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Effects on Frailty and Cognitive Decline in Individuals Over 65 Years After Participating in a Multicomponent Exercise Program: A Systematic Review

Efectos sobre la fragilidad y el deterioro cognitivo en personas mayores de 65 años después de participar en un programa de ejercicio multicomponente: una revisión sistemática

Efeitos na Fragilidade e no Declínio Cognitivo em Indivíduos com Mais de 65 Anos Após a Participação em um Programa de Exercícios Multicomponentes: Uma Revisão Sistemática

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ABSTRACT

Introduction: Aging is a biological and inevitable phenomenon associated with molecular and cellular damage over time. This process significantly increases the risk of various clinical syndromes, such as frailty and cognitive decline. Consequently, various tools, including physical exercise, have been developed to reduce or prevent these issues in the older population. **Objective:** The objective of this study is to assess the effectiveness of multicomponent exercise programs in individuals over 65 years, focusing on their effects in reducing signs of frailty and cognitive decline. **Methods:** Following PRISMA guidelines, searches were conducted in four databases: Pubmed, Google Scholar, Scielo, and Dialnet, selecting a total of twenty-two articles published between 2014 and 2024. Eight studies were chosen where multicomponent training was used to address frailty and cognitive decline. **Results:** The results from this systematic review indicate that engaging in a multicomponent exercise program for a minimum duration of 8-12 weeks improves signs of frailty and cognitive decline in older individuals. **Conclusions:** Multicomponent exercise also appears to be an effective tool in preventing and/or reducing disability, frailty, and cognitive decline.

Keywords: aging, cognitive deterioration, elderly, fragility, physical condition, physical exercise

RESUMEN

Introducción: El envejecimiento es un fenómeno biológico e inevitable, asociado con el daño molecular y celular, a lo largo del tiempo. Este proceso aumenta significativamente el riesgo de sufrir diversos síndromes clínicos, como la fragilidad y el deterioro cognitivo. En consecuencia, se han desarrollado diversas herramientas, incluido el ejercicio físico, para reducir o prevenir estos problemas en la población mayor. **Objetivo:** El objetivo de este estudio es evaluar la eficacia de programas de ejercicio multicomponente en personas mayores de 65 años, centrándose en sus efectos en la reducción de los signos de fragilidad y deterioro cognitivo. **Métodos:** Siguiendo las pautas PRISMA, se realizaron búsquedas en cuatro bases de datos: Pubmed, Google Scholar, Scielo y Dialnet, seleccionando un total de veintidós artículos publicados entre 2014 y 2024. Se eligieron ocho estudios donde se utilizó el entrenamiento multicomponente para abordar la fragilidad y el deterioro cognitivo. **Resultados:** Los resultados de esta revisión sistemática indican que participar en un programa de ejercicio multicomponente durante una duración mínima de 8 a 12 semanas mejora los signos de fragilidad y el deterioro cognitivo en personas mayores. **Conclusiones:** El ejercicio multicomponente también parece ser una herramienta eficaz para prevenir o reducir la discapacidad, la fragilidad y el deterioro cognitivo.

Palabras clave: adulto mayor, condición física, deterioro cognitivo, ejercicio físico, envejecimiento, fragilidad

RESUMO

Introdução: O envelhecimento é um fenômeno biológico e inevitável associado a danos moleculares e celulares ao longo do tempo. Esse processo aumenta significativamente o risco de diversas síndromes clínicas, como a fragilidade e o declínio cognitivo. Consequentemente, diversas ferramentas, incluindo o exercício físico, têm sido desenvolvidas para reduzir ou prevenir esses problemas na população idosa. **Objetivo:** Avaliar a eficácia de programas de exercícios multicomponentes em indivíduos com mais de 65 anos, com foco em seus efeitos na redução de sinais de fragilidade e declínio cognitivo. **Métodos:** Seguindo as diretrizes PRISMA, foram realizadas buscas em quatro bases de dados: PubMed, Google Scholar, Scielo e Dialnet, selecionando um total de vinte e dois artigos publicados entre 2014 e 2024. Oito estudos foram escolhidos, nos quais o treinamento multicomponente foi utilizado para abordar a fragilidade e o declínio cognitivo. **Resultados:** Os resultados desta revisão sistemática indicam que a participação em um programa de exercícios multicomponentes por uma duração mínima de 8 a 12 semanas melhora os sinais de fragilidade e declínio cognitivo em idosos. **Conclusões:** O exercício multicomponente também se mostra uma ferramenta eficaz na prevenção e/ou redução da incapacidade, fragilidade e declínio cognitivo.

Palavras-chave: condição física, deterioração cognitiva, envelhecimento, exercício físico, fragilidade, idosos

INTRODUCTION

Aging is a biological and inevitable phenomenon associated with molecular and cellular damage that occurs over time (McMurdo, 2000; World Health Organization [WHO], 2022), leading to a decline in physical and intellectual capacities (Peinado *et al*., 2000). This process may also be influenced by social changes, such as retirement, where individuals may face challenges in managing their newfound free time, potentially leading to reduced mobility and physical activity (González, 2005; WHO, 2022).

The global population is undergoing a demographic transformation (Cardona-Arango and Peláez, 2012). According to WHO (2002), it is estimated that by 2050, the number of people over 60 years old will significantly increase from 10% to 21%. Currently, 19.3% of the global population are older individuals, as supported by statistical data from the National Institute of Statistics (2022), mirroring the situation in Spain (Pérez *et al*., 2020; Fernández-Ballesteros and Sánchez-Izquierdo, 2020).

This aging process brings functional limitations, such as reduced walking speed (Doherty, 2003), an increased risk of falls (Rhonda *et al*., 2008), and a loss of independence in daily activities (Puyol and Abellán, 2006). Furthermore, the loss of independence and morbidity is closely related to the physiological syndrome known as frailty (Fried *et al*., 2001). Frailty poses a significant health risk (Rockwood *et al*., 1999), involving physical (Clegg *et al*., 2013), cognitive (Miyamura *et al*., 2019), and psychological challenges (Morley *et al*., 2006).

Frailty can be considered a clinical sign distinguishing between a healthy older adult and a vulnerable one, with an increased risk of adverse events and higher mortality rates (Rockwood, 2005; Jürschik *et al*., 2012). Numerous studies define frailty as a clinical syndrome with specific symptoms (Rockwood, 2005; Fried *et al*., 2001; Béland and Zunzunegui, 1999), related to various physical capacities: strength, speed, and balance (Reeve *et al*., 2018; Diaz *et al*., 2019). An increase or decrease in these capacities indicates the presence of frailty (Izquierdo, 2019).

