls, a very common accident among this population.

Keywords: Mild Cognitive Impairment, Physical Fitness, Aging, Rikli & Jones Test.

## INTRODUCTION

Physical fitness is closely related to health-related quality of life among older people with dementia (Hesseberg, Bergland, Rydwick, & Brovold, 2016), since it is essential to carry out daily task, to participate social life and to live autonomously (Donnezan, Perrot, Belleville, Bloch & Kemoun, 2018). Prevention of decline in physical fitness is important since it is related to older person's independence and wellbeing. However, aging brings chronic diseases, cognitive impairment/dementia and hospitalization which have direct impact on physical fitness and ability to stay active (Hesseberg et al., 2016). Cognitive impairment/dementia may be associated with lower levels of physical fitness and become a serious threat to older people's independence and quality of life (Bárrios, Narciso, Guerreiro, Maroco, Logsdon & de Mendonça, 2013; Hesseberg et al., 2016; Pettersson, Olsson, & Wahlund, 2005).

Dementia is characterized by cognitive impairment that affects the ability to process thinking, generating learning and memory problems; dementia is generally a consequence of several cardiovascular and neurological diseases, such as Alzheimer's disease, a disease characterized by neurodegeneration caused by the accumulation of proteins such as Beta amyloid and tau proteins, which cause neuronal apoptosis, altering the synapse, as a result there are notorious signs and symptoms such as short and long-term memory loss, as well as other related behaviors, for example, changes in personality mood, which leads to isolation (Strøm, 2016).

According to the statistics of the World Alzheimer Report 2018 (Associação Alzheimer, 2018) in the world, every 3 seconds a person is diagnosed with dementia. In 2018, 50 million people were diagnosed; a number that is expected to triple, that is, by 2030, 82 million people will be diagnosed and, in 2050, about 152 million people will have dementia. Regarding the costs of these diseases, the "World Alzheimer Report 2018" stated that the annual cost for the management and treatment of dementia was US \$ 1 trillion, a figure that will double by 2030.

As Dementia is a chronic neurodegenerative disease that results in a progressive loss of functional capacity and a gradual decline in autonomy and independence (Serrano et al. 2010), it has a great emotional, social and economic impact for families / caregivers and for the society.

Considering that the characteristic cognitive decline of Dementia is directly related to the loss of autonomy and the need for institutionalization, and knowing that there is no effective pharmacological treatment capable of treating dementia (Duong et al. 2017) it is important to investigate non-pharmacological treatments aimed to delay cognitive decline.

Previous literature has found that physical activity interventions positively influence cognitive function in patients with dementia (Groot et al 2016). Moreover, Rolland et al. (2007) showed that a preventive approach to balance, muscle strength, range of motion, gait and cardiovascular capacity, allows the maintenance and improvement of physical condition in people with dementia. Yang, et al. (2015) reinforces the potentiality of aerobic exercise at moderate intensities to improve cognitive function and physical condition in patients with dementia.

Physical exercise increases cerebral blood circulation (Querido and Sheel 2007), stimulates the release of substances that assist in the functioning of the central nervous system, such as the brain derived neurotrophic factor ((Sleiman et al. 2016), promotes neural growth, maintaining brain functions and improving its plasticity ((Lin et al. 2018). Moreover, physical activity can promote neurotrophic factors, hippocampal neurogenesis, synaptic plasticity and oxidative stress and inflammation, contributing to improvements in cognitive function(Llorens-Martín 2018).

Therefore, physical activity interventions, are an attractive alternative or complement to the current pharmacological treatment of cognitive symptoms in patients with dementia

The aim of this study was to determine the effect of a tailored, dual task, exercise program in physical fitness in individuals with mild cognitive impairment/dementia.

