

# Different physical activity programs for older women: which is better?

*Diferentes programas de atividade física para idosas: qual é o melhor?*

Rafaela Korn <sup>\*</sup>

Marilda Moraes da Costa 

Mauren da Silva Salin 

Antonio Vinicius Soares 

Universidade da Região de Joinville (UNIVILLE), Joinville, SC, Brazil

**Date of first submission:** July 22, 2025

**Last received:** October 12, 2025

**Accepted:** January 22, 2026

**Associate editor:** Emmanuel Souza da Rocha

**\*Correspondence:** rafaelakorn@hotmail.com

## Abstract

**Introduction:** There is strong evidence of the benefits of physical activity (PA) for older adults. However, there is still no consensus on which modality is more effective than the others regarding muscle mass and functional capacity. **Objective:** To compare three different PA programs for older women. **Methods:** The study included 107 participants between 60 and 75 years old who practiced PA in three different programs, which were: strength training group (STG), aerobic training group (ATG) and adapted sports group (ASG). To evaluate body composition, we used the body mass index and the total muscle mass index. For the functional tests, we employed the Sit-to-Stand Test (SST) and the Timed Up and Go Test (TUGT). **Results:** All participants of the three groups presented good physical performance, as the STG group presented the best result in the SST while the ASG group was better in the TUGT. **Conclusion:** The study reinforces the need to stimulate the practice of PA for elderly, and that intrinsic motivation should be considered to offer something that is pleasurable and maintains their adherence to the program.

**Keywords:** Physical activity. Exercise. Health promotion. Aged.

## Resumo

**Introdução:** Há fortes evidências dos benefícios da atividade física (AF) para pessoas idosas. No entanto, ainda não há consenso sobre qual modalidade é mais eficaz que as demais em relação à massa muscular e à capacidade funcional. **Objetivo:** Comparar três diferentes programas de AF para mulheres idosas. **Métodos:** O estudo incluiu 107 participantes com idade entre 60 e 75 anos que praticavam AF em três programas distintos: grupo de treinamento de força (GTF), grupo de treinamento aeróbico (GTA) e grupo de esportes adaptados (GEA). Para avaliar a composição corporal, foram utilizados o índice de massa corporal e o índice de massa muscular total. Nos testes funcionais, foram aplicados o Teste de Sentar e Levantar (TSL) e o teste Timed Up and Go (TUG). **Resultados:** Todos os participantes dos três grupos apresentaram bom desempenho físico, sendo que o GTF obteve o melhor resultado no TSL, enquanto o GEA se destacou no TUG. **Conclusão:** O estudo reforça a necessidade de estimular a prática de AF em idosos, destacando que a motivação intrínseca deve ser considerada para oferecer algo que seja prazeroso e favoreça a adesão ao programa.

**Palavras-chaves:** Atividade física. Exercício. Promoção de saúde. Envelhecimento.

## Introduction

The population transition phenomenon occurs due to the reduction in birth and mortality age ranges, causing visible modifications in the age groups of the world population.<sup>1,2</sup> Population aging consists of a worldwide phenomenon and is considered a natural process of human life.<sup>3,4</sup> However, the way in which the individual goes through this stage of life depends on their genetic heritage and their life habits during this journey.<sup>4</sup> It is known that a sedentary lifestyle and poor eating habits are negative factors for health, and may imply the development of various diseases and, consequently, dysfunctions, disabilities, hospitalizations, and loss of autonomy.<sup>4</sup>

Advancing age brings with it changes in body composition and reduction of physiological reserves, causing progressive physical disability and favoring a health con-

dition with more fragility.<sup>2,5,6</sup> Body composition changes are characterized by fat redistribution and reduced lean mass, changes in the locomotor apparatus that induce muscle hypotrophy, more frequently observed in women.<sup>2,5-7</sup>

With the association of these factors occurs the reduction of muscle strength, and as a result the reduction of physical performance, hurting the life of the elderly. It may also develop a muscle disease called sarcopenia, where there is a reduction of muscle quantity and its quality.<sup>5,6,8,9</sup> Other factors that may be associated with clinical decline are related to menopause, which causes musculoskeletal changes due to estrogen deficiency. These hormonal alterations may contribute to a reduction in physical activity levels,<sup>7</sup> in addition to women living longer than men.<sup>10</sup>

Considering that population aging is occurring at an accelerated pace on a global scale, promoting healthy aging becomes essential. According to the Decade of Healthy Ageing document from the World Health Organization,<sup>10</sup> healthy aging refers to the development and maintenance of functional ability that enables well-being in older age, going beyond the mere absence of disease.

