

Effect of a Physical Exercise Program on the Physical, Functional, and Cognitive Capacity of Older Adults

Efeito de um Programa de Exercício Físico na Capacidade Física, Funcional e Cognitiva de Idosos

Efecto de un Programa de Ejercicio Físico en la Capacidad Física, Funcional y Cognitiva de los Adultos Mayores

RESUMO

O objetivo deste estudo foi verificar os efeitos de um programa de exercícios físicos na capacidade física funcional e cognitiva de pessoas idosas. O programa de treinamento funcional consistiu de duas sessões semanais por 12 semanas. Participaram do estudo 16 idosos, com média de idade de 65,5 anos. Incluíram-se exercícios de força muscular, resistência aeróbica e equilíbrio. Os resultados demonstraram aumento significativo na força muscular de membros superiores e na força e resistência muscular de membros inferiores ($p < 0,05$). Não foram observadas diferenças significantes na flexibilidade de membros inferiores, agilidade e equilíbrio dinâmico, resistência aeróbica e capacidade cognitiva dos participantes. Assim, um programa de 12 semanas de treinamento funcional para idosos foi capaz de proporcionar modificações benéficas nos níveis de força muscular, porém não promoveu mudanças nas demais capacidades físico-funcionais e na capacidade cognitiva.

DESCRIPTORES: Treinamento Funcional. Envelhecimento. Funcionalidade Física. Capacidade Cognitiva.

ABSTRACT

The objective of this study was to assess the effects of a physical exercise program on the physical, functional, and cognitive capacity of older adults. The functional training program consisted of two weekly sessions for 12 weeks. Participated in the study, sixteen older adults, mean age of 65.5 years. Muscle strength, aerobic endurance, and balance exercises were included. The results demonstrated significant increases in upper-limb muscle strength and lower-limb strength and endurance ($p < 0.05$). No significant differences were observed in lower-limb flexibility, agility and dynamic balance, aerobic endurance, or cognitive capacity. Thus, a 12-week functional training program for older adults was able to provide beneficial changes in muscle strength levels, but did not promote changes in other physical-functional capacities or cognitive capacity.

DESCRIPTORS: Functional Training. Aging. Physical Functionality. Cognitive Capacity.

RESUMEN

El objetivo de este estudio fue evaluar los efectos de un programa de ejercicio físico en la capacidad física, funcional y cognitiva de los adultos mayores. El programa de entrenamiento funcional consistió en dos sesiones semanales durante 12 semanas. Dieciséis adultos mayores, con una edad media de 65,5 años, participaron en el estudio. Se incluyeron ejercicios de fuerza muscular, resistencia aeróbica y equilibrio. Los resultados demostraron aumentos significativos en la fuerza muscular de las extremidades superiores y la fuerza y resistencia de las extremidades inferiores ($p < 0,05$). No se observaron diferencias significativas en la flexibilidad, agilidad y equilibrio dinámico de las extremidades inferiores, la resistencia aeróbica o la capacidad cognitiva. Por lo tanto, un programa de entrenamiento funcional de 12 semanas para adultos mayores pudo proporcionar cambios beneficiosos en los niveles de fuerza muscular, pero no promovió cambios en otras capacidades físico-funcionales ni en la capacidad cognitiva.

DESCRIPTORES: Entrenamiento Funcional. Envejecimiento. Funcionalidad física. Capacidad cognitiva.

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INTRODUCTION

The population of people over the age of 60 is growing globally at a rate of approximately 3% per year, which represents faster growth than all younger age groups. In Brazil, in 2022, the proportion of the population aged 60 years or older increased by 56% compared to 2010, with a prevalence of around 15.6% of Brazilians, which in absolute numbers already exceeds 32 million individuals¹.

The aging process causes several psychological, social, and intellectual changes. It is a gradual and inevitable process that alters motor, systemic, sensory, and biological functions, decreasing physical abilities such as strength, balance, flexibility, and cardiorespiratory capacity^{2,3}. In addition, aging causes changes in cognitive ability and body composition, leading to changes in balance, modifications in gait, and an increased risk of falls⁴.

