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Original article

Community physical activity in stimulating memory in older adults with mild cognitive impairment

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ABSTRACT

In Cuba, promoting physical activity among older adults aims to improve this population group's physical fitness, reduce risk factors associated with non-communicable chronic diseases, and contribute to mental healthcare. This research examines the relationship between physical activity and geriatrics within the context of Cuba's population aging. This demographic trend has increased the number of older adults diagnosed with memory deficits due to mild cognitive impairment (MCI). Seeking outpatient care, these individuals attend mental health consultations where specialists recommend community-based



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physical activity programs as a primary intervention strategy, given their recognized benefits for cognitive and physical well-being. From this perspective, a pre-experimental study was conducted to determine the effect of coordination exercises combined with cognitive tasks on stimulating immediate memory in older adults with MCI. A minimal control was applied by comparing pre-test and post-test results following the implementation of the independent variable.

Keywords: Physical Activity; Aged; Mild Cognitive Impairment; Memory.

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Introduction

Cuba has a population of 11,101,363 inhabitants, of whom 2,438,100 are 60 years of age or older, representing 21.9%. (1) Furthermore, it was found that by 2030, 30% of its population is expected to be considered older adults (OA). (2) The Cuban population is classified as one of the oldest in Latin America and the Caribbean. This stage is reached naturally and inevitably. Physical and mental limitations begin to appear, with memory being the most affected cognitive function, typically represented by mild cognitive impairment. (3)

In this regard, it is suggested that between 5 and 8% of these older adults suffer from cognitive impairment at some point during aging, (4) and this stage is also considered the most prevalent associated with cognitive impairment. (5)

Today, the application and use of physical exercises that recognize memory stimulation as an essential component of care for older adults with mild cognitive impairment is indispensable in minimizing the progression of cognitive decline that can occur during aging. Therefore, Cuban society increasingly demands better comprehensive care for older



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adults with mild cognitive impairment to improve their quality of life and promote a fulfilling lifespan. This, in turn, requires a growing effort in training professionals better prepared to meet the challenge and refine the care process for older adults with mild cognitive impairment within the context of community-based physical activity.

For the aging population, it is commendable that there are social options dedicated to their care regarding their physical and mental state, allowing them greater independence in the family, community, and social spheres. In this respect, Cuba is a paradigm, having taken the initiative in 1984 to implement the grandparents' circle program, which strengthens working relationships between two departments responsible for the care of the elderly through community physical activity and health: the National Institute of Sports, Physical Education, and Recreation (INDER) and the Ministry of Public Health (MINSAP).

Community-based physical activity is a non-pharmacological tool that provides significant mental health benefits with a personalized approach to cognitive stimulation for older adults. It allows them to exercise their memory through games, recall sequences of exercises, scenarios, and various activities performed, among other benefits. (6,7) Physical activities with broad sensorimotor involvement, such as martial arts, dance, and others, produce positive effects on both the physical and cognitive functions of older adults. (8) Regular physical exercise is an important part of a healthy lifestyle, as it allows for better physical and mental health, improving the overall sense of well-being in older adults. (9) Stimulating and maintaining mental capacities through activities that require brain effort and intellectual tasks results in improved functionality in the activities of daily living for older adults. (10)

The research presented declares tools in which dialectical relationships are established between theory and practice, prescriptive elements are conceived, both from the point of view of physical coordination exercises, as well as cognitive ones that require mental efforts to stimulate memory in older adults with mild cognitive impairment through



community physical activity.

Based on the above and taking into account the theoretical assessment made by the author, he was able to formulate the following research problem: How can we contribute to the stimulation of immediate memory in older adults with mild cognitive impairment during community physical activity?

This study aims to determine the effect of physical coordination exercises combined with cognitive actions to stimulate immediate memory in older adults with mild cognitive impairment.

Methods

A pre-experimental minimal control study was conducted for the same group, which was given a pretest on the sensorimotor coordination and immediate memory variables. Then, physical coordination exercises combined with cognitive actions were implemented to stimulate immediate memory in older adults with mild cognitive impairment. Subsequently, a post-test was performed to allow comparison between the two and evaluate the effectiveness of the applied independent variable, which includes physical coordination exercises combined with cognitive actions, and the result of the dependent variable, which consists of the stimulation of immediate memory in older adults with mild cognitive impairment.