Various functional assessments, such as the Time Up to Go (Podsiadlo & Richardson, 1991), and frailty level assessment protocols, including the Barder questionnaire (Barber *et al*., 1980), Clinical Frailty Scale (Church *et al*., 2020), or the FRAIL scale (Morley *et al*., 2006), are used to detect these symptoms. The most widely used internationally is Fried's phenotype, proposing five physical indicators (Fried *et al*., 2001): unintended weight loss, muscle weakness, fatigue or exhaustion, slow walking speed, and low physical activity level. To be considered frail, an individual must meet at least 3 of these indicators (Fried

et al., 2001), and depending on the number of indicators, they are classified as robust (no indicators), pre-frail (1 or 2 indicators), or frail (3 or more indicators) (Vellas *et al*., 2012).

On the other hand, aging also involves cognitive decline (Casanova *et al*., 2004), defined as "the loss of cognitive functions, depending on both physiological and environmental factors, subject to considerable interindividual variability" (Borras *et al*., 2016). Cognitive functions encompass areas such as memory, language, information processing, attention, and perception (Borras *et al*., 2016). Cognitive decline ranges from minor forgetfulness to interfering with daily life operations (American Psychiatric Association, 1995). This decline is not only linked to aging but is also associated with the individual's prior pathologies, mood, and the presence of other syndromes, such as frailty (Benavides-Caro, 2017). Cognitive decline also influences the appearance of various frailty factors, such as slow walking (Hervás and García de Jalón, 2005). Various tools, such as the Pfeiffer test (De la Iglesia *et al*., 2001), Fototest (Vilar *et al*., 2007), or the Folstein Mini-Mental State Examination (Folstein *et al*., 2002), are used to detect cognitive decline.

Additionally, physical activity tends to decrease with age, leading to increased sedentary behavior (González, 2005). This sedentary lifestyle significantly impacts physical condition, resulting in greater bone mass loss and an increased risk of falls (Batty, 2002; Gregg *et al*., 2003). Sedentary behavior is also associated with a higher risk of cardiovascular diseases (McPhee *et al*., 2016), type II diabetes (García-Molina *et al*., 2010), osteoporosis (Cenarruzabeitia *et al*., 2003), as well as decreased walking pattern, autonomy (Pahor *et al*., 2014; Kehler *et al*., 2018), increased cognitive decline, and consequently, a higher risk of frailty (Falck *et al*., 2017). Sedentary behavior is also a risk factor for depressive disorders (Wilson-Escalante *et al*., 2009; Cenarruzabeitia *et al*., 2003), contributing to a lower quality of life (Varo *et al*., 2003).

To address issues related to low physical activity, poor physical condition, and the subsequent presence of frailty and cognitive decline, multicomponent exercise programs are proposed. These programs have been proven to be most suitable for working with older individuals (Cadore *et al*., 2014; Casas-Herrero *et al*., 2022; Plaza-Carmona *et al*., 2022). These programs include strength, aerobic, balance, and flexibility exercises (Jiménez *et al*., 2020; Plaza-Carmona *et al*., 2022; Izquierdo, 2019). Moreover, numerous studies reference the Vivifrail program for carrying out interventions. This program comprises seven tests assessing functional capacity and the risk of falls. After evaluation, participants are categorized into seven types, ranging from Type A (person with disability) to Type D (robust individual), depending on their level of functionality. Based on this classification, different multicomponent exercise programs are proposed, considering the

duration and types of exercises participants can perform (Izquierdo, 2019). This program is part of the health promotion and quality of life strategy of the European Union, as well as within the Ministry of Health and Consumer Affairs in Spain. For this reason, this type of program is most suitable for frailty management (Viladrosa *et al*., 2017), as it not only prevents functional deterioration but also has a positive impact on the effects of aging, improving physical and psychological well-being (Izquierdo, 2019).

Therefore, the aim of this systematic review is to assess the effectiveness of multicomponent physical exercise programs in individuals over 65 years, focusing on their effects on reducing signs of frailty and cognitive decline.

MATERIALS AND METHODS

Search Strategy and Databases Used

For this literature review, a search was conducted based on PRISMA guidelines (Liberati *et al*., 2009). The databases Pubmed, Google Scholar, Scielo, and Dialnet were utilized. The search involved the combination of different keywords connected with boolean connectors, with the search strategy being: "multicomponent exercise" AND "cognitive decline" OR "frailty."

Initially, titles and abstracts of all identified articles in various databases were reviewed. Potentially relevant publications were selected according to the established inclusion criteria.

Out of a total of 562 initially found articles, 56 were excluded as duplicates across different databases. The remaining 506 underwent a review of titles and abstracts, with 300 selected for a detailed full-text analysis. During this phase, 20 were excluded for not aligning with the study's objectives.

Finally, a total of 8 articles that met the inclusion criteria were included in the comprehensive review. These review and selection processes are visually detailed in Figure 1 using the PRISMA flowchart.

