

The Power of Resistance Training: Evidence-based Recommendations for Middle-aged and Older Women's Health

El potencial del entrenamiento de la fuerza: recomendaciones basadas en la evidencia para la salud de las mujeres de mediana edad y mayores

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Abstract. Women have a longer life expectancy, but also a poorer quality of life due to the combined effects of aging and menopause. Among the most widely used non-pharmacological therapies that slow down the effects of these phenomena is resistance training. The aims of this narrative review were: 1) to analyze the strength in health parameters of middle-aged and older women; and 2) to provide a series of practical recommendations for resistance training for women. It was found that resistance training has been shown to prevent and/or treat chronic diseases, improve muscle strength, increase bone density, and reduce the risk of falls and fractures in older women. To conduct our search, we utilized various databases, including MedLine (Pubmed) and Cochrane (Wiley), searching for MeSH-compliant keywords such as: (strength training OR resistance training) AND (middle-aged women OR older women). Our search was limited to manuscripts published from April 1, 2013, to April 1, 2023, although some earlier studies were referenced to provide additional context in certain areas of the narrative review. The narrative review highlights that regular resistance training can help older women maintain independence and improve their overall quality of life. Additionally, the narrative review suggests that resistance training may also have beneficial effects on other health outcomes, such as cardiovascular health, function, and musculoskeletal health. Overall, the narrative review provides evidence to support the inclusion of resistance training in the exercise regimen of older women to promote healthy aging. This narrative review aims to provide information on the health benefits of resistance training on middle-aged and older women, and proposes a series of recommendations to promote its safe and effective practice, to help them enjoy healthy aging.

Keywords: sarcopenia, functional independence; physical exercise; strength training, quality of life.

Resumen. Las mujeres tienen una esperanza de vida más larga, pero también una peor calidad de vida debido a los efectos combinados del envejecimiento y la menopausia. Entre las terapias no farmacológicas más utilizadas que frenan los efectos de estos fenómenos se encuentra el entrenamiento de fuerza. Los objetivos de esta revisión narrativa fueron: 1) analizar la fortaleza de los parámetros de salud de mujeres de mediana edad y mayores; y 2) proporcionar una serie de recomendaciones prácticas para el entrenamiento de fuerza para mujeres. Se descubrió que se ha demostrado que el entrenamiento de fuerza previene y/o trata enfermedades crónicas, mejora la fuerza muscular, aumenta la densidad ósea y reduce el riesgo de caídas y fracturas en mujeres mayores. Para realizar nuestra búsqueda, utilizamos varias bases de datos, incluidas MedLine (Pubmed) y Cochrane (Wiley), buscando palabras clave que cumplieran con MeSH, como: (strength training OR resistance training) AND (middle-aged women OR older women). Nuestra búsqueda se limitó a manuscritos publicados desde el 1 de abril de 2013 hasta el 1 de abril de 2023, aunque se hizo referencia a algunos estudios anteriores para proporcionar contexto adicional en ciertas áreas de la revisión narrativa. La revisión narrativa destaca que el entrenamiento de resistencia regular puede ayudar a las mujeres mayores a mantener la independencia y mejorar su calidad de vida en general. Además, la revisión narrativa sugiere que el entrenamiento de fuerza también puede tener efectos beneficiosos sobre otros resultados de salud, como la salud cardiovascular, la función y la salud musculoesquelética. En general, la revisión narrativa proporciona evidencia que respalda la inclusión del entrenamiento de fuerza en el régimen de ejercicio de las mujeres mayores para promover un envejecimiento saludable. Esta revisión narrativa tiene como objetivo proporcionar información sobre los beneficios para la salud del entrenamiento de fuerza en mujeres de mediana edad y mayores, y propone una serie de recomendaciones para promover su práctica segura y efectiva, para ayudarlas a disfrutar de un envejecimiento saludable.

Palabras clave: sarcopenia, independencia funcional; ejercicio físico; entrenamiento de fuerza, calidad de vida.

Fecha recepción: 27-04-23. Fecha de aceptación: 26-09-23

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Background

The world's population has been aging considerably since the middle of the 20th century, and the general life expectancy has also increased. The increase in life expectancy is due to the improvement in the quality of life, and mainly to the medical advances that have taken place in recent decades. Individuals are reaching ages that were unthinkable in earlier times, and the number of octogenarians has increased significantly. Globally, the demographic landscape is changing, with an increasing number of older people (Kluge, Zaghenni, Loichinger, & Vogt, 2014). In developed countries, the population continues to reach older ages because of the increase in life expectancy (Thiel,

Seiberth, & Mayer, 2017). In 2020, the number of people aged 60 and older surpassed the number of children under five, and it is estimated that by 2025 there will be 1.2 billion people over 60, and 2 billion by 2050, with an increase in both developed and developing countries (World Health Organization, 2022).

The aging process in humans is influenced by various factors and manifests itself differently in each person (Marcos-Pardo et al., 2019). Major changes that affect them physically, psychologically, and socially, causing a decline in their quality of life (Estebansari et al., 2020). More specifically, the aging process commonly results in a reduction in total muscle strength, which can greatly impact an older person's ability to perform activities of daily living (ADL)

and limit their mobility and functional autonomy (Borzuola et al., 2020), with functional autonomy understood as individual's physical independence and their capability to complete everyday tasks (de Noronha Ribeiro Daniel et al., 2011). The reduction in muscle strength that occurs with aging is largely related to sarcopenia (Martin et al., 2010), a pathology with a high incidence in the older population that is characterized by a gradual decline in muscle mass (Lemos, Guadagnin, & Mota, 2020). This process is associated with changes in motor unit remodeling, hormonal fluctuations, and decreased protein synthesis, ultimately leading to reduced muscle strength and resulting in functional dependence (Cascon et al., 2017). In particular, the loss of muscle mass in the lower extremities can cause diminished walking speed, increased frailty, and fatigue as individuals age, which can negatively impact their overall health (Borzuola et al., 2020).

Furthermore, oxidative stress levels tend to rise with age, leading to the accumulation of harmful effects that may contribute to the development of serious pathophysiological conditions (Brancaccio et al., 2020). Along these lines, mitochondrial dysfunction and changes in oxidative stress that occur during aging have been linked to the incidence of diseases such as cancer (Kudryavtseva et al., 2016), Alzheimer's disease (Ionescu-Tucker & Cotman, 2021), or cardiovascular diseases (Cai, Liu, Men, & Zheng, 2021), among others.

In addition, the level of physical activity in the older population decreases with age (Fragala et al., 2019). This affects not only the intensity of exercise, but also its duration, which ultimately results in difficulties in performing daily tasks and an overall decrease in quality of life (Briggs et al., 2016). This state of physical inactivity is considered one of the main causes of obesity, mortality and functional disability in the aging population (Keegan, Middleton, Henderson, & Girling, 2016; Yates, Djoussé, Kurth, Buring, & Gaziano, 2008). Improving lower extremity strength has significant implications for functionality in the older population (Espinoza-Salinas et al., 2023)

Although aging should not be considered a terminal condition, it does cause structural and functional changes that progressively affect the individual's capabilities and, consequently, his or her health and quality of life (Briggs et al., 2016; De Labra, Guimaraes-Pinheiro, Maseda, Lorenzo, & Millán-Calenti, 2015; Garber et al., 2011; Nicklas et al., 2015). Likewise, reduced physical functioning in this population is associated with negative outcomes in the near future, including an increased risk of frailty (Mañas et al., 2020), dementia, and premature mortality (Hamer, David Batty, Kivimaki, & Stamatakis, 2011).

To mitigate the negative consequences of aging, engaging in physical exercise can be highly beneficial (Horne & Tierney, 2012). It can help prevent muscle strength loss, enhance joint mobility, and boost muscle tone (Nelson et al., 2007). Performing physical exercise can improve one's ability to perform daily activities, enhance overall well-being,

foster self-confidence, and promote functional autonomy. Additionally, physical exercise can improve psychological and social aspects (Lemos et al., 2020). When paired with proper nutrition, physical exercise triggers molecular mechanisms that encourage adaptive physiological responses in muscle function. These responses can positively impact daily living activities and prevent the negative effects of aging-related oxidative stress, ultimately reducing stress levels (de Araújo et al., 2019; de Resende-Neto et al., 2019). Therefore, promoting an active, healthy, and fulfilling lifestyle is crucial to mitigate common health issues associated with aging (Keating et al., 2021).

