

Multicomponent exercise in the older adult and its effect on frailty syndrome

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María Fernanda Sandoval Ramos^{1*}, Eneida Sarai Parrilla Andrade², Lissette Haydée Padilla Pimentel³

1-3. Dr. José Matías Delgado University, Antiguo Cuscatlán, La Libertad, El Salvador.

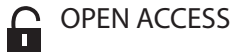
* Correspondence

✉ mafernandasand@gmail.com

1.  0000-0002-2196-8120

2.  0000-0003-1097-7088

3.  0000-0002-2196-8120



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Ejercicio multicomponente en el adulto mayor y su efecto en el síndrome de fragilidad

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Abstract

Aging causes an increase in the vulnerability of older adults. The practice of multicomponent exercise has been proposed to improve the physical and cognitive functionality of the older adult, reduce the frequency of falls and fractures, and prevent sarcopenia. Therefore, this literature review aims to determine the effects of multicomponent exercise in the older adult to prevent the progression of frailty syndrome. A literature search was performed in the Hinari, PubMed, Scopus and Embase databases, using the Boolean operators "AND" and "OR" and as keywords "frailty", "older adult", "falls", "fractures", "sarcopenia" to delimit useful literature for this research. Literature review articles, case-controls, meta-analysis, original articles, systematic reviews less than five years old, published in both English and Spanish were taken into account. Multicomponent exercise causes an improvement in physical functionality, independence, fall prevention, and reduction of sarcopenia, being a useful tool for the regression of frailty syndrome in the elderly.

Keywords

Frail Elderly, Frailty, Exercise, Accidental falls, Fractures, Bone.

Resumen

El envejecimiento ocasiona un aumento en la vulnerabilidad del adulto mayor. El ejercicio multicomponente se ha propuesto como una práctica para mejorar la funcionalidad física y cognitiva del adulto mayor, reducir la frecuencia de caídas y fracturas y prevenir la sarcopenia. Por tanto, en esta revisión bibliográfica se propone determinar los efectos del ejercicio multicomponente en el adulto mayor para evitar la progresión del síndrome de fragilidad. Se realizó una búsqueda bibliográfica en las bases de datos Hinari, PubMed, Scopus y Embase utilizando los operadores booleanos «AND» y «OR» y como palabras clave «fragilidad», «adulto mayor», «caídas», «fracturas», «sarcopenia» para delimitar literatura de utilidad a esta investigación. Se tomaron en cuenta artículos de revisión bibliográfica, casos y controles, metaanálisis, artículos originales, revisiones sistemáticas con vigencia menor a cinco años, en los idiomas inglés y español. El ejercicio multicomponente ocasiona una mejoría en la funcionalidad física, dependencia, prevención de caídas y reducción de la sarcopenia, siendo una herramienta útil para la regresión del síndrome de fragilidad en el adulto mayor.

Palabras clave

Adulto mayor, fragilidad, ejercicio físico, accidentes por caídas, fracturas óseas.

Introduction

Frailty syndrome is a multifactorial clinical condition that alters physiological functions and limits the ability to cope with external stressors, and increases the deterioration of health¹, given that it is associated with age, the biological process of physiological, psychological, and social changes that occur

in older adults that increase their vulnerability¹. Nevertheless, there is still no international consensus on the definition of frailty².

In the frail population, alterations in strength, endurance, and physiological functions contribute to a decreased ability to cope with stressors and lead to increased risk of falls, hospitalizations, dependency, and mortality¹.

Currently, there is an increment in the population of older adults. In accordance with the World Health Organization (WHO), between 2020 and 2030, this population will increase by 34 %, and by 2050, it will be close to 65 %³. According to Menéndez *et al.*, the worldwide prevalence of frailty syndrome varies widely between 4.0 % and 59.1 % due to the lack of consensus on its definition.⁴ In a systematic review published by Siriwardhana *et al.*, the prevalence of frailty syndrome is 17 %, more frequent in women and in low- and middle-income countries⁵. In addition, in Latin America, a prevalence of 7.7 % to 39.3 % is observed, associated with the existence of comorbidities and a higher risk of developing disabilities in the future⁶.

Nascimento *et al.* assert that with aging, people tend to lead a more sedentary life, and only 28 % to 34 % of older adults engage in some physical activity. In addition, it has been described that low-intensity physical exercise improves muscle strength very little, assuring that the incorporation of an exercise program composed of strength and functional training⁷, which contains resistance, coordination, balance, and flexibility exercises, increases the physical functionality of the frail older adult; this is known as multicomponent exercise and can be adjusted according to the characteristics or recommendations for those who perform it⁸.

According to the study by Llano *et al.*, in a rural area of Brazil, a prevalence of frailty syndrome of 43.4 % was determined, among which physical inactivity and obesity were risk factors⁹. A study conducted by Dent *et al.* concluded that 94.7 % of all frail older adults should exercise to improve physical functionality, and prevent sarcopenia, falls, and fractures¹⁰. However, authors Toots *et al.*, in their study conducted in a nursing home during 12 months, found no positive association between the practice of multicomponent exercise and a reduction in the number of falls¹¹.

Nonetheless, due to the impact that the practice of this exercise has on the quality of life and functionality of older adults, it is essential to continue studying it. This review aims to determine the effects of multicomponent exercise in older adults to prevent the progression of the frailty syndrome through its description, the relationship between this exercise with falls and fractures, and the development of sarcopenia.

For the purpose of this narrative review, a search of international scientific publications using the Hinari, Pub-Med, Scopus, and Embase databases, was undertaken, using

terms from the MeSH thesaurus, taking into account the Boolean operators "AND" and "OR." The keywords used were "frailty," "older adult," "falls," "fractures," and "sarcopenia." Original articles, clinical trials, literature review articles, and systematic reviews with a publication period of fewer than five years in English and Spanish were included, and their quality was assessed by analyzing their variability, reliability, and validity.

Discussion

Multicomponent exercise and frailty syndrome in older adults

Frailty in older adults is assessed through different evaluation methods. One of them is Fried's criteria, which evaluates five aspects: unintentional weight loss in the last three years, fatigue sensation in the last four weeks, low physical activity, decrease in walking speed, and muscle weakness. Patients presenting one or two criteria, are classified as pre-fragile, and those meeting three or more are classified as fragile.¹² There are other scales, such as The Clinical Frailty Scale, which evaluates cognitive status, functionality, and comorbidities, with a score between one and nine, where one means that the patient is fit and nine means that the patient is in the terminal stage¹³.

Another assessment scale corresponds to the SARC-F (Strength, Assistance with walking, Rising from a chair, Climb stairs, and Falls), which measures the degree of sarcopenia more precisely. It consists of the evaluation of the parameters of strength, ambulation with assistance, standing from a chair, climbing stairs and falls, each measured on a scale of zero to two (zero: not at all and two: very difficult), a score greater than or equal to four points makes the screening results positive for sarcopenia¹⁴. The lack of a definition of frailty causes difficulties in finding appropriate interventions for its regression and onset².

In the last few years, a significant correlation has been identified between physical exercise and the onset of frailty syndrome; it was demonstrated that the greater the physical activity, the lower the risk of mortality, and the greater the improvement in the physical and cognitive function of the older adult. Multicomponent exercise has shown greater benefits in delaying frailty syndrome due to the combination of strength, balance, gait, and endurance, which have a positive impact on the functionality of the older adult, as well as on the performance of basic activities of daily living in patients at home or hospitalized¹⁵⁻¹⁷.

On the other hand, the Short Physical Performance Battery (SPPB) is a test that measures physical functionality and performance through walking speed, balance, and the ability to stand. The test has a maximum score of 12 divided into four points for each of the categories, where the higher the score, the higher the level of physical functionality¹⁸. Exercise must be adjusted according to age and adapted in intensity and frequency until the program that best suits each patient is found¹⁹.

Hubbard *et al.* demonstrated that older adults who exercise decrease frailty and mortality risk compared to those sedentary. Frail patients have a mortality risk of 1.21, and those who do not exercise present a risk of death of 1.95 at a 95 % confidence interval of [1.19-1.24] and [1.73-2.28], respectively²⁰.

According to Casas *et al.*, in a study conducted with a group of 188 older adults with cognitive impairment, the results of one group of members that performed multicomponent exercise were compared with the other group that maintained routine care. Satisfactory results in functional capacity were obtained, measured with the SPPB in the group that performed the exercise program. In this group, the SPPB increased by 0.86 points at the end of the first month and 1.4 points at the end of three months, with $p < 0.01$ and $p < 0.001$, respectively. However, adherence to the program decreased in the second month, and the patients who persisted improved cognitively ($p < 0.05$) at the end of the three-months follow-up²¹.

No standard exists regarding the amount of time, frequency, and types of training to be done in multicomponent exercises. According to Monteiro *et al.*, the recommended order for this physical activity consists of starting each session with stretching, then aerobic training, following strength exercises, and ending with stretching and cooling down. Following this model, the authors achieved results, obtaining more benefit in muscle strength, balance, and agility and improve overall physical functionality²².

The Vivifrail program has been developed in Europe to establish parameters for its implementation. It specifically targets older adults and its purpose is to reduce the incidence and regression of frailty syndrome. The SPPB has been used to diagnose the physical condition, and based on the results, the exercise program suitable for each patient is individualized. The Vivifrail divides into four categories: Category A includes older adults with severe limitations; B, those with mild limitations; C, those who can walk and D, those who are robust^{23,24}.

The long-term benefits of exercise in older adults were described in the meta-analysis of Souto Barreto *et al.*, which focuses on the existence of a positive association between the practice of exercise for a period longer than one year and the decreasing risk of falls. Furthermore, Oh *et al.* demonstrated the effectiveness of multicomponent exercise when implemented for a period of between six and 12 months, in addition to the fact that it contributes to the prevention of frailty syndrome and improves the physical condition of patients²⁵.

Multicomponent exercise and the incidence of falls and fractures in older adults

It is estimated that one in three older adults is at risk of suffering a fall per year and that 30 % of older adults with a history of a previous fall will fall again. In most cases, patients seek medical attention when they suffer some type of injury, such as fractures, head trauma, decreased mobility, hospitalization, or death²⁶. Falls occur more frequently in older adults who present musculoskeletal alterations such as weight loss, decreased strength and speed, fatigue, or sensory, cognitive, and nervous system alterations²⁷.

According to Thomas *et al.*, physical inactivity in older adults is associated with an increment in morbidity and mortality. For this reason, the WHO recommends at least 150 minutes per week of aerobic physical activity accompanied by muscular strength exercises. This study asserts that multicomponent exercise, due to the integration of aerobic and anaerobic components, in addition to balance and resistance exercises, seems to contribute to the reduction of falls and fractures in this population²⁸.

Multicomponent exercise performed in a 12-week program, with one-hour sessions three times a week, showed results associated with a lower risk of falls²⁹, and injuries caused by falls were lower in those who practiced exercise³⁰; this effect can be extended up to 24 weeks after the intervention²⁹. In addition, Hentschke *et al.* verified that after 24 months, the patients who were not part of the intervention group had an average of 3.11 falls per year³⁰.

In the study by Puente *et al.*, the control group received three weekly sessions of multicomponent exercise for six months. Despite not finding a significant change in bone mineral density between the control group and the intervention group, the results showed an improvement in balance and gait in the patients who participated in the training, and participation in the exercise

program proved to be a protective intervention against the risk of suffering a fall³¹.