The most prescribed therapy for health maintenance and disease treatment is physical activity (PA), which is defined as any movement produced by the body through skeletal muscles with energy expenditure.<sup>11-13</sup> According to Camargo,<sup>14</sup> it is recommended that the practice of PA for the elderly is at least 150 to 300 minutes of aerobic PA from moderate to intense, and 75 to 150 minutes per week for activities considered vigorous.

Resistance and aerobic training have the function of improving the overall functional capacity and may delay or prevent the progression of a particular disease.<sup>15</sup> The aerobic exercise has the functionality to use large muscle groups, being continuous, and its energy supply happens through the oxidative system.<sup>15</sup> This type of exercise aims to make changes in weight and body composition.<sup>15,16</sup>

Exercises that involve muscle strength, endurance and require mobilization of loads, which are determined by machines, elastics, free weights, even the body weight itself, are called weight training.<sup>16,17</sup> The benefits that accompany this modality is the improvement of coordination, balance, power, strength, endurance, metabolic and cardiorespiratory improvements, as well as in the aspects of health and quality of life of the elderly.<sup>16,17</sup>

Another possibility to promote and encourage increased PA for the elderly is through sports. However, especially for the elderly population, this strategy requires a redoubled attention, being necessary appropriate adaptations to physical, psychological, social and cultural characteristics.<sup>16</sup> The benefits that adapted sports generate for the elderly population is the improvement of physical conditioning and balance, besides the promotion of independence and autonomy of this population.<sup>18</sup> That is, there are many approaches to the treatment and prevention of physical and functional decline in older adults. However, it is not yet known which approach or approaches are the most effective for this purpose. Therefore, the objective of this study was to compare three PA programs adapted for the elderly population in two cities in southern Brazil.

## Methods

This is an observational study of descriptive type, approved by the Research Ethics Committee of Universidade da Região de Joinville (Approval No. 11331919.0.0000.5365). The study involved 107 elderly women between the age range of 60 to 75 years, who were regularly

enrolled in three different PA programs for the elderly with a minimum duration of practice of six months, which offer PA practices to improve the quality of life of the population: aerobic training group (ATG; n = 30), strength training group (STG; n = 37), and adapted sports group (ASG; n = 40). The study excluded elderly people who, at the time of the functional test evaluation, had acute musculoskeletal and/or cardiorespiratory complaints, preventing them from performing the tests.

The purpose of the ATG is to perform systematic PA in groups, involving gymnastics, dancing, monitored walking, postural exercises, breathing, stretching, and relaxation, always with a physical education professional to supervise, with an average duration of 60 minutes (1 hour), and performed twice a week. With the STG group, 10 minutes of stretching, warm-up, after global resistance and aerobic exercises lasting 40 minutes, and the final 10 minutes of stretching, totaling 60 minutes, were performed twice a week. Finally, in the ASG, the sports performed were volleyball, basketball, and handball for a group of seniors aged 60 and older, with a frequency of twice a week and a duration of 50 minutes each day. They were distributed by sport category, with 18 participants in volleyball, 12 in basketball, and 10 in handball (Table 1).

**Table 1** - Description of the training groups

Groups	Description	Participants	Frequency	Duration
Aerobic training	Gymnastics, dance, supervised walking, postural exercises, breathing, stretching, and relaxation.	30	Twice a week	60 minutes
Strenght training	Ten minutes of stretching and warm-up were performed, followed by 40 minutes of resistance and aerobic exercises, ending with an additional ten minutes of stretching.	37	Twice a week	60 minutes
Adapted sports	Performed modalities such as adapted volleyball, basketball, and handball.	40	Twice a week	50 minutes

### Assessment procedure and measurement instruments

Initially, an anthropometric evaluation (weight, height, body mass index - BMI, and total muscle mass index - TMSI) and functional tests (Sit and Stand Test - SST; and Timed Up Go Test - TUGT) were performed. The assessment steps were applied successively, following the predefined sequence. To collect body weight, a digital scale (model 2096PP, Toledo Brand®, BR) was used,

and to measure the participants' height, a stadiometer (model ES2020 of Sanny March®, BR) was used. With this information, it was possible to define the BMI, which is an anthropometric indicator, non-invasive, low cost and easy to apply.<sup>19</sup> For classification, the recommendation made by the Nutrition Screening Initiative and Nutrition (SISVAN) was used, which indicates low weight (BMI < 22 kg/m<sup>2</sup>), eutrophic (BMI = 22 to 27 kg/m<sup>2</sup>), and overweight (BMI >27 kg/m<sup>2</sup>).

The evaluation of the TMSI was performed through a predictive equation,<sup>20</sup> which aims to evaluate the mass through the variables of body weight, height, age, gender, and ethnicity. Its range is between 5.9 and 9.5 kg.m<sup>-2</sup>.<sup>21</sup>

The SST has the purpose of evaluating the muscular strength and power of the lower limbs. Therefore, the objective is to quantify the maximum number of repetitions in 30 seconds of activity, being performed in a chair with a straight back, with a height of 43 cm from the floor to the seat, and the person should have their arms crossed at chest height. The reference values used for the elderly population are equal to or greater than 19 repetitions.<sup>22</sup>

The TUGT aims to assess the functional mobility of the elderly. This test consists of getting up from a chair, walking for three meters, turning, returning to the chair, and sitting down again.<sup>23</sup> The reference values used were that a time equal to or greater than twelve seconds was considered a low physical performance.<sup>24</sup>

## Data analysis

The data were analyzed using GraphPad Prism 8<sup>®</sup> software. Descriptive statistics were used (mean, standard deviation, minimum and maximum values). The Shapiro-Wilk test was used to verify the normality of the data. ANOVA was used for intergroup analysis (Tukey's multiple comparisons test). A 5% significance level was adopted for all tests ( $p < 0.05$ ).

## Results

Table 2 shows the summary results of the comparison of the three different PA programs for the elderly. The mean values and standard deviations of each variable controlled in the study are presented, along with the ANOVA values and the results of the multiple comparisons test.

**Table 2** - Summary of the results of the comparison between the groups

	ATG	STG	ASG	Frequency	p-value
Age (years)	66.3 (3.6)	67.0 (4.2)	66.5 (4.4)	0.24	0.786
Body mass index (kg/m <sup>2</sup> )	29.7 (3.7)*	27.6 (5.1)	26.9 (3.9)	4.04	0.020
Total Muscle Mass Index (kg.m <sup>-2</sup> )	8.4 (0.9)*	7.6 (1.3)	7.5 (1.0)	5.73	0.004
Sit and Stand Test (repetitions)	17.9 (3.7)	20.3 (5.3)*	17.8 (4.1)	3.61	0.031
Timed Up and Go Test (seconds)	6.4 (0.7)	6.4 (1.3)	5.8 (1.0)*	4.78	0.010

Note: ATG = aerobic training group (n = 30); STG = strength training group (n = 37); ASG = adapted sports group (n = 40). \*Significant difference.

Analyzing Table 2, the ATG was overweight, as indicated by a higher average BMI than the other groups, with the TMSI showing higher values in the same group, as it uses the same variables. When analyzing the STG group, it was observed that the BMI was within the normal range, but with a higher standard deviation compared to the other groups.

When referring to the functional tests, the STG group showed better performance in the SST test, which may be related to the specificity of resistance training, as this type of exercise promotes significant gains in muscle strength, endurance, and joint stability, which are key factors for the efficient execution of this test. In turn, the ASG group demonstrated better performance in functional mobility, as assessed by the TUGT, a result

that may be associated with the dynamic nature of the team sports activities performed by this group. These modalities require agility, balance, reaction speed, and quick changes in direction, which tend to enhance the motor skills involved in functional mobility.

## Discussion

Collective PA programs are strategies beyond the already known benefits to the locomotor and cardiorespiratory systems.<sup>25,26</sup> This interaction among the elderly promotes good social interaction and generates collective motivation that expands the possibilities of lasting and effective adherence, promoting health in a broad

sense and in all spheres of life. However, knowing individual tastes can be useful to screen the elderly and offer different possibilities for PA practice.<sup>25,26</sup> However, the differentiation of the groups occurred due to the specificity of training, but it is worth noting that all groups of elderly who practice PA showed satisfactory results, especially in physical performance tests.

When analyzing the results found in this research, it was possible to verify that the group STG presented a higher BMI when compared to the other groups. This increase in BMI is commonly found in elderly women, due to the late deposition of fat mass, resulting from menopause, where there is a drop in estrogen levels causing an accumulation of fat, and thus, reflecting in BMI values.<sup>27</sup> Consequently, the BMI variable was higher in STG, because it is evaluated by an equation that uses anthropometric data, a calculation studied by Rech et al.,<sup>21</sup> who evaluated 180 elderly people who presented a basis for estimating the amount of muscle mass in this population. There is a high correlation between BMI and TMSI, and this can be justified using variables such as weight and height for applications in BMI and TMSI calculations, i.e., the higher the BMI, the higher the TMSI.<sup>20</sup>

In the SST all the groups showed a good performance, but the STG performed better because it is a specific training that involves resistance exercises. Corroborating our findings, Souza et al.<sup>28</sup> compared levels of muscular strength of the lower limbs of elderly people, doing exercises twice a week for 12 months, and found that the group that did weight training showed an improvement in strength performance. According to Rabelo et al.,<sup>29</sup> the specificity of resistance training provides the elderly with increased muscle strength and endurance, improved balance, and cognitive ability, as well as improved performance of activities of daily living, making the elderly more independent, and thus improving their quality of life.

Studies indicate that, resistance training yields positive outcomes, offering benefits such as increased strength and muscle mass, reduced body fat, and improvements in functional capacity as well as cardiorespiratory and metabolic indicators.<sup>30</sup> It is worth noting that physically active older adults have a lower risk of cardiovascular changes and experience significant improvements in quality of life. Therefore, the development of public interventions to encourage this population to engage in physical exercise is of great importance.<sup>31</sup> It is known that the lack of physical exercise practices during the aging process enables a more intense

musculoskeletal physiological decline, as resistance training acts as an ally for the promotion of the individual's quality of life.<sup>32</sup> Several requirements guide the context about quality of life during the aging process. The capacity for functional autonomy is a condition sometimes insufficient, due to the effects of sarcopenia. Resistance exercise can be understood as a determining element for the maintenance of physical integrity.<sup>33</sup>

Regarding the TUGT, the ASG group showed superior results; however, the other groups showed values within normal parameters, i.e., elderly who practice ASG have reduced risks of falls and improved functional mobility, being of great importance for the maintenance of health and quality of life.<sup>34</sup> Team sports, due to their basic characteristics (cooperation, sociability, playfulness, competition, unpredictability), are appropriate for the elderly and are well accepted. The motivation that encourages the elderly to participate in an adapted team sport is strictly interconnected with the possibilities of social interaction and health goals.<sup>35</sup>

From the perspectives of well-being, health, and social interaction, adapted sports are one more possibility of physical exercise to avoid the aggravations of sedentary lifestyles, besides ensuring the elderly their totality as individuals. Studies show that positive effects from structured exercises and recreational/sports activities on the following outcomes: physical activity, falls, functional capacity, social, cognitive, and emotional functioning, and improved quality of life.<sup>36</sup> This is a diversity of advantages in adapted sport for health promotion during the aging process, positively enhancing physical failures.<sup>34</sup> These data, coupled with the recommendations available in the literature favoring PA practice to prevent and treat sarcopenia and frailty in the elderly,<sup>37</sup> make programs supervised by trained physical education professionals who have extensive knowledge of exercise recommendations for this special population very prestigious.

A limitation of this study refers to the small sample size and the absence of longitudinal follow-up, which prevents confirmation of the maintenance of the observed benefits over time. Furthermore, factors such as diet, adherence to PA outside the supervised environment, and psychosocial variables were not controlled and may have influenced the results. Therefore, future studies are recommended to include a larger number of participants, different intervention settings, and monitoring of behavioral and environmental aspects that may affect PA and functional performance in older adults.

## Conclusion

Based on the data presented, we can consider that these exercise programs presented clear favorable effects for elderly individuals who seek healthy habits, better quality of life and to be motivated to practice PA, bringing the possibility of exercise variability, such as gymnastics, weight training and adapted sports that have a wide range of modalities and possibilities, besides promoting social interaction.

Considering that the public in this research belongs to the risk group for sarcopenia and frailty, we can observe that the individuals in this study are potentially protected, because all of them performed very well in the physical and functional tests to which they were submitted. These results should further encourage health professionals to promote PA practice for the elderly in its various forms, and above all, represents an invitation to all seniors who seek to improve their health integrally, and for this, should insert exercise in their routines as something fundamental and irreplaceable to achieve this goal.

## Authors' contributions

RK was responsible for the written production. MMC and MSS, for data collection. AVS, for the manuscript revision. All authors approved the final version.

## Data availability statement

The data from this study are part of the *SARCOFF Project - Sarcopenia: Interdisciplinary approach to clinical research, prevention, and treatment modalities*, which is ongoing. In order to respect the confidentiality of the research, the data is not yet available for consultation.

## References

- Melo LA, Ferreira LMBM, Santos MM, Lima KC. Socioeconomic, regional and demographic factors related to population ageing. *Rev Bras Geriatr Gerontol.* 2017;20(4):493-501. <https://doi.org/10.1590/1981-22562017020.170004>
- Miranda GMD, Mendes ACG, Silva ALA. Population aging in Brazil: current and future social challenges and consequences. *Rev Bras Geriatr Gerontol.* 2016;19(3):507-19. <http://dx.doi.org/10.1590/1809-98232016019.150140>
- Moreira VG, Perez M, Lourenço RA. Prevalence of sarcopenia and its associated factors: the impact of muscle mass, gait speed, and handgrip strength reference values on reported frequencies. *Clinics (São Paulo).* 2019;74:e477. <https://doi.org/10.6061/clinics/2019/e477>
- Oliveira TA, Duarte SFP, Reis LA. Relationship between elderly body mass index and motor performance in peer groups. *Texto Contexto Enferm.* 2016;25(4):e3370014. <https://doi.org/10.1590/0104-07072016003370014>
- Marques KM, Ferreira MPN, Freitas TI, Goulart RMM, Aquino RC, Previdelli AN. Evaluation of dynapenia in the elderly in São Caetano do Sul, São Paulo, Brazil. *Fisioter Mov.* 2019;32:e003218. <https://doi.org/10.1590/1980-5918.032.AO18>
- Silva NA, Pedraza DF, Menezes TN. Physical performance and its association with anthropometric and body composition variables in the elderly. *Cienc Saude Colet.* 2015;20(12):3723-32. <https://doi.org/10.1590/1413-812320152012.01822015>
- Freitas J, Forte I. *Envelhecimento e exercício.* Vol. 4. São Paulo: CREF4/SP; 2018.
- Cruz EB, Canhão H, Fernandes R, Caeiro C, Branco JC, Rodrigues AM, et al. Prognostic indicators for poor outcomes in low back pain patients consulted in primary care. *PLoS One.* 2020;15(3):e0229265. <https://doi.org/10.1371/journal.pone.0229265>
- Paula JA, Wamser EL, Gomes ARS, Valderramas SR, Cardoso Neto J, Schieferdecker MEM. A Analysis of methods for detecting sarcopenia in independent community-dwelling elderly women. *Rev Bras Geriatr Gerontol.* 2016;19(2):235-46. <https://doi.org/10.1590/1809-98232016019.140233>
- World Health Organization. UN Decade of Health Aging: Plan of Action 2021-2030. 2020 [cited 2025 Oct 5]. Available from: <https://tinyurl.com/mfxjbak8>
- Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Rep.* 1985;100(2):126-31. <https://pubmed.ncbi.nlm.nih.gov/articles/PMC1424733>

12. Sallis R, Young DR, Tartof SY, Sallis JF, Sall J, Li Q, et al. Physical inactivity is associated with a higher risk for severe COVID-19 outcomes: a study in 48 440 adult patients. *Br J Sports Med.* 2021;55(19):1099-105. <https://doi.org/10.1136/bjsports-2021-104080>
13. Wood S, Fryer G, Tan LLF, Cleary C. Dry cupping for musculoskeletal pain and range of motion: A systematic review and meta-analysis. *J Bodyw Mov Ther.* 2020;24(4):503-18. <https://doi.org/10.1016/j.jbmt.2020.06.024>
14. Camargo EM, Añez CRR. Diretrizes da OMS para atividade física e comportamento sedentário: num piscar de olhos. Curitiba; 2020 [cited 2025 Jul 17]. Available from: <https://www.saudemental.ufscar.br/pt-br/assets/arquivos/diretrizes-atividade-fisica-oms.pdf>
15. Batista DS, Santana F. Capacidade funcional de idosos submetidos a diferentes treinamentos: resistido e aeróbio. *Braz J Dev.* 2020;6(7):49419-30. <https://doi.org/10.34117/bjd.v6n7-549>
16. Silva N, Brasil C, Furtado H, Costa J, Farinatti P. Exercício físico e envelhecimento: benefícios à saúde e características de programas desenvolvidos pelo LABSAU/IEFD/UERJ. *Rev Hosp Univ Pedro Ernesto.* 2014;13(2):75-85. <https://doi.org/10.12957/rhupe.2014.10129>
17. Kuster LM, Cruz JL, Razuk M, Rinaldi NM. Benefícios do treinamento de força nos componentes da capacidade funcional em idosos: Uma revisão narrativa. *Braz J Dev.* 2021;7(1):9851-67. <https://doi.org/10.34117/bjdv7n1-668>
18. Finger J, Teixeira SA. Esporte coletivo adaptado: atividade física e socialização aos idosos. In: Cavalli AS et al., org. *Envelhecimento baseado em evidências: Tendências e Inovações.* Campina Grande: Realize Editora; 2021. p. 1083-101. <https://tinyurl.com/vhh946mp>
19. Sass A, Marcon SS. Comparação de medidas antropométricas de idosos residentes em área urbana no sul do Brasil, segundo sexo e faixa etária. *Rev Bras Geriatr Gerontol.* 2015;18(2):361-72. <https://doi.org/10.1590/1809-9823.2015.13048>
20. Lee RC, Wang Z, Heo M, Ross R, Janssen I, Heymsfield SB. Total-body skeletal muscle mass: development and cross-validation of anthropometric prediction models. *Am J Clin Nutr.* 2000;72(3):796-803. <https://doi.org/10.1093/ajcn/72.3.796>
21. Rech CR, Dellagrana RA, Marucci MFN, Petroski EL. Validity of anthropometric equations for the estimation of muscle mass in the elderly. *Rev Bras Cineantropom Desempenho Hum.* 2012;14(1):23-31. <https://doi.org/10.5007/1980-0037.2012v14n1p23>
22. Oliveira DV, Pereira AP, Antunes MD, Nascimento Jr JRA. Avaliação da flexibilidade e força muscular de membros inferiores em idosos praticantes de hidroginástica. *Saude Pesq.* 2017;10(1):91-9. <https://tinyurl.com/2ccanf8h>
23. Ruzene JRS, Navega MT. Avaliação do equilíbrio, mobilidade e flexibilidade em idosos ativas e sedentárias. *Rev Bras Geriatr Gerontol.* 2014;17(4):785-93. <https://doi.org/10.1590/1809-9823.2014.13105>
24. Martone AM, Marzetti E, Calvani R, Picca A, Tosato M, Bernabei R, et al. Assessment of sarcopenia: from clinical practice to research. *J Gerontol Geriatr.* 2019;67:39-45. <https://www.jgerontology-geriatrics.com/article/view/105>
25. Moura CRB, Alves WS, Macêdo JLC, Silva AM, Mota PS, Riedel TL, et al. A melhora da qualidade de vida e os benefícios da atividade física em idosos: uma revisão sistemática. *Braz J Health Rev.* 2020;3(4):10381-93. <https://doi.org/10.34117/bjhrv3n4-258>
26. Oliveira JC, Vinhas W, Rabello LG. Benefícios do exercício físico regular para idosos. *Braz J Dev.* 2020;6(3):15496-504. <https://doi.org/10.34117/bjdv6n3-429>
27. Pereira IFS, Spyrides MHC, Andrade LMB. Estado nutricional de idosos no Brasil: uma abordagem multinível. *Cad Saude Publica.* 2016;32(5):e00178814. <https://doi.org/10.1590/0102-311X00178814>
28. Souza L, Coelho B, Freire B, Delevatti R, Roncada C, Tiggemann C, et al. Comparação dos níveis de força e equilíbrio entre idosos praticantes de musculação e de hidroginástica. *Rev Bras Ativ Fis Saude.* 2014;19(5):647. <https://doi.org/10.12820/rbafs.v.19n5p647>
29. Rabelo AO, Souza LA, Caetano TA, Silva SL, Santos GO. O efeito da musculação na terceira idade. *Nucl Conhecimento.* 2020;3(9):144-52. <https://tinyurl.com/4huj6cjr>
30. Freitas Jr, Forte I. *Envelhecimento e exercício.* São Paulo: CREF4/SP; 2018. 256 p. <https://tinyurl.com/4xha5s87>

31. Stopassola CR, Faria VMG, Silva MM, Macedo FE, Cassemiro JNM, Rabite MS, et al. Os impactos da atividade física em idosos: benefícios na qualidade de vida dos indivíduos com doenças cardiovasculares. *Braz J Implantol Health Sci.* 2025;7(2):2325-38. <https://doi.org/10.36557/2674-8169.2025v7n2p2325-2338>
32. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med.* 2020;54(24):1451-62. <https://doi.org/10.1136/bjsports-2020-102955>
33. Ribeiro TP, Dantas TCN. Influência do treinamento resistido para idosos [undergraduate thesis]. Brasília: Centro Universitário de Brasília; 2020. <https://repositorio.uniceub.br/jspui/handle/prefix/14619>
34. Lima DS, Oliveira RAR, Leite G, Ferreira EF. Esportes adaptados e envelhecimento: uma revisão sistemática. *Rev Cient UNIFAGOC.* 2019;4(1):17-24. <https://revista.unifagoc.edu.br/index.php/caderno/article/view/325>
35. Sepulchro BN, Gonçalves EC, Fernandes Filho J. Fatores motivacionais que levam à prática do voleibol de quadra adaptado à terceira idade. *Rev Carioca Educ Fis.* 2017;12(1):43-51. <https://revistacarioca.com.br/revistacarioca/article/download/44/42/132>
36. Pinheiro MB, Oliveira JS, Baldwin JN, Hassett L, Costa N, Gilchrist H, et al. Impact of physical activity programs and services for older adults: a rapid review. *Int J Behav Nutr Phys Act.* 2022;19(1):87. <https://doi.org/10.1186/s12966-022-01318-9>
37. Bray NW, Smart RR, Jakobi JM, Jones GR. Exercise prescription to reverse frailty. *Appl Physiol Nutr Metab.* 2016;41(10):1112-6. <https://doi.org/10.1139/apnm-2016-0226>