Aging itself is complex and involves several factors, such as genetics, lifestyle, and chronic diseases, which interact with each other and influence how an individual ages⁵. It should be noted that lifestyle has a crucial influence on the quality of life of older adults, and regular physical activity is one of the factors that contributes to a healthier life, as it aids in daily activities, prevents disease, increases autonomy and independence, and improves cognitive functions such as memory and language⁶. The literature highlights that, regardless of the

type of training program, there is an improvement in mobility and balance associated with increased muscle strength and a reduced risk of falls^{7,8}.

According to Cadore *et al.*⁹, functional training that seeks to integrate strength, cardiorespiratory endurance, and balance exercises has proven to be an appropriate strategy for improving the overall health of older adults, due to the stimulation of physical functional capacities that are essential for this age group.

Furthermore, according to the Position Stand of the American College of Sports Medicine¹⁰, systematic physical activity has several benefits in slowing down the physiological changes of aging, improving the ability to perform daily activities, helping to control chronic diseases, promoting cognitive and psychological well-being, and increasing longevity. However, even with so many benefits for the elderly population, it is observed that only 30.2% of this population engages in at least 150 minutes of moderate-intensity physical activity per week¹¹.

Different strategies for systematic physical activity for older adults are reported in the literature, notably functional exercise programs, or multicomponent exercises, which have been increasingly recommended for this population. Exercises that promote the development of strength, power, and muscular endurance, decrease body fat, increase lean mass, improve physical fitness, and enhance quality of life can facilitate daily activ-

ities and benefit cognitive ability^{13,14}.

However, despite numerous studies showing the benefits of physical activity programs for older adults, it still seems to be a challenge for health professionals to implement lasting and/or permanent strategies, mainly due to operational costs and adherence by this population. In this sense, studies that aim to analyze the effect of physical exercise programs on the physical functional and cognitive capacity of older adults are important, mainly to increase the body of evidence of low-cost exercise programs for groups of older adults, aiming to promote adherence and stimulate a more active life with additional benefits in the physical functional and cognitive capacities of older adults.

Thus, the objective of the present study was to verify the effect of a functional physical exercise program on the physical and cognitive functional capacity of older adults.

METHODS

This was a descriptive, longitudinal, quantitative field study that verified the effect of a functional training program on the physical and cognitive functional capacity of older adults. The activities were carried out at the Open University for the Elderly (Unati) of UNIOESTE (State University of Western Paraná) at the Francisco Beltrão unit.

Before the start of the proposed activities, this study was submitted to the Research Ethics Committee of

the University of Paraná (UNIPAR), in accordance with Resolution No. 466/2012, in order to maintain ethics and compliance with the rules and laws that govern our country, which makes secrecy and confidentiality indispensable for all scientific research, preserving the identity of the participants and maintaining the reliability and security of scientific work. It is worth noting that the project was previously approved under Opinion No. 6,696,495, in the year 2024.

Elderly residents of the city of Francisco Beltrão participated in the study. The inclusion criteria were: (1) individuals aged 60 years or older, of both sexes; (2) enrolled and participating in Unati; (3) without restrictions on the practice of systematic physical activity; (4) who signed the Free and Informed Consent Form.

The functional physical fitness of the elderly was measured by the Elderly Physical Fitness Test (Tafi) battery described by Rikli and Jones¹⁵. The Tafi includes physical parameters identified as components of functional fitness, which are: (1) lower limb muscle strength (sitting and standing up from a chair); (2) upper limb strength (elbow flexion and extension); (3) lower limb flexibility (reaching the foot); (4) agility and dynamic balance (standing up, walking, and sitting back down); (5) upper limb flexibility (reaching behind the back); and (6) aerobic endurance (six-minute walk).

Cognitive ability was assessed using the Mini Mental State Examination (MMSE). The MMSE was administered to assess cognitive status according to the procedures and scoring proposed by Guerreiro et al.⁽¹⁶⁾. The test consists of 30 questions, scored with a value of 0: when the individual does not respond or gives an incorrect answer; or 1: when the examinee provides a correct answer. The questions are organized into six cognitive domains: (1) Orientation:

five items on temporal orientation and five on spatial orientation; (2) Retention: repetition of three words; (3) Attention and Calculation: series of five subtractions; (4) Evocation: the examinee must spontaneously recall the three retained words; (5) Language: includes two naming items, one sentence repetition item, one three-step verbal command comprehension item, one written command comprehension item, and one spontaneous writing item (meaningful and grammatically correct sentence); (6) Constructive Ability: one item. The test allows for a maximum score of 30 points, with higher scores indicating better performance. All tests were administered before and after 12 weeks of the functional physical exercise program.

In the physical exercise program, participants underwent functional exercise sessions twice a week for three months. The physical activities lasted a maximum of 60 minutes. The exercises were performed in groups in the afternoon. The activities included localized exercises and movements, using the participants' own body weight and materials such as sticks, balls, chairs, mats, and hoops.

The American College of Sports Medicine's Position Stand "Exercise and Physical Activity for Older Adults"¹⁰ emphasizes that aerobic and resistance exercises should be the cornerstones of any exercise program for older adults. Therefore, the proposed training sought to integrate strength, cardiorespiratory endurance, and balance exercises.

The training was systematized into four blocks, with the main blocks taking the form of a circuit, consisting of a total of six stations, with muscle strength and cardiorespiratory endurance exercises for the main muscle groups, focusing on multi-joint and multifunctional exercises, with transfer to activities of daily living. The volume and intensity were manipu-

lated by increasing the number of sets and repetitions and the complexity of the exercises.

Exercise sequences were performed every two weeks. The sequences began with two sets (10 to 15 repetitions per exercise) of each exercise in the first weeks and progressed to three sets (15 to 25 repetitions per exercise) in the following weeks. Cardiorespiratory endurance exercises were performed for 40 seconds, progressing to 60 seconds. The intervals between sets were 40 seconds, progressing to 20 seconds, and between blocks, the intervals were 60 seconds, progressing to 30 seconds.

Each exercise sequence consisted of two muscle strength exercises and one cardiorespiratory endurance exercise, which was the composition of the two main blocks, each of which consisted of different exercises (dynamic stretching, cardiorespiratory endurance exercise, strength exercises, recreational activities, coordination, attention, and agility). It is worth noting that the training was designed similarly to that presented by Resende-Neto⁽¹⁷⁾, adapted to the physical conditions of the participants and the availability of material and space for the development of the activities.

For data analysis, the data were previously entered into an Excel spreadsheet and exported to the Statistical Package for Social Science – SPSS-20.0. Initially, the Shapiro Willk Test was performed for data normality, followed by descriptive statistics to characterize the sample and frequency distribution for categorical data. Subsequently, Student's t-test was used for paired data to verify the differences established before and after the intervention period. The level of significance adopted was $p < 0.05$.

RESULTS

Sixteen individuals participated in

this study, including 14 women and two men. The average age was 65.5 ± 7.82 years, with an average body weight of 68.23 ± 11.49 kg and an average height of 1.56 ± 0.07 m. The average Body Mass Index (BMI) was 27.72 ± 3.76 kg/m². At the beginning of the program, 75% (n=12) of

the participants performed some type of unsystematic physical activity, and 25% (n=4) did not perform any type of physical activity.

Table 1 shows the average differences in the analyzed components of the functional physical capacity of elderly participants in a physical

exercise program. There was a significant increase in lower limb strength and endurance ($p=0.002$) and upper limb strength ($p=0.026$), as well as a significant decrease in right shoulder flexibility ($p=0.042$) and left shoulder flexibility ($p=0.046$).

Table 1. Mean differences in functional capacity of elderly participants in a physical exercise program (n= 16).

Assessment	Pre-training	Post-training	P
Lower limb strength and endurance (rep)	$12,75 \pm 3,19$	$15,81 \pm 5,21$	0,002
Upper limb strength (rep)	$20,31 \pm 5,93$	$23,44 \pm 5,53$	0,026
Leg flexibility (cm)	$4,98 \pm 8,79$	$1,13 \pm 14,62$	0,200
Right shoulder flexibility (cm)	$1,81 \pm 9,88$	$-6,78 \pm 11,65$	0,042
Left shoulder flexibility (cm)	$-2,61 \pm 15,79$	$-12,46 \pm 11,51$	0,046
Agility and balance (sec)	$5,71 \pm 0,68$	$5,77 \pm 1,00$	0,749
Aerobic endurance (m)	$518,70 \pm 108,04$	$521,81 \pm 123,65$	0,836
Total functional capacity (points)	$54,50 \pm 16,32$	$55,63 \pm 19,15$	0,652

Note: LM = Lower limbs; UL = Upper limbs; pts = points.

Table 2 shows the mean differences in cognitive ability in the elderly before and after training. No significant

changes were observed in any of the variables evaluated ($p>0.05$).

Table 2. Differences between the mean cognitive abilities of elderly participants in a physical exercise program (n= 16), as assessed by the Mini Mental State Examination

Assessment	Pre-training	Post-training	P
Spatial orientation (points)	$9,88 \pm 0,34$	$9,69 \pm 0,48$	0,180
Records (points)	$2,94 \pm 0,25$	$3 \pm 0,00$	0,317
Attention and calculation (points)	$4,33 \pm 1,05$	$4,60 \pm 1,12$	0,219
Memories (points)	$2,50 \pm 0,52$	$2,63 \pm 0,62$	0,527
Language (points)	$8,50 \pm 0,97$	$8,38 \pm 0,62$	0,564
Total MMSE (points)	$27,94 \pm 1,88$	$28,00 \pm 2,31$	0,688

Note: MMSE = Mini Mental State Examination; pts = points.

Table 3 shows the relative and absolute frequencies for functional capacity and cognitive capacity of the elderly in this study. Physical func-

tional capacity was classified into three categories: Good, Very Good, and Fair, with 31.3% of the elderly classified as having Good physical capacity both before and after training. There was an increase in frequency

from zero to 6.3% in the Very Good classification and a reduction in Fair from 68.8% to 62.5% (n=10).

Table 3 – Frequencies for functional and cognitive capacity of elderly participants in a physical exercise program (n= 16).

Assessment	Pré-Treino N (%)	Pós-Treino N (%)
Fair	11 (68,8)	10 (62,5)
Good	5 (31,3)	5 (31,3)
Very good	0	1 (6,3)
Cognitive Ability		
Below	7 (43,8)	4 (25,0)
Adequate	9 (56,5)	12 (75,0)

With regard to cognitive ability, participants were classified as Below Average and Adequate. There was an improvement from 56.5% to 75% in the Adequate classification, and a reduction in the Below Average classification from 43.8% to 25%.

DISCUSSION

This study examined the effect of a physical exercise program on the physical and cognitive functional capacity of a group of elderly people participating in UNATI in Francisco Beltrão-PR. The main findings of this study show that 12 weeks of functional training were beneficial for increasing strength in both the lower and upper limbs; however, it was not sufficient to promote significant changes in the other functional and cognitive capacities of the participants.

The results related to increased muscle strength were consistent with a previous study conducted by Correa *et al.*¹⁸ with 32 elderly women, in which a 12-week functional training program was applied and there was an increase in lower limb strength endurance, as well as an improvement in cardiorespiratory endurance and lower limb flexibility in the participants.

The increase in strength levels found in the present study is important because only with acceptable levels of strength can older adults

perform various activities of daily living, such as climbing stairs, walking, shopping independently, among others, with greater ease and autonomy, and also have a lower probability of falls¹².

In the present study, there were no significant changes in cognitive ability variables, a result that corroborates the study conducted by Vital *et al.*¹⁹ with 34 elderly women with Alzheimer's disease, where a low-intensity resistance training program was applied, and no significant improvements were observed in the cognitive functions analyzed using the Mini Mental State Examination.

In a study conducted by Ferreira *et al.*⁽²⁰⁾, a resistance training program with 31 sedentary elderly women promoted an increase in cognitive ability. The participants in the present study were initially classified, for the most part (56.6%), as having adequate cognitive capacity, and similarly, the majority (75%) reported that they practiced some type of non-systematic physical activity, which may partly explain the absence of significance in the results analyzed.

Furthermore, in the case of elderly individuals, even without significant improvements, the maintenance of cognitive abilities demonstrates an important gain, since physiologically these individuals gradually reduce these abilities¹⁴. In addition, in the

relative classifications of the present study, there was an increase in cognitive ability adequacy.

Regarding the shoulder flexibility assessments, there was a significant reduction in both the right and left shoulders, which contrasts with other findings in the literature, which observed improvements in this component of physical fitness in elderly individuals who underwent 12 weeks of Pilates training, which is characterized by movements performed with greater amplitude and fluency, which can generate a higher level of flexibility²¹.

In a study conducted concurrently with this study, i.e., with the same population, it was observed that 11.1% of the elderly enrolled in the program had some type of chronic musculoskeletal disease in the shoulder joints, which did not prevent participation in physical activities, but limited some movements, which possibly interfered with these elderly individuals' ability to fully perform the proposed activities and may partly explain the significant reduction in shoulder flexibility²².

In aerobic endurance, another capacity assessed in this study, there was no significant change, a result that corroborates the research conducted by Silveira *et al.*²³, in which eight weeks of training were conducted with 20 elderly people with Parkinson's disease, and the effects of functional training and stationary bicycle exercise on respiratory function were compared, and there were no significant improvements in cardiorespiratory capacity.

No significant changes in balance were found either, which is in line with the study conducted by Lustosa *et al.*²⁴, in which seven elderly women participated in a functional exercise program for eight weeks and, despite a tendency toward improved balance, there were no significant changes in this capacity. In contrast, a study con-

ducted with proprioceptive training for four weeks found significant improvement in the balance of irregularly active elderly individuals²⁵.

It is worth noting that, although this study presents important evidence of the benefits of functional exercises for the elderly, some limitations cannot be overlooked, such as the fact that there was no control group, which limited the quantification of the effect size of the program applied. It was also necessary to group the analyses between the sexes due to the limited number of elderly males.

Another limitation was the duration of the study, since 12 weeks may not have been sufficient for the physiological stimuli of most of the variables analyzed. Previous studies that carried out interventions with even shorter durations also did not show significant improvements in the com-

ponents of functional fitness in older adults^{19,23,24}. Additionally, it should be emphasized that the elderly participants in this study are members of the Open University for the Third Age (UNATI), where, in addition to some reporting that they practice some type of unsystematic physical activity, they are also involved in different cognitive and recreational motor activities, which may have partially interfered with the initial assessments, especially those related to cognition.

However, it is worth noting that the implementation of the functional training program applied to a group of elderly people in this study had low operational costs (financial and personnel) and good engagement in the functional exercise program sessions, which may contribute to maintaining adherence and prolonging the programs, factors that greatly contribute

to lasting strategies, thus contributing more effectively to the health care of groups of elderly people from different regions, regardless of socioeconomic status.

CONCLUSION

The results suggest that a 12-week functional training program for older adults, with two weekly sessions, was able to provide beneficial changes in upper and lower limb strength, in addition to preserving other physical-functional and cognitive abilities, which may contribute to maintaining the autonomy and independence of older adults. These findings support the inclusion of functional training in health programs for elderly groups, helping them to improve their physical health and overall well-being.