Study Selection Criteria

Inclusion Criteria

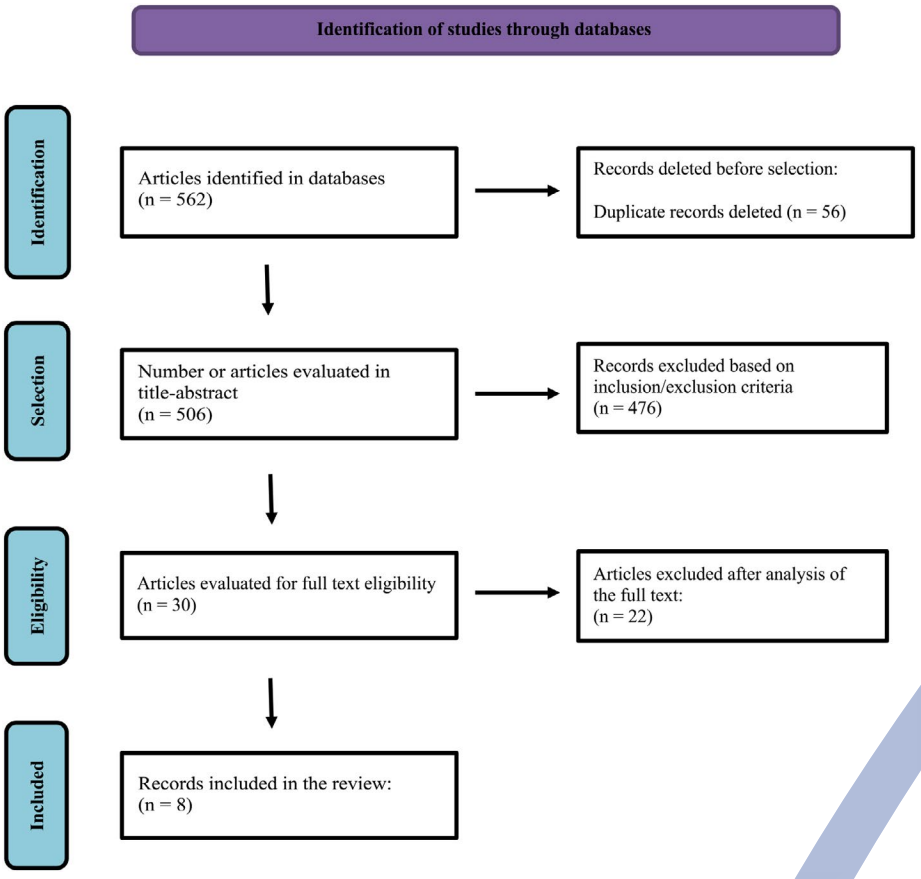
The following inclusion criteria were applied for article selection: (1) multicomponent exercise interventions for individuals over 65 years old, (2) study participants showing symptoms of frailty or cognitive decline, and (3) articles including pre-post measures of frailty and cognitive decline, either through subjective tests or assessments of physical condition related to these frailty indices.

Exclusion Criteria

Exclusion criteria used were: (1) articles involving individuals under 65 years old and (2) articles written in languages other than Spanish, English, or Portuguese.

Results

Figure 1
PRISMA flowchart



As shown in the PRISMA diagram (Figure 1), out of a total of 562 articles found, 476 were excluded after title and abstract screening for not meeting the inclusion criteria. The remaining 30 were selected for full-text analysis, with 22 being excluded for not aligning with the study's objectives. Finally, 8 articles that met the selection criteria were included as the final study sample.

Table 1

Summary table of research studies on the effects on frailty and cognitive impairment in people over 65 years of age after completing a multicomponent exercise program

Author	Sample	Frailty assessment	Cognitive impairment assessment	Multicomponent intervention characteristics	Results
Cadore *et al.*, 2014	n=24 (17 women y 7 men) Divided into CG (n=13) and IG (n=11)	- Fried criteria -TUG -GTV -Barthel Index	TUG with dual task	During a period of 12 weeks, 2 sessions per week were carried out, each lasting 40 minutes, distributed as follows: -Warm up 5´ - Upper and lower limb strength 20´ (8-10 reps, 40-60% 1RM) combined with balance and walking exercises 10' - Stretching 5´	GI vs GC ↑ Gait speed ↑ Balance ↓ Fall rate ↑ Muscle strength in upper and lower limb ↓ Time in single and dual TUG ↑ Grip strength ↓ Barthel Index Score ↑ Power and muscle mass in lower extremities
Casas-Herrero *et al.*, 2022	n= 188 (132 women and 56 men) Divided into CG (n=100) and IG (n= 88)	-Fried criteria -Barthel Index - Battery SPPB	-MEC-Lobo -MOCA	12 week period -3 sessions a week of strength, balance and flexibility -5 walking sessions Both following the intensity, volume and frequency criteria of the Vivifrail program.	GI vs GC ↑ Punctuation SPPB ↑ Muscle strength in upper and lower limb ↓ Number of people with disabilities ↑ Grip strength ↑ PunctuationMOCA ↑ Punctuation MEC-Lobo
Sánchez-Sánchez *et al.*, 2022	n=188 (132 women and 56 men) Divided into VG (n=100) and CG (n=88)	-Fried criteria -Barthel Index - Battery SPPB	-MOCA	12 week period -3 sessions a week of strength, balance and flexibility -5 walking sessions Both following the intensity, volume and frequency criteria of the Vivifrail program.	VG vs GC Improvement of Intrinsic Capacity in terms of: ↑ Locomotion ↑ Punctuation MOCA ↑ Vitality (Hand pressure strength)

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Author	Sample	Frailty assessment	Cognitive impairment assessment	Multicomponent intervention characteristics	Results
Plaza-Carmona *et al*., 2022	n=118 (96 women and 22 men) Two groups were created: IG1 (n=58) who begin physical maintenance activities and IG2 (n= 62) with ≥ 2 years of participation in maintenance activities.	-Battery SPPB where not fraile (SPPB ≥10) And fraile (SPPB < 10) - Fried criteria	-	Duration of 12 weeks with 3 sessions a week of 60' duration with aerobic, strength, joint mobility, balance and coordination exercises The exercises followed the volume and design of the Vivifrail program.	Both groups improved their muscle strength in the upper and lower limb, however, GE1 had significant improvements in gait speed and GE2 had ↓ SPPB score. Likewise, significant changes were observed in terms of classifying people from pre-frail to robust in both groups.
Tarazona-Santabalbina *et al*., 2016	n=100 Dividided into two groups: IG (n=51) and CG (n=49)	- Fried criteria -Edmonton Frailty Scale - Barthel Index -TUG -Battery SPPB -6MWT -FAC -Tinetti Scale	-MMSE	Duration of 24 weeks with 5 sessions a week of 65'. The distribution was: - Proprioception + balance 10-15´ -Endurance 40´ (initially 40% HRMáx and progression up 65% HRmáx) -Resistance (initially 25% de 1RM and progression up 75% 1RM) -Stretching 5´	GI vs GC ↑ SPPB Score ↑ Barthel Index ↑ Gait speed ↓ Risk of Falls ↑ Muscular strength in upper and lower limb ↑ MMSE Score ↓ Fragilty Score where it stands out that there was a significant change in subjects who went from being classified as frail to robust.