In addition to the above, it should be noted that women have a longer life expectancy than men (Baum, Musolino, Gesesew, & Popay, 2021). However, numerous studies show that their quality of life is worse at all levels and that they have poorer physical, psychological, and social well-being (Reimers, Knapp, & Reimers, 2012). This is not only due to socio-demographic factors, but also to the hormonal changes that women undergo during aging, associated with menopause, and which lead to physiological alterations in the cardiovascular system (Graziottin, Banerji, & Hall, 2019), in the lipid profile (Tuna et al., 2010), and in blood pressure (Wenger et al., 2018) or to a decrease in bone mineral density (Greendale et al., 2019), which often leads to osteopenia or osteoporosis (Ramezani Tehrani & Amiri, 2021).

Non-pharmacological intervention strategies such as regular exercise are needed to help prevent and even reverse diseases, and to allow women enjoy healthy aging with higher levels of overall health. However, most exercise programs have focused on the effects of aerobic resistance training (Lobo et al., 2014; Stojanovska, Apostolopoulos, Polman, & Borkoles, 2014), with resistance training-based exercise programs being much more novel (Peña et al., 2022; Pucci, Neves, Santana, Neves, & Saavedra, 2021). Nevertheless, resistance training is a very interesting type of training for middle-aged and older women as its effects mitigate many of the effects of aging and menopause (Westcott, 2012). Thus, the aims of this study were: 1) to review the scientific literature in a narrative manner, in order to analyze the effects of resistance training on the health of middle-aged and older women; and 2) to provide a series of practical recommendations for resistance training, so that women can benefit from it and promote their health.

Material and methods

Design

In this article we conducted a narrative review to analyze the effects that resistance training may have on the health of middle-aged and older women, and then provide a series of practical recommendations on resistance training so that women can benefit from it to promote their health.

Eligibility criteria

The selection of scientific studies was based on the following inclusion criteria: a) experimental or quasi-experimental designs; b) intervention based on the systematic performance of resistance training; and c) assessment of a health-related parameter. We applied the exclusion criteria defined in previous reviews (Bustamante-Sanchez et al., 2022; Clemente-Suárez, Navarro-Jiménez, Jimenez, et al., 2021; Clemente-Suárez, Navarro-Jiménez, Ruisoto, et al., 2021): a. Analysis conducted outside of the designated time frame; b. Topics covered that were not within the scope of the review; c. Utilized unpublished materials such as conference proceedings, abstracts, and PhD dissertations. No limitation was placed on the age of the participants or on their initial level of health or fitness. Methodological designs that lacked a control group were included, since health parameters do not change significantly in a short period of time in the absence of physical exercise or a systematic nutritional intervention (Marcos-Pardo, Abelleira-Lamela, González-Gálvez, et al., 2022; Marcos-Pardo, Abelleira-Lamela, Vaquero-Cristobal, & González-Gálvez, 2022).

Search Methods and Strategies for Research Identification

In order to achieve our research goal, we carried out a comprehensive evaluation and analysis by scrutinizing primary sources such as scholarly research and secondary sources, including databases, web pages, and bibliographic indexes, using the same procedures as those applied in previous critical narrative reviews (Bustamante-Sanchez et al., 2022; Clemente-Suárez, Navarro-Jiménez, Jimenez, et al., 2021; Clemente-Suárez, Navarro-Jiménez, Moreno-Luna, et al., 2021; Clemente-Suárez, Navarro-Jiménez, Ruisoto, et al., 2021). To conduct our search, we utilized various databases, including MedLine (Pubmed), and Cochrane (Wiley), searching for MeSH-compliant keywords such as: (strength training OR resistance training) AND (middle-aged women OR older women). Our search was limited to manuscripts published from April 1, 2013, to April 1, 2023, although some earlier studies were referenced to provide additional context in certain areas of the narrative review.

Study selection and data extraction

We included studies that met rigorous scientific methodological standards and were relevant to the subsections addressed in this narrative review. Data analysis was carried out by the review's three authors. The principal investigator assessed the eligibility of the studies according to their title and abstract in a first review, with an assistant in a second review to jointly verify these criteria and the results obtained. In this second review, the full text of the articles was read and reviewed. Research that did not meet the inclusion and exclusion criteria was excluded. A form was designed in Microsoft Office Excel® to extract relevant data from the studies. The flow chart with the selection process of the articles is shown in Figure 1. Finally, a total of 115 studies

were selected, read, and deemed suitable for evaluating our research objective according to the search criteria. These studies composed the present narrative review.

