Effects of a dual-task intervention program in institutionalized older adults: a pilot randomized controlled trial

Efectos de un programa de intervención con doble tarea en adultos mayores institucionalizados: un ensayo piloto controlado y aleatorizado

Authors

Natalia Pinto Rojas [1];
Walter Sepúlveda-Loyola [1*];
Macarena Moyano Fuentes [1];
Constanza Arévalo Cea [1];
Katherine Agüero Villa [1];
Fabiola Briones Pineda [1];
Ignacio Astudillo Ganora [1];
Alejandro Álvarez-Bustos [2,3*]

[1] Universidad de Las Américas, Santiago, Chile
[2] Institute of Health Carlos III, Madrid, Spain
[3] Instituto de Investigación IdiPaz, Madrid, Spain

Corresponding authors:
Prof. Walter Sepúlveda-Loyola, PT, MSc, PhD
wsepulveda@udla.cl
Dr. Alejandro Álvarez-Bustos
a.alvarezbu@gmail.com

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Abstract

Objective: to compare the effects of single-task (ST) and dual-task (DT) training on physical and cognitive function in institutionalized older adults.
Methods: Participants included in this pilot study were assigned randomly into two groups, ST (multicomponent physical exercise, MPE) and DT training (MPE + cognitive tasks). Both groups performed the exercise three times per week for 1 month. Short Physical Performance Battery (SPPB), isometric handgrip strength (IHS), Barthel Index and Montreal Cognitive Assessment (MoCA) were used to assess physical and cognitive performance, respectively. Participants were evaluated at the beginning (V1), at the end of the exercise (V2), as well as one month later (V3). Paired Student's t-test and lineal regression models were used to explore the effect of the exercise interventions.
Results: 24 (58.3% men, mean age 67.33±3.36) institutionalized older adults were included. Adherence in both groups was 100%. After the training period, both groups significantly improved SPPB and IHS, while MoCA only increased in the DT group. At V3, both groups presented significantly higher MoCA scores, although only DT increased IHS scores. Significant differences between groups were observed in ΔV1-V2 SPPB (p-value <0.001) and ΔV1-V3 IHS (p-value <0.05). Once cognitive function was considered, only ΔV1-V2 SPPB [β (95%CI): 1.63 (0.78, 2.47), p-value 0.001] and ΔV1-V2 IHS [β (95%CI): 0.97 (0.10, 1.84), p-value 0.031] were significantly different between groups.
Conclusions: Dual-task exercise may produce greater effect on physical, but not cognitive function, in comparison with single-task exercise in institutionalized older adults. Larger randomized-controlled trials are needed to confirm our findings.

Keywords

Dual-task exercise; institutionalized; physical function; randomized controlled trial.

Resumen

Objetivo: Comparar los efectos del entrenamiento en modalidad de tarea única (ST) y de tarea dual (DT) sobre la función física y cognitiva en personas mayores institucionalizadas.
Métodos: Los participantes fueron aleatorizados en dos grupos: ST (ejercicio físico multicomponente, MPE) y DT (MPE + tareas cognitivas). Ambos grupos realizaron el ejercicio tres veces por semana durante un mes. El rendimiento físico y cognitivo se evaluaron mediante la Batería de Rendimiento Físico Corto (SPPB), la fuerza de prensión (IHS), el Índice de Barthel y la Evaluación Cognitiva de Montreal (MoCA); al inicio (V1), al finalizar el programa de ejercicio (V2) y un mes después (V3). Los resultados se analizaron mediante la prueba t de Student para muestras relacionadas y modelos de regresión lineal.
Resultados: Se incluyeron 24 participantes (58,3 % hombres, edad media 67,33±3,36). La adherencia fue del 100 % en ambos grupos. Entre V1-V2, ambos grupos mejoraron significativamente en SPPB e IHS, mientras que MoCA solo aumentó en el grupo DT. Se observaron diferencias significativas entre los grupos en ΔV1-V2 SPPB (p<0.001) y ΔV1-V3 IHS (p<0.05). Al considerar la función cognitiva, solo ΔV1-V2 SPPB [β(IC95 %): 1.63(0.78, 2.47), p=0.001] y ΔV1-V2 IHS [β(IC95 %): 0.97(0.10, 0.84), p=0.031] mostraron diferencias significativas entre los grupos.
Conclusiones: El ejercicio de tarea dual podría generar un mayor efecto sobre la función física, pero no cognitiva, en comparación con el ejercicio de tarea única en adultos mayores institucionalizados. Se requieren ensayos controlados aleatorizados de mayor tamaño para confirmar estos hallazgos.