Author	Sample	Frailty assessment	Cognitive impairment assessment	Multicomponent intervention characteristics	Results
Concha-Cisternas *et al*., 2020	n=28 (17 women and 11 men)	Freid Criteria	-	- Duration 6 weeks 90' sessions 2 days a week. -Warm up 15´ -Endurance training 25´ (55-70% HRMáx) -Resistance training 15-20´ (8-10 reps at 20% 1RM until progressing to a 40% 1RM) - Agility and balance 10-15' combined with resistance and endurance. - Static flexibility of 30´ ´ for each muscle group	After participating in the intervention, the group of older adults show significant improvements regarding fragilty
Sadjapong *et al*., 2020	n=64 Divided into two groups: IG (n=32) and CG (n=32)	- Freid Criteria -TUG -6MWT (Vo2Máx) -BBS	-	- 24-week program, where the first 12 were carried out in a center and the next 12 in homes. Sessions of 60' were carried out 3 times a week. -Warm up 5-10´ -Endurance 30´ (initially 40% HRMáx until progressing to 65% HRMáx) -Resistance (initially 65% 1RM of 1-2 series of 6-8 reps, after 1 month ↑85% 1RM of 3 series of 8-12 reps - Static + dynamic balance 15´	GI vs GC ↑ Balance ↑ Tour in 6´(V02máx) ↓ Fall rate ↑ Grip strength ↑ Muscular strength in upper and lower limb ↓ Frailty Score which highlights that there was a significant change in subjects who went from fragilty to pre-fragilty
Martínez-Velilla *et al*., 2019	n=370 (209 women and 161 men). Divided in IG (n=185) and CG (n=85)	- Battery SPPB - Barthel Index - Grip strength	-MMSE	The duration depends on the length of hospitalization. Carrying out 2 daily sessions of 20' (one session was carried out in the morning and the other in the afternoon) The exercises followed the Vivifrail program.	GI vs GC ↑ SPPB Score ↑ Grip strength ↑ Barthel Index ↑ MMSE Score Reverses functionall deterioration in elderly patients undergoing acute hospitalization.

Note: GC: Control Group, IG: Intervention Group, TUG: Time up and go, GTV: 4-meter walking speed test, 6MWT: 6-minute walking test, FAC: Functional Ambulation Categories, BBS: Berg Balance Scale, 1RM: Maximum repetition, HRMáx: Maximum Heart Rate, SPPB: Short Physical Performance Battery, MEC-Lobo: Minimental Cognitive State Examination of Lobo, MOCA: Montreal cognitive assessment, MMSE: Mini Mental de Folstein.

DISCUSSION

The aim of this systematic review is to assess the effectiveness of multicomponent physical exercise programs in individuals over 65 years, focusing on their impacts on reducing indicators of frailty and cognitive decline.

Based on the found data, it is relevant to emphasize that various components of physical fitness, such as strength, balance, and walking speed, play a crucial role in frailty (Reeve, 2018; Diaz *et al*., 2019). In addition to the results found in this study, other studies, like Reeve's (2018), highlight how grip strength and walking speed are key indicators of frailty. However, walking speed and balance are categorized as the best indicators of this syndrome (Kim *et al*., 2010), closely linked to the risk of falls and gait disturbance, both frailty factors (Kim *et al*., 2010; Toraman and Yildirim, 2010). The importance of intervening in these components of physical fitness in frail or pre-frail patients to delay or reduce frailty presence is also emphasized (Izquierdo, 2019).

Regarding muscle strength, this systematic review includes several studies (Cadore *et al*., 2014; Casas-Herrero *et al*., 2022; Plaza-Carmona *et al*., 2022; Tarazona-Santabalbina *et al*., 2016; Sadjapong *et al*., 2020) where improvements in both lower and upper limb strength were observed after a multicomponent exercise intervention, leading to enhancements in physical fitness factors such as balance and walking speed. These findings align with other studies like Font-Jutglà *et al*. (2020), where they observed that strength and power training not only improves components like balance and walking speed but could also be a functional tool to prevent pre-frail older adults from developing frailty. Similarly, within the context of muscle strength, it's important to highlight the significant improvement in grip strength in the dominant hand (Cadore *et al*., 2014; Casas-Herrero *et al*., 2022; Martínez-Velilla *et al*., 2019; Sadjapong *et al*., 2020). This grip strength is closely related to overall body muscle strength and, in turn, linked to sarcopenia (Clark *et al*., 2017), being a clear indicator of frailty influencing the predisposition to disability (Kim *et al*., 2010).

In relation to disability, defined by Fernández-López *et al*. (2009) as a "generic term that includes deficiencies in functions and structures, limitations in activity, and/or participation restrictions in society," there is a higher prevalence of deficiencies, such as reduced mobility, loss of sight, hearing, short-term memory, and lack of skill, in older people (Mejía *et al*., 2014). It has been established that factors such as frailty and cognitive decline are considered antecedents to disability (Jauregui and Rubin, 2012). This systematic review includes articles that measure disability through different tools, such

as the Barthel Index (Cadore *et al*., 2014; Casas-Herrero *et al*., 2022; Martínez-Velilla *et al*., 2019; Tarazona-Santabalbina *et al*., 2016; Sánchez-Sánchez *et al*., 2022; Concha-Cisternas *et al*., 2020). These measurements are crucial for planning multicomponent interventions since, similar to frailty, it's essential to adapt exercises to the individual capacities of participants. This classification follows the guidelines of different Vivifrail programs, which also divide subjects by measuring their disability (Cadore *et al*., 2014; Casas-Herrero *et al*., 2022; Sánchez-Sánchez *et al*., 2022; Plaza-Carmona *et al*., 2022). Within these programs, the importance of addressing modifiable factors such as strength, walking speed, and balance in frail or pre-frail patients is emphasized with the goal of delaying or reducing the presence of disability (Concha-Cisternas *et al*., 2020; Tarazona-Santabalbina *et al*., 2016; Casas-Herrero *et al*., 2022). Similar to the results found in this study, Makizako *et al*. (2015) pointed out in their study that the presence of frailty and impaired cognitive function are significant drivers of disability over a period of approximately two years.

