RBCE
Revista Brasileira de Ciências do Esporte

Original Articles

Effects of calisthenic on sit-to-stand test and 6-minute walk test in older women

Efeitos da calistenia nos testes de sentar e levantar e caminhada de 6 minutos em idosas

Efectos de la calistenia sobre la prueba de sentarse y levantarse y la prueba de caminata de 6 minutos en mujeres mayores

João Paulo Lima Vasconcelos[a], Evanice Avelino de Souza[b]*, Felipe Rocha Alves[b], Julio Cesar Barbosa de Lima Pinto[b], Roberta Jeane Bezerra Jorge[a], Thyago Moreira de Queiroz[a]

Keywords:
Physical activity;
Older adults;
Primary health care.

ABSTRACT
This study analyzed the effects of a calisthenics-based exercise program on the anthropometric, blood pressure, and functional profiles of hypertensive older women receiving primary health care. Participants were assigned to an intervention group, which performed moderate-intensity calisthenics twice weekly for eight weeks, or a control group, which did not engage in structured exercise. Anthropometric measures, blood pressure, and functional capacity were assessed using the six-minute walk test and the chair stand test. Following the intervention, the intervention group demonstrated a mean increase of 1.32 repetitions in the chair stand test and an average improvement of 78.12 meters in the six-minute walk test, along with reductions in body mass index (−0.57 kg/m^2), waist circumference (−0.75 cm), and hip circumference (−1.37 cm), whereas the control group remained stable. These results indicate that the calisthenics program effectively enhanced functional capacity and promoted favorable anthropometric changes in hypertensive older women.

Palavras-chave:
Atividade física;
Terceira idade;
Atenção primária de saúde.

RESUMO
O estudo analisou os efeitos de um programa de exercícios calistênicos no perfil antropométrico, pressórico e funcional de mulheres idosas hipertensas atendidas na Atenção Primária à Saúde. As participantes foram distribuídas em grupo intervenção, submetido a calistenia moderada duas vezes por semana durante oito semanas, e grupo controle, sem exercício estruturado. Avaliaram-se medidas antropométricas, pressão arterial e capacidade funcional por meio dos testes de caminhada de seis minutos e de sentar e levantar. Após a intervenção, o grupo intervenção apresentou aumento médio de 1,32 repetições no teste de sentar e levantar e incremento de 78,12 metros no teste de caminhada, além de reduções no índice de massa corporal (−0,57 kg/m^2), circunferência da cintura (−0,75 cm) e do quadril (−1,37 cm), enquanto o grupo controle manteve estabilidade. Os resultados indicam que a calistenia foi eficaz para melhorar a capacidade funcional e favorecer o perfil antropométrico dessas mulheres.

Palabras clave:
Actividad física;
Adultos mayores;
Atención primaria de la salud.

RESUMEN
El estudio analizó los efectos de un programa de ejercicios calisténicos sobre los perfiles antropométrico, de presión arterial y funcional de mujeres adultas mayores hipertensas atendidas en la Atención Primaria de la Salud. Las participantes fueron asignadas a un grupo de intervención, que realizó calistenia de intensidad moderada dos veces por semana durante ocho semanas, y a un grupo control, que no realizó ejercicio estructurado. Las medidas antropométricas, la presión arterial y la capacidad funcional se evaluaron mediante la prueba de caminata de seis minutos y las pruebas de sentarse y levantarse. Tras la intervención, el grupo de intervención presentó un aumento medio de 1,32 repeticiones en las pruebas de sentarse y levantarse y una mejora media de 78,12 metros en la prueba de caminata de seis minutos, además de reducciones en el índice de masa corporal (−0,57 kg/m^2), la circunferencia de la cintura (−0,75 cm) y la circunferencia de la cadera (−1,37 cm), mientras que el grupo control se mantuvo estable. Estos hallazgos indican que el programa de calistenia fue eficaz para mejorar la capacidad funcional y promover cambios favorables en el perfil antropométrico de mujeres adultas mayores hipertensas.