Palabras clave

Ejercicio en modalidad de tarea dual; ensayo controlado aleatorizado; función física; institucionalizados.

Introduction

Ageing of the population poses as one of the most significant challenges of the society (United Nations, 2022). As we age, individuals experience both a decline in physical and cognitive function, among others(Prince et al., 2021). In fact, World Health Organization has defined healthy ageing as the preservation of intrinsic capacity, basically composed of physical and cognitive abilities("WHO | World Report on Ageing and Health 2015," 2015). Advanced physical and cognitive impairments attempt with the individual's functional independence, often leading to the necessity of institutionalization in older adults(Luppa et al., 2010). Thus, improving physical and cognitive variables in older adults living in nursing homes seems to be a priority in this population in order to maintain quality of life and reduce the risk of falls or worsening disability, among others. Physical exercise programs (physical activity interventions performed with the objective of improving some specific component, detailing the type of exercise, duration, or frequency)(WHO, 2020.) have proved to improve physical and cognitive function in this population(Valenzuela et al., 2023).

However, studies on physical exercise in older adults living in nursing homes have generally not compared the efficacy of different exercise programs(Valenzuela et al., 2023), so several specific aspects of exercise have not been elucidated yet(Coelho & Marzetti, 2023; Valenzuela et al., 2023). This is the case for the so-called dual task exercise training, in which the individual simultaneously performs cognitive and physical tasks. This type of interventions has shown to prevent or decelerate age-related deterioration, maintaining or improving functional aspects (i.e., balance or walking speed) and cognitive status and reduces the risk of falls(Silsupadol et al., 2009; Tait et al., 2017; Varela-Vásquez et al., 2020). Nevertheless, most of these studies have been conducted in community-dwelling older adults and there is insufficient evidence in institutionalized older adults(Varela-Vásquez et al., 2020; Yu et al., 2023), or has included individuals from other settings in addition to residential care (Lemke et al., 2019). In this regard, Rezola-Pardo et al. (Rezola-Pardo et al., 2019) observed that a dual task program did not offer significant benefits compared to a multicomponent program. However, Delbroek and colleagues (Delbroek et al., 2017) did observe that a virtual reality dual task program improved motor tasks such as timed up and go in institutionalized older adults with dementia.

Thus, the objective of this study is to evaluate the effects of a 1-month dual task intervention program on cognitive status and functional function compared to single-task in institutionalized older adults. We hypothesize that dual task programs are superior to simple tasks in improving physical and cognitive function in this population.

Method

The present study was a pilot assessor-blind randomized controlled trial conducted at the Fundación Pequeño Cottolengo, in the Cerrillos district (Metropolitan, Chile). The research was conducted from September to November 2023, with the approval of the Ethics Committee of the Universidad de las Américas, Chile (Code number: CEC_FP_2023042) and conducted according to the Declaration of Helsinki. The study protocol was registered in ClinicalTrials.gov (Registration number: NCT06361615).

Participants were evaluated at the beginning (V1), at the end of the exercise (V2), as well as one month after the end of the intervention in which no training was performed (V3).

Participants

Older adults' residents from a nursing-home were eligible for inclusion if they were between 65-75 years old, with more than 3 years of institutionalization, who had not exercised or performed physical therapy during the last year, without any specific medical diagnosis of dementia,11 and that could carry out independent walking with or without technical assistance. Participants were excluded if they suffered from a chronic or acute uncompensated pathology that prevents exercise. Participants provided written informed consent before being evaluated for inclusion.

Randomization and Masking

Participants who signed the consent form were randomly allocated to one of the two groups using the computer-generated random sequence. Randomization was performed using randomly selected blocks with a 1:1 allocation ratio, assigning two participants per block. A research assistant who was not involved in any other procedures of this study helped with participant allocation and informed participants about their group allocation. Although blinding was not possible for participants in exercise-intervention research, the outcome assessors and data analysts were masked to group assignments. The study was unblinded after the statistical analyses were completed.