## **Materials and Methods**

### **Participants**

This investigation is a cross-sectional study in individuals with mild cognitive impairment. A total of 36 nursing home residents (mean 79.36 years) from both genders participated in this study. Inclusion criteria: all participants have mild cognitive impairment according to the Mini Mental State Examination (Guerreiro, Silva Botelho, Leitão, Castro Caldas & Garcia, 1994). Exclusion criteria: clinical diagnosis of advanced dementia syndrome; uncontrolled hypertension (Blood Pressure > 160/90 mmHg); frequent hypoglycaemia; severe congestive heart failure; acute myocardial infarction in the last year; severe anaemia (Haemoglobin < 8 g / dl); severe respiratory disease; severe osteoporosis; sensory deficit (vision / hearing) that disables collaboration in the physical exercise program; severe psychiatric disorders.

### **Measures**

Evaluation of cognitive impairment was made according to the Mini Mental State Examination (Guerreiro, et al., 1994).

Physical fitness parameters, including sitting walking chair stand, push ups, reach behind your back, sit and reach and walking 6 minutes were assessed using the Rikli & Jones Test (Rikli & Jones, 1999).

### **Intervention**

The intervention lasted 6 months, twice a week. Each exercise session lasted 50 minutes. The exercise program was based on the Dual Task methodology, which combines supervised and functional exercise with cognitive stimulation.

The exercise consisted of aerobic components, strength training and joint flexibility training. We tried to include functional and dynamic exercises, having created different circuits where different motor responses were requested.

Muscle coordination training, balance, agility, endurance and muscle strength were sought.

As for cognitive stimulation, memory exercise, relating concepts, creating stories, concentration are included.

The design of the program was based on a previous investigation (Rondão, Esteves & Mota, 2019).

### **Procedures**

Participants were completely free to participate in the study, after the presentation of researchers' affiliation, investigation goals and guaranty of total confidentiality. An informed consent was signed by participant and relative. All evaluation procedures were made by a qualified professional: Mini Mental State Examination by a physiologist and Physical fitness by a sport professional, PhD student.

For data analysis, inferential statistics was used, Program SPSS Statistics version 27.

## Results

Comparative analyses on scores of physical fitness parameters from the pre-test to post-test were made. A general improvement was found. Significant differences were verified to dynamic balance test, superior strength, push ups, sitting and walk 2.44m and reach behind your back test ( $P < 0.05$ ). No significative diference was found on, chair stand, sit and reach and walking 6 minutes.