[a]Universidade Federal do Ceará – UFC, Programa de Pós-graduação em Ciências Morfofuncionais. Fortaleza, CE, Brasil.
[b]Centro Universitário Fatene – UniFatene, Curso de Educação Física. Fortaleza, CE, Brasil.

***Corresponding author:**
Evanice Avelino de Souza
E-mail: profeas@gmail.com

Received 11 November 2024; accepted 6 May 2026.

Responsible Editors:
Executive Editor: Pedro Otavio Pimpim Bezerra
Associate Editor: André Ivaniski Mello
Assistant Editor: Fábio Lanferdini
Chief Editor: Ari Lazzarotti Filho

DOI: https://doi.org/10.1590/rbce.48.e20240120

This is an Open Access article distributed under the terms of the Creative Commons Attribution license (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

According to the latest report from the World Health Organization (WHO, 2020) Chronic Noncommunicable Diseases (NCDs) are the main causes of death worldwide. Among NCDs, cardiovascular diseases, diabetes, cancer and chronic respiratory disease are the main contributors to morbidity and mortality, worsening people's quality of life, causing permanent clinical complications, loss of autonomy and functional incapacity, especially in the elderly population (Silva et al., 2021).

In 2022, the total number of people aged 65 or over in Brazil (22,169,101) reached 10.9% of the population, an increase of 57.4% compared to 2010, when this contingent was 7.4% (Brasil, 2023). NCDs in the elderly are associated with decrease in functionality and are the main causes of dysfunctions in most South American countries, including Brazil. Dysfunctionality refers to deficiencies, physical limitations or restrictions in social participation (Figueiredo et al., 2021).

The Strategic Action Plan for Coping with Chronic Diseases and Non-Communicable Diseases in Brazil, spanning from 2021 to 2030 (referred to as the Dant Plan), was introduced in 2021. It serves as a comprehensive roadmap for mitigating risk factors associated with NCDs and promoting health to address health disparities. A key focus within the plan involves enhancing therapeutic programs, particularly within Primary Health Care (PHC), to encompass activities that promote physical exercise, healthy dietary habits, cessation of tobacco consumption, and fostering self-care (Brasil, 2023).

In 2023, the Brazilian Ministry of Health invested over R$40 million in fostering the practice of physical activities within the Unified Health System (UHS). However, despite this substantial investment, there remains a lack of standardized guidelines dictating the frequency, intensity, or types of activities provided. Instead, the implementation of physical activity programs varies based on the unique circumstances of each city, the resources available for conducting classes, and the existing infrastructure (Oliveira et al., 2022). Therefore, it would be beneficial to develop structured physical exercise programs alongside promoting physical activity. This approach is crucial for ensuring proper monitoring of exercise frequency, volume, and intensity, which are essential for maintaining overall health.

Thus, calisthenics may represent an effective strategy for promoting health in older women, as these exercises use body weight as resistance, enabling safe and progressive adaptations to the physiological changes associated with female aging (Liu and Latham, 2009). Evidence demonstrates improvements in muscular strength, balance, mobility, and functional autonomy, thereby contributing to the prevention of falls, frailty, and osteoporosis (ACSM, 2009; Cadore et al., 2013). Furthermore, calisthenics tend to promote higher adherence due to their low cost, minimal equipment requirements, and suitability for group-based interventions, while also positively influencing self-esteem and quality of life—particularly relevant outcomes in community settings and primary health care contexts (WHO, 2020).

Therefore, the present study aimed to analyze the effects of a physical exercise program based on calisthenics on the anthropometric, blood pressure, and functional profiles of older women assisted by Primary Health Care services. It is hypothesized that a calisthenics exercise program is capable of promoting improvements in muscular strength and functional capacity in older women, as reflected by performance in the chair stand and six-minute walk tests, without significant changes in anthropometric and hemodynamic parameters after a two-month intervention period.