Intervention groups

Exercise protocols are displayed in Supplementary Table 1. Single-task (ST) training group performed an exercise program based on Functional Exercise Circuit (FEC) protocol. This exercise program has been published previously(Loyola et al., 2018). It considered 15 different exercises in a functional exercise circuit. The selected exercises aim to improve participants' agility (i.e., walking over obstacles), coordination (i.e., lateral displacements), aerobic capacity (i.e., skipping), strength (i.e., biceps curl or bench press with rubber band, getting up from a chair) and balance (i.e., monopodal support on a balance disc). Participants carried out twelve sessions, 3 times per week, for one month, with a duration of 1 hour each session. Sessions were divided into three stages: dynamic warm-up, main work-out and return to calm; and performed under the supervision of at least by a physical therapist and a physical therapist's student. Intensities of the agility, coordination, aerobic capacity and muscular strength exercises were evaluated according to the maximum number of repetition (MNR) that a participant could perform an exercise. For this purpose, during a session prior to the commencement of the exercise program, each participant was instructed to perform these exercises for one minute. Their maximum number of repetitions (MNR) for each task was recorded and subsequently used to prescribe the intensity for the following sessions. Exercise was performed between 50% (1-2 weeks) to 60% (3-4 weeks) of the MNR. Each exercise intensity was evaluated according to the modified Borg scale (Borg, 1982), ranging from 0 to 10, being the latest the highest possible intensity. Participants were encouraged to perform the exercise with an intensity between 3 to 6.

Dual-task (DT) training group performed motor (FEC) plus cognitive tasks. Cognitive tasks in addition to physical exercise included counting days of the week or singing a song, among others (Sepúlveda-Loyola et al., 2025).

Primary outcome

Short Physical Performance Battery (SPPB)

The SPPB is a physical performance battery of tests that include: the 4-meter walking test (4MWT) performed at usual pace, the 5-times sit-to-stand test (5STS), and Romberg balance test, assessing the ability of standing upright in three progressively standing conditions (feet together, semi-tandem and full-tandem) for a maximum period of ten seconds. SPPB scores range from 0 (inability to complete the test) to 4 (best performance), obtaining a total score ranging from 0 (worst performance) to 12 (best performance) (Guralnik et al., 1994).

Secondary outcomes

Montreal Cognitive Assessment (MoCA)

MoCA(Nasreddine et al., 2005) was used to assess cognitive status. This test evaluates older adults' attention, language, calculation, orientation, construction, visual and memory. This test has been validated in Spanish(Vázquez González et al., 2022) and cut-off scores have been adjusted to the Chilean population(Gaete et al., 2023).

Barthel Index

Disability status was assessed by the Barthel Index(Mahoney & Barthel, 1965). This test measures the individual's independence in Basic Activities of Daily Living (BADLs). Barthel Index classifies individuals in four categories: severe disability (scores from 0 to 60), moderate disability (scores from 65 to 85), mild disability (from 90 to 95) and no disability (scores of 100).

Isometric Handgrip Strength (IHS)

IHS was evaluated by using a hydraulic JAMAR dynamometer (J. A. Preston Corporation, Clifton, NJ, USA) following standard procedures(Ottenbacher et al., 2002). The best of two performances with one minute of resting between them was registered. IHS was performed in both hands.

Immobility Syndrome Scale

Staging of dismobility was assessed by the tool proposed by Dinamarca (ETADI) (Dinamarca M, 2003). ETADI classifies older individuals according to their immobility level: Stage 1, corresponds to the level in which the patient can spend most of the day in standing; Stage 2, sedentary, and Stages 3, 4 and 5 correspond to the substages of bed rest. Sub-stage "A" corresponds to greater independence and Sub-stage "B" to greater dependence on the patient.

Data analysis

Data are presented as mean (standard deviation) and frequency (percentages) for continuous and categorical variables, respectively. Differences in participants' characteristics according to the randomization group were analyzed through t-test or U Mann-Whitney and $\chi 2$ test for continuous and categorical variables, when corresponding. Repeated t-tests measures were performed to evaluate the effects of the training program for each group. Lineal regression models adjusted by cognitive status at baseline was conducted to evaluate changes in the SPPB, Barthel Index and MoCA according to the randomization group.