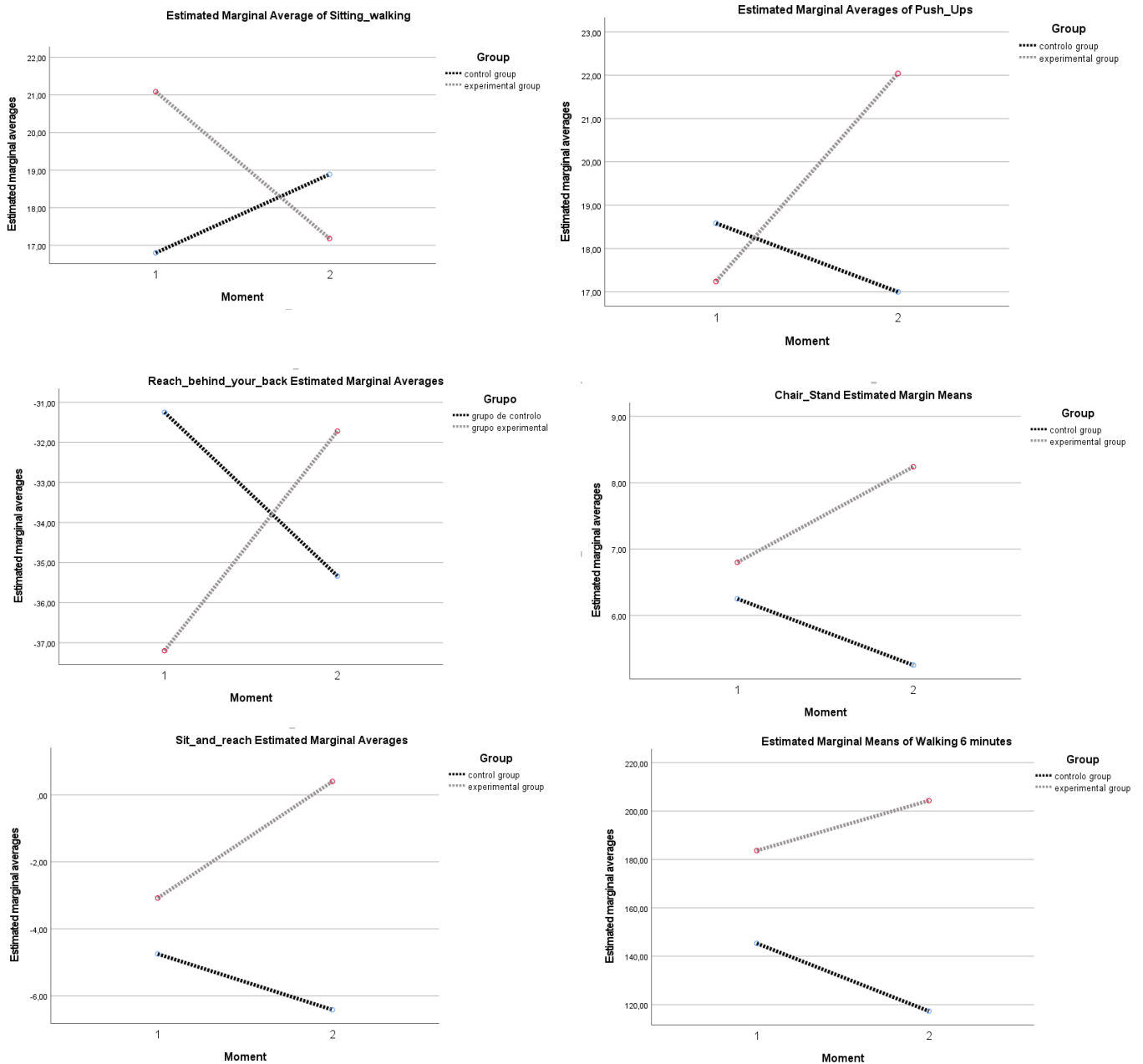


Figure 1 - Physical fitness of individuals with mild cognition impairments, according to Rikli & Jones Test

## Discussion

Physical activity, by increasing aerobic fitness and cerebral blood flow, seems to contribute to the reduction of chronic inflammation in the central nervous system, increasing neuroplasticity and promoting the reorganization of neural circuits (Erickson et al., 2011). Physical activity is considered an effective non-pharmacologic strategy in attenuating or delaying the evolution of degenerative diseases related to dementia (Maliszewska-Cyna, Lynch, Jordan, Michael & Aubert, 2017; Paillard, Rolland & de Souto Barreto, 2015). Consequently, it is important to implement exercise programs specific for dementia.

The results show that the application of an exercise program in people with mild cognitive impairment for 6 months has positive effects on different parameters of physical fitness, namely at the level of superior strength in the push ups test, flexibility test reach behind your back and dynamic balance as sitting walking test. These results find similar results on the benefits of exercise on the functional motor capacity and physical fitness of people with dementia Chang, Hsu, Wu, Huang & Han, 2016; Hesseberg et al., 2016; Song, Doris, Li, & Lei, 2018).

After applying the physical exercise program for 6 months, there was a general improvement in all tests in the experimental group, however there were only significant differences in dynamic balance, superior flexibility and superior strength.

Which leads us to think that there may be some possible reasons for not having significant differences in all tests. 1- the fact that the other physical capacities such as resistance, lower strength and lower flexibility are at the very weak level, the intervention time was not enough to have significant differences despite the observed improvements. 2- the intervention program may have focused more on capacities where there were significant differences.

## CONCLUSION

The aim of this study was to determine the effect of a tailored dual task exercise program in physical fitness of people with dementia. The results found a general improvement of physical fitness. These results support the need for more physical activity interventions, based on dual task exercise, target to dementia patients, since those intervention may retard the deterioration of their motor abilities and allows an improvement in aerobic capacity, balance, strength and generic motor skills.

Based on this conclusion, authors designed and implemented a specific physical activity program to individuals with mild cognitive impairment: MEMO\_MOVE program.



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