Pinheiro *et al.* identified that combining different types of exercise has a mild effect on the bone mineral density of the femoral neck (standardized effect size 0.09, 95 % CI -0.03-0.21) and the spine (standardized effect size 0.17, 95 % CI 0.04-0.30) as a positive aspect in the prevention of osteoporosis³².

Alhambra *et al.* conducted a study that verified a reduction in the risk of falls and fractures and found an improvement in physical performance, balance, and a decrease of 0.4 points in the body mass index in older adults who practiced multi-component exercise ($p = 0.045$). In addition, this group presented better self-care skills and a reduced frequency of medical consultations and hospitalization³³.

On the other hand, women have a higher prevalence of falls and fractures, this being related to the loss of bone density and secondary muscle mass due to menopause, as described by Ooi *et al.*³⁴ and Alabdullgader *et al.*³⁵. Consequently, increasing the physical functionality of older adults becomes a protective factor that improves balance and flexibility in this population³⁶.

Postmenopausal women who practiced multicomponent exercise, three sessions per week for 12 months, showed improvement in bone mineral density of the femoral neck and lumbar spine, increased muscle strength, and improved balance. All these factors prevent osteoporosis, falls, and fractures³⁷. Along the same line, improvement in posture and the quality of movements in sedentary older women were found after practicing flexibility exercises³⁸.

Multicomponent exercise and its relationship to sarcopenia

Sarcopenia is a problem of significant importance in older adults because of its association with reduced physical performance, increased risk of fractures, and premature death³⁹. According to a study by Barrientos *et al.*, the prevalence of sarcopenia in Costa Rica is 33.2 % between the 70 and 79 years old population, with an increase of 10.3 % in people over 80 years old, with a frequency of 1.7 times higher in women⁴⁰.

The factors contributing to muscle mass loss are associated with physical inactivity, inadequate diet, and aging. Genetic factors and endocrine and metabolic alterations are also involved⁴¹. Multicomponent exercise has shown to be a preventive strategy for sarcopenia and to increase physical performance in older adults⁴², although, its effectiveness may depend on the time and

frequency of the exercise, whether it is practiced in groups or individually, as well as the comorbidities of each participant⁴³.

According to a study conducted by Zambrano *et al.*, the patients with comorbidities evolved with improved functionality and independence after practicing multicomponent exercise, with above-average results in the SPPB battery with a $p < 0.001$. In addition, the patients in the study presented a significant increase in the Barthel scale with a $p = 0.0019$. Regarding anthropometric measurements, an increase in leg circumference and nutritional status was also observed (with results of $p = 0.0014$ and 0.0471 , respectively)⁴⁴.

Hospitalizations increase the vulnerability of older adults to frailty syndrome. Starting the exercise program as soon as possible, in combination with an adequate diet during hospitalization or immediately upon discharge, and limiting bed rest^{45,46}, significantly reduces frailty syndrome^{47,48}. In addition to the supervision by qualified professionals the exercises limit the evolution of sarcopenia and functional decline⁴⁷. In this sense, Sáez de Asteasu *et al.* showed that multicomponent exercise improved muscle strength in patients who received the usual care during hospital admission, with emphasis on progressive resistance exercise with notable improvement in muscular strength of the extremities^{45,46}.

It is necessary to promote the use of this exercise program in the older adult population because it is a strategy that reduces the economic impact, is easily replicable, and improves the overall health of both healthy individuals and patients with comorbidities, with a considerable reduction in the incidence of the frailty syndrome and, in those who already suffer from it, allows its regression⁴⁹.

Conclusion

Multicomponent exercise intervention program is a strategy that has proven to contribute to the regression of frailty syndrome with the reduction of sarcopenia and the improvement of balance, gait, and bone mineral density that leads to optimizing physical function, reduction of the risk of falls, increment of independency and prevent mortality in older adults.

Although it has not yet been defined how long the benefits of multicomponent exercise on physical functionality can be seen and whether these are mainly in short or long-term, it is necessary that this topic continues to gain momentum and continue to be studied.

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