Regarding gait speed, we found significant differences after the implementation of an 8-12-week multicomponent program (Cadore *et al*., 2014; Casas-Herrero *et al*., 2022; Sánchez-Sánchez *et al*., 2022; Plaza-Carmona *et al*., 2022; Tarazona-Santabalbina *et al*., 2016; Sadjapong *et al*., 2020). These findings indicate an increase in gait speed after the multicomponent intervention. In contrast, the control group showed negative values in various measurements, implying a decrease in gait speed over time (Cadore *et al*., 2014). This difference between the experimental and control groups underscores the effectiveness of the multicomponent program in improving gait speed. These results support the importance of considering specific multicomponent training interventions to address and enhance walking ability in vulnerable populations or those at risk of frailty. In relation to this, the results presented by Vellas *et al*. (2012) show how gait speed is an indicative marker of frailty highly associated with the risk of falls, which is why increasing this speed directly contributes to a significant reduction in frailty.

Our review findings include an increase in gait speed, a decrease in the number of falls, and improvements in balance, which align with other studies, such as Cigarroa *et al*. (2021), supporting that achieving an increase in gait speed and balance after a multicomponent program not only reduces the number of falls in subjects but also has a significant positive impact on frailty.

In the context of balance, various studies show significant differences when comparing the intervention group with the control group after the implementation of the multicomponent program, similar to the study conducted by Sadjapong et al. (2016), where the experimental group showed improvements in balance, and the control group

no está en las referencias

not only performed worse than in the pretest but also increased the risk of experiencing any falls. Additionally, the use of the SPPB battery in several studies (Casas-Herrero *et al*., 2022; Sánchez-Sánchez *et al*., 2022; Plaza-Carmona *et al*., 2022; Tarazona-Santabalbina *et al*., 2016; Martínez-Velilla *et al*., 2019) has allowed for significant improvements in various aspects of physical condition, enabling the classification of subjects based on the risk of frailty and observing if there is improvement compared to the control group (Tarazona-Santabalbina *et al*., 2016).

The results regarding the improvement of physical condition and frailty align with other studies such as Cigarroa *et al*. (2021), showing the close relationship of improving physical condition to prevent or decrease frailty. However, it is interesting to note that the study by Theou *et al*. (2011) suggests that, although exercises at moderate intensity can improve physical abilities in pre-frail subjects, they do not show improvements in frail subjects.

Regarding cognitive decline, which is closely linked to frailty due to common pathophysiological data such as disability, falls, and even death (Benavides-Caro, 2017), the relationship is so strong that various authors propose the term "cognitive frailty" (Chacón-Valenzuela *et al*., 2019).

Frailty and dementia share symptoms such as decreased daily activities and gait speed (Kelaiditi *et al*., 2013). Therefore, within our review, several articles study cognitive decline along with frailty, concluding that multicomponent exercise plays a crucial role in reducing both syndromes (Cadore *et al*., 2014; Casas-Herrero *et al*., 2022; Sánchez-Sánchez *et al*., 2022; Tarazona-Santabalbina *et al*., 2016; Martínez-Velilla *et al*., 2019). In line with this, we find that a week of multicomponent exercise performed both in the morning and afternoon can have a positive impact on reversing cognitive decline in hospitalized patients (Martínez-Velilla *et al*., 2019). Additionally, the study by Subirats *et al*., (2012) reinforces the idea that a combination of aerobic, strength, and flexibility exercises can be effective not only in reducing cognitive decline but also in decreasing falls and increasing functional dependence.

CONCLUSION

The results obtained in this systematic review reveal that the implementation of a multicomponent exercise program with a minimum duration of 8-12 weeks leads to improvements in various physical aspects, such as muscle strength, gait speed, fall rate, endurance, and balance in frail individuals with cognitive impairment. Similarly, multicomponent exercise appears to be an effective tool for preventing and/or reducing disability, frailty, and cognitive decline.

REFERENCES

American Psychiatric Association. (1995). Association, AP Diagnostic and statistical manual of mental disorders. Arlington, VA, US.

Araya, A. (2017). Actividad física en el adulto mayor institucionalizado: Un enfoque epistemológico constructivista. R*evista Peruana de Ciencias de la Actividad Física y del deporte, 4(2)*, 448-451. https://doi.org/10.15359/mhs.14-2.2

Barber, J, Wallis, J., & McKeating, E. (1980). A postal screening questionnaire in preventive geriatric care. *The Journal of the Royal College of General Practitioners*, *30*(210), 49-51.

Batty, G. (2002). Physical activity and coronary heart disease in older adults. A systematic review of epidemiological studies. *European Journal of Public Health, 12,* 171-176. https://doi.org/10.1093/eurpub/12.3.171

Béland, F., & Zunzunegui, M. (1999). Predictors of functional status in older people living at home. *Age and ageing*, *28*(2), 153-159. https://doi.org/10.1093/ageing/28.2.153

Benavides-Caro, C. A. (2017). Deterioro cognitivo en el adulto mayor. *Revista Mexicana de anestesiología*, *40*(2), 107-112

Borrás, C., y Viña, J. (2016). Neurofisiología y envejecimiento. Concepto y bases fisiopatológicas del deterioro cognitivo. Revista Española de Geriatría y Gerontología, 51, 3-6. https://doi.org/10.1016/S0211-139X(16)30136-6

Cadore, E. L., Casas-Herrero, A., Zambom-Ferraresi, F., Idoate, F., Millor, N., Gómez, M., Rodriguez-Mañas, L., & Izquierdo, M. (2014). Multicomponent exercises including muscle power training enhance muscle mass, power output, and functional outcomes in institutionalized frail nonagenarians. *Age* 36(2), 773-785. https://doi.org/10.1007/s11357-013-9586-z

Cardona-Arango, D., y Peláez, E. (2012). Envejecimiento poblacional en el siglo XXI: oportunidades, retos y preocupaciones. *Revista Salud Uninorte*, *28*(2), 335-348.

Casanova Sotolongo, P., Casanova Carrillo, P., & Casanova Carrillo, C. (2004). Deterioro cognitivo en la tercera edad. *Revista cubana de medicina general integral*, *20*(5-6), 0-0.

Casas-Herrero, Á., Sáez de Asteasu, M. L., Antón-Rodrigo, I., Sánchez-Sánchez, J. L., Montero-Odasso, M., Marín-Epelde, I., Ramón-Espinoza, F., Zambom-Ferraresi, F., Petidier-Torregrosa, R., Elexpuru-Estomba, J., Álvarez-Bustos, A., Galbete, A., Martínez-Velilla, N., & Izquierdo, M. (2022). Effects of Vivifrail multicomponent intervention on functional capacity: a multicentre, randomized controlled trial. *Journal of cachexia, sarcopenia and muscle*, *13*(2), 884-893. https://doi.org/10.1002/jcsm.12925

Cenarruzabeitia, J., Hernández, J, & Martínez-González, M. (2003). Beneficios de la actividad física y riesgos del sedentarismo. *Medicina clínica*, *121*(17), 665-672. https://doi.org/10.1016/S0025-7753(03)74054-8.