This research was conducted in the Horacio Rodríguez community of the municipality of Manzanillo, during the period from January to December 2023. This community was selected because it is one of the most referenced in the work with older adults and at the same time it is one of the areas in the municipality that presents the highest incidence of older adults with mild cognitive impairment, which served as an incentive to carry out the research project.

The sample was selected using stratified, non-probabilistic purposive sampling, considering only older adults with mild cognitive impairment. Fifteen subjects were selected, representing 51.7% of a population of 29. Of these, 11 were female and 4 were



male, all aged 65 years or older, with a mean age of 67.9 years. Twelve of the participants were new to community-based physical activity programs for older adults, while 3 had only one year of experience. Regarding educational level, university education predominated (7 participants), followed by secondary education (6 participants), and primary education (2 participants).

The following inclusion, exclusion, and withdrawal criteria were established. Inclusion criteria: older adult with mild cognitive impairment of a single amnesic type, age between 60-74 years, be endorsed by medical personnel to perform physical activity. **Exclusion criteria:** elderly adult with cognitive impairment moderate or severe, Visual or auditory impairments that hinder participation in the study, medical prescriptions that prevent physical activity, and personal and family decisions not to participate in the research. Exit criteria: failure to consistently attend the exercise sessions and withdrawal of the participant's own volition.

A group of specialists from different branches related to research was also selected to join the multidisciplinary team in the specialized care of older adults with mild cognitive impairment. The criteria for their selection included having interest and motivation to participate in the project and having 10 years or more of experience in activities related to the care of older adults.

The coordination exercises, as well as the cognitive actions, were performed systematically 3 times a week and for a duration of 30 minutes with 2-minute rest intervals between each eighth of exercises. In both cases, they were not combined during the first 9 times to achieve basic training and adaptation in their execution; from the 10th time onwards, the physical exercises were combined with the cognitive ones, all with a moderate intensity to avoid fatigue in older adults with mild cognitive impairment that negatively affects the stimulation of immediate memory.

The cognitive exercises were tailored to the participants' educational level, resulting in three subgroups: primary, secondary, and upper secondary/university levels. Similarly, the



selection of physical exercises was based on each senior's abilities. Coordination exercises involved movements in eighths for the arms and then for the legs. These were combined with counting exercises, first forward and then backward, and counting in units of two, three, and four places, both forward and backward. The specific number of units was indicated by the therapist. Other cognitive exercises included spelling previously given words in forward and reverse order, and immediately recalling the antonyms of words spoken by the therapist.

The sensorimotor coordination test was applied before and after the implementation of physical exercises combined with cognitive actions for the stimulation of immediate memory in the elderly adult with mild cognitive impairment, it was evaluated in five categories each with their respective scores that are in correspondence with the demand met by each elderly adult in the execution of the coordination.

The sensorimotor coordination test was structured as follows: 0_ no coordination is present in any movement pattern, 1_ coordination is present sometimes, 2_ coordination is present almost all the time, and 3_ coordination is present from beginning to end in each movement pattern. The evaluative categories were determined by the total sum of the points obtained in each movement pattern, which establishes score ranges for each category. (11)

The Digit Span subtest of the Wechsler Adult Intelligence Scale, Third Edition, was used. (12) This test consists of several items distributed across two subtests: Digit Span Forward and Digit Span Backward. In the first subtest, the examinee must repeat the numbers in the same order as they are called by the examiner, while in the second, the examinee repeats the numbers in the reverse order. In both subtests, the sequence of numbers gradually increases as the subtest progresses. The test is stopped when the examinee fails two consecutive attempts at the same item. The score for both subtests is recorded based on each examinee's performance, with one point awarded for each correct answer, for a total of 16 points for Digit Span Forward and 14 points for Digit Span Backward, for a total



of 30 points across both subtests.

Statistical hypotheses

For the analysis of the sensorimotor coordination test, the following null hypothesis (Ho) and alternative hypotheses (Ha) were taken into account:

Ho: there are no differences between pre- and post-test sensorimotor coordination after implementing physical exercises combined with cognitive actions.

