Impact of three exercise programs on physical fitness and coping and adaptation process in elderly adults

Impacto de tres programas de ejercicio en la aptitud física y el proceso de afrontamiento y adaptación en adultos mayores

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How to cite in APA

Gaviria Chavarro, J., Rojas Padilla, I. C., Gómez Gaviria, M. L., & Zambrano Bermeo, R. N. (2025). Impact of three exercise programs on physical fitness and coping and adaptation process in elderly adults. *Retos*, *71*, 459–469. https://doi.org/10.47197/retos.v71.114005

Abstract

Background/Objectives: The global population ageing has increased the prevalence of chronic diseases and disabilities, thereby affecting the quality of life of elderly adults. Exercise interventions have been proven effective in enhancing the functional capacity of this population. The aim was to assess the effect of three exercise programs on physical fitness and the coping and adaptation process in elderly adults.
Methods: A quasi-experimental study was conducted with 450 adults aged 60 years or older, randomly assigned to three intervention groups. The Senior Fitness Test was used to assess physical fitness, and Roy's Coping and Adaptation Processing Scale was used to measure coping and adaptation. The data were analyzed using linear mixed models.
Results: Multimodal intervention was significantly more effective in improving muscle strength, specifically in the Sitting-Rising and Push-Up tests. However, no significant improvements in flexibility or aerobic fitness were observed. Age was a determining factor, with lower performance observed in physical tests as age increased. There were no significant improvements in the coping and adaptation process, although an overall improvement in adaptation was observed in the intermediate age ranges.
Conclusions: Multimodal training emerges as the most effective intervention for improving muscle strength in elderly adults. However, a lack of improvement in flexibility and aerobic fitness may suggest the need for more specific interventions. Age negatively impacted physical performance, underscoring the importance of tailoring exercise programs to this population.

Keywords

Ageing; functional capacity; multimodal exercise; adaptation; elderly adults.

Resumen

Introducción. El envejecimiento poblacional global ha incrementado la prevalencia de enfermedades crónicas y discapacidades, afectando la calidad de vida de los adultos mayores. Las intervenciones de ejercicio han mostrado ser efectivas para mejorar la capacidad funcional.
Objetivo. Evaluar el impacto de tres programas de ejercicio en la capacidad física y el proceso de afrontamiento y adaptación en adultos mayores.
Método. Se realizó un estudio cuasiexperimental con 450 adultos mayores de 60 años, distribuidos aleatoriamente en tres grupos de intervención. Se utilizaron el Senior Fitness Test para evaluar la capacidad física y la Escala de Medición del Proceso de Afrontamiento y Adaptación de Roy para medir afrontamiento y adaptación. Los datos fueron analizados mediante modelos lineales mixtos.
Resultados. La intervención Multimodal fue significativamente más efectiva en mejorar la fuerza muscular, particularmente en las pruebas de Sentarse-Levantarse y Flexiones de Brazo. Sin embargo, no se observaron mejoras significativas en la flexibilidad o capacidad aeróbica. El rango de edad fue un factor determinante, mostrando un desempeño inferior en las pruebas físicas a medida que aumentaba la edad. Las intervenciones no lograron mejoras significativas en afrontamiento y adaptación, aunque se observaron mejoras generales en la adaptación en rangos de edad intermedios.
Conclusiones. El entrenamiento multimodal destaca como la intervención más efectiva para mejorar la fuerza muscular en adultos mayores. Sin embargo, la falta de mejoras en flexibilidad y capacidad aeróbica sugiere la necesidad de intervenciones más específicas. La edad influyó negativamente en el desempeño físico, subrayando la importancia de diseñar programas de ejercicio personalizados para esta población.

Palabras clave

Envejecimiento; capacidad funcional; ejercicio multimodal; adaptación; adultos mayores.