Chacón-Valenzuela, E., Morros-González, E., Vargas Beltrán, M. P., Venegas-Sanabria, L. C., Gómez, R., Chavarro D., y Cano, C. (2019). Fragilidad cognitiva, un desafío en evolución. *Universitas Medica, 60*(3), 58-68.

Church, S., Rogers, E., Rockwood, K., & Theou, O. (2020). A scoping review of the Clinical Frailty Scale. *BMC geriatrics*, *20*(1), 1-18. https://doi.org/10.1186/s12877-020-01801-7

Cigarroa, I., Ledezma-Dames, A., Sepúlveda-Martin, S., Zapata-Lamana, R., Leiva-Ordoñez, A. M., Concha-Cisternas, Y., & Reyes-Molina, D. (2021). Efectos de un programa de ejercicio multicomponente en personas mayores que viven en comunidad. MediSur, 19(4), 590-598.

Clark, A. L., Coats, A. J. S., Krum, H., Katus, H. A., Mohacsi, P., Salekin, D., Schultz, M. K., Packer, M., & Anker, S. D. (2017). Effect of beta-adrenergic blockade with carvedilol on cachexia in severe chronic heart failure: results from the COPERNICUS trial. *Journal of cachexia, sarcopenia and muscle, 8*(4), 549–556. https://doi.org/10.1002/jcsm.12191

Clegg, A., Young, J., Iliffe, S., Rikkert, M, & Rockwood, K. (2013). Frailty in elderly people. *Lancet (London, England)*, *381*(9868), 752-762. https://doi.org/10.1016/S0140-6736(12)62167-9

Concha-Cisternas, Y., Contreras-Reyes, S., Monjes., B., Recabal., B & Guzmán-Muñoz, E. (2020). Efectos de un programa multicomponente sobre la fragilidad y calidad de vida de adultos mayores institucionalizados. *Revista Cubana de Medicina Militar, 49*(4).

De la Iglesia, J., DueñasHerrerob, R., Vilchesa, M., Tabernéa, C, Colomerc, C, & Luquec, R. (2001). Adaptación y validación al castellano del cuestionario de Pfeiffer (SPMSQ) para detectar la existencia de deterioro cognitivo en personas mayores de 65 años. *Medicina clínica*, *117*(4), 129-134. https://doi.org/10.1016/S0025-7753(01)72040-4

Díaz, E., Ramírez, J., Fernández, N., Gallego, C. y Hernández, D. (2019). Efecto del ejercicio de fuerza muscular mediante bandas elásticas combinado con ejercicio aeróbico en el tratamiento de la fragilidad del paciente anciano con diabetes mellitus tipo 2. *Endocrinología, Diabetes y Nutrición, 66*(9), 563-570. https://doi.org/10.1016/j.endinu.2019.01.010

Doherty, T. (2003). Invited review: aging and sarcopenia. *Journal of applied physiology*. https://doi.org/10.1152/japplphysiol.00347.2003

Falck, R., Landry, G., Best, J., Davis, J, Chiu, B., & Liu-Ambrose, T. (2017). Cross-Sectional Relationships of Physical Activity and Sedentary Behavior with Cognitive Function in Older Adults with Probable Mild Cognitive Impairment. *Physical therapy*, *97*(10), 975-984. https://doi.org/10.1093/ptj/pzx074

Fernández-Ballesteros, R. y Sánchez-Izquierdo, M. (2020). Impacto del COVID-19 en las personas mayores en España: algunos resultados y reflexiones. *Clínica y Salud*, 31(3),165-169. https://doi.org/10.5093/clysa2020a25

Fernández-López, J. A., Fernández-Fidalgo, M., Geoffrey, R., Stucki, G., y Cieza, A. (2009). Funcionamiento y discapacidad: la clasificación internacional del funcionamiento (CIF). *Revista española de salud pública, 83*(6), 775-783.

Folstein, M., Gary., Folstein, S., & Mc Hugh, P. (2002). *MMSE Examen Cognoscitivo Mini-Mental: manual.* TEA

Font-Jutglà, C., Gimeno, E., Roig, J., da Silva, M., y Villarroel, R. M. (2020). Efectos de la actividad física de intensidad suave sobre las condiciones físicas de los adultos mayores: revisión sistemática. *Revista Española de Geriatría y Gerontología*, 55(2), 98-106.

Fried, L., Tangen, C, Walston, J., Newman, A., Hirsch, C., Gottdiener, J., Seeman, T., Tracy, R., Kop, W., Burke, G & McBurnie, M. (2001). Frailty in older adults: evidence for a phenotype. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *56*(3), M146-M157 https://doi.org/10.1093/gerona/56.3.m146

García-Molina, V., Carbonell-Baeza, A., y Delgado, M. (2010). Beneficios de la actividad física en personas mayores. *Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte,* 10(40): 556-576 (2010).

González, A. (2005). Incidencia de la Actividad Física en el adulto mayor. *Revista Internacional de Medicina y Ciencias de la Actividad Física y del Deporte/International Journal of Medicine and Science of Physical Activity and Sport*, *5*(20), 222-236.

Gregg, E., Cauley, J., Stone, K., Thompson, T., Bauer, D., Cummings, S., Kristine E. & Study of Osteoporotic Fractures Research Group. (2003). Relationship of changes in physical activity and mortality among older women. *Jama*, *289*(18), 2379-2386. https://doi.org/10.1001/jama.289.18.2379

Hervás, A., y García de Jalón, E. (2005). Situación cognitiva como condicionante de fragilidad en el anciano: Perspectiva desde un centro de salud. *Anales del Sistema Sanitario de Navarra 28(1),*35-47.

Instituto Nacional de Estadística. (2022). Estadísticos del Padrón Continuo. Madrid: Instituto Nacional de Estadística.

Izquierdo, M. (2019). Prescripción de ejercicio físico. El programa Vivifrail como modelo [Multicomponent physical exercise program: Vivifrail]. *Nutricion hospitalaria, 36*(Spec No2), 50-56. https://doi.org/10.20960/nh.02680

Jauregui, J. R., & Rubin, R. K. (2012). Fragilidad en el adulto mayor. *Revista del hospital italiano de Buenos Aires, 32*(3), 110-115.

Jiménez, D., Carbonell, A. & Lavie, C. (2020). Physical exercise as therapy to fight against the mental and physical consequences of COVID-19 quarantine: Special focus in older people. *Progress in cardiovascular diseases*, 63(3), 386. https://doi.org/10.1016/j.pcad.2020.03.009

Jürschik, P., Nunin, C., Botigué, T., Escobar, M. A., Lavedán, A., & Viladrosa, M. (2012). Prevalence of frailty and factors associated with frailty in the elderly population of Lleida, Spain: the FRALLE survey. *Archives of gerontology and geriatrics*, *55*(3), 625-631. https://doi.org/10.1016/j.archger.2012.07.002

Kehler, D., Hay, J., Stammers, A., Hamm, N., Kimber, D, Schultz, A., Szwajcer, A., Arora, R., Tangri, N. & Duhamel, T. A. (2018). A systematic review of the association between sedentary behaviors with frailty. *Experimental gerontology*, *114*, 1-12. https://doi.org/10.1016/j.exger.2018.10.010

Kelaiditi, E., Cesari, M., Canevelli, M., Van Kan, G., Ousset, P., Gillette-Guyonnet, S., Ritz, P., Duveau, F., Soto, M., Provencher, V., Nourhashemi, F., Salvà, A., Robert, P., Andrieu, S., Rolland, Y., Touchon, J., Fitten, J., Vellas, B., & IANA/IAGG (2013). Cognitive frailty: rational and definition from an (I.A.N.A./I.A.G.G.) International consensus group. *The journal of nutrition, health & aging, 17*(9), 726-734. https://doi.org/10.1007/s12603-013-0367-2

Kim, J. W., Eom, G. M., Kim, C. S., Kim, D. H., Lee, J. H., Park, B. K., & Hong, J. (2010). Sex differences in the postural sway characteristics of young and elderly subjects during quiet natural standing. *Geriatrics & gerontology international, 10*(2), 191-198. https://doi.org/10.1111/j.1447-0594.2009.00582.x

Kojima, G. (2018). Frailty as a predictor of nursing home placement among community-dwelling older adults: a systematic review and meta-analysis. *Journal of geriatric physical therapy*, *41*(1), 42-48. https://doi.org/10.1519/JPT.0000000000000097

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P., Ioannidis, J., Clarke M., Devereaux P., Kleijnen J. & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. Annals of internal medicine, 151(4), W-65. https://doi.org/10.7326/0003-4819-151-4-200908180-00136.

Makizako, H., Shimada, H., Doi, T., Tsutsumimoto, K., & Suzuki, T. (2015). Impact of physical frailty on disability in community-dwelling older adults: a prospective cohort study. *BMJ open, 5*(9). http://dx.doi.org/10.1136/bmjopen-2015-008462

Martínez-Velilla, N., Casas-Herrero, A., Zambom-Ferraresi, F., Sáez de Asteasu, M. L., Lucia, A., Galbete, A., García-Baztán, A., Alonso-Renedo, J., González-Glaría, B., Gonzalo-Lázaro, M., Apezteguía-Iráizoz, I., Gutiérrez-Valencia, M., Rodríguez-Mañas, L., & Izquierdo, M. (2019). Effect of Exercise Intervention on Functional Decline in Very Elderly Patients During Acute Hospitalization: A Randomized Clinical Trial. *JAMA internal medicine, 179*(1), 28-36. https://doi.org/10.1001/jamainternmed.2018.4869

McMurdo, M. (2000). A healthy old age: realistic or futile goal? *The Bmj,* 321(7269), 1149. https://doi.org/10.1136/bmj.321.7269.1149.

McPhee, J., French, D., Jackson, D., Nazroo, J., Pendleton, N., & Degens, H. (2016). Physical activity in older age: perspectives for healthy ageing and frailty. *Biogerontology*, *17*, 567-580. https://doi.org/10.1007/s10522-016-9641-0

Mejía, M., Rivera, P., Urbina, M., Alger, J., Maradiaga, E., Flores, S., Rápalo, S., Zúñiga, L., Martínez, C., y Sierra, L. (2014). Discapacidad en el adulto mayor: características y factores relevantes. *Rev. Fac. Cienc. Méd, 11*(2), 27-33.

Merlos, E. V., Morante, D. J., y Martínez, D. (2017). *Análisis prospectivo de los factores implicados en el desarrollo de fragilidad de las personas mayores en residencias* (Tesis Doctoral, Universidad Católica San Antonio de Murcia).

Miyamura, K., Fhon, J., Bueno, A., Fuentes-Neira, W., Silveira, R., y Rodrigues, R. (2019). Síndrome de fragilidad y deterioro cognitivo en los adultos mayores: una revisión sistemática de la literatura. *Rev. Latino-Am. Enfermagem, 2* http://dx.doi.org/10.1590/1518-8345.3189.3202

Morley, J., Haren, M., Rolland, Y., & Kim, M. (2006). Frailty. *Medical Clinics of North America*, *90*(5), 837-847. https://doi.org/10.1016/j.mcna.2006.05.019

Organización Mundial de la Salud. (2022). Envejecimiento y Salud. Recuperado de https://www.who.int/es/news-room/fact-sheets/detail/ageing-and-health

Pahor, M., Guralnik, J., Ambrosius, W, Blair, S., Bonds, D., Church, T., Espeland, M., Fielding, R., Gill, T., Groessl, E., King, A., Kritchevsky, S., Manini, T., McDermott, M., Miller, M., Newman, A., Rejeski, J., Sink, K., Williamson, J., & LIFE Study Investigators. (2014). Effect of structured physical activity on prevention of major mobility disability in older adults: the LIFE study randomized clinical trial. *Jama*, *311*(23), 2387-2396. https://doi.org/10.1001/jama.2014.5616

Peinado, M., Moral, M., Esteban, F., Martínez-Lara, E., Siles, E., y Jiménez, A. (2000). Envejecimiento y neurodegeneración: bases moleculares y celulares. *Rev Neurol*, *31*(11), 1054-65. https://doi.org/10.33588/rn.3111.2000382

Pérez Díaz, J., Abellán García, A., Aceituno Nieto, P. y Ramiro Fariñas, D. (2020). Un perfil de las personas mayores en España, 2020. Indicadores estadísticos básicos. I*nformes Envejecimiento en red, 25,* 1-39.