Ha: There are differences between pre- and post-test sensorimotor coordination after implementing physical exercises combined with cognitive actions.

For the analysis of the digit span subtest, the following null hypothesis (Ho) and alternative hypotheses (Ha) were taken into account:

Ho: there are no differences between the pre- and post-test digit span subtest variables after implementing physical exercises combined with cognitive actions.

Ha: There are differences between the pre- and post-test digit span subtest variables after the implementation of therapeutic physical exercises.

Results

The lack of outpatient therapies based on the implementation of community physical activity through the application of sensorimotor coordination exercises combined with cognitive actions that require mental effort, has an impact as one of the main modifiable factors that influence the increase in older adults with mild cognitive impairments, which brings with it a greater prevalence in the impairment of memory in this population group. Regarding the sensorimotor coordination test (graph 1), the results obtained through the initial test reveal a predominance of older adults evaluated in the fair and poor categories, with figures showing 47% and 40% respectively in each evaluative category. These negative results are due to the fact that these older adults, during the execution of the test, sometimes demonstrate coordination and other times do not demonstrate coordination at all. In both cases, this was caused by a lack of immediate memory to recall



and follow the sequence of movements that would allow them to perform the movements from beginning to end. On the other hand, a very small percentage (13%) achieve good results, as the two older adults in this evaluation manage to maintain coordination of the movement patterns from beginning to end.

Regarding the final test (Figure 1) (Table 1), the data show a predominance of very good and good results in coordination, with 60% and 33% respectively, while 7% achieved excellent results. These data demonstrate significant improvements in immediate memory stimulation among the 15 older adults compared to the pretest results. This reflects the effectiveness of the physical coordination exercises combined with cognitive actions, which allowed 10 participants to recall the movement sequence from beginning to end, while 5 others were able to memorize the sequence of coordination movements almost the entire time. These posttest results, compared to the pretest results, show a significant difference between the two tests after the application of the sensorimotor coordination exercises combined with cognitive actions ($p < 0.000$ for the established alpha value).

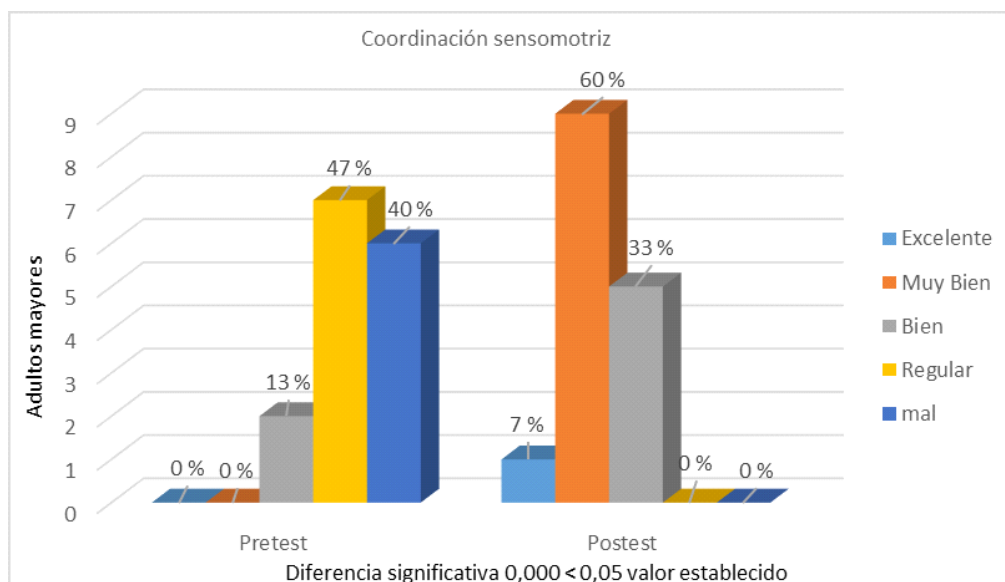


Chart 1.Results of sensorimotor coordination before and after the application of physical coordination exercises combined with cognitive actions.



Table 1. Sensorimotor coordination test ranges.