Introduction

The global trend of population age has led to an increase in the number of people over 60 years of age, which in turn is related to a higher prevalence of chronic diseases and disabilities. Although the proportion of healthy older adults has remained stable, the additional years of life are often marked by health problems. When older adults are in good health and live in suitable environments, they can maintain a functional capacity comparable to that of younger people (Bonilla-Cruz et al., 2025). However, physical and mental deterioration have negative consequences for both individuals and society (World Health Organization, 2022), underscoring the importance of promoting their health and well-being (Fiallos, 2025). In this context, physical fitness directly influences the autonomy, functionality, and quality of life of this population (Guillem-Saiz et al., 2021), as well as adaptability to upcoming changes (Jimenez & Coromina, 2025), which are fundamental.

Age-related functional decline is a significant challenge for healthcare systems worldwide. It is estimated that approximately 30% of people over 65 years of age have some degree of limitation in their ability to perform activities of daily living, fostering dependence and increasing the need for long-term care (Fried et al., 2004) which adds to the fact that some people who may not have limitation do not engage in physical activity (Aguilar-Robles & Ketil-Pabón, 2025), subsequently affecting the quality of life of such people and imposing an economic burden on public health systems (Prince et al., 2015).

Due to the increasing impact of population aging, various interventions have been proposed to mitigate functional decline and improve the quality of life of older adults. Physical exercise programs, which include resistance, flexibility, and balance training, are effective in improving the physical and mental health of this population (Nelson et al., 2007). More specifically, multimodal training has shown promising results by combining different exercises to optimize functional capacity (Bouaziz et al., 2016). Also, programs based on dance and coordination have been evaluated, and benefits have been observed not only in physical fitness, but also in social cohesion and mental health (Keogh et al., 2016; Merom et al., 2016), without ignoring, work on physical capacities such as strength and its effectiveness in functional physical capacity, maximal strength, execution speed and neuromuscular activation (Baron et al., 2024). Despite the observed physical benefits, interventions based on coordination, dance, and multimodal programs may have failed to significantly impact older adults' coping and adaptation because of their limited attention to psychosocial factors. These interventions, while effective in improving physical aspects such as strength and balance, do not necessarily comprehensively address the emotional, cognitive, and social dimensions that influence older adults' ability to cope with the challenges of aging. The absence of explicit components that promote personal reflection, a strengthened sense of purpose, or group emotional support may have restricted their reach in these fundamental areas of well-being.

That is why some studies have focused on the ability of older adults to adapt to aging-related changes. In this regard, the Roy Coping and Adaptation Processing Scale has been used to assess how individuals manage their stress as well as the challenges associated with aging (Terela, 2025). This validated instrument measures coping and adaptation mechanisms, thus providing a comprehensive view of how older adults cope with changes associated with health and function (Cosardereliogl u et al., 2025). Results indicate the presence of moderate to severe anxiety (Mariam et al., 2025). However, in other populations of older adults, positive levels of resilience, a sense of purpose in life, and an acceptable quality of life are observed, reflecting human strength and adaptive capacity (Vinaccia et al., 2025).

Given the increasing aging of the global population, it is essential to identify practical, accessible, and scalable intervention strategies (Salas, 2025). Interventions that incorporate physical exercise, tailored to the abilities and limitations of older adults, can help to improve functional capacity and reduce the frequency of falls, one of the most common and serious health problems at this stage of life (Sherrington et al., 2008). Likewise, the assessment of coping and adaptation using the Roy scale allows a better understanding of psychological and behavioral responses to the challenges of aging, providing valuable information for the design of more personalized and effective interventions (Cosardereliogl u et al., 2025).

The responses of older individuals to exercise programs can vary widely, depending on factors such as age, previous fitness level, and health status (Arayici et al., 2025). However, studies report that, even at older ages, substantial improvements in functional capacity and general well-being can be achieved

after regular participation in well-designed physical exercise programs (Landi et al., 2016). Moreover, coping and adaptation capacity, as measured by Roy's scale, is an essential predictor of the success of these interventions, thus suggesting the importance of considering these psychological and social factors in the design of health programs (Chen, 2025).