Significance level was set at p-value <0.05. Analyses were performed using SPSS Statistics® (Version 23; IBM; New York; United States).

Results

Twenty-four (67.3±3.36 mean age, 14 men) nursing-home residents were included. Characteristics of the study participants at baseline according to the randomization group are shown in Table 1. Significant differences in the MoCA score were observed among groups.

Table 1. Characteristics of the participants at baseline according to the randomization group.

	ST (n=12)	DT (n=12)	p-value
Age, mean (SD)	67.33 (3.11)	67.33 (3.73)	1.000
Sex, n (%)	7 (58.33)	7 (58.33)	1.000
Barthel Index, mean (SD)	85.00 (13.82)	84.58 (11.17)	0.936
MoCA score, mean (SD)	12.58 (2.87)	16.00 (2.76)	**0.007**
SPPB, mean (SD)	5.58 (2.39)	6.42 (2.68)	0.430
IHS (left hand), mean (SD)	16.34 (2.72)	14.72 (7.46)	0.490
IHS (right hand), mean (SD)	18.46 (4.32)	16.30 (11.89)	0.564
BMI, mean (SD)	24.48 (2.12)	24.46 (2.58)	0.986
Intelectual disability, n (%)	1 (8.33)	0 (0)	0.307
Epilepsy, n (%)	5 (41.67)	5 (41.67)	1.000
Organic brain damage, n (%)	7 (58.33)	8 (66.67)	0.673
Autism Spectrum Disorder, n (%)	1 (8.33)	0 (0)	0.307
Down Syndrome, n (%)	1 (8.33)	0 (0)	0.307
Hypertension, n (%)	2 (16.67)	1 (8.33)	0.537
Cerebral palsy, n (%)	1 (8.33)	1 (8.33)	1.000
Depression, n (%)	0 (0)	1 (8.33)	0.307
Type-2 Diabetes, n (%)	0 (0)	1 (8.33)	0.307
Parkinson, n (%)	0 (0)	2 (16.67)	0.140
Venous insufficiency, n (%)	0 (0)	1 (8.33)	0.307
Congestive heart failure, n (%)	1 (8.33)	0 (0)	1.000
Hypotiroidism, n (%)	1 (8.33)	0 (0)	0.307
Schizophrenia, n (%)	0 (0)	1 (8.33)	0.307
ETADI			
1A, n (%)	4 (33.33)	4 (33.33)	
1B, n (%)	5 (41.67)	6 (50.00)	0.554
2B, n (%)	3 (25.00)	1 (8.33)	

BMI: Body Mass Index. ETADI: Stages of Dysability scale. IHS: Isometric Handrip Strength. MoCA: Montreal Cognitive Assessment. SPPB: Short Physical Performance Battery.

Attendance for training sessions during the 1-month exercise intervention was 100% on both groups. All participants completed all follow-up visits, and no adverse events were reported.

Mean scores of the variables along the study are shown in Table 2. After the training period, both groups significantly improved in SPPB scores (p-value <0.05) and in handgrip strength (p-value <0.01). On the other hand, MoCA scores only increased in the DT group (diff. 0.58±0.23, p-value 0.027). At V3, both groups presented significantly higher MoCA scores (p-value <0.001), although only DT performed higher IHS scores (diff. 2.12±0.60, p-value 0.005).

Table 2. Mean values of the main outcomes according to the different visits.

	ST				DT			
	V1	V2	V3	SC	V1	V2	V3	SC
SPPB, mean (SD)	5.58 (2.39)	6.33 (2.27)	5.75 (2.45)	a	6.42 (2.68)	8.75 (2.34)	7.25 (2.18)	a, c
Barthel Index, mean (SD)	85 (13.82)	85 (13.82)	85 (13.82)		84.58 (11.17)	85.83 (11.45)	85.83 (11.45)	
MoCA, mean (SD)	12.58 (2.87)	12.92 (2.87)	14.5 (2.91)	b, c	16 (2.76)	16.58 (3.09)	18.17 (3.07)	a, b, c
IHS (Left hand), mean (SD)	16.34 (2.72)	17.04 (2.71)	16.09 (3.31)	a	14.72 (7.46)	16.09 (7.07)	16.76 (7.38)	a, b
IHS (Right hand), mean (SD)	18.46 (4.32)	19.14 (4.31)	18.79 (4.01)	a	16.3 (11.89)	17.43 (11.68)	18.42 (11.01)	a, b

a: p-value <0.05 when comparing V1 and V2. b: p-value <0.05 when comparing V1 and V3. c: p-value <0.05 when comparing V2 and V3. IHS: Isometric Handgrip Strength. MoCA: Montreal Cognitive Assessment. SD: Standard Deviation. SC: Significant Comparison. SPPB: Short Physical Performance Battery.