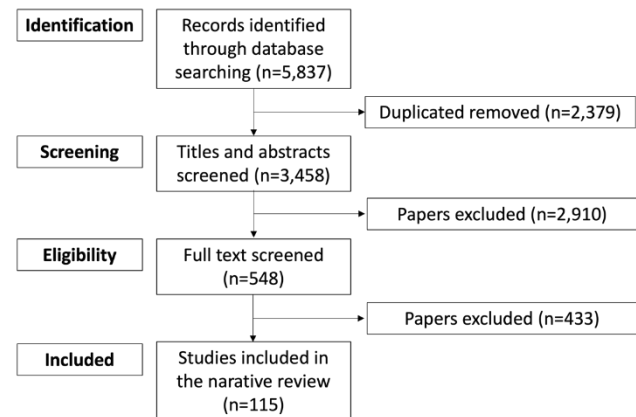


Figure 1. Flow diagram of the article selection process.

Results

Health benefits of resistance training

For most chronic diseases, physical activity has the best risk/benefit ratio and probably the best cost/benefit ratio of any medical intervention, but even this option remains underutilized in the health care system (Huber, 2022). Abundant evidence shows that physical activity and exercise are among the most important factors influencing the health status of older adults. They are associated with improved psychological and physical health and help to reduce healthcare costs (Chodzko-Zajko et al., 2009).

Although the benefits of cardiovascular exercise such as walking, running, cycling or swimming are well known, resistance training has been undervalued in recent decades. In recent years, this type of training has gained relevance and become an interesting topic in clinical settings, especially for older people (Marcos-Pardo et al., 2019; Ramos et al., 2022). Resistance training is recommended because it helps to curb the negative effects of aging, such as functional decline related to sarcopenia, and because it is considered the most effective method to improve muscle mass, strength, functional decline, and power, which are key for counteracting future disability in adults and older people (Botero et al., 2013; Eduardo L. Cadore, Casas-Herrero, et al., 2014; Chodzko-zajko, 2014; Ransdell et al., 2021). It is recommended that resistance training programs for older individuals integrate protocols emphasizing maximum force/muscle hypertrophy and rapid force production, in order to induce comprehensive health-related and functionally-important improvements in this population (Walker, Peltonen, & Häkkinen, 2015). A large-scale cross-sectional study conducted on menopausal women demonstrated a significant decline in both muscle mass and bone density across all menopausal groups. Notably, strength training was observed to enhance muscle mass among postmenopausal women, and hence, its inclusion in their daily life could

be crucial, as it may reduce the risk of sarcopenia in later stages of life (Sipilä et al., 2020). Other studies have shown that resistance training can improve musculoskeletal health in middle-aged women who are experiencing an accelerated decline in bone mineral density, muscle strength, and balance (Gerage et al., 2013; Idland, Sylliaas, Mengshoel, Petersen, & Bergland, 2014; Wu et al., 2017). Other studies have shown that resistance training is a viable long-term method to prevent weight gain, and to reduce body mass index (BMI) and deleterious changes in body composition in postmenopausal women, as they tend to experience increases in fat mass or decreases in muscle and bone mass (Bea et al., 2010; Botero et al., 2013; Gelecek et al., 2012). In addition, resistance training has been shown to positively affect mobility (Idland et al., 2014). Therefore, resistance training should be promoted for older people, as it has the potential to improve physical performance, thereby prolonging healthy, independent aging (Geirsdottir et al., 2012).

Furthermore, resistance training has been shown to increase carotid systolic luminal diameter and flow velocity in older women. Thus, regular combined exercise, including aerobic exercise and resistance training, could help prevent atherosclerotic disease by improving carotid artery health in older women (Park & Park, 2017). Another study showed that a supervised resistance training program reduced systolic blood pressure, without affecting diastolic blood pressure or heart rate variability in postmenopausal women (Gerage et al., 2013). Another study found that resistance training could generate adaptations on certain cardiovascular risk factors in postmenopausal women, such as heart rate, systolic blood pressure, and estimated mean peak VO₂ (Gelecek et al., 2012).

In addition to improving functional capacity and the performance of activities of daily living, resistance training has been shown to prevent osteoporosis and bone fractures, lower LDL cholesterol levels, lower general cholesterol levels, decrease markers of inflammation, improve stress and anxiety, reduce back and joint pain, reduce osteoarthritis-related discomfort, and improve body posture, as well as improve sleep quality, mood (Alcazar et al., 2021; Baltasar-Fernandez et al., 2021; Botero et al., 2013; Fragala et al., 2019; García-Hermoso, Ramírez-Vélez, Celis-Morales, Olloquequi, & Izquierdo, 2018; Gelecek et al., 2012; Leong et al., 2015; Seguin & Nelson, 2003; Syed-Abdul, 2021; Volaklis, Halle, & Meisinger, 2015), quality of life (Haraldstad et al., 2017; Hart & Buck, 2019; Kekäläinen, Kokko, Sipilä, & Walker, 2018; Khodadad Kashi, Mirzazadeh, & Saatchian, 2023), and depression (Khodadad Kashi et al., 2023). It all this were not enough, resistance training has also been shown to significantly reduce the risk of all-cause mortality (even in populations with chronic diseases such as cardiovascular disease, cancer, COPD, arthritis, etc.) (Liu et al., 2019; Yusuf et al., 2020), type II diabetes (it improves glucose tolerance and insulin resistance), and cardiovascular disease, colon cancer and breast cancer. Par-

ticipation in resistance training programs has been associated with a decrease in all-cause and cancer mortality, and a reduction in the incidence of cardiovascular disease, hypertension, and symptoms of anxiety and depression (Fyfe, Hamilton, & Daly, 2022). Resistance training is an effective primary preventive measure for type 2 diabetes in older women with low muscle mass (Sawada et al., 2019). Also, water-based resistance training programs can be an appealing option for promoting strength gains in older women, through the use of moderate loads and fast-paced movements (Bento & Rodacki, 2015; Ochoa-Martínez, Hall-López, Diaz, Trujillo, & Teixeira, 2019). Older women can achieve comparable gains in muscle strength through a once or twice weekly resistance exercise program as they would with a 3-day-a-week program. Moreover, this type of program is linked to enhanced neuromuscular performance, which may reduce the risk of falls and fractures in this population (Taaffe, Duret, Wheeler, & Marcus, 1999)

In summary, resistance training exercises performed regularly and at a moderate to high intensity promote beneficial effects on several organs and systems, mainly on muscular, bone and adipose tissue (Leite, Prestes, Pereira, Shiguemoto, & Perez, 2010), prevent many chronic diseases, including cardiovascular diseases, stroke, diabetes, osteoporosis, obesity, mental health, and sarcopenia, improve strength and muscle mass, and help preserve bone mineral density loss, functional independence, vitality (Izquierdo et al., 2021; Marcos-Pardo, Espeso-García, López-Vivancos, Abelleira Lamela, & Keogh, 2020; Marcos-Pardo, Martínez-Rodríguez, & Gil-Arias, 2018; Marcos-Pardo et al., 2019; Rose, Mielke, Durr, & Schaumberg, 2021; Seguin & Nelson, 2003). In addition, resistance training improves fragility (Eduardo L. Cadore, Moneo, et al., 2014; Eduardo Lusa Cadore & Izquierdo, 2018), and quality of life perception (Chang & Chiu, 2020; Haraldstad et al., 2017; Hart & Buck, 2019; Khodadad Kashi et al., 2023), allowing for a better quality of life in post-menopause women. These multiple benefits of resistance training have made this type of training a fundamental public health tool and should be especially recommended for middle-aged and older women.

Practical recommendations for the performance of resistance training in middle-aged and older women

Based on previous studies (Alcazar et al., 2021; Baltasar-Fernandez et al., 2021; Bea et al., 2010; Botero et al., 2013; Geirsdottir et al., 2012; Gelecek et al., 2012; Marcos-Pardo et al., 2021; Marcos-Pardo, Jiménez Pavón, Isidori, González-Gálvez, & Vaquero Cristóbal, 2020; Marcos-Pardo et al., 2019; Park & Park, 2017; Ransdell et al., 2021; Suchomel, Nimphius, Bellon, Hornsby, & Stone, 2021; Walker et al., 2015), the following recommendations are proposed for safe and effective resistance training for middle-aged and older women:

How many days a week does resistance training have to be performed? For how long?

- Perform resistance training at least 2-3 days per week,

trying not to make them consecutive (Marcos-Pardo et al., 2021; 2023).

- It is recommended that the session last between 60 and 90 minutes (Marcos-Pardo et al. 2023).

How should the program be planned?

- In each session include 8 to 10 polyarticular exercises involving large muscle groups (arms, shoulders, chest, abdomen, lower back, hips, and legs), with guided machinery, with free weights, with self-loads, or performed with specific material, for example, elastic bands (Marcos-Pardo, Espeso-García et al., 2020; Marcos-Pardo et al., 2021; 2023).

- One set of 8 to 12 repetitions of each exercise is effective, although two or three sets may be more effective. Muscle strengthening exercises should be performed to the point where it is difficult to do another repetition without assistance but avoiding failure (Marcos-Pardo et al., 2020).

- Maintain a moderate intensity, 5 to 6 points out of 10 on the perceived exertion scale (Gearhart, Lagally, Riechman, Andrews, & Robertson, 2011), or 60-75% of 1RM, to vigorous intensity, 7 to 8 points out of 10 on the perceived exertion scale (Gearhart et al., 2011) or between 75-80% of 1RM (Caserotti et al., 2008; Marcos-Pardo et al., 2021).

- Resistance training performed at high speeds in older women appears to have a better effect on improving endurance, strength, agility, and muscle power rather than strength training performed at low speeds (Fernández Ortega & Hoyos Cuartas, 2020).

- For sedentary, middle-aged women and older women at risk of fragile cardiovascular disease or osteoporosis, a low intensity is recommended. In these cases, it is advisable to start with 20-30% of the 1RM, prioritizing exercises in a sedentary position, and progressively increasing the loads (Molina-Sotomayor, Castillo-Quezada et al., 2020; Molina-Sotomayor, Espinoza-Salinas et al., 2021).

- The recovery between sets and exercises should be at least 10-30 seconds (Marcos-Pardo et al., 2021).

- The development of muscular strength and endurance should be progressive over time. This means that gradually increasing the amount of weight or days per week of exercise will result in stronger muscles (Molina-Sotomayor, Castillo-Quezada et al., 2020; Molina-Sotomayor, Espinoza-Salinas et al., 2021).

What should be considered during the session?

- Start the session with a specific 5 to 10 minute warm-up (Marcos-Pardo et al., 2021; 2023).

- Special attention should be paid to the correct technical execution in each of the resistance exercises (Marcos-Pardo et al., 2021).

- Once the technique for executing the exercises has been mastered, one should try to perform the strength exercises at the maximum possible speed. In this way, not only is strength improved, but also muscle power, which has shown to have even more health benefits (Caserotti et al.,

2008; Marcos-Pardo et al., 2023).

How to choose the right trainer?

- It is advisable to train under the advice of a Sports Physical Educator, who teaches how to train safely and effectively, and carry out proper training planning, based on the principles of training (Marcos-Pardo, Espeso-García et al., 2020; Marcos-Pardo et al., 2021).

Where can I do resistance training?

- Classically, resistance training has been carried out at fitness centers. Within these, there are specialized programs for older women (Bea et al., 2010; Lange et al., 2019). However, there are other alternatives.

Outdoor fitness equipment areas are outdoor sports facilities commonly located in public places, composed of machines that seek to have a certain similarity with the weight training machines found in indoor sports centers. This type of machine can be an alternative to promote resistance training in older women due to its low cost for the user and the fact that it allows for outdoor exercise (Marcos-Pardo et al., 2023).

For older women who do not like to do resistance training on land, they can opt for an aquatic muscle resistance training program. There is evidence that aquatic physical training helps to achieve physical benefits such as improved aerobic capacity and strength, as well as psychological and social benefits in older adults (Bento, Pereira, Ugri-nowitsch, & Rodacki, 2012; Bergamin, Zanuso, Alvar, Ermolao, & Zaccaria, 2012; Waller et al., 2016). Physical training in the aquatic environment has a lower risk of traumatic fracture, lower joint impact, and lower load due to buoyancy, as compared to exercise in the terrestrial environment (Simas, Hing, Pope, & Climstein, 2017), making it safer and less injurious for adults and older women. Resistance training in the aquatic environment was shown to improve blood pressure, lipid profile, metabolic fitness, and muscle strength gain (David et al., 2022; Delevatti, Marson, & Krueel, 2015; Way, Sultana, Sabag, Baker, & Johnson, 2019).

- Home resistance training with minimal supervision is also a safe, effective, and a low-cost exercise option for increasing muscular strength and functional capacity in healthy older women, as well as older women with a variety of health conditions who can overcome some of the common barriers to exercise (Henwood et al., 2019; Mañas et al., 2021).

What considerations should be taken into account when resistance training at home?

- Resistance training with home equipment, it is an attractive, viable and, from a public health point of view, feasible alternative to supervised resistance training in gyms (Kis, Buch, Stern, & Moran, 2019). Training with lightweight, small load equipment, such as bottles or dumbbells available for home use, as well as elastic resistance training bands are effective and easy-to-use resistance training

equipment for this age group (Andersen et al., 2011; Jensen et al., 2014).

- Training with elastic bands allows strength training with low-cost, portable equipment that can be used almost anywhere (Andersen et al., 2011; Jensen et al., 2014).

- The use of elastic resistance training bands has multiple advantages for home training; they are easy to use, can be adjusted to different loads, are less expensive and do not take up as much space as dumbbells or specialized strength training machines. Multiple studies have compared elastic band training with traditional resistance training based on free weights (e.g., dumbbells) in terms of muscle activation levels (Andersen et al., 2010; Colado et al., 2010; Melchiorri & Rainoldi, 2011). Training with elastic materials promotes similar electromyographic activity and muscle damage as compared to the isoinertial weight machine (Aboodarda, Page, & Behm, 2016).

- The resistance of training elastic bands varies from brand to brand and differs in color. Each color offers a different level of resistance to the practitioner. It is very important for the safety and effectiveness of the training that the practitioner is familiar with the load (resistance of the band), the range of motion (ROM), including the start and end position, the number of repetitions per set and the optimal speed of execution. To control the intensity of exercise with elastic bands, it is advisable to use the Resistance Intensity Scale for Exercise (RISE) in older people (Colado, Furtado, Teixeira, Flandez, & Naclerio, 2020).

- The following recommendations on how elastic resistance training exercises can be performed, progressed,

and incorporated into a circuit format for middle-aged and older women are based on previous studies (Colado et al., 2020; Fritz et al., 2018; Krause et al., 2019; Osuka et al., 2019; Rieping et al., 2019; Silva et al., 2018; Souza et al., 2019). Older women with little experience in resistance training can initially perform 1 or 2 sets of the circuit, with a load that allows for 12 to 15 repetitions per set at a low to moderate level of effort on the RISE. Each repetition should be performed under control, with a concentric (lifting the weight) and an eccentric (lowering the weight) phase of two seconds. You can increase the intensity of the exercises, as assessed by the RISE, towards a perceived hard level of effort between the second and fourth week. After four weeks of training, it is advisable to progressively increase the number of training sets, eventually aiming to perform three to four sets of the exercise circuit. As the weeks go by, and the older woman adapts to the load, she should optionally increase the repetitions or increase the load, in this case switching to another elastic band of higher resistance. For older women with some experience in resistance training, they can start with a moderate level of intensity, with a higher resistance elastic band and perform 10 to 12 repetitions per set, with a perceived level of hard effort when performing three or four sets of training, progressing to three or four days a week (Fragala et al., 2019; Marcos-Pardo, Espeso-García et al., 2020; Marcos-Pardo et al., 2021; Peterson et al., 2010).

The following Table 1 summarizes the main recommendations for safe and effective resistance training for middle-aged and older women:

Table 1.

Principal recommendations for performing resistance training.