Thus, this research aims to evaluate the impact of three exercise programs (Coordination, Multimodal, and Aerobic/Dance) on physical capacity and the coping and adaptation process in older adults. Understanding which type of intervention offers the most significant benefits will enable the design of more targeted, personalized, and practical strategies, contributing to a more active, autonomous, and healthy aging process.

Method

This study adopted a quasi-experimental design with randomized comparative groups and pre- and post-intervention measurements. Although it was not possible to assign participants from a general population, simple random assignment was used to distribute the older adult participants equally into three intervention groups. This approach enables partial control over selection biases, thereby increasing internal validity by establishing baseline comparability between groups.

Context and place of the study

The study was conducted in community and sports centers in Cali, which were intentionally selected for their accessibility, safe infrastructure, and previous experience in activities with older adults. Each center had physical space, support staff, and material resources to ensure the homogeneous implementation of the programs.

Participants

The study sample consisted of 450 older adults, all of whom were 60 years or older, as defined by the World Health Organization (WHO) criteria for this population. The participants were selected from community groups that regularly attended sports and social centers in Cali. We performed a simple random assignment to ensure comparability between intervention conditions, distributing the older adults equally across three experimental groups: Coordination, Multimodal, and Aerobic/Dance, with 50 participants in each.

The inclusion criteria required that the adults had preserved cognitive capacity, were autonomous enough to perform physical exercise, and had signed the informed consent form, thus demonstrating an understanding of the study's objective and willingness to participate. On the other hand, individuals were excluded if they presented recent traumatic injuries, severe osteoarticular diseases, uncontrolled cardiac arrhythmia, or any chronic pathology not stabilized, as well as those who had recently participated in other exercise programs, had recent or planned surgery, used orthoses that interfere with functional mobility or did not reach at least 85% attendance at the sessions.

This selection strategy aimed to ensure the safety of participants and maintain the homogeneity of initial conditions, thereby strengthening the study's internal validity. In addition, active and voluntary participation was a guiding principle in all stages of the process, according to the ethical guidelines of health research

Procedure

Experimental procedure

Inclusion criteria: Being 60 years old, having preserved cognitive capacity, being able to participate in the exercise program autonomously, and having signed the informed consent form.

Exclusion criteria: Being an elderly adult with recent traumatic injuries, having significant osteoarticular diseases, having participated in other exercise programs, having undergone recent surgeries or planning to do so, having uncontrolled cardiac arrhythmia or uncontrolled chronic diseases, having a medical contraindication to physical activity, failing to complete 85% of the program sessions, or using orthotics. Each intervention group participated in a 12-week exercise program, consisting of three 60-

minute weekly sessions. The sessions included warm-up, core activity, and cool-down phases, designed according to the recommendations of the American College of Sports Medicine, using the Borg rating of perceived exertion scale to adjust exercise intensity.

Instrument

Senior Fitness Test: This comprises the following tests: sitting in chair (Sit-ting-Rising); push-ups (Push-Ups); 2-minute walk (2_Minute_Walk); trunk flexion in the chair (Trunk_Flexion_Chair); reaching hands behind the back (Reaching_Hands_Back); and rising, walking, and sitting (Rising_Walking_Sitting).

This set of tests covers four main areas: muscular strength, flexibility, cardiovascular endurance, and mobility. These tests are essential for assessing the functional capacity necessary to perform daily living activities and to identify possible limitations that may affect autonomy. The validity and reliability of these tests have been widely supported in the literature, with Cronbach's alpha coefficients consistently above 0.80, indicating a high degree of internal consistency and reliability (Baek et al., 2024). Their international validity has also been confirmed, which reinforces their applicability in diverse contexts (Navarra, 2023).