Differences in the main variables, as well as the changes in them, according to the randomization groups are shown in Table 3. We found significant differences between-groups in SPPB score (ΔV1-V2 and ΔV2-V3) and handgrip strength (ΔV1-V3). In these findings, DT exhibited significantly better results than ST. We assessed whether changes in outcomes according to randomization groups were influenced by baseline differences in the MoCA test. When the model was adjusted for baseline cognitive status, significant differences were found in the change in SPPB [ΔV1-V2 β(95%CI): 1.63 (0.78, 2.47), p-value 0.001] and left IHS [ΔV1-V3 β(95%CI): 0.97 (0.10, 1.84), p-value 0.031]. No other significant result was obtained.

Table 3. Associations between changes in physical and cognitive outcomes according to the randomization groups.

	ST		DT	
	V1	V2	V1	V2
V1-V2				
ΔBarthel Index	1.25 (-1.34, 3.84)	0.328	-0.51 (-3.28, 2.27)	0.71
ΔMoCA	0.25 (-0.36, 0.86)	0.408	0.16 (-0.58, 0.90)	0.66
ΔSPPB	1.58 (0.00, 2.28)	<0.001	1.63 (0.78, 2.47)	0.001
ΔIHS (Left hand)	0.68 (-0.07, 1.42)	0.074	0.97 (0.10, 1.84)	0.031
ΔIHS (Right hand)	0.45 (-0.27, 1.17)	0.210	0.50 (-0.38, 1.37)	0.25
V2-V3				
ΔBarthel Index	NA		NA	
ΔMoCA	0.00 (-1.02, 1.02)	1	0.23 (-1.01, 1.44)	0.72
ΔSPPB	-0.92 (-2.45, 0.61)	0.227	-1.19 (-3.04, 0.65)	0.19
ΔIHS (Left hand)	1.62 (-0.31, 3.54)	0.096	0.38 (-1.71, 2.47)	0.71
ΔIHS (Right hand)	1.33 (-0.22, 2.89)	0.089	0.43 (-1.29, 2.15)	0.61
V1-V3				
ΔBarthel Index	1.25 (-1.34, 3.84)	0.328	-0.51 (-3.28, 2.27)	0.71
ΔMoCA	0.25 (-0.81, 1.31)	0.63	0.38 (-0.91, 1.66)	0.55
ΔSPPB	0.67 (-1.02, 2.35)	0.421	0.44 (-1.60, 2.48)	0.66
ΔIHS (Left hand)	2.29 (0.11, 4.48)	0.041	1.34 (-1.18, 3.87)	0.28
ΔIHS (Right hand)	1.78 (0.03, 3.53)	0.046	0.93 (-1.07, 2.93)	0.35

Model 1: raw model. Model 2: adjusted by MoCA score at baseline.
IHS: Isometric Handgrip Strength. In bold: p-value <0.05. NA: Not Available. MoCA: Montreal Cognitive Assessment. SD: Standard Deviation. SPPB: Short Physical Performance Battery.

Discussion

The main findings of the present study indicate that both single- and dual-task exercise interventions seem to improve physical and cognitive function. Nevertheless, improvements in the physical function were greater in the dual task group during the exercise period. Our results present a considerable clinical relevance in the proper management of institutionalized older adults. Although the benefits of physical exercise in this population have been widely described(Valenzuela et al., 2023), our results show that adding cognitive to motor tasks provides greater benefits in physical function variables.

Other studies have explored the role of dual task training in nursing-home residents. On the one hand, Rezola-Pardo et al. (Rezola-Pardo et al., 2019) compared single- and dual-task intervention improved physical function. Nevertheless, they did not observe benefits in adding cognitive tasks to the physical exercise intervention. Moreover, Bischoff et al.(Bischoff et al., 2021) also observed improvements in physical function after a dual task intervention. They also observed improvements in psychosocial well-being. Nevertheless, in this randomized controlled trial, the control group received usual care. In non-institutionalized older adults, the findings found by Brustio et al. (Brustio et al., 2018) and Silsupadol et al. (Silsupadol et al., 2009a)also showed a greater effect in physical domains in the group that performed DT.

Physical function, as assessed by the SPPB, is a widely used tool in both clinical and research settings, due to its brief implementation time and high predictive capacity for adverse events, such as falls, hospitalization, disability or death(de Fátima Ribeiro Silva et al., 2021; Guralnik et al., 1994; Pavasini et al., 2016; Sanchez-Sanchez et al., 2022; Vasunilashorn et al., 2009). In addition, this tool enables the close management of older adults, as it has been shown to be a sensitive measure for change, in which 1-point changes significantly increase or decrease the risk of adverse events, being this (1 point) the minimum clinical difference (Kwon et al., 2009; Perera et al., 2006). Notably, trajectory-based SPPB scores have been closely associated with mortality in nursing home residents(Charles et al., 2020). Thus, it seems to be an excellent tool to identify those individuals that present a higher risk of suffering from any adverse events with the aim of proposing interventions. Physical exercise interventions have been proposed as a valid approach to increasing the SPPB score. Nevertheless, according to our results, despite both groups improved their SPPB after training, only DT group exceeded this 1-point threshold by average, even doubling it, which guarantees not only statistical, but also clinical improvements(Kwon et al., 2009; Perera et al., 2006). Moreover, these between-groups differences were maintained even when baseline cognitive status was considered in the analysis. However, a significant reduction in this test was observed after one month of detraining. A decrease in SPPB in periods of detraining has already been described in community-dwelling older adults(Rodriguez-Mañas et al., 2019) as well as in nursing home residents(Courel-Ibáñez et al., 2022). In our study, we did not collect physical activity levels either before the intervention or among the detraining period, so it is likely that many of our participants presented very high levels of sedentary lifestyle in the month of detraining, leading to a significant loss of some of the improvements during the intervention. The older adults included in this study were individuals from a public nursing home, where access to other exercise programs is very limited. Thus, the absence of specific exercise stimuli led to a rapid regression on relatively labile neuromuscular adaptations or cognitive-motor integration processes.

This finding underscores the need for long-term interventions, especially in institutionalized older adults.

In terms of muscle strength, both groups showed improvements after the intervention, but only the DT group achieved significantly higher levels at follow-up compared to baseline values. However, despite the differences between-group were significantly different in the V1-V2 comparison, this was not the case in the V1-V3 comparison. In adults over 65 years of age, a one-kilogram improvement has been associated with a 30% reduction in cardiovascular risk and a 9% reduction in all-cause mortality risk (Lee, 2020).

Previous studies have shown positive effects of physical rehabilitation interventions in older adults living in nursing homes on the Barthel Index(Crocker et al., 2013; Valenzuela et al., 2023). The absence of improvement in our study may be attributed to the short duration of the intervention. Longer exercise interventions that include comparison between ST and DT are necessary to evaluate the effect on this variable.

Regarding cognitive function, both groups showed improvements in cognitive status as assessed by the MoCA, with significantly higher scores at V2 and V3. However, the changes were not significantly different between groups, even when considering baseline MoCA scores. This suggests that the multicomponent exercise interventions used in both groups, regardless of additional stimuli, provide benefits on cognitive function (Loyola et al., 2018). Previous studies have reported the benefits of multicomponent exercise programs on cognitive function. Casas-Herrero and colleagues reported improvements in MoCA score after three months of a multicomponent non-supervised physical exercise program in community-dwelling older adults with mild cognitive impairment or dementia(Casas-Herrero et al., 2022). On the other hand, Mollinedo Cardalda and colleagues performed a block-randomized controlled trial comparing the effect of two physical exercise programs on cognitive and functional status of frail institutionalized older adults. Exercise programs consisted of 12 weeks of training. One group performed a muscular strength program using elastic bands, another group performed an exercise program based on calisthenics mostly performed in the seated position, and a control group performed usual care. After the 12-week of follow-up, the control group worsened their cognitive status, while the exercise groups maintained or improved on it, finding significant differences between the three groups(Mollinedo Cardalda et al., 2019). Therefore, although the literature recognizes the effects and benefits of multicomponent exercise programs (Casas-Herrero et al., 2022; Mollinedo Cardalda et al., 2019), a notable gap remains in understanding how incorporating cognitive stimuli into motor tasks affects outcomes and whether different types of stimuli yield varying effects. This gap is particularly significant given that nursing home residents receive fewer cognitive stimuli compared to those living in the community. For this reason, more studies are necessary in this field(Ali et al., 2022), assessing whether the reported effects of dual-task training on certain markers in community-dwelling older adults are also observed in the nursing home population (Imaizumi et al., 2025).

