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ORIGINAL

Upper body motor relearning to improve activities of daily living in older adults through recreational exercises

Reaprendizaje motor del tren superior para mejorar actividades de la vida diaria en el adulto mayor, mediante ejercicios lúdicos

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ABSTRACT

Introduction: aging leads to functional and cognitive decline, affecting the ability to perform activities of daily living (ADLs). Upper body function is key to maintaining autonomy. A recreational exercise-based intervention was proposed to promote motor relearning and executive stimulation in older adults.
Method: a quasi-experimental study was conducted in 55 older adults (mean age 74,87 ± 7,54 years), who participated in a six-week recreational exercise program focused on the upper body (three 45-minute sessions per week). Instrumental functioning (Lawton and Brody scale), executive functions (FAB-E), and five functional motor tasks were assessed before and after the intervention. Student's t-test was applied for related samples.
Results: statistically significant reductions were observed in the execution times of the eight variants of the pouring water activity ($p < 0,001$), with improvements ranging from 0,62 to 0,94 seconds. The following tasks showed improvements: lowering a jar (−5,86 s; $p = 0,021$), lifting groceries (−2,91 s; $p = 0,045$), tying shoelaces (−0,85 s; $p = 0,016$), and putting on a sweater (−0,63 s; $p = 0,048$). The Lawton and Brody scale improved significantly (pre-test: 6,05 ± 1,94; post-test: 7,43 ± 1,84; $p = 0,008$), as did the FAB-E (pre-test: 12,04 ± 4,31; post-test: 14,65 ± 5,12; $p = 0,034$).
Conclusions: the playful program improved upper body function and executive functions, demonstrating its effectiveness as an accessible and motivating therapeutic strategy for older adults.

Keywords: Older Adults; Functionality; Executive Functions; Recreational Exercises; Motor Relearning.

RESUMEN

Introducción: el envejecimiento conlleva deterioro funcional y cognitivo, afectando la capacidad para realizar actividades de la vida diaria (AVD). La funcionalidad del tren superior es clave para mantener la autonomía. Se propuso una intervención basada en ejercicios lúdicos para favorecer el reaprendizaje motor y la estimulación ejecutiva en adultos mayores.
Método: se realizó un estudio cuasi-experimental en 55 adultos mayores (edad media 74,87 ± 7,54 años), quienes participaron en un programa de ejercicios lúdicos centrados en el tren superior durante seis semanas (tres sesiones semanales de 45 minutos). Se evaluó la funcionalidad instrumental (escala de Lawton y Brody), funciones ejecutivas (FAB-E) y cinco tareas motoras funcionales antes y después de la intervención. Se aplicó la prueba t de Student para muestras relacionadas.

Resultados: se observaron reducciones estadísticamente significativas en los tiempos de ejecución de las ocho variantes de la actividad de verter agua ($p < 0,001$), con mejoras entre 0,62 y 0,94 segundos. Las tareas complejas mostraron mejoras: bajar un tarro (−5,86 s; $p = 0,021$), levantar compras (−2,91 s; $p = 0,045$), atarse cordones (−0,85 s; $p = 0,016$) y colocarse un suéter (−0,63 s; $p = 0,048$). La escala de Lawton y Brody mejoró significativamente (pre: 6,05 ± 1,94; post: 7,43 ± 1,84; $p = 0,008$), al igual que la FAB-E (pre: 12,04 ± 4,31; post: 14,65 ± 5,12; $p = 0,034$).
Conclusiones: el programa lúdico mejoró la funcionalidad del tren superior y las funciones ejecutivas, evidenciando su eficacia como estrategia terapéutica accesible y motivadora para adultos mayores.

Palabras clave: Adultos Mayores; Funcionalidad; Funciones Ejecutivas; Ejercicios Recreativos; Reaprendizaje Motor.