Roy's Coping and Adaptation Processing Scale: This is divided into 33 items that are grouped into several key factors and assessed using a Likert-type scale with scores of 0–3 (minimum score of 0 and maximum score of 99). The content of this version is validated with a content validity index of 0.83 according to Lawshe's proposal. Additionally, internal consistency is acceptable, yielding a Cronbach's alpha of 0.71, which suggests that the scale is reliable and valid for its application in various contexts (Moreno-Ferguson et al., 2009).

These results confirm that the scale helps identify areas where elderly adults may need additional support for coping and adaptation. Previous studies have shown the importance of adequately assessing and supporting these processes in this population, considering their direct impact on quality of life and functional capacity (Cosardereliogl u et al., 2025; Leite Junior et al., 2025).

Data Source: Data were collected through direct measurements before and after the interventions. The physical assessment was conducted following standardized protocols of the Senior Fitness Test, and the psychological evaluation was performed using Roy's Coping and Adaptation Processing Scale.

Bias: Given the quasi-experimental design of the study, testing procedures were standardized, and evaluators were blinded to minimize measurement bias. Furthermore, adherence to the exercise program was monitored to ensure the integrity of this study.

Sample Size: The sample size was determined using G Power software (v. 3.1.7), considering a confidence level of 95%, an alpha error of 0.05, a power of 90%, and an effect size of 0.32, based on previous studies (Courel-Ibañez et al., 2022). Thus, a sample size of 407 participants was estimated; however, to compensate for an expected attrition rate of 10%, the sample size was increased to 450 participants, which would be equally distributed among the intervention groups.

Data analysis

Statistical analysis was performed using Python, as well as the Pandas and Statsmodels libraries. For categorical variables, such as educational and socioeconomic level, frequencies and percentages were calculated to describe the sample distribution. For quantitative variables, such as Senior Fitness Test results, descriptive statistics were used, including minimum values, maximum values, means, and standard deviations.

Additionally, linear mixed models were adjusted for each Senior Fitness Test variable to evaluate the effects of the intervention, time, age, and their interactions. Furthermore, a multilevel mixed model was used to analyze adaptation based on Roy's questionnaire. In this analysis, the dependent variable was adaptation (C_Roy), and fixed effects included the type of intervention (dance, multi-modal, coordination) and time (before and after). Age was considered a random effect to capture the variability existing between different age groups.

Ethical considerations

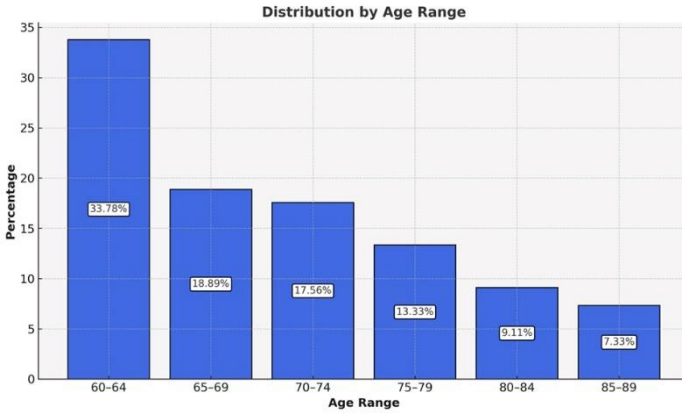
This study was approved by the corresponding institutional ethics committee on August 11, 2023, following the principles of the Declaration of Helsinki. All participants were informed regarding the

study's objectives, procedures, and possible risks and benefits, and provided their Informed Consent before participating. Additionally, data confidentiality and the right of participants to withdraw from the study at any time without repercussions were guaranteed.

Results

The older adults who participated in the programs at the general level were primarily distributed in the 60-64 age range, representing 33.8% (n = 152) of the total population. The other age groups included participants aged 65 to 69 years (18.9%, n = 85), 70 to 74 years (17.6%, n = 79), and 75 to 79 years (13.3%, n = 60). The older age groups (80-84 and 85-89 years) are less well represented, with 9.1% (n = 41) and 7.3% (n = 33), respectively (Figure 1).

Figure 1 Percentage of participants according to age range



Results revealed that most of the sample (44.2%) had incomplete high school education, followed by 36.2% with complete high school education. Moreover, most participants were at socioeconomic level 3 (97.8%), and only 2.2% were at level 2.

Table 1 provides a detailed summary of the minimum, maximum, mean, and standard deviation values for each of the physical variables measured, including those from the Sitting-Standing, Push-Up, and 2-minute Walk tests. This table is essential for understanding the distribution and variability of the participants' physical fitness and may be the basis for subsequent statistical analysis.

Table 1. Descriptive values of functional capacity tests in elderly adults.

Variables	Minimum	Maximum	Mean	Standard deviation
Sitting-Rising	6	18	12.65	2.89
Push-Ups	8	20	14.26	2.9
2_Minute_Walk	51	111	85.44	13.79
Trunk_Flexion_Chair	-3.3	6	1.43	2.21
Reaching_Hands_Back	-8	2.5	-1.5	2.36
Rising_Walking_Sitting	3.4	10.5	5.89	1.43

Source: Own elaboration.

Linear mixed models were used to assess the effect of the three physical interventions (Dance, Coordination, Multimodal) and their interaction with time and age on the physical fitness and coping tests. The variables analyzed included Sitting-Rising, Push-Ups, 2-Minute Walk, Trunk Flexion Chair, Reaching Hands Back, and Roy's Coping and Adaptation Processing Scale.

Participant distribution according to age range indicated an evident concentration in the 60–64 years group in all interventions, evidencing greater participation among younger older adults. Specifically, the Dance group had 50 participants within this age range, and the Coordination and Multimodal groups each had 51 participants.

As age increased, a progressive decrease in the number of participants was observed in all groups. For example, in the 65–69 age range, counts were slightly lower, with 29 participants in the Dance group, 30 in the Coordination group, and 26 in the Multimodal group. This downward trend continued in the more advanced age ranges, culminating in the 85–89 age range, where the counts were the lowest, 9 participants in both the dance and coordination groups and 15 in the Multimodal group.

In the Sitting-Rising test, results exhibited a significant positive effect on participants' ability to perform the test, with an intervention coefficient of 0.942 ($p = 0.031$). Specifically, it was observed that the Multimodal intervention was significantly more effective than the Dance ($p = 0.0159$) and Coordination ($p = 0.0024$) interventions, with no significant difference between the dance and coordination interventions. However, time had no significant effect, suggesting that participants' performance did not vary substantially between the pre-and post-intervention periods. Additionally, the age range had a negative and significant impact (coefficient = −0.645, $p = 0.010$), indicating that older participants tended to perform worse on this test compared to younger ones.

In the Push-Ups test, results also showed a significant positive effect, with an intervention coefficient of 1.102 ($p = 0.023$). Post-hoc comparisons revealed that the Multimodal intervention was significantly more effective than the Dance ($p = 0.0163$) and Coordination ($p = 0.0054$) interventions. Similar to the Sitting-Rising results, age showed a negative and significant effect (coefficient = −0.570, $p < 0.001$), thus suggesting that older participants did fewer push-ups compared to younger participants.

In the 2-Minute Walk test, the analysis revealed that the distance covered by participants decreased significantly in the post-intervention period (coefficient = −11.056, $p = 0.014$). However, the effect of the interventions was not statistically significant, indicating no significant impact on participants' ability to walk the distance. However, age had a negative and highly significant effect (coefficient = −3.709, $p < 0.001$), confirming that older participants walked shorter distances.

For the Trunk_Flexion_Chair variable, results suggested a possible decrease in flexibility after the interventions, although this effect was not statistically significant (coefficient = −0.794, $p = 0.055$). Additionally, age showed a negative and significant effect (coefficient = −0.509, $p < 0.001$), thus indicating less flexibility in older participants. Post-hoc comparisons revealed no significant differences between interventions in terms of trunk flexibility improvement.

Regarding the Reaching_Hands_Back test, age had a negative and significant impact on shoulder flexibility (coefficient = −0.581, $p < 0.001$), with older participants showing less flexibility. However, neither the interventions nor the time had a significant effect on the participants' improvement.

Finally, Roy's Coping and Adaptation Processing Scale was used to assess how physical interventions affected the participants' ability to cope with and adapt to the changes associated with aging. Although overall improvements in coping levels were observed, especially in the middle age range group, statistical analyses did not identify significant differences between the interventions (Figure 1). This suggests that, although the physical interventions may have affected the coping and adaptation levels, the differences were not statistically significant (Table 2).

Figure 2. Levels of adaptive coping by age range and pre/post-intervention assessment.

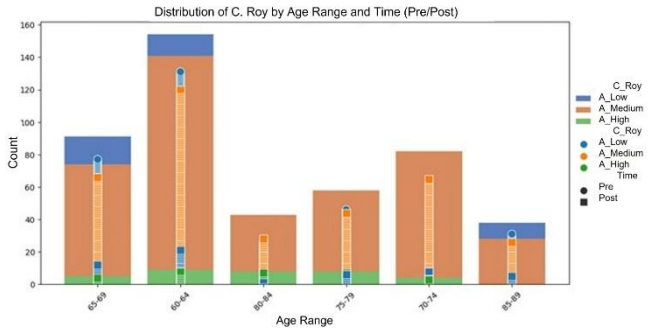


Table 2. Summary of Significant Effects by Test and Factor Type (Intervention, Time, and Age).

Test	Effect Type	Coefficient	p-value	Details
Sitting-Rising	Intervention	0.942	0.031	Multimodal > Dance (p=0.0159), Coordination (p=0.0024)
Sitting-Rising	Age	-0.645	0.01	Negative effect with increasing age
Push-Ups	Intervention	1.102	0.023	Multimodal > Dance (p=0.0163), Coordination (p=0.0054)
Push-Ups	Age	-0.57	< 0.001	Negative effect with increasing age
2-Minute Walk	Time	-11.056	0.014	Post-intervention decrease
2-Minute Walk	Age	-3.709	< 0.001	Older participants walked less
Trunk Flexion (Chair)	Time	-0.794	0.055	Trend toward reduction in flexibility
Trunk Flexion (Chair)	Age	-0.509	< 0.001	Older participants showed less flexibility
Reaching Hands Behind Back	Age	-0.581	< 0.001	Negative impact on shoulder flexibility
Roy's Coping & Adaptation	Intervention			No significant differences between groups

Discussion

Our study assessed the effect of three types of physical interventions — Dance, Coordination, and Multimodal — on the functional capacity and coping and adaptation processes of older adults, using the Senior Fitness Test and Roy's Coping and Adaptation Processing Scale. Our findings indicated that the Multimodal intervention was particularly effective in the Sitting-Rising and Push-Up tests, suggesting that a combination of exercises may increase muscle strength in the elderly population. However, no significant improvements were observed in tests such as the 2-Minute Walk, Trunk Flexion, and Reach Behind the Back, suggesting that strength improvements do not necessarily translate into increased flexibility or aerobic capacity, highlighting the need for more specialized interventions in these areas.

Our study results are consistent with those of previous investigations, highlighting the efficacy of multimodal training in improving muscular strength and balance in elderly adults. A systematic review concluded that multi-component programs are more effective than those focusing on a single modality, especially for improving strength and endurance (Bouaziz et al., 2016). Furthermore, a recent study highlighted that combined resistance and aerobic exercise programs offer significant improvements in muscular strength but may not be as effective in increasing flexibility or aerobic capacity, where specific interventions are required (Di Lorito et al., 2021).