Among the strengths of this study, we highlight that the training protocol has been previously detailed and validated(Loyola et al., 2018). Additionally, the excellent adherence of participants to the program is noteworthy, as all participants completed the entire exercise protocol. Possible explanations for this high adherence are the short time in which the program was carried out (only one month), the convenience sample (in which only those participants who wanted to do the exercise and completed the selection criteria were recruited), the involvement of all professionals engaged in the project and the support provided by family members. Moreover, the participants had no other scheduled activities and resided permanently at the nursing home facility. Therefore, this intervention was an event they looked forward to each week, enhancing their motivation and willingness to participate. The intervention was conducted in a public nursing home, where access to other physical or cognitive stimulation programs is very limited. This context may have positively influenced participants' adherence, contributing to their consistent 100% participation rate throughout the intervention. Another important strength was that the outcome assessors and the statistician were blinded to group assignments.

In addition, randomization on the basis of variables that could interfere in the results, such as age, gender, or functional status. Furthermore, although the individuals presented significant differences in terms of cognitive status, we took this into account in the regression models for a correct interpretation of our findings. In this line, Valenzuela and colleagues (Bischoff et al., 2021) observed in a systematic-review that exercise interventions conducted in nursing homes improved physical function independently of cognitive status.

This study presents some limitations that must be acknowledged. First, this is a small-scale study based on a convenience sample, a fact that may limit the interpretation of our findings. This limitation is compounded by the small sample size included, as well as the duration of the intervention. Since it was a pilot randomized controlled trial that helps researchers prepare for a future full-scale RCT with large sample size and interventions of longer duration that could produce greater effects on both physical and cognitive variables in older adults living in nursing homes. Furthermore, enriching such interventions by involving a multidisciplinary team—including occupational therapists and speech therapists—and evaluating their effects on subpopulations based on clinical conditions seems to be the logical next step. Additionally, it should be noted that our study population was relatively young compared to nursing home residents in other countries, which may impact the external generalizability of our findings.

Conclusions

The findings of this pilot randomized study show that both single and dual task exercise program improve physical and cognitive function in older adults living in nursing homes. However, the group that incorporated dual-task exercises might exhibit a greater improvement in physical but not in cognitive function. In addition, some of the benefits provided by the intervention might be lost after training, such as the physical function assessed by SPPB. Larger randomized-controlled trials incorporating multicenter designs to enhance diversity, stratified randomization, standardized outcome measures (i.e., falls, quality of life) and extended intervention and follow-up periods a higher sample size are needed to confirm our findings.

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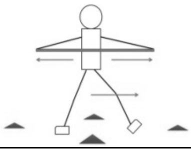
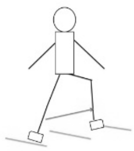
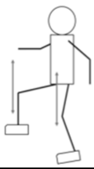
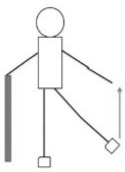
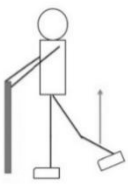
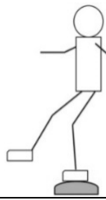
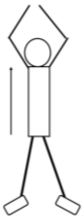
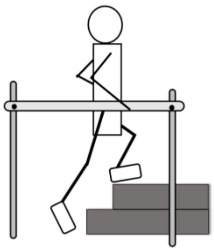
Authors' and translators' details:

Natalia Pinto Rojas	natyandreap.r@gmail.com	Author
Walter Sepúlveda-Loyola	wsepulveda@udla.cl	Author/translator
Macarena Moyano Fuentes	macarena.moyano19@gmail.com	Author
Constanza Arévalo Cea	constanza.a.c97@gmail.com	Author
Katherine Agüero Villa	aguerokatherine862@gmail.com	Author
Fabiola Briones Pineda	fbrionesp@udla.cl	Author
Ignacio Astudillo Ganora	iastudillo@udla.cl	Author
Alejandro Álvarez-Bustos	a.alvarezbu@gmail.com	Author/translator

Supplementary Table:

Supplementary Table 1. Functional Exercise Circuit program.