Plaza-Carmona, M., Requena-Hernández, C., y Jiménez-Mola, S. (2022). El ejercicio físico multicomponente como herramienta de mejora de la fragilidad en personas mayores. *Gerokomos,* 33(1), 16-20.

Podsiadlo, D., & Richardson, S. (1991). The timed "Up & Go": a test of basic functional mobility for frail elderly persons. *Journal of the American geriatrics Society, 39(*2), 142-148. https://doi.org/10.1111/j.1532-5415.1991.tb01616.x

Puyol, R., y Abellán, A. (2006). *Envejecimiento y dependencia*. *Una mirada al panorama futuro de la población española*. Mondial Assistance.

Reeve, T. Ur, R., Craven, T., Kaan, J., Goldman, M., Edwards, M., Hurie, J., Velazquez-Ramirez, G., & Corriere, M. (2018). Grip strength measurement for frailty assessment in patients with vascular disease and associations with comorbidity, cardiac risk, and sarcopenia. *Journal of vascular surgery, 67*(5), 1512-1520. https://doi.org/10.1016/j.jvs.2017.08.078

Rockwood, K., Stadnyk, K., MacKnight, C., McDowell, I., Hébert, R., & Hogan, D. B. (1999). A brief clinical instrument to classify frailty in elderly people. *Lancet 353*(9148), 205-206. https://doi.org/10.1016/S0140-6736(98)04402-X

Rockwood, K. (2005). What would make a definition of frailty successful? *Age and ageing*, *34*(5), 432-434. https://doi.org/10.1093/ageing/afi146

Rhonda, 0., Raymond, J., & Singh, M. (2008). Efficacy of progressive resistance training on balance performance in older adults: a systematic review of randomized controlled trials. *Sports medicine*, *38*, 317-343. https://doi.org/10.2165/00007256-200838040-00004

Sadjapong, U., Yodkeeree, S., Sungkarat, S., & Siviroj, P. (2020). Multicomponent Exercise Program Reduces Frailty and Inflammatory Biomarkers and Improves Physical Performance in Community-Dwelling Older Adults: A Randomized Controlled Trial. *International journal of environmental research and public health, 17(11*), 3760. https://doi.org/10.3390/ijerph17113760

Sánchez-Sánchez, J. L., de Souto Barreto, P., Antón-Rodrigo, I., Ramón-Espinoza, F., Marín-Epelde, I., Sánchez-Latorre, M., Moral-Cuesta, D., & Casas-Herrero, Á. (2022). Effects of a 12-week Vivifrail exercise program on intrinsic capacity among frail cognitively impaired community-dwelling older adults: secondary analysis of a multicentre randomised clinical trial. *Age and ageing, 51(12).* https://doi.org/10.1093/ageing/afac303

Subirats Bayego, E., Subirats Vila, G., & Soteras Martínez, I. (2012). Prescripción de ejercicio físico: indicaciones, posología y efectos adversos. *Medicina Clínica, 138*(1), 18-24. https://doi.org/10.1016/j.medcli.2010.12.008

Tarazona-Santabalbina, F. J., Gómez-Cabrera, M. C., Pérez-Ros, P., Martínez-Arnau, F. M., Cabo, H., Tsaparas, K., Salvador-Pascual, A., Rodriguez-Mañas, L., & Viña, J. (2016). A Multicomponent Exercise Intervention that Reverses Frailty and Improves Cognition, Emotion, and Social Networking in the Community-Dwelling Frail Elderly: A Randomized Clinical Trial. *Journal of the American Medical Directors Association*, *17(5)*, 426-433. https://doi.org/10.1016/j.jamda.2016.01.019

Theou, O., Stathokostas, L., Roland, K. P., Jakobi, J. M., Patterson, C., Vandervoort, A. A., & Jones, G. R. (2011). The effectiveness of exercise interventions for the management of frailty: a systematic review. *Journal of aging research*, *2011*, 569194. https://doi.org/10.4061/2011/569194

Toraman, A., & Yildirim, N. U. (2010). The falling risk and physical fitness in older people. *Archives of gerontology and geriatrics, 51(*2), 222-226. https://doi.org/10.1016/j.archger.2009.10.012

Varo, J., Martínez, J., y Martínez-González, M. (2003). Beneficios de la actividad física y riesgos del sedentarismo. *Medicina Clínica, 121(17)* 665-672. https://doi.org/10.1016/S0025-7753(03)74054-8

Vellas, B., Cestac, P., & Morley, J. (2012). Implementing frailty into clinical practice: we cannot wait. *The journal of nutrition, health & aging*, *16*, 599-600. https://doi.org/10.1007/s12603-012-0096-y

Vilar, I.,Pérez, M., Ruiz, J., Vilchez, R. y Montoro, M. (2007). Utilidad diagnóstica del Test de las Fotos (Fototest) en deterioro cognitivo y demencia. *Neurol*, *22*(10), 860-869. https://doi.org/10.1016/j.nrl.2021.01.017

Viladrosa, M., Casanova, C., Ghiorghies, A., y Jürschik, P. (2017). El ejercicio físico y su efectividad sobre la condición física en personas mayores frágiles. Revisión sistemática de ensayos clínicos aleatorizados. *Revista española de geriatría y gerontología*, *52*(6), 332-341. https://doi.org/10.1016/j.regg.2017.05.009

Weissberger, G., Gibson, K., Nguyen, C., & Han, D. (2018). Neuropsychological case report of MCI reversion at one-year follow-up. *Applied Neuropsychology: Adult*. https://doi.org/10.1080/23279095.2018.1519510

Wilson-Escalante, L., Sánchez-Rodríguez, M., y Mendoza-Núñez, V. (2009). Sedentarismo como factor de riesgo de trastornos depresivos en adultos mayores. Un estudio exploratorio. *Revista de la Facultad de Medicina UNAM*, *52*(6), 244-247.

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CRediT (Contribution Role Taxonomy)
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Software: Not applicable
Validation: Marta Santiago
Formal analysis: Andrea Charda – Marta Santiago
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Writing – review & editing: Marta Santiago
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DECLARATION OF INTEREST STATEMENT

The authors declare no conflicts of interest in the research.