The lack of significant improvements in flexibility and aerobic capacity observed in our study is consistent with previous findings (Nelson et al., 2007), which suggest that although multimodal training is effective for improving strength and balance, a more focused approach should be applied to improve flexibility and aerobic capacity. Complementary findings suggest that both structured exercise and incidental physical activity provide significant daily benefits to the well-being of this population. However, the amount of time spent in these activities plays a crucial role in influencing health perception and positive affect (Whitehead et al., 2017). This is further supported by Salas (2025) and Fiallos (2025), who emphasize the role of recreational physical activity in not only improving physical function but also enhancing subjective well-being in older adults. They suggest that enjoyment and social engagement may act as mediators in the psychological benefits of exercise.

Additionally, Aguilar-Robles and Ketil-Pabon (2025), as well as Ibarra-Salinas (2024), identified that physical inactivity has a direct negative effect on muscle metabolism in older adults, accelerating sarcopenia and functional decline. These findings reinforce the necessity of ongoing and progressive strength-focused programs such as the multimodal intervention applied in our study

Furthermore, Baron et al. (2024) compared two strength training approaches and concluded that both had a positive impact on functional capacity and muscle activation in older adults, aligning with our finding that multimodal training is effective in improving muscle strength, especially in upper and lower limb tests.

From a social and quality-of-life perspective, Bonilla-Cruz et al. (2025) and Vinaccia et al. (2025) emphasize the importance of broader contextual factors, such as community support and life purpose, in enhancing well-being among older adults. This aligns with our interpretation that physical exercise alone may be insufficient to significantly improve coping and adaptation processes without addressing social determinants and psychological support structures.

Regarding the coping and adaptation process, results obtained through Roy's Coping and Adaptation Processing Scale showed general improvements in coping levels, particularly in those in the

intermediate age range. However, these improvements did not show significant differences between interventions. This finding suggests that, although physical interventions may positively influence coping and adaptation, the magnitude of these effects may not be as evident as those observed for physical fitness.

The importance of exercise duration and intensity to obtain daily psychological benefits, such as reduced stress and improved sleep quality, has been highlighted (Whitehead and Blaxton, 2017). According to the authors, although any amount of physical activity can be beneficial, longer and higher-intensity activities tend to increase benefits in terms of positive effects and improved health perception. This reinforces the need to structure exercise programs that consider not only exercise modality but also timing and intensity to maximize effects. However, as suggested by Mariam et al. (2025), individual differences in anxiety and adaptation levels among older adults may be strongly influenced by community context and emotional support, which were not the focus of our intervention.

Jimenez and Coromina (2025) also emphasize the role of educational actions that enhance self-perception and self-esteem in older adults, factors that are likely to mediate effective coping but were not explicitly included in our program. Thus, future interventions may need to incorporate educational or psychosocial components or target psychological outcomes more effectively.

An additional relevant perspective has been provided by investigating the effects of including trunk strengthening exercises in a multimodal exercise program (Shahtahmassebi et al., 2022). Although the authors found no significant intergroup differences in terms of physical activity levels or psychological outcomes such as fear of falling, anxiety, and depression after 12 weeks of intervention, they did observe improvements. Specifically, the group that performed trunk strengthening exercises showed improvements in moderate and vigorous physical activity, as well as a reduction in sedentary time, during the first 6 weeks. These findings suggest that the inclusion of trunk strengthening exercises may have a positive effect on the physical activity and psychological well-being of older adults, although the magnitude of this effect may depend on the timing of the intervention and its combination with other types of exercise.

However, the study protocol explored the effects of combining cognitive and physical training on the cognitive function and physical fitness of older adults (Chow et al., 2022). This multi-modal approach is relevant to our study, as it suggests that greater benefits can be obtained by integrating multiple training modalities as opposed to isolated interventions. The protocol also emphasizes the importance of measuring effects over time, which may be essential to understanding the sustained effects of interventions in this population. Therefore, this suggests that intervention programs combining physical exercise and cognitive training could have a significant impact on both physical function and cognitive health, which was not entirely addressed in our study but could be an important area for further research.

In theory, these results support the notion that multimodal interventions are highly effective in addressing age-related muscle deterioration, with significant implications for fall prevention and enhanced mobility. From a practical perspective, the findings suggest that these exercise programs should incorporate a combination of strength, resistance, and balance training to maximize functional benefits. However, considering the lack of significant improvements in flexibility and aerobic capacity, multimodal programs should be supplemented with specific exercises to enhance flexibility and aerobic activities, such as walking or swimming, to address these areas more effectively. It is also essential to recognize the necessity of adapting program exercises to the participants' characteristics and abilities (Gaviria-Chavarro et al., 2025) to achieve a significant impact.

Regarding the coping and adaptation process, results obtained through Roy's Coping and Adaptation Processing Scale showed general improvements in coping levels, particularly in those in the intermediate age range. However, these improvements did not show significant differences between interventions.

This finding suggests that, although physical interventions may positively influence coping and adaptation, the magnitude of these effects may not be as evident as those observed for physical fitness. This finding is consistent with the literature, which emphasizes the importance of exercise duration and intensity for achieving significant psychological benefits, such as reduced stress and improved sleep quality in the elderly (Whitehead & Blaxton, 2017).

Improvements in coping and adaptation may be more related to contextual or psychological factors, such as personal motivation or social support, than to the exercise modalities employed. Additionally, it was discovered that, although there were no significant differences between groups in terms of psychological outcomes, improvements within groups were observed, suggesting that stress perception and response may vary significantly between individuals (Whitehead and Blaxton, 2022).

From a theoretical perspective, these results support the notion that multimodal interventions can benefit not only physical fitness but also psychological adaptation in older adults. However, a customized approach should be applied to maximize these benefits. Moreover, this study suggests that integrating multiple modalities may offer superior benefits in psychological adaptation, which may be an area of interest for future research (Shahtahmassebi et al., 2022).

Limitations and implications of the study

One of the main limitations of this study is its quasi-experimental design. Despite efforts to standardize assessment procedures and blind the evaluators, a bias in outcome measurement cannot be completely ruled out. Furthermore, the lack of a control group and the reliance on self-reported measures to assess psychological adaptation may have limited the ability to capture the effects of the interventions fully.

Thus, future studies should consider the inclusion of control groups. The long-term effects of these interventions should also be explored, as well as how psychological adaptations may mediate or moderate the physical benefits of exercise programs. Ultimately, the implementation of personalized interventions tailored to individual characteristics, such as age, health status, and prior functional capacity, can optimize outcomes and provide more targeted recommendations for promoting healthy aging.

Conclusions

Multimodal intervention was shown to be the most effective in improving participants' performance in the Sitting-Rising and Push-Up tests. This highlights its potential as a preferred approach for improving muscle strength in elderly adults. Age was confirmed as a critical factor, with lower performance on physical fitness tests correlating with increased age. This highlights the importance of considering age when designing and customizing exercise programs.

Although the Multimodal intervention showed some effectiveness in improving the distance walked by participants, the overall effects of the interventions on this variable were not significant. Age and post-intervention time had a significantly negative impact. Furthermore, flexibility, as measured by the Trunk Flexion and Reaching Hands Behind the Back tests, decreased with age, and interventions did not achieve significant improvements. This suggests that more specific strategies are needed to improve this ability. In the Rising-Walking-Sitting test, the time required to complete the task increased with age and remained unchanged after the intervention, reflecting a deterioration of functional capacity that was not mitigated by the intervention.

Financing

This research has been funded by Dirección General de Investigaciones of Universidad Santiago de Cali under call No. DGI-01-2025 and project 441-621124-752.

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