Exercise	Aim	Description of task	
		Exercise part A	Exercise part B
	Agility Coordination Aerobic Capacity	Walking over 5 obstacles, 50 cm apart each other, forth and backwards. Instructed to repeat this according to the percentage of MNR. The maximum number of laps at the initial evaluation was used as MNR.	Mentioning the days of the week.
	Coordination	Standing: Keeping one foot on the centre, moving the other foot in the direction of the cones (forward, back, left and right). Simultaneously to the lower limb exercises, arms must perform abduction and adduction when the lower limb returns to the centre. Instructed to repeat with each leg according to the percentage of MNR. MNR was calculated from the maximum number of repetitions in the initial evaluation.	Color game, touching the color that will be mentioned at the moment.
	Coordination	Walking over 5 marked lines on the floor, 50 cm apart each other, in a lateral gait, left and right. Repeat this according to the percentage of MNR. MNR was calculated from the maximum number of laps in the initial evaluation.	Transfer a ball from one end to the other, placing it inside a basket.
	Strength	Sitting on a chair: Biceps pulley from 90º to 120º of elbow flexion. Repeat it according to the percentage of MNR. MNR was calculated with the moderate resistance chosen by the patient at baseline.	Say a color each time there is an extension of the elbows.
	Aerobic capacity	Standing: Stationary gait with the elevation of each lower limbs. Repeat with each leg according to the percentage of MNR. MNR was calculated from the maximum number of repetitions between both lowers limbs in the initial evaluation.	Coordination of upper and lower limb, touching the raised knee with the hand.
	Strength	Sitting on a recumbent chair: Abdominal crunches ranging from 45º to 90º position. Repeat it according to the percentage of MNR. MNR was calculated from the maximum number of repetitions in the initial evaluation.	Identify colors that will be shown on cards.
	Strength Power	Standing: Rest your hands on the back of the chair for stability if necessary and perform a Squat. Repeat it according to the percentage of MNR. MNR was calculated from the maximum number of repetitions in the initial evaluation.	Count out loud each time you stand up
	Strength	Standing: Rest your hands on the back of a chair for stability. Raise one leg to the side as far as is comfortable, keeping your back and hips straight. Avoid tilting to the other leg. Repeat it with each leg according to the percentage of MNR. MNR was calculated from the maximum number of repetition in the initial evaluation.	Name right and left according to the side being abducted.
	Strength	Standing: Rest your hands on the back of a chair for stability. Standing upright, raise your leg backwards, keeping it straight. Keep the back straight as you take your leg back. Repeat it with each leg according to the percentage of MNR. MNR was calculated from the maximum number of repetitions in the initial evaluation.	Grasp a water bottle each time you perform an extension.

	Balance	Standing: Put one foot over the balance-disc and keep your back straight and rise the other foot; keeping the balance for 15 seconds. And change your leg. In the beginning you can rest your hands on the back of the chair for more stability. The level of difficulty and progression were done adding other tasks.	Count to 20.leg forward and backward.
	Strength Power Coordination	Pass behind your back the elastic band and stretch forward with your arms, doing lunges, one leg at a time. Keeping your back straight. . Repeat it with each leg according to the percentage of MNR. MNR was calculated from the maximum number of repetition in the initial evaluation.	Perform reaching with the upper extremities, touching an image that will be attached to the wall.
	Stretching	Place both palms together, performing a bipedal hand extension.	Sing a song.
	Balance	With the help of parallel bars, go up and down a step.	Identify everyday objects (table, chair, house, etc) from different cards with images.

MNR: maximum number of repetitions. Single-task exercise program included only part A
Dual-task exercise program included part A and B
Each exercise intensity was evaluated according to the modified Borg scale. Participants were encouraged to perform the exercise with an intensity between 3 to 6.