Post-test sensorimotor coordination - Pre-test sensorimotor coordination	N	Average range	Sum of ranks
Negative ranges	0a	,00	,00
Positive ranges	15b	8.00	120.00
Ties	0c		
Total	15		

a. Post-test sensorimotor coordination < Pre-test sensorimotor coordination

b. Post-test sensorimotor coordination > Pre-test sensorimotor coordination

c. Post-test sensorimotor coordination = Pre-test sensorimotor coordination

Applying the Wilcoxon test, it can be seen that the p-value (0.000) is less than 0.05, so the null hypothesis must be rejected, which means that there are significant differences between the physical coordination exercises combined with cognitive actions and the pre- and post-test sensorimotor coordination.

Contrast statistics to

Post-test sensorimotor coordination - Pre-test sensorimotor coordination

Z = - 3.571b

Bilateral sign =,000

- Wilcoxon signed-rank test
- Based on negative ranges

As shown in Graph 2, the results achieved regarding immediate memory evaluated through the digit span test show that after the application of physical coordination exercises combined with cognitive ones, the effects show significant figures of high levels compared to negative results at the low level obtained in the pretest.

The percentages in the post-test. The results show that 73% of older adults scored at a high level, while the same percentage scored low in the pretest. Other results obtained in



the posttest reveal that 20% of older adults scored at a medium level, representing an increase in this group compared to the 13% who scored low in the pretest. A negative finding in the posttest is that, despite the decrease in the number of older adults at the low level in the pretest, one older adult (7%) still scored low. Overall, the statistically significant difference between the pretest and posttest results after the application of the sensorimotor coordination exercises combined with cognitive tasks ($p < 0.000$ for the established alpha value) is shown.

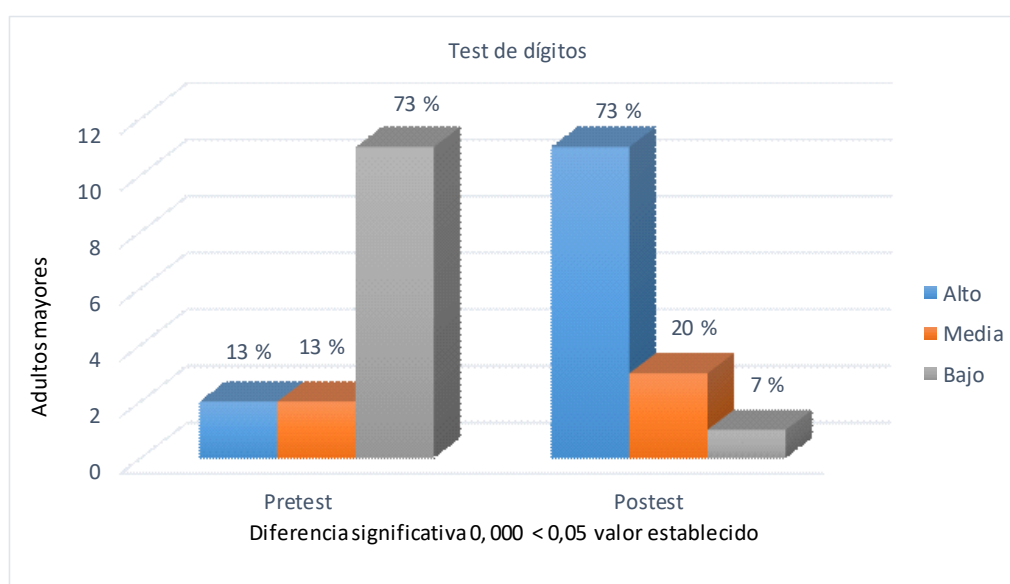


Chart 2.Results of the digit span test before and after the application of physical coordination exercises combined with cognitive actions.

Table 2.Ranges Digit test.

Digit Span Test Posttest - Digit Span Test Pretest	N	Average range	Sum of ranks
Negative ranges	0a	,00	,00
Positive ranges	12b	6.50	78.00
Ties	3c		
Total	15		



- a. Digit Span Test Posttest < Digit Span Test Pretest
- b. Digit Span Posttest > Digit Span Pretest
- c. Digit Span Posttest = Digit Span Pretest

Applying the Wilcoxon test to the digit span test (Table 2) shows that the p-value is less than 0.05 for the variables, so the null hypothesis must be rejected, which means that there are significant differences between the physical coordination exercises combined with cognitive actions and the pre- and post-test digit span retention.

Contrast statistics to

Digit Span Test Posttest - Digit Span Test Pretest

$Z = -3.153$ c

Bilateral sign = ,002

- a. Wilcoxon signed-rank test.
- b. Based on positive ranges.
- c. Based on negative ranges.

Discussion

PTo maintain a good level of cognition, it is very important to possess a relevant capacity to adapt to changes and modifications that may occur in lifestyles, such as: active interaction on social networks, the use of cognitive activities as a way to occupy free time, as well as the systematic practice of physical activity; these can contribute to minimizing the acceleration of cognitive decline. (13)

In the field of scientific research, there are several precedents that address, from their dissimilar theoretical and methodological perspectives, the role of physical activity in the mental health of older adults. The use of general physical development exercises and other traditional exercises in this age group benefits physical health with some influence on mental health. An example of this can be seen in the booklet on cognitive and physical stimulation by the Chilean authors Ferrada and colleagues (14), who, unlike in this study, propose separate exercises for memory and physical health, which, in the opinion of the



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authors of this article, do not achieve the desired cognitive effects for these older adults. Similar to the study presented in the present research, Barrientos and collaborators, (15) in their research work Methodology for the stimulation of memory and executive function in the elderly through physical activity, used the combination of physical exercises with cognitive exercises through a control group and an experimental group, which allowed the authors to conclude their research with significant data that allowed them to verify in practice that the results recorded in the experimental group in cognitive stimulation were superior to those of the control group, which justifies the relevance and effectiveness of the combination of physical exercises with cognitive actions to stimulate the memory of the elderly.

On the other hand, in accordance with the present study, Briñones Fernández and Briñones Montero, (9) in their research entitled “Didactic intervention of physical activity to stimulate short-term memory”, applied aerobic physical exercises combined with natural number counting training, which demonstrates the combination between physical and cognitive work to stimulate short-term memory in older adults. These authors achieved results that showed improvements in cognitive aspects after the physical-cognitive intervention, which is expressed in a better quality of physical and mental life in this population group. These results are closely related to those of the present research since they reaffirm the positive effect of physical activity combined with cognitive actions to stimulate the memory of older adults with mild cognitive impairment.

The Multicomponent Physical Training Program and its effect on the cognitive functions of older adults by the authors Morales and collaborators, (16) shows a quantitative research approach of experimental type with quasi-experimental design and correlational scope of pre and post-test type, which aimed to determine the effect of multicomponent physical training on the cognitive functions of older adults and based their training on playful activities in the land and aquatic environment during which materials such as ladders, elastic bands, hoops and mats were used to carry out progression circuits, strength



training, resistance, coordination and flexibility; balls, hoops, submersible weights and music for the training of coordinative patterns, balance and strength respectively, these were carried out with a frequency of 3 times a week, of which two days were training in the land environment and the remaining day, in the aquatic environment.

It is worth noting that these aforementioned authors, despite not using specific cognitive actions in their multicomponent training to stimulate memory that are combined at the same time with physical activities, do use movement patterns for coordination through music, which allowed the subjects under study to exercise their memory to remember the sequences of movements to be performed and execute them to the rhythm of the music. Finally, the findings allowed these authors to conclude that multicomponent physical training has an effect on cognitive functions, demonstrating significant changes in the Rey Total and MoCA tests. Therefore, they infer that the training improved short-term memory and word recognition in the older adults in the experimental group. Furthermore, regarding physical fitness, the study did not show significant changes, but positive changes were observed in the senior fitness test.

The results of the aforementioned study are in proportion to those achieved by the authors of the present research, as they also show how physical activity mixed with other activities that require mental effort, whether through multicomponent training or combined with cognitive actions, achieves a positive effect on stimulating the memory of older adults.

Conclusions

The results obtained through the comparison between the pretest and the posttest after the implementation of physical coordination exercises combined with cognitive actions, allowed us to verify the effectiveness of this extra-hospital therapy, since the stimulation of immediate memory was achieved in older adults with mild cognitive impairment



through community physical activity.

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Conflicts of interest

The authors declare that there are no financial, personal or professional conflicts of interest that may have influenced the performance or interpretation of the results of this study.



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