REFERENCES

1. IBGE. Censo 2022: número de pessoas com 65 anos ou mais de idade cresceu 57,4% em 12 anos | Agência de Notícias [Internet]. Agência de Notícias - IBGE. 2023. Available from: <https://agenciadenoticias.ibge.gov.br/agencia-noticias/2012-agencia-de-noticias/noticias/38186-censo-2022-numero-de-pessoas-com-65-anos-ou-mais-de-idade-cresceu-57-4-em-12-anos>
2. China DL, Frank IM, Silva JB da, Almeida EB de, Silva TBL da. Envelhecimento Ativo e Fatores Associados. *Revista Kairós-Gerontologia* [Internet]. 2021 Apr 11;24:141–56. Available from: <https://revistas.pucsp.br/index.php/kairós/article/view/53768/34973>
3. Dias DS, Santos AT, De M, Christie E. Avaliação do equilíbrio em idosos da cidade de montes claros. *RENEF* [Internet]. 2019 May 15 [cited 2025 Sep 16];8(11):65–77. Available from: <https://www.periodicos.unimontes.br/index.php/renef/article/view/548>
4. Nordling Y, Sund R, Joonas Sirola, Heikki Kröger, Mousoud Isanejad, Rikonen T. Body composition, balance, functional capacity and falls in older women. *Aging Clinical and Experimental Research* [Internet]. 2024 Mar 21;36(1). Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10957703/>
5. Li Q, Zhang H, Xiao N, Liang G, Lin Y, Yang X, et al. Aging and Lifestyle Modifications for Preventing Aging-Related Diseases. *The FASEB Journal*. 2025 Apr 28;39(9).
6. Ferreira LK, Meireles JFF, Ferreira MEC. Evaluation of lifestyle and quality of life in the elderly: a literature review. *Revista Brasileira de Geriatria e Gerontologia*. 2018 Oct;21(5):616–27.
7. Niyazi A, Mir E, Ghasemi Kahrizsangi N, Mohammad Rahimi N, Fazolahzade Mousavi R, Setayesh S, et al. The effect of functional exercise program on physical functioning in older adults aged 60 years or more: A systematic review and meta-analysis of randomized controlled trials. *Geriatric Nursing* [Internet]. 2024 Oct 29;60:548–59. Available from: <https://www.sciencedirect.com/science/article/pii/S0197457224003422#abs0002>
8. Souza EC de, Reis NM, Reis SMD dos, Bemvenuto RP, Ferreira IR, Rosário RWS do, et al. Riscos de quedas em idosos e a COVID-19: Um alerta de saúde e proposta de exercícios funcionais. *Revista Brasileira de Atividade Física & Saúde* [Internet]. 2020 Dec 31;25:1–7. Available from: <https://docs.bvsalud.org/>

biblioref/2021/03/1148245/14446-texto-do-artigo-56855-1-10-20210226.pdf

9. Cadore EL, Rodríguez-Mañas L, Sinclair A, Izquierdo M. Effects of Different Exercise Interventions on Risk of Falls, Gait Ability, and Balance in Physically Frail Older Adults: A Systematic Review. *Rejuvenation Research* [Internet]. 2013 Apr;16(2):105–14. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3634155/>

10. American College Of Sports Medicine. ACSM's Guidelines for Exercise Testing and Prescription. 10th ed. Philadelphia: Lippincott Williams & Wilkins; 2018.

11. Vigil Brasil 2023 - Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico — Ministério da Saúde [Internet]. www.gov.br. Available from: <https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/svsa/vigitel/vigitel-brasil-2023-vigilancia-de-fatores-de-risco-e-protecao-para-doencas-cronicas-por-inquerito-telefonico/view>

12. Yang X, Li S, Xu L, Liu H, Li Y, Song X, et al. Effects of multicomponent exercise on frailty status and physical function in frail older adults: A meta-analysis and systematic review. *Experimental Gerontology* [Internet]. 2024 Nov;197:112604. Available from: <https://www.sciencedirect.com/science/article/pii/S053155652400250X>

13. Wiedenmann T, Held S, Morat T, Rappelt L, Isenmann E, Berndsen E, et al. The Effects of Different Resistance Training Modalities on Muscle Strength in Community-Dwelling Older Adults: A Network Meta-Analysis. *Gerontology* [Internet]. 2025;71(7):576–88. Available from: <https://pubmed.ncbi.nlm.nih.gov/40452461/>

14. Zhang M, Jia J, Yang Y, Zhang L, Wang X. Effects of exercise interventions on cognitive functions in healthy populations: A systematic review and meta-analysis. *Ageing Research Reviews*. 2023 Dec 1;92:102116–6.

15. Rikli RE, Jones CJ. Development and Validation of a Functional Fitness Test for Community-Residing Older Adults. *Journal of Aging and Physical Activity*. 1999 Apr;7(2):129–61.

16. Guerreiro MP. Adaptação à população portuguesa da tradução do "Mini Mental State Examination"(MMSE). *Revista Portuguesa de Neurologia*. 1994;1:9.

17. Resende-Neto AG, Da Silva-Grigoletto ME, Santos MS, Cyrino ES. Treinamento funcional para idosos: uma breve revisão. *Revista brasileira de ciência e movimento*.

2016;24(3):167–77. Available from: <https://caueteixeira.com/wp-content/uploads/2020/01/2016-TF-e-idosos-revis%C3%A3o-RBCM.pdf>

18. Correa L da P, Bento TPF, Guariglia DA, Rodrigues GF, Conti MHSD. Effects of functional training on pain and functional capacity in elderly women. *Fisioterapia em Movimento*. 2022;35: e35149.

19. Vital TM, Hernández SSS, Pedroso RV, Teixeira CVL, Garuffi M, Stein AM, et al. Effects of weight training on cognitive functions in elderly with Alzheimer's disease. *Dementia & Neuropsychologia*. 2012 Dec;6(4):253–9.

20. Ferreira B de S, Pereira RD, Silva DP da, Ferreira AC, Mostarda C, Brito-Monzani J de O. Efeitos do treinamento resistido em idosas com declínio cognitivo. *Fisioterapia em Movimento* [Internet]. 2022 Jun 13;35. Available from: <https://www.scielo.br/j/fm/a/YsxgwSsM9sthXN-n6nL6L9Gz/?lang=pt>

21. Guimarães AC de A, Azevedo SF de, Simas JPN, Machado Z, Jonck VTF. The effect of Pilates method on elderly flexibility. *Fisioterapia em Movimento*. 2014 Jun;27(2):181–8.

22. Santana LDP, Silva J, Oliveira M, Souza EC. Prevalência de doenças osteomusculares em idosos inscritos em programa de atividade física. VIII Congresso Internacional de Ciência, Tecnologia e Inovação e XXIII Encontro Anual de Iniciação Científica da UNIPAR; Umuarama, PR, 2024. *Anais* (on-line). Available from: <https://sisweb02.unipar.br/eventos/anais/5940/html/33376.html>

23. Almeida R, Karen Valadares Trippo, Gleison Vieira Duarte, Mansueto Gomes Neto, Jarmy Oliveira-Filho, Daniel Dominguez Ferraz. The effects of functional training and stationary cycling on respiratory function of elderly with Parkinson disease: a pilot study. *Fisioterapia em Movimento*. 2018 Jun 7;31(0).

24. Lustosa LP, Oliveira LA de, Santos L da S, Guedes R de C, Parentoni AN, Pereira LSM. Efeito de um programa de treinamento funcional no equilíbrio postural de idosos da comunidade. *Fisioterapia e Pesquisa*. 2010 Jun;17(2):153–6.

25. Nascimento LCG do Patrizzi LJ, Oliveira CCES. Efeito de quatro semanas de treinamento proprioceptivo no equilíbrio postural de idosos. *Fisioterapia em Movimento* [Internet]. 2012 Jun 1;25:325–31. Available from: <https://www.scielo.br/j/fm/a/mD4ymDgxVDb3pmD-nTh6bQgB/abstract/?lang=pt>