Acute and Chronic Effects of Exercise in Health

Effects of online-supervised home-based power training protocols on blood pressure and functional performance in older adults: a pilot study

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Abstract - Aim: This study examined the effects of online-supervised home-based muscle power training (MPT) protocols on blood pressure (BP) and functional parameters in older adults. **Methods:** Sixteen older adults were randomized into the dynamic power training group (DPTG; *n* = 8) and the power training group (PTG; *n* = 8). Researchers performed all evaluations and administered the exercise protocols online via WhatsApp® video calls. The training protocols were performed with elastic bands, three times per week over 12 weeks. BP and functional performance (elbow flexion and chair-to-stand tests) were assessed pre- and post-intervention. **Results:** Both groups showed significant improvements in diastolic BP from baseline to week 12. However, there was no significant time versus group interaction ($p > 0.05$). Furthermore, a large effect size was observed in the SBP for DPTG compared to PTG. No significant changes were observed in systolic BP. Functional performance significantly improved in both groups, with no time versus group interaction ($p > 0.05$). **Conclusion:** The findings of this study demonstrate the feasibility of online-supervised home-based MPT protocols and suggest their potential to improve BP and functional performance in a sample of older adults.

Keywords: aging, strength, cardiovascular health, exercise training.

Introduction

A robust body of evidence indicates that power training (PT) is safe and effectively improves functional parameters in healthy older adults[1-3]. Studies have demonstrated that it improves dynamic balance, muscle power, maximal strength, and the ability to rise from the ventral decubitus position after different PT protocols[2-7].

Additionally, older adults' hemodynamic parameters have improved after PT practice. According to a study by Bavaresco Gambassi et al.[8], the systolic blood pressure (SBP) decreased after PT practice with elastic bands. Likewise, systematic review and meta-analysis study[9] found decreased SBP in older adults after PT practice.

Studies in this context point out the health benefits of PT with elastic bands in older adults[8,10-12]. In addition to the benefits demonstrated in the literature, PT with elastic bands can overcome barriers to exercise practice such as lack of time and difficulty accessing adequate traditional PT facilities. Moreover, exercise with elastic bands is low-cost, easy to apply, and can be performed anywhere (e.g., online home-based exercise training).

Although the benefits of home-based exercise training have been demonstrated[13,14] little is known about protocols in this modality involving the effects of PT on BP in older adults.

Given the above, our objective was to investigate the effects of different online-supervised home-based MPT protocols on older adults' BP and functional parameters.

Methods

Study design

This is an interventional, controlled, randomized study conducted upon approval by the Ceuma University Ethics Committee (Approval No. 5.257.795).

Procedures

This study involved older adults who performed different MPT protocols (i.e., using elastic bands) three times a week, for 12 weeks. Before and after the training period, the participants were evaluated for resting BP and functional parameters. The pre- and post-tests were performed in the same order, at the same time of the day, and by the same investigator.

The research group (eight physical education undergraduate students and two lead investigators from Ceuma University) performed all evaluations and administered the exercise protocols online via WhatsApp® (WhatsApp LLC, Menlo Park, CA, United States of America [USA]) video calls. This app allows participants and researchers to communicate through text messages, voice, and video calls. The lead investigators had previously trained the students for two weeks. The students were distributed to aid the participants as follows: three students assisted four participants in a single video call; one student assisted another four participants in a single video call; two students assisted four participants in a single video call; and the other two students assisted four participants in a single video call. Each group tried to make the WhatsApp® video calls always at the same time.

All participants spent 1 week getting acquainted with WhatsApp® (WhatsApp LLC) video calls so they could handle them properly. Additionally, they spent the following 3 weeks getting acquainted with the assessments and protocols.

Participants

The participants were selected by convenience sampling. Initially, our group contacted 25 sedentary older adults to participate in the different online-supervised home-based PT protocols. Candidates were eligible if they met the inclusion criteria: 60 years old or above, able to walk with or without walking aid, and perform basic daily activities. Exclusion criteria were as follows: not being able to sign the digital informed consent form; with a history of smoking or regular alcohol consumption; with uncontrolled hypertension (n = 3) and/or diabetes mellitus. Also, potential participants were excluded if they felt disabling pain during exercise (n = 2), were unable to perform exercise sessions, and/or participated in any of the evaluations. After using the exclusion criteria, 20 older adults (18 women) comprised the study sample.

Participants were assigned to one of two groups by simple randomization with a list of random numbers generated by a computer program. Allocation concealment was ensured with opaque and sealed sequentially numbered envelopes. The random process allocated participants to the following experimental conditions: (1) dynamic power training group (DPTG); (2) power training group (PTG). Twenty older adults were recruited and agreed to be evaluated for eligibility. After the initial evaluations, four participants did not adapt to training schedules. Thus, the sample consisted of DPTG (n = 8) and PTG (n = 8) (Figure 1).

All participants gave written informed consent, and the study protocols were approved by the Ceuma University Ethics Committee. The experiment complied with the Declaration of Helsinki (1964, revised 2013). Anthropometric measures were taken to describe the participants' characteristics. They self-weighed on their home scales and informed them of their height based on the last measure taken in our in-person project (2019). The body mass index (BMI) was calculated as total body mass (kg) divided by the square of height (m^2).

Blood pressure (BP)

BP was measured between 08:00 and 10:00 am, according to the procedures detailed in the Brazilian Guidelines of Hypertension[15] (via WhatsApp® [WhatsApp LLC] video calls). Participants were instructed to refrain from exercising for 48 h and from drinking caffeinated beverages and/or alcohol 24 h before the evaluation. An automatic, noninvasive, calibrated, and validated arterial BP monitor (HEM-7200, Omron Healthcare Inc., Lake Forest, IL, USA) was used to measure SBP and diastolic BP (DBP).

Functional parameters

A researcher detailed the operational procedures, demonstrated the tests, and evaluated the participants' motor patterns during each physical performance test (via WhatsApp® [WhatsApp LLC] video calls). All participants performed a familiarization trial to ensure that they understood the tests. All tests were performed in triplicate, and the mean result was used in the final

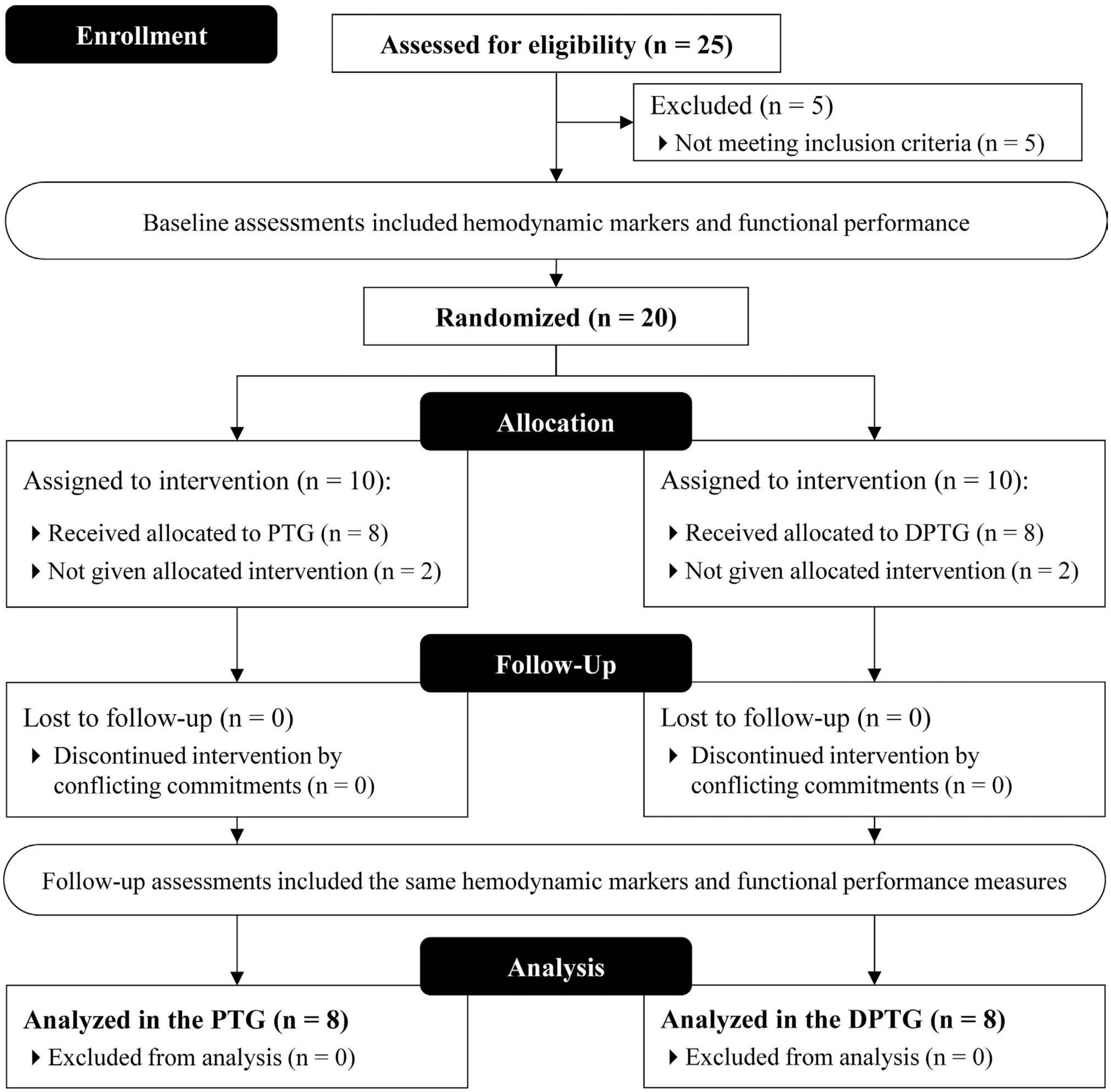

Figure 1 - Flow diagram of participants.

analysis. A 1-min rest was allowed between consecutive trials.

Chair-to-stand (30-s chair stand test)

Participants stand up totally from a chair and return to the initial seated position as many times as possible for 30 s, with arms crossed on the chest[16].

Elbow flexion (30-s arm curl test)

Participants performed a unilateral biceps curl with a 5-pound weight, returning to the initial extended arm position, and completing as many repetitions as possible within 30 s. The test was conducted with the participant seated[16].

Training protocols (dynamic power training and power training)

The protocols were described following the recommendations of the Basic Guidelines for the Application of the Main Variables of RT in the Elderly[17].

Online-supervised PT protocols were performed via WhatsApp® (WhatsApp LLC) video calls, three times per week over 12 weeks, with a minimum 24 h rest interval between exercise sessions. Exercises were performed using elastic bands (THERABAND, Akron, OH, USA).

The protocols consisted of multiarticular and monoarticular exercises (vertical chest press, hip abduction, seated row, squat on the chair, plantar flexion) performed with elastic bands in chairs of appropriate height. Except for the squat on the chair, all exercises were performed with a full range of motion, with concentric contractions performed as fast as possible while the eccentric contractions were performed slowly for 3 s. Additionally, participants were instructed to avoid the Valsalva maneuver during the exercise.

Training intensity was monitored and controlled with the rate of perceived exertion (RPE)[18]. The RPE was reported after the end of each set of exercises and, if the participant reported an RPE below the expectations (low intensity), the tension of the elastic band was increased (moderate intensity).

In the first 2 weeks, participants got familiarized with two sets of six repetitions (reps) (low intensity). The exercise training volume was mainly increased over the 12 weeks [1st - 2nd week (2 sets x 6 reps); 3rd - 4th week (2 sets x 8 reps); 5th - 6th week (2 sets x 10 reps); 7th - 8th week (3 sets x 8 reps); 9th - 10th week (3 sets x 10 reps); 11th - 12th week (3 sets x 12 reps) at moderate intensity].

Dynamic muscle power training

The protocol consisted of a sequence of four combinations of two consecutive exercises without intervals of absolute rest throughout the session. The protocol consisted of: (i.e., 2 sets):

- vertical chest press interspersed with squat on the chair; vertical chest press interspersed with squat on the chair;
- plantar flexion interspersed with squat on the chair; plantar flexion interspersed with squat on the chair;
- seated row interspersed with squat on the chair; seated row interspersed with squat on the chair;
- hip abduction interspersed with squat on the chair; hip abduction interspersed with squat on the chair.

Muscle power training

The protocol consisted of a sequence of four combinations of two consecutive exercises with a 30-s rest between sets and combinations. The protocol consisted of: (i.e., 2 sets).

- vertical chest press interspersed with squat on the chair; 30-s rest; vertical chest press interspersed with squat on the chair; 30-s rest;
- plantar flexion interspersed with squat on the chair; 30-s rest; plantar flexion interspersed with squat on the chair; 30-s rest;
- seated row interspersed with squat on the chair; 30-s rest; seated row interspersed with squat on the chair; 30-s rest;
- hip abduction interspersed with squat on the chair; 30-s rest; hip abduction interspersed with squat on the chair; 30-s rest.

Statistical analysis

Statistical analysis was performed using Prism software (GraphPad Inc., San Diego, CA, USA, version 8.4.3, 2020). The normality of the distribution and the homogeneity of the outcome measures were tested using the Shapiro-Wilk and Levene tests, respectively. Means and standard deviations were calculated for each dependent variable. A two-way ("group" versus "time") analysis of variance (ANOVA) with repeated measures was used to evaluate training-related effects over time or between groups. The Greenhouse-Geisser was used to assess changes in the outcomes; when a significant interaction effect was found, a Bonferroni post hoc test was applied to check for intragroup differences over time. All measurements were two-tailed, and p-values calculated with significance levels set at 5%. The effect size (ES) was determined using partial eta-squared (η^2_p) values[19]. According to Espírito Santo and Daniel[20], values of $\eta^2_p \geq 0.01$ were considered small ES, $\eta^2_p \geq 0.06$ was considered medium ES, and $\eta^2_p \geq 0.14$ was considered large ES.

Results

The study participants' baseline characteristics are shown in Table 1. The whole sample's mean age was given in years and the mean BMI, in kg/m^2. No significant differences were observed between the groups. Additionally, the 16 participants had 100% adherence.

Blood pressure

The two-way ANOVA showed a significant main effect for the time factor ($p \leq 0.05$) in DBP (Table 2). Both groups improved significantly in DBP from week 0 to week 12 (Table 2). However, there was no significant time vs. group interaction ($p > 0.05$) (Table 2). Additionally, there were no significant time effects, group effects, or time vs. group interaction in SBP ($p > 0.05$) after 12 weeks in either group (Table 2). In addition, a large effect size was observed in the SBP for DPTG compared to PTG.

Functional parameters

The two-way ANOVA showed a significant main effect for the time factor ($p \leq 0.05$) in functional parameters (Table 2). Both groups improved significantly in functional parameters (elbow flexion, 30-s chair-stand)

Table 1 - Baseline clinical characteristics of participants (*n* = 16).

Variables	PTG (*n* = 8)	DPTG (*n* = 8)	p-value
Age (years)	66.5 ± 8.4	67.3 ± 12.5	0.890
Body mass index (kg/m^2)	22.6 ± 3.5	23.5 ± 2.3	0.576
Women *n* (%)	8(100)	6(75)	0.130
Associated comorbidities (%)			
Hypertension	100	87.5	0.301
Type 2 diabetes mellitus	25	12.5	0.521
Medications (%)			
Angiotensin receptor blockers	50	37.5	0.614
Diuretics	25	12.5	0.521
Angiotensin-converting enzyme (ACE) inhibitors	12.5	25	0.521
Beta-blockers	37.5	37.5	1.000
Hypoglycemic agents	25	12.5	0.521

Data are shown as mean ± standard deviation or n (%). DPTG: dynamic power training group; PTG: power training group.

performance from week 0 to week 12 (Table 2). However, there was no significant time vs. group interaction ($p > 0.05$) (Table 2).

Discussion

The present study aimed to compare the effects of 12 weeks of different online-supervised home-based PT protocols on older adults' BP and functional parameters. The main finding of this study was that both groups (DPT and PT) improved significantly and similarly in DBP and functional parameters. Furthermore, a large effect size was observed in the SBP for DPTG compared to PTG.

Additionally, although with no statistical difference, a large effect size was observed in the SBP for DPTG compared to PTG. In addition, an important clinical reduction was observed in SBP in the DPT group (Δ = -12.4 mmHg). This finding has important clinical implications since a 5-mmHg reduction in SBP represents a lower mortality risk[21]. In the same sense, the present research observed a 7.1-mmHg reduction in DBP in both the DPT and the PT groups. According to Cook et al.[22] a 2-mmHg reduction in DBP can prevent coronary heart disease and stroke.

The hypothesis that may account for our findings lies in the dynamic characteristic of the DMPT, as there were no absolute rest intervals in between sets and exercises so the cardiovascular system was constantly stimulated throughout each session (constant cardiorespiratory stimulation, similar to aerobic exercise)[8,23].

In this sense, it may be that the combination of power exercises with the dynamics of the protocol (without absolute rest between sets and exercises) has caused vascular shear stress, releasing nitric oxide from endothelial cells and positively influencing SBP and DBP. Indeed, Orsano et al.[24] demonstrated greater nitric oxide production after PT than after RT after 30 min of exercise.

Table 2 - Changes in blood pressure and functional parameters at baseline and after 12 weeks of interventions (*n* = 16).

Variables	DPTG (*n* = 8)	PTG (*n* = 8)	DPTG *vs.* PTG MD (95% CI)	Group p (η^2_p) values	Time p (η^2_p) values	Interaction p (η^2_p) values
Blood pressure						
Systolic blood pressure, mmHg				0.09 (0.00)	0.07 (0.09)	0.18 (0.31)
Pre	126.2 ± 15.2	130.0 ± 15.0	-3.9 (-18.6-10.8)			
Post	113.8 ± 8.9	128.0 ± 9.1	-14.3 (-29.0-0.5)			
Diastolic blood pressure, mmHg				0.46 (0.25)	**0.01** (0.07)	0.26 (0.16)
Pre	75.5 ± 9.1	70.4 ± 6.5	5.1 (-5.6-15.9)			
Post	68.4 ± 11.7	67.3 ± 8.2	1.1 (-9.6-11.9)			
Functional parameters						
30-s-arm curl, repetitions				0.08 (0.00)	**<0.001** (0.08)	0.95 (0.26)
Pre	17 ± 5.9	21 ± 4.1	-3.8 (-9.1-1.5)			
Post	23 ± 4.6	27 ± 2.6	-3.9 (-9.2-1.4)			
30-s chair stand, repetitions				0.34 (0.27)	**<0.001** (0.07)	0.30 (0.22)
Pre	17 ± 4.5	18 ± 3.7	-1.3 (-6.8-4.3)			
Post	22 ± 5.4	25 ± 5.0	-3.0 (-8.5-2.6)			

Values are expressed as mean ± standard deviation. CI: confidence interval; DPTG: dynamic power training group; MD: mean difference; PTG: power training group; η^2_p: partial eta squared.

Although we have observed health benefits in older adults through home-based exercise[13,14] to our knowledge, this study appears to be the first to investigate the effects of different online-supervised home-based PT protocols on older adults' BP and functional parameters.

Besides the positive effects on BP, the present study revealed important changes in functional parameters after 12 weeks of different online-supervised home-based PT protocols. These findings may be related to increased frequency of nerve impulse triggering, better intramuscular and intermuscular recruitment, and greater synchronization of motor units when performing high-speed movements in the concentric phase in exercises in both groups.

The improvement in functional parameters demonstrated in the present research has important clinical and public health implications since better physical function in older adults is associated with independence to perform activities of daily living, a better quality of life, fewer falls, and lower risk of depression[25,26].

Finally, the sample size is a limitation of our study, since a post hoc sample size calculation estimated that about 12 participants in each group would be needed to detect improvements in BP and functional parameters considering within- and between-group comparisons, with 80% power at the 5% significance level. This should be addressed by future investigations to confirm and expand our findings.

Conclusion

These findings demonstrated that practicing different online-supervised home-based MPT protocols is feasible and seemingly benefited the BP and functional parameters in the present study sample. In fact, assessing the effects of PT on BP depends on the various possibilities of an exercise program (e.g., manipulating protocol variables, the degree of hypertension, and the medications they are taking). In this sense, future studies are still needed to confirm our findings.

AI use statement

No AI was used in this research.

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Data availability statement

I declare, for all due purposes, that the research data is available in the body of the document.

Conflict of interest statement

The authors have no conflicts of interest to declare. All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report.

Author contributions (CRediT)

Graciely dos Santos Lima: conceptualisation, investigation, methodology, data curation, writing - original draft, writing - review and editing, visualisation. **Luiz Filipe Costa Chaves:** investigation, methodology, visualisation. **Jodean de Souza Moura:** investigation, methodology, visualisation. **Matheus Silva de Souza:** investigation, methodology, visualisation. **Jozimar Prazeres:** investigation, methodology, data curation, visualisation. **Cyrene Piazera Silva Costa:** conceptualisation, writing - review and editing, visualisation. **Manoel Pereira Guimarães:** conceptualisation, writing - review and editing, visualisation. **Paulo Adriano Schwingel:** conceptualisation, writing - review and editing, visualisation. **Eduardo Lusa Cadore:** conceptualisation, writing - original draft, writing - review and editing, visualisation. **Bruno Bavaresco Gambassi:** conceptualisation, investigation, methodology, data curation, writing - original draft, writing - review and editing, visualisation.

References

1. Radaelli R, Trajano GS, Freitas SR, Izquierdo M, Cadore EL, Pinto RS. Power training prescription in older individuals: is it safe and effective to promote neuromuscular functional improvements? Sports Med. 2023;53 (3):569-76. doi
2. Radaelli R, Brusco CM, Lopez P, Rech A, Machado CLF, Grazioli R, et al. Muscle quality and functionality in older women improve similarly with muscle power

training using one or three sets. Exp Gerontol. 2019;128:110745. doi
3. Lopez P, Rech A, Petropoulou M, Newton RU, Taaffe DR, Galvão DA, et al. Does high-velocity resistance exercise elicit greater physical function benefits than traditional resistance exercise in older adults? A systematic review and network meta-analysis of 79 trials. J Gerontol A Biol Sci Med Sci. 2023;78(8):1471-82. doi
4. Bandeira-Guimarães M, Blanco-Rambo E, Vieira AF, Sáez de Asteasu ML, Pinto RS, Izquierdo M, et al. Chronic effects of different intensities of power training on neuromuscular parameters in older people: a systematic review with meta-analysis. Sports Med Open. 2023;9(1):98. doi
5. Costa Chaves LF, Bavaresco Gambassi B, Cadore EL, Sotão S, Sousa TM, Dias DDS, et al. Power exercises with elastic bands combined with endurance training improve pulse pressure, systolic blood pressure, and functional parameters in older adults. Blood Press Monit. 2025;1;30(2):49-56. doi
6. Ramírez-Campillo R, Castillo A, de la Fuente CI, Campos-Jara C, Andrade DC, Álvarez C, et al. High-speed resistance training is more effective than low-speed resistance training to increase functional capacity and muscle performance in older women. Exp Gerontol. 2014;58:51-7. doi
7. Bavaresco Gambassi B, Cadore EL, Chaves LFC, da Silva Sousa TM, Mostarda CT, Lopes de Siqueira AF, et al. Effects of combined muscle power and endurance training with different volumes on functional and hemodynamic parameters in previously trained older adults. Aging Clin Exp Res. 2023;35(11):2623-31. doi
8. Bavaresco Gambassi B, Nobre I, Prazeres J, de Melo MH, Bianco R, Novais TM, et al. Impact of dynamic explosive resistance exercise with elastic bands on pulse pressure in hypertensive older adults: a randomized crossover study. Blood Press Monit. 2023;28(4):208-14. doi
9. Coelho-Júnior HJ, Silva Aguiar S, Calvani R, Picca A, de Azevedo Carvalho D, Rodrigues B, et al. Acute and chronic effects of traditional and high-speed resistance training on blood pressure in older adults: a crossover study and systematic review and meta-analysis. Exp Gerontol. 2022;163:111775. doi
10. Liu HW, Lee OK. Effects of resistance training with elastic bands on bone mineral density, body composition, and osteosarcopenic obesity in elderly women: a meta-analysis. J Orthop. 2024;53:168-75. doi
11. Gargallo P, Tamayo E, Jiménez-Martínez P, Juesas A, Casaña J, Benitez-Martinez JC, et al. Multicomponent and power training with elastic bands improve metabolic and inflammatory parameters, body composition and anthropometry, and physical function in older women with metabolic syndrome: a 20-week randomized, controlled trial. Exp Gerontol. 2024;185:112340. doi
12. Stojanović MDM, Mikić MJ, Milošević Z, Vuković J, Jezdimirović T, Vučetić V. Effects of chair-based, low-load elastic band resistance training on functional fitness and metabolic biomarkers in older women. J Sports Sci Med 2021;20(1):133-41. doi
13. Hill KD, Hunter SW, Batchelor FA, Cavalheri V, Burton E. Individualized home-based exercise programs for older people to reduce falls and improve physical performance: a systematic review and meta-analysis. Maturitas. 2015;82(1):72-84. doi
14. Kis O, Buch A, Stern N, Moran DS. Minimally supervised home-based resistance training and muscle function in older adults: a meta-analysis. Arch Gerontol Geriatr. 2019;84:103909. doi
15. Feitosa ADM, Barroso WKS, Mion Junior D, Nobre F, Mota-Gomes MA, Jardim PCBV, et al. Brazilian guidelines for in-office and out-of-office blood pressure measurement - 2023. Arq Bras Cardiol. 2024;121(4):e20240113. doi
16. Rikli RE, Jones CJ. Development and validation of criterion-referenced clinically relevant fitness standards for maintaining physical independence in later years. Gerontologist. 2013;53(2):255-67. doi
17. Bavaresco Gambassi B, Lopes Dos Santos MD, Furtado Almeida FJ. Basic guide for the application of the main variables of resistance training in elderly. Aging Clin Exp Res. 2019;31(7):1019-20. doi
18. Colado JC, Furtado GE, Teixeira AM, Flandez J, Naclerio F. Concurrent and construct validation of a new scale for rating perceived exertion during elastic resistance training in the elderly. J Sports Sci Med. 2020;24;19(1):175-86.
19. Lakens D. Calculating and reporting effect sizes to facilitate cumulative science: a practical primer for t-tests and ANOVAs. Front Psychol. 2013;4:863. doi
20. Espírito-Santo H, Daniel F. Calculating and reporting effect sizes on scientific papers (3): guide to report regression models and ANOVA effect sizes. Rev Port Invest Comport Soc. 2018;4(1):43-60. doi
21. Whelton PK, He J, Appel LJ, Cutler JA, Havas S, Kotchen TA, et al. National high blood pressure education program coordinating committee. Primary prevention of hypertension: clinical and public health advisory from the national high blood pressure education program. JAMA. 2002;16;288(15):1882-8. doi
22. Cook NR, Cohen J, Hebert PR, Taylor JO, Hennekens CH. Implications of small reductions in diastolic blood pressure for primary prevention. Arch Intern Med. 1995;10;155(7):701-9.
23. Roberson KB, Potiaumpai M, Widdowson K, Jaghab AM, Chowdhari S, Armitage C, et al. Effects of high-velocity circuit resistance and treadmill training on cardiometabolic risk, blood markers, and quality of life in older adults. Appl Physiol Nutr Metab. 2018;43(8):822-32. doi
24. Orsano VSM, de Moraes WMAM, de Sousa NMF, de Moura FC, Tibana RA, Silva AO, et al. Comparison of the acute effects of traditional versus high velocity resistance training on metabolic, cardiovascular, and psychophysiological responses in elderly hypertensive women. Clin Interv Aging. 2018;31;13:1331-40. doi

25. Trombetti A, Reid KF, Hars M, Herrmann FR, Pasha E, Phillips EM, et al. Age-associated declines in muscle mass, strength, power, and physical performance: impact on fear of falling and quality of life. Osteoporos Int. 2016;27(2):463-71. doi
26. Szlejf C, Suemoto CK, Brunoni AR, Viana MC, Moreno AB, Matos SMA, et al. Depression is associated with sarcopenia due to low muscle strength: results from the ELSA-Brasil Study. J Am Med Dir Assoc. 2019;20 (12):1641-46. doi

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