METHODS

STUDY DESIGN

This research is a component of the "Movimente Sua Saúde" (Move your health) project conducted by the Center for Research in Exercise and Sport at the Federal University of Ceará. The project was implemented in the Basic Health Unit (BHU) of "Regional II" in Fortaleza, a city characterized by pronounced socio-economic disparities and specific challenges typical of coastal areas like Cais do Porto, such as gang conflicts and elevated street violence. The present study adopted a quasi-experimental design with parallel groups and a two-month follow-up and was conducted between May and June 2022. The sample consisted exclusively of older women due to the small number of men assisted in the BHU, which precluded their inclusion in the study.

All participants provided their signature on the Free and Informed Consent Form, and every aspect of the study received approval from the Research Ethics Committee of the Federal University of Ceará, in adherence to Resolution 466/12 of the National Health Council (opinion number: 5.5288021.1.0000.5054).

PARTICIPANTS

During the month of April, recruitment was carried out through posters and guidance provided by physicians at the BHU, inviting and informing patients who met the following inclusion criteria: (a) age between 60 and 76 years; (b) not engaging in physical activity under professional supervision; and (c) current use of medication for hypertension and/or diabetes mellitus to participate in the Movimente sua saúde program

Participants were excluded if they: (a) presented poor medication control and/or musculoskeletal conditions requiring a more individualized approach to physical training; and/or (b) had clinical conditions that prevented regular participation in physical exercise, such as motor impairments of neurological, vascular, or orthopedic origin, among others.

After random allocation, 18 participants were assigned to the Control Group (CG) and 18 to the Intervention Group (IG). Participants in the Control Group (CG) underwent an initial physical assessment and a reassessment after a two-month period and, during this interval, were instructed not to engage in any type of physical activity under professional supervision. Adherence to this recommendation was monitored through periodic follow-up contacts conducted via telephone calls and messages sent through the WhatsApp application, with the aim of verifying compliance with the guidelines and ensuring that participants were not engaged in structured physical activities during the study period. Figure 1 presents the sample description of the present study.

INTERVENTION

The older women selected for the Intervention Group received 50-minute training for eight weeks, structured as follows:

The guidelines adopted for the *Movimente Sua Saúde* program were based on the recommendations of the American College of Sports Medicine (ACSM, 2009), which advocate the prescription of resistance training at least twice per week (Crump and Freeman, 2021) for a minimum period of two months, with sessions lasting approximately 50 to 60 minutes (Ribeiro et al., 2022). Exercise intensity was monitored using the Borg Rating of Perceived Exertion Scale (6–20), with target values corresponding to moderate to moderately vigorous effort. Training intensity progression occurred primarily through an increase in the number of exercise repetitions, while respecting the participants' individual perceptions of effort.

The exercise sessions were conducted on the beach and in public spaces located near the BHU. There was no interference from adverse weather conditions during the intervention period, as the activities did not coincide with the rainy season and were carried out in a city with a predominantly warm climate, such as Fortaleza. This context allowed the continuous implementation of outdoor sessions without the need for cancellation or relocation.

INSTRUMENTS AND PROCEDURES

The study conducted anthropometric assessment, which included measurements of body mass and height to calculate the Body Mass Index (BMI) following international anthropometric standards (Lohman et al., 1988).

Specific BMI values were associated with different nutritional status categories, defined as underweight (BMI < 18.5 kg/m^2), normal weight (BMI between 18.5 and 24.9 kg/m^2), overweight (BMI between 25.0 and 29.9 kg/m^2), and class II obesity (BMI between 35.0 and 39.9 kg/m^2), according to the cutoff points established by the World Health Organization (WHO, 2020) Waist, abdominal, and hip circumference measurements were obtained using a Sanny measuring tape. Additionally, the waist/hip ratio (WHR) was calculated using waist and hip measurements to assess an individual's risk of cardiovascular disease.

Lower limb strