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Effects of manual motor and cognitive training on functionality and cognition of institutionalized elderly people.

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Abstract

This study aimed to verify the effects of manual and cognitive motor training on the functionality and cognition of institutionalized elderly people. 26 institutionalized elderly participated in the study and were divided into two groups at random: Intervention Group (IG) (n=13) and Control Group (CG) (n=13). In the IG, 17 interventions were performed with games that worked on cognitive functions and playful-collective activities that stimulated memory, social interaction, and manual motor skills, whereas the CG did not. To assess functionality, the Katz Scale and the Barthel Index were used. For cognitive evaluation, the Mini Mental State Examination (MMSE), the Clock-drawing Test, and the Verbal Fluency Test were used. In the statistical analysis, the difference between the final and initial scores (delta), the t test for comparison between groups, and a significance level of 5% were used. As a result, the IG was composed mainly of women (61.54%) and had a mean age of 78.07 years. In the CG, there were more men (61.54%), with a mean age of 74.84 years. There was a significant improvement in the IG in the scores of the Katz Scale, MMSE and Verbal Fluency Test, compared to the CG. The use of activities that assist in independence, cognition, memory, and socialization are necessary to maintain and/or improve functionality, contributing to guarantee the quality of life of the elderly. Thus, this study contributes to the practice of sensory-motor and cognitive stimulation in long-term care facilities for the elderly, acting in a complementary way to public health policies for the elderly.

Keywords: Cognition. Population dynamics. Elderly health. Long-term care facility for the elderly.

INTRODUCTION

Cognition reflects the individual's mental functioning and includes some skills such as the ability to think, feel, perceive, remember, reason, respond to stimuli, and perform functions[1]. The maintenance of cognitive function is correlated with current epidemiological changes, in that there is an increase in life expectancy triggering an increasing aging population[2].

With advancing age, dysfunctions can occur that compromise physical and mental independence, negatively influencing the performance of activities of daily living (ADL), autonomy, and cognition. These conditions promote an increase in the risk of falls, causing dependencies, hospitalizations, and institutionalizations. Consequently, cognitive loss is related to institutionalizations and to the risk of death in the elderly[1,3].

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cognitive dysfunctions predisposes elderly the referral by their family members to Long-Term Care Institutions for the Elderly (LTCF)[4]. Inactivity and leisure are frequent characteristics in the LTCF, as well as the lack of social and family interaction. Thus, in addition to deficits arising from advanced age, the LTCF itself can further deteriorate the physical-functional and cognitive capacity of institutionalized elderly people, requiring multiprofessional care[5].

Cognitive training in the elderly has shown positive results in relation to memory and learning, increased cognitive performance, and improvement or maintenance of functionality[6]. Manual and cognitive motor training are non-pharmacological interventions with the objective of preserving or enhancing intellectual and motor capacities (neuroplasticity), through the performance of combined activities. Such training relates to the development of strategies, ability to concentrate, attention, memory, and problem solving with activities that also require motor coordination of the upper limbs for their execution[6,7].

In this context, there is a lack of consensus in the national literature on which interventions cause better results on cognitive training in the elderly[8]. Some authors highlight the need to expand the number of studies to test the effectiveness of interventions. Additionally, in two literature reviews, a difficulty was highlighted in consolidating some facts in the literature, such as: the different types of interventions, number of sessions, lack of control group, and different instruments[8,9].

Thus, the development of this study aimed to verify the effects of manual (upper limbs) and cognitive motor training on the cognition and functionality of institutionalized elderly. The hypothesis was that this training would improve the functional and cognitive capacity of institutionalized elderly people.

METHOD

This was a randomized clinical trial. The sample consisted of residents of a philanthropic LTCF, located in Campo Grande (MS). The study was carried out from September to December 2016.

Because it is a large LSIE, there are many elderly people in different health conditions. Thus, the methods proposed by this study were presented to health professionals who work at this LTCF. After the presentation, the institution's psychologist listed all the possible elderly people who would be able to participate in this study, taking into account cognitive, psychological, physical and motor issues of the upper limbs.

The elderly were excluded from the study if they missed more than three sessions of the interventions, if they possessed visual problems that interfered in the performance of the proposed activities, and those with physical and motor impairments of the upper limbs.

The sample consisted of 26 elderly people of both sexes, who were randomly divided into two groups: Intervention (IG; n=13) and Control (CG; n=13). The methodological protocol of the study was carried out in three stages: (1) evaluation, (2) intervention, and (3) reassessment. The IG went through three stages: evaluation, intervention, and reassessment. The CG received an initial assessment and a reassessment, without intervention. All evaluations were performed by two physiotherapists previously trained to apply the evaluations and interventions.

In the 1st stage, the following instruments were used to assess functionality: Katz scale and Barthel index. For the cognitive evaluation, Mini Mental State Examination (MMSE), Clock-drawing Test, and Verbal Fluency Test were used.

In the 2nd stage, interventions in the IG

were performed twice a week, totaling 17 interventions, lasting 90 minutes, during the three months of study duration. The meetings were held in the LTCF cafeteria on Tuesdays and Thursdays in the afternoon, and this place offered an adequate structure to carry out the proposed activities. For the development of activities, the elderly were invited to sit in groups, around tables that had four seats. Depending on the activity and need, the elderly sat in pairs or even individually. Such interventions were carried out in rotation, so that all members could carry out all the activities offered.

During the interventions, games were used that worked on cognitive functions, memory, social interaction, and motor skills of the upper limbs, such as assembling puzzles and figures, painting, drawing, writing sentences and words, playing dominoes and mathematical games, fitting shapes, recognizing colors, and more.

In the 3rd stage, the reassessment (final evaluation) of both groups was applied, using the same protocol as in the 1st stage. The study flowchart is described in Figure 1.

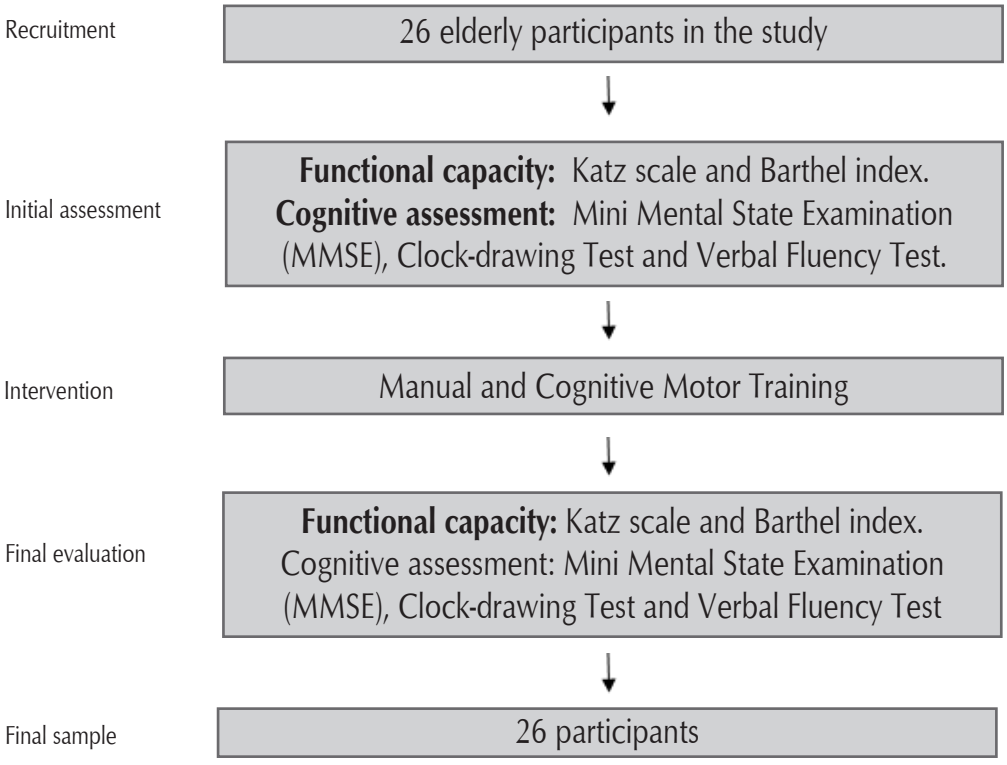

Figure 1- Study flowchart

The Katz Index was developed to measure the ability of the elderly to perform their daily activities independently and, thus, determines the appropriate rehabilitation interventions. The skills of showering, dressing, using the bathroom, transferring, continence, and food are assessed, classifying elderly people as independent or dependent[10]. In this study, the score of ≤2 points = very dependent; 4 points = moderate dependence; 6 points = independent.

The Barthel Index is one of the most used instruments to assess basic activities of daily living (BADL) in the elderly, which analyzes functional independence in personal care, mobility, locomotion, and eliminations. The score ranges from 0 to 100 points, in five-point intervals, and the higher scores indicate greater independence[11]. In this study, the following scores were used: 0-20 indicates total dependence; 21-60, severe dependence; 61-90, moderate dependency; 91-99, very light dependency; and 100, independence[12].

The MMSE is a tool, quick and easy to use, used for the screening of cognitive impairment, detecting cognitive losses, evolution of diseases, monitoring the response to treatment, and helping in the diagnosis of dementia. MMSE was worth five areas: guidance, registration, attention and calculation, recovery and language. The MMSE involves two categories of response, verbal and non-verbal. The score can vary between 0 and 30 points, with the standard cut-off value being 24 points. Below this value, it was considered an indication of cognitive deficit. The application of the cut-off score must be modified according to the patient's level of education, and for illiterates the cut-off value was 18 points[13].

The Clock-drawing Test is a quick resource to be applied and translates the frontal and temporoparietal functioning pattern. This test assesses several cognitive dimensions, such as memory, motor function, executive function, and verbal comprehension. The score consists of a point scale from 0 (totally incorrect or nonexistent clock) to 10 points (totally correct clock). The ideal cutoff point for the test is 6 points[14]. In this test, it is important to observe the time and strategies used, in addition to the final result such as such steps in the process can contribute with valuable information. The educational level must always be taken into account. For carrying out the test, guidance is provided on the clock to be drawn, as well as what time the hands should mark. Then, a sheet of paper is offered to the individual and he/she is free to choose where to make the drawing on the paper, if he thinks the drawing was not good and wants to draw again, it is allowed[15].

The Verbal Fluency Test is part of a series of neuropsychological tests and provides information regarding the storage capacity of the semantic memory system, the ability to retrieve stored information, and the processing of executive functions[16]. At the end, 1 point is given for each non-repeated animal name. The cut-off score for illiteracy individuals is 12 points and for literate individuals is 17 points[17].

For statistical analysis, the SPSS software was used. The data were subjected to the Shapiro-Wilk and Levene tests to verify the normality and homogeneity of the distribution. Subsequently, after checking the normal distribution of the data, the t test was performed for independent samples for comparison between groups (control and intervention). In all cases, a significance level

of 5% was considered.

This study was approved by the Human Research Ethics Committee of the Federal University of Mato Grosso do Sul (UFMS), under Opinion no. 1.816.837, CAAE 58762116.7.0000.0021. Objectives and methodology were presented and each volunteer signed the Informed Consent Form (ICF), according to Resolution 466/2012 of the National Health Council of the Ministry of Health (Brazil) and Resolution No. 510/2016.

RESULTS

The IG was composed of eight females (61.54%) and five males (38.46%). The average age was 78.07 (±8.89) years old, with 23.07% between 60-69 years old, 30.76% between 70-79 years old, 30.76% between 80-89 years old, and 15.38% over 90 years old. In the CG, five individuals were female (38.46%) and eight were male (61.54%). Regarding age, the average obtained was 74.84 (±12.82) years old, with 30.76% between 60-69 years old, 38.46% between 70-79 years old, 23.07% between 80 -89 years old, and 7.69% over 90 years old.

When analyzing the age group, the age of the participants in the sample ranged from 60 to 106 years, with an average age of 76.46 (+10.55) years. With regard to education, six elderly people (two males and four females) were illiterate, representing 20% of the participants.

Table 1 shows the descriptive measures in relation to the cognitive tests applied in the assessment and reassessment in the IG and CG and the results of the applied statistical tests. In comparison to the CG, there was a statistically significant difference in the performance of the IG in the Katz Scale, MMSE, and in the Verbal Fluency Test, showing that the intervention was positive to improve patients in these tests. The CG presented negative deltas in the Katz scale, Barthel scale, Clock-drawing Test, and verbal fluency test, that is, there was a worsening in the functional and cognitive performances of the evaluation for reassessment. The only test that the mean of the CG did not decrease was the MMSE, but, when compared with the IG, the performance of the group without intervention was lower. Regarding the level of dependence through the Barthel Test, there was a numerical improvement in the mean of the IG and a numerical worsening in the mean of the CG. However, this difference was not statistically significant (p=0.09) in the performance of the functionality by this test.

In the analysis of cognitive tests for signs of deficit before and after the intervention, the results are described in Table 2.

Regarding the level of dependence, Tables 3 and 4 show the results of the Katz Scale and the Barthel Index, respectively, in the assessment and reevaluation of both groups. In the CG there is a drop in the averages of the evaluation and reevaluation of the Katz Scale, Barthel Scale, Verbal Fluency, and Clock-drawing Test, showing a worsening in the classification of some elderly people. In the reassessment, on the Katz Scale, there was an increase in the number of elderly individuals independent of the IG.

Table 1- Cognitive and motor characteristics, before and after the intervention, Campo Grande, MS, Brazil, 2017.

Tests	Intervention Group			Group control			T test
	Evaluation	Revaluation	Delta	Evaluation	Revaluation	Delta	
Katz scale	3.69 (±2.05)	4.07 (±2.06)	0.4 (±1.2)	4.53 (±2.33)	3.76 (±2.68)	-0.8 (±1.2)	0.02*
Barthel scale	65.38 (±28.39)	71.15 (±33.48)	5.8 (±19.9)	71.15 (±35.83)	63.84 (±40.78)	-7.3 (±17.2)	0.09
MMSE	13.76 (±5.50)	20.46 (±6.57)	6.7 (±6.5)	17.61 (±2.90)	18.84 (±4.29)	1.2 (±3.0)	0.01*
Clock-drawing Test	5.75 (±5.07)	6.54 (±4.71)	0.8 (±2.4)	3.07 (±3.94)	2.92 (±4.31)	-0.2 (±2.3)	0.34
Teste de Fluência Verbal	7.46 (±2.87)	8.38 (±3.75)	0.9 (±3.2)	9.0 (±2.94)	5.84 (±2.93)	-3.2 (±3.3)	0.004*

IG: Intervention Group; GC Group: Control; MMSE: Mini Mental State Examination.
The results are presented as averages (±standard deviation).

* P-value <0.05.

Table 2- Results of the Mini Mental State Examination, Clock-drawing Test, and Verbal Fluency Test, before and after the intervention, Campo Grande, MS, Brazil, 2017.

Tests	Groups	Evaluation		Revaluation	
		Indication of cognitive deficit	Without cognitive deficit	Indication of cognitive deficit	Without cognitive deficit
MMSE	IG	13 (100%)	0 (0%)	8 (61.54%)	5 (38.46%)
	CG	12 (92.30%)	1 (7.70%)	10 (76.92%)	3 (23.07%)
Clock-drawing Test	IG	11 (84.61%)	2 (15.39%)	9 (69.23%)	4 (30.76%)
	CG	12 (92.30%)	1 (7.70%)	12 (92.30%)	1 (7.70%)
Verbal Fluency Test	IG	12 (92.30%)	1 (7.70%)	10 (76.98%)	3 (23.07%)
	CG	10 (76.98%)	3 (23.07%)	13 (100%)	0 (0%)

MMSE: Mini-Mental State Examination; IG: Intervention Group; GC: Control Group.
The results are presented in absolute frequencies (relative frequency).

Table 3- Results of the Katz Scale, before and after the intervention, Campo Grande, MS, Brazil, 2017.

Groups	Katz scale					
	Evaluation Rating			Revaluation Rating		
	Very dependent	Moderately dependent	Independent	Very dependent	Moderately dependent	Independent
IG	4 (30.76%)	4 (30.76%)	5 (38.46%)	4 (30.76%)	3 (23.07%)	6 (46.15%)
CG	4 (30.77%)	0 (0%)	9 (69.23%)	5 (38.46%)	0 (0%)	8 (61.54%)

IG: Intervention Group
CG: Control Group

Table 4- Results of the Barthel Scale, before and after the intervention, Campo Grande, MS, Brazil, 2017.

Groups	Barthel scale							
	Evaluation Rating				Revaluation Rating			
	I	II	III	IV	I	II	III	IV
IG	0 (0%)	7 (53.84%)	2 (15.39%)	4 (30.76%)	1 (7.70%)	5 (38.46%)	1 (7.70%)	6 (46.15%)
CG	2 (15.39%)	2 (15.39%)	2 (15.39%)	7 (53.84%)	3 (23.07%)	2 (15.39%)	4 (30.76%)	4 (30.76%)

I: Dependent; II: Severely dependent; III: Moderately dependent; IV: Independent.
IG: Intervention Group; GC: Control Group.
The results are presented in absolute frequency (relative frequency).

DISCUSSION

In the present study, as an overview, the elderly in the IG achieved better results and classifications compared to the CG. This panorama was not observed in the study by Loureiro *et al.*[18], where 23 sessions of cognitive rehabilitation intervention were carried out with institutionalized elderly people and no significant gains in functional capacity were found (p-value=0.3173). The authors concluded that functional capacity may have been affected by motor limitations, other dependencies involved, and by the institutional organization of the LTCF.

With regard to cognitive tests, in the reevaluation of the IG, there was an improvement in the performance of the MMSE, where five elderly people (38.46%) started not to have cognitive deficit, a fact that diverged from the initial assessment where all the elderly people had cognitive deficit. The mean of the MMSE values of the CG also showed improvement. In a study carried out by Souza and Chaves[19], the MMSE was applied to a sample of healthy elderly people, followed by activities that stimulated memory. After eight meetings, lasting two hours each, a reassessment was carried out by the MMSE, verifying that 66% of the elderly showed improvement in the performance of the cognitive test, converging with the results of this study.

A study carried out with 53 elderly people, divided into two groups (G1: 22 institutionalized elderly and G2: 31 non-institutionalized elderly), showed cognitive impairment, assessed by the MMSE, in G1, with a result of 11.73 (±6.04) points, and cognitive functions preserved in G2, with an average of 26.39 (±3.2) points[20]. The lower cognitive performance of elderly people in LTCF compared to those living in the community suggests that institutionalization can worsen cognitive loss. According to Marin *et al.*[21], LTCFs offer housing, hygiene, food, medical care. However, such institutions distance the individual from family life, favoring social isolation, physical and mental inactivity and dependence, and resulting in decreased functionality and, consequently, losses in the performance of BADL.

In the present study, the IG showed improvement in the Clock-drawing Test, given that only two elderly people (15.39%) were without cognitive impairment before the intervention and after the intervention, this value doubled. Even so, the Delta of the Test's average score was low (GI: 6.53 points, and CG: 2.92 points). It is possible that this result

is due to the poor mental representation of the analog clock, either due to the greater use of digital clocks or because they are not encouraged to observe the time. Executive functions are defined as responsible for the appropriate behavior, solving problems that arise in daily life, and carrying out a future project[22]. Changes related to the deficit of these functions in the long-term can significantly interfere in the development of the individual, in their understanding, in the memory of activities, and in the malleability of cognition.

In the Verbal Fluency Test, GI also showed improvement in values after the intervention. In the assessment, 92.30% of the elderly had cognitive decline and in the reassessment there was a decrease to 76.98%. In the CG, in the initial assessment, 76.98% of the elderly had a deficit and in the reevaluation, 100% of them had cognitive decline. Such results show that physical and mental inactivity can worsen the cognitive and, consequently, their functional state, and is able to anticipate and even accentuate the declines resulting from the aging process and impair the quality-of-life[23].

In addition to cognitive and functional improvement, greater communication and social interaction was observed between the participants of the IG, as they moved from their rooms to carry out the activities and met in the cafeteria of the institution before the scheduled time for the start of each intervention. At this time, the elderly initially talked about their day-to-day difficulties and sometimes continued to tell their life's stories. In addition, the playfulness of the interventions enabled the awakening of creativity and imagination, leading to a greater interaction between the participants and the people around them[21]. Another study also reported[24] participants' satisfaction in developing group activities. Such activities provided motivation, social interaction, and bonding among the participants, who felt included in the community again.

In a study[25] carried out with 21 institutionalized elderly people, the beneficial effects of cognitive training in relation to memory were analyzed, with the main functions favored being understanding, reasoning, judgment, guidance, attention, and memory. The training also stimulated the cognitive reserve, improving of this ability. Another study carried out in Portugal[26] with 12 institutionalized elderly people showed, during cognitive training, the improvement of language skills and constructive ability, orientation, retention, attention, calculation, and evocation, showing significant progress in the elderly individuals' cognition, in addition to the feeling of well-being and improvement in quality-of-life.

A study carried out in Belgium[27], with 20 institutionalized elderly, used virtual reality training associated with functional activity (cognitive and motor) with the aid of a platform. The results showed that the associated training provided satisfaction and situations that demanded quick decision making, in addition to beneficial effects on the executive function, functionality during commuting, changes in direction, and balance of the elderly.

In the literature, other studies have shown that moments of social interaction were extremely important to reduce the feeling of isolation. Often, institutionalization triggers depression, due to the loss of identity, freedom, and self-esteem, the state of loneliness, and even the refusal of life itself, justifies the high prevalence of mental illness in a LTCF[28,29].

Neuroplasticity is the brain's ability to recover from stimuli and is the result of experiences lived by the individual at

any stage of life. Such neural plasticity is expressed through learning and memory, but it can occur through the loss or malfunction of neurons. Additionally, the brain has the ability to reestablish connections, which can improve its performance through training. Thus, multisensory and cognitive stimulations cooperate to establish neuroplasticity and improve cognition, in addition to contributing to the individual's adaptation to new experiences[26,30].

Oliveira *et al.*[31] investigated the benefits of a multisensory and cognitive stimulation program in institutionalized and non-institutionalized elderly people and observed that the elderly in the second group obtained better results in the proposed tests. The authors suggested that the impoverished environment of the LTCF, in terms of promoting stimuli, could result in lower cognitive scores. The same study group performed a follow-up at five different times (two, four, six, eight, and twelve months), reassessing these elderly people, from both groups. After one year, the non-institutionalized elderly showed less neuropsychological decline compared to institutionalized elderly. This fact was again related to the living environment of the elderly, emphasizing that non-institutionalized elderly people have more experiences in their ADL, community and family environment, sustaining the effects of the intervention for a longer time[30].

Regarding the limitation of this study, it was carried out with a small sample number, since most of the invited elderly did not meet all the inclusion criteria to participate in the study. In addition, there was no blinding of the evaluations, which may have influenced the results. It is known that aging can cause dysfunctions that compromise physical and mental independence, the execution of ADLs and the autonomy of the elderly, especially when institutionalized. The lack of neuropsychomotor stimulation makes the elderly passive in their aging and compromises the psychocognitive aspects and their ADL[32,33]. The data obtained in this study showed that the cognitive motor training adopted in 17 interventions, proved to be effective in improving the functionality and cognition of the elderly.

CONCLUSION

The results show that, after the interventions, there was a statistical improvement in the Katz Scale, MMSE, and Verbal Fluency Test in the IG. The CG had worse results on the Katz Scale, Barthel Scale, Clock-drawing Test, and Verbal Fluency Test, showing a cognitive decrease and functional motor ability.

The use of activities that help maintain independence, cognition, memory, and socialization are necessary to maintain and/or improve functionality, contributing to guarantee the quality-of-life of the elderly. Thus, this study contributes to the practice of sensory-motor and cognitive stimulation within long-term institutions, acting in a complementary way to public health policies for the elderly.

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