Recommendations	Details	References
Frequency	Perform resistance training at least 2-3 days per week, with non-consecutive days	Marcos-Pardo et al. (2021; 2023)
Session duration	Recommended session time is between 60 and 90 minutes.	Marcos-Pardo et al. (2023)
Exercise selection	Include 8 to 10 polyarticular exercises involving large muscle groups	Marcos-Pardo, Espeso-García et al. (2020); Marcos-Pardo et al. (2021; 2023)
Warm-up	Start with a specific warm-up of 5-10 minutes.	Marcos-Pardo et al. (2021; 2023)
Sets and repetitions	One set of 8-12 reps of each exercise is effective; two or three sets may be more effective	Marcos-Pardo et al. (2020)
Intensity	Maintain moderate intensity (5 or 6 out of 10 on the perceived exertion scale) or vigorous intensity (7 or 8 out of 10 on the perceived exertion scale), depending on fitness level or 60-80% of 1RM	Caserotti et al. (2008); Gearhart et al., (2011); Marcos-Pardo et al. (2021)
Recovery	Allow at least 10-30 seconds between sets and exercises.	Marcos-Pardo et al. (2021)
Progression	Gradually increase weight or days per week of exercise to build muscular strength and endurance, as the person adapts to the load and feels that he/she must increase the number of repetitions or the load to reach that perceived exertion	Molina-Sotomayor, Castillo-Quezada et al. (2008); Molina-Sotomayor, Espinoza-Salinas et al. (2021)
Technique	Pay close attention to correct technical execution in each exercise.	Marcos-Pardo et al. (2021)
Trainer	Train under the advice of a Sports Physical Educator to ensure safe and effective training planning	Marcos-Pardo, Espeso-García et al. (2020); Marcos-Pardo et al. (2021)
Location	Resistance training can be done in a fitness center, outdoor fitness equipment areas, or aquatic environments. Home training with minimal supervision is also an option	Bea et al. (2010); Bento et al., 2012; Bergamin et al. (2012); Henwood et al. (2019); Lange et al. (2019); Mañas et al. (2021); Marcos-Pardo et al. (2023); Waller et al. (2016)
Home training considerations	Resistance training with lightweight, small load equipment, such as bottles or dumbbells, or elastic band resistance training, are effective and easy-to-use options. Familiarity with the resistance intensity scale is important for controlling exercise intensity with elastic bands	Andersen et al. (2011); Colado et al. (2010; 2020); Fritz et al. (2018); Jensen et al. (2014); Kis et al. (2019); Krause et al. (2019); Melchiorri & Rainoldi (2011); Osuka et al. (2019); Rieping et al. (2019); Simas et al. (2017); Silva et al. (2018); Souza et al. (2019)

Conclusions

Following these recommendations can help middle-aged and older women reduce the loss of muscle mass and strength, control and/or reduce body weight, prevent the accumulation of fatty tissue, and combat the onset of or reduce chronic diseases as well as loss of function. Resistance training is a beneficial and necessary option to improve muscle mass, strength, power, and functional capacity, and helps maintain musculoskeletal and psychosocial health, allowing the woman practitioner to enjoy healthy aging.

The data available thus far indicate that resistance training should be an important component of any exercise program for middle-aged and older women. Therefore, healthcare professionals should encourage and support older women to seek the advice of a sports physical educator to undertake a resistance training program under their planning and supervision in order to improve their overall health and quality of life.

Fundings

The participation of Pablo J. Marcos-Pardo in the present research is supported by a young researchers' mobility grant from the "Agencia de Ciencia y Tecnología de la Región de Murcia" Spanish SENECA Foundation "Jiménez de la Espada" Postdoctoral stay (expedient n° 19987/EE/15).

The participation of Raquel Vaquero-Cristóbal in the present research is supported by the Spanish Ministry of Science, Innovation and Universities (Collaboration-Retos 2017) with the support and funding of the project: "Intelligent outdoor fitness equipment: Design and manufacture of new ergonomic, efficient and healthy outdoor fitness equipment with an application for mobile devices (APP) to assess and control training" (code RTC-2017- 6145-1).

Acknowledgments

The authors would like to thank to the Prevention and Rehabilitation Research Group, Institute of Sports and Sports Science of the University of Heidelberg. Special thanks to the Spanish SENECA Foundation of the Region of Murcia for funding the postdoctoral stay of Pablo J. Marcos-Pardo (expedient n° 19987/EE/15) and to the "Spanish Ministry of Science, Innovation and Universities" for funding the participation of Raquel Vaquero-Cristóbal.

Conflicts of Interest

The authors declare no conflict of interest.

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