INTRODUCTION

Aging is a natural process that involves a progressive decline in functional, cognitive, and sensory abilities, which affects the independence and quality of life of older adults. The loss of upper body function, in particular, represents a significant barrier to the independent performance of activities of daily living (ADL), such as dressing, feeding, grooming, and handling objects.[1,2] This functional decline is often accompanied by a decline in executive functions, which are essential for planning, sequencing, and executing complex tasks.[3]

Several studies have shown that physical exercise is an effective tool for maintaining and improving functionality in older adults.[4] More recently, the use of playful interventions, which incorporate structured games and meaningful activities, has been proposed as a motivating alternative that promotes not only movement but also cognitive, emotional, and social stimulation.[5,6] Playful exercises encourage motor relearning through functional repetition in contexts with high symbolic and affective value, which promotes neuroplasticity and long-term adherence.[7,8]

Among the functional and cognitive assessment tools used in the older adult population, the Lawton and Brody Scale, which assesses the ability to perform instrumental ADLs, and the Frontal Assessment Battery (FAB-E), which measures the performance of executive functions, especially those mediated by the prefrontal cortex, are particularly noteworthy. These instruments have shown good validity and reliability in detecting clinically relevant changes in intervention settings.

Previous studies have shown that intervention programs that integrate physical exercise and cognitive stimulation generate significant benefits in both functional performance and neuropsychological performance in older adults.[12,13] However, there is still limited evidence specifically analyzing the impact of upper body recreational exercises on daily functioning and executive function, especially in community settings with limited resources. Likewise, it has been reported that lack of participation in meaningful activities can lead to negative effects such as isolation, accelerated cognitive decline, and loss of functional autonomy.[14]

This study aims to identify changes in functionality (using the Lawton and Brody scale), executive function (FAB-E), and five selected upper body functional activities after the implementation of a recreational exercise program in older adults.

METHOD

This research was a quasi-experimental descriptive analysis conducted between April 2024 and May 2025. Through a non-probabilistic convenience sample, 98 participants were initially included, of whom 43 dropped out during the course of the research, leaving a total of 55 participants. All participants signed an informed consent form and belonged to a geriatric community in urban and rural areas that met the inclusion criteria: age ≥ 65 years, ability to understand simple instructions, and mild or moderate level of functional dependence according to the Lawton and Brody scale. Those with a clinical diagnosis of advanced dementia, progressive neurological disorders, or medical conditions that prevented physical activity were excluded. The research adhered to the ethical guidelines of the Helsinki Declaration for human subjects.

All participants were enrolled in a single intervention group where they took part in a recreational exercise program focused on the upper body, structured in 45-minute sessions, three times a week for 6 weeks. The activities focused on functional motor tasks with cognitive components, such as coordination games, object manipulation, simulation of activities of daily living (dressing, reaching for objects, handling utensils), and group dynamics that encourage participation. The difficulty progressed gradually, taking into account the safety and autonomy of each participant.

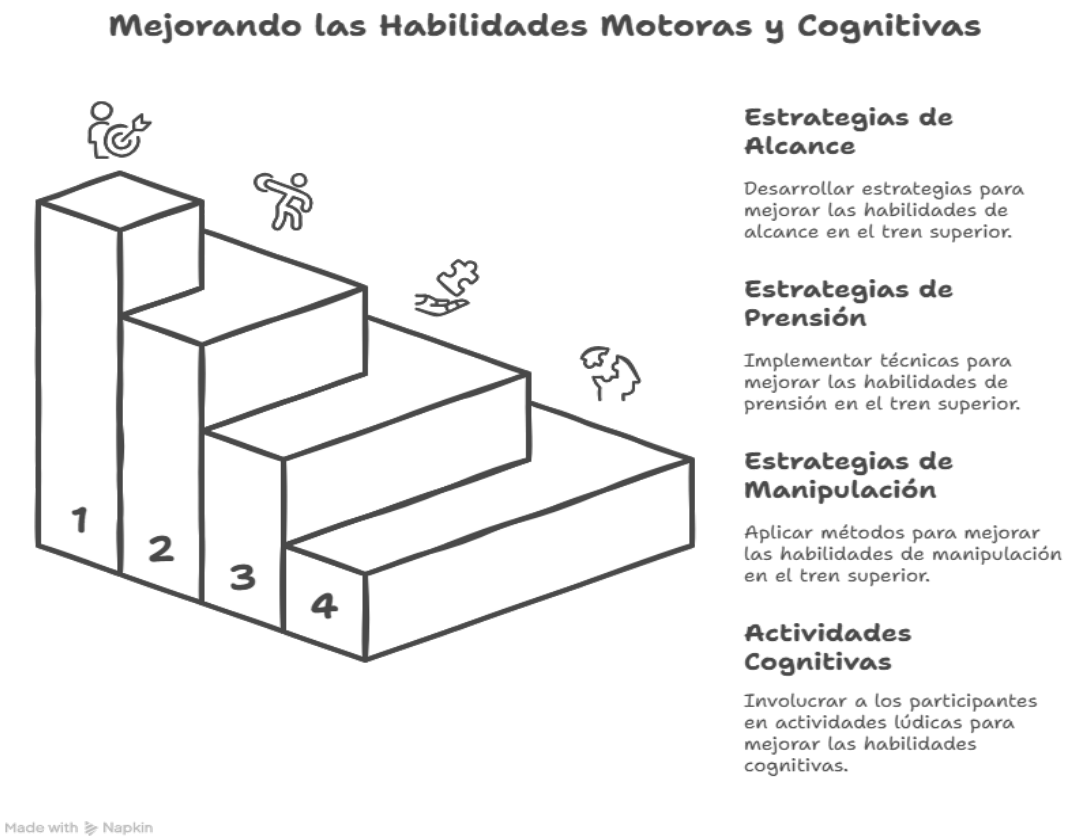

Figure 1. Intervention protocol outline

Two instruments were used before and after the intervention: the Lawton and Brody Scale, to measure functional capacity in instrumental activities of daily living; and the Frontal Assessment Battery (FAB-E), to assess executive functions related to the prefrontal cortex. In addition, performance was recorded in five specific upper body functional activities related to everyday tasks, such as 1. Picking up a jug of water and pouring a glass; 2. Taking a jar down from the cupboard; 3. Picking up groceries from the floor; 4. Tying shoelaces; 5. Putting on and taking off a sweater. The measurements were taken by trained evaluators who were blind to the specific purpose of the study.

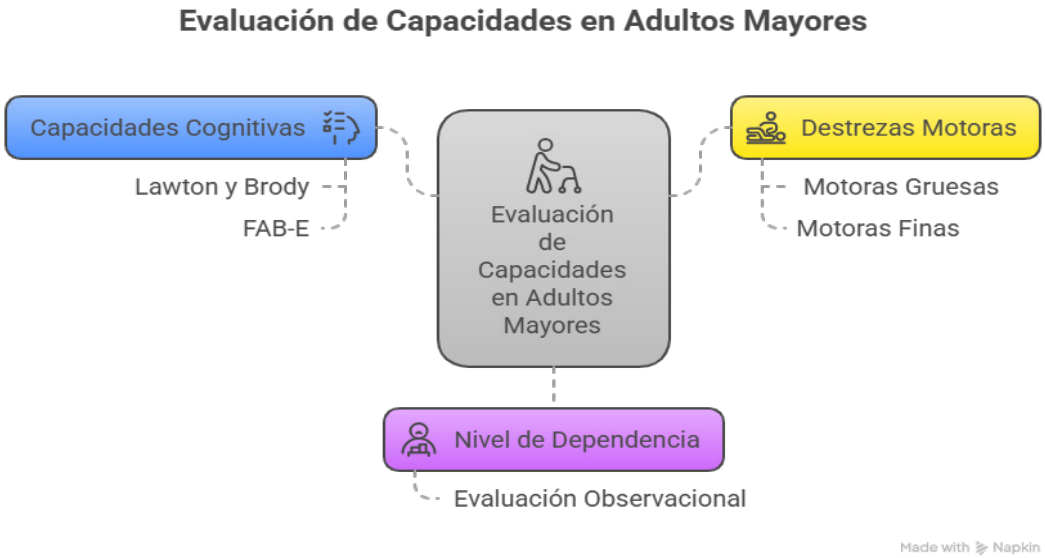

Figure 2. Evaluation protocol outline

RESULTS

Table 1. Clinical and epidemiological characteristics of the study population

	Mean/n	SD
Gender		
Female	47	85,5
Male	8	14
Age (years)	74,87	7,54
Weight (kg)	59,13	10,96
Size (m)	1,49	0,07
BMI	27,73	7,1
Lower limb dominance		
Right	5	9
Left	1	1,8
Lower limb dominance		
Right	53	96
Left	1	1,8
Both	1	1,8
Disability		
No	47	85,5
Yes	8	14,5
Total	55	

The effects of an intervention based on recreational exercises on motor activity performance, instrumental functionality, and executive function in older adults were analyzed. The sample consisted of subjects evaluated before and after the intervention. The normality of the data was verified using Shapiro-Wilk tests, with no significant value ($p > 0,05$), which allowed the use of parametric tests. To compare the pre- and post-intervention values, the Student's t-test for related samples was used.

Table 2. Effects of intervention based on playful exercises on the performance of motor activities

	Pre-intervention (sg)	SD	Post-intervention (sg)	SD	Difference (sg)/p value	
Activity	**Take a jug of water and pour it into a glass**					
Right extremity, seated, height 20 cm	7,15	3,2	6,2	1,86	0,94	<,001 ***
Right limb, bipedal height 20 cm	5,7	2	4,98	1,64	0,78	<,001 ***
Right extremity seated height 40 cm	6,3	2,1	5,5	0,81	0,73	<,001 ***
Right bipedal limb height 40 cm	5,62	1,39	4,93	0,6	0,69	<,001 ***
Left extremity seated height 20 cm	6,56	2,1	5,9	0	0,62	<,001 ***
Left limb height of 20 cm	5,8	1,95	5,12	0	0,70	<,001 ***
Left extremity seated height 40 cm	6,39	1,68	5,7	0	0,65	<,001 ***
Left limb height 40 cm	5,98	1,71	5,11	0	0,87	<,001 ***
Activity 2	Take a jar down from the cupboard					
	3	13,0	25,3	11,2	-5,8	0,021
Activity 3	Increase purchases from the floor					
	11,93	10,45	9,02	7,3	-	0,045
Activity 4	Tying shoelaces					
	4,7	1	3,8	1	-0,85	0,016
Activity 5	Putting on and taking off a sweater					
	4,3	1,51	3,7	1,2	-0,63	0,048
Evaluation test						
Lawton and Brody test	6,05	1,94	7,43	1,84	-1,38	0,008**
FAB scale	12,04	4,31	14,65	5,1	-2,61	0,034

Statistically significant decreases were observed in the execution times of the eight motor items analyzed ($p < 0,001$ in all cases). The differences ranged from 0,63 to 0,94 seconds, showing an improvement in motor efficiency after the intervention (table 1). These results suggest a positive effect of playful exercises on the coordination, speed, and motor planning of the participating older adults.

Functional activities 2, 3, 4, and 5 also showed significant reductions in execution times after the intervention. The differences were −5,86 s ($p = 0,021$), −2,91 s ($p = 0,045$), −0,85 s ($p = 0,016$), and −0,63 s ($p = 0,048$), respectively. These improvements reflect a generalized functional gain in tasks requiring more complex motor integration and basic cognitive strategies. Regarding instrumental functionality, a significant increase was recorded in the Lawton and Brody scale score (pre: 6,05 ± 1,94; post: 7,43 ± 1,84; $p = 0,008$). Similarly, the Frontal Assessment Battery (FAB) showed a significant increase (pre: 12,04 ± 4,32; post: 14,65 ± 5,12; $p = 0,034$), indicating an improvement in executive and frontal control processes.

DISCUSSION

The results of this study show that a recreational exercise program focused on the upper body produces statistically and clinically significant improvements in key domains of functionality in older adults, including motor performance, autonomy in instrumental activities of daily living (IADL), and executive functions.

Regarding the functional activity of "picking up a jug of water and pouring a glass," a significant improvement in execution times was observed in all variants evaluated (sitting and standing, at 20 and 40 cm, using both arms). For example, in the right upper limb in a seated position at 20 cm, the average time decreased from 7,15 ± 3,23 s to 6,21 ± 1,86 s (−0,94 s; $p < 0,001$). These improvements remained consistent across all conditions, with reductions ranging from −0,62 to −0,94 seconds. These findings are consistent with those reported by Schättin et al.[15], who demonstrated that repetitive functional practice in meaningful contexts facilitates the reorganization of motor patterns through neuroplasticity mechanisms, which are especially relevant in aging populations. In addition, studies such as that by Seidler et al.[16] highlight that motor training in older adults can induce structural and functional changes in the motor and prefrontal cortex, facilitating transfer to everyday tasks.

Complex functional tasks also showed significant improvements. In the activity of "taking a jar down from the cupboard," the average time was significantly reduced from 31,18 ± 13,04 s to 25,32 ± 11,22 s (−5,86 s; $p = 0,021$), while in "picking up groceries from the floor," it went from 11,93 ± 10,45 s to 9,02 ± 7,38 s (−2,91 s; $p = 0,045$). These tasks require intersegmental coordination, anticipatory postural control, and complex motor planning, suggesting a transfer of motor relearning to more demanding functional tasks. Law et al.[17] and Hiyamizu et al.[18] agree that programs focused on functional movements that simulate the demands of daily life improve anticipatory motor control and biomechanical efficiency in older adults.

In personal care tasks, such as "tying shoelaces" and "putting on/taking off a sweater," time reductions of 0,85 s ($p = 0,016$) and 0,63 s ($p = 0,048$) were observed, respectively. Although these values are moderate, they are considered clinically relevant as they represent activities critical to daily autonomy. Studies such as that by Van het Reve et al.[19] have documented that changes of just half a second in self-care tasks can mean substantial functional differences in frail geriatric populations.

With regard to overall functionality, assessed using the Lawton and Brody scale, a significant increase from 6,05 ± 1,94 to 7,43 ± 1,84 points was recorded after the intervention (difference: +1,38; $p = 0,008$). This change exceeds the threshold of clinical significance suggested by Lawton[20] and is associated with tangible improvements in autonomy and a reduction in the risk of dependency or institutionalization. This is in line with the findings of García et al.[21] and Giné et al.[22], who highlight that physical interventions integrated with significant cognitive components generate a greater perception of functional competence in older adults.

From a cognitive standpoint, the FAB-E executive function test showed a significant improvement in average scores, from 12,04 ± 4,31 to 14,65 ± 5,12 (difference: +2,61; $p = 0,034$). This gain suggests a strengthening of functions such as planning, inhibitory control, and cognitive flexibility. According to Diamond[23], exercise programs that integrate cognitive tasks (e.g., with rules, working memory, problem solving, or motor sequences with variability) stimulate the prefrontal cortex and promote neuroplasticity in older adults. The playful and symbolic dynamics of the program, characterized by group challenges, creative sequences, and motor problem solving, may have been a key facilitator of these results. This approach is consistent with the findings of Best et al.[24], who argue that dual cognitive-motor training is particularly effective in older populations.

Finally, the playful and social component of the program probably acted as a positive motivational and emotional modulator. Chao et al.[25] emphasize that a socially stimulating and meaningful environment promotes adherence, motor learning, and sustained participation, especially in gerontological interventions. Intrinsic motivation, enhanced by play and social interaction, has been identified as a key predictor of therapeutic success in older adults.[26,27]

Although the study has methodological limitations, such as the absence of a control group and a small sample size ($n = 55$) after the loss of subjects, the results obtained are statistically robust and clinically

relevant, justifying their consideration. Future research should include randomized controlled designs with longitudinal follow-up to evaluate the sustainability and generalizability of the observed effects.

CONCLUSIONS

Playful exercises focused on tasks for the lower limbs demonstrated significant improvements in the performance of functional activities, in the ability to perform instrumental activities of daily living, and in the performance of executive functions in older adults. The proposed intervention is presented as an effective, accessible, and motivating strategy to promote motor relearning and comprehensive functionality in this population. It is worth highlighting the significant contribution of group and playful exercises in promoting adherence to exercise, which is a determining factor in promoting overall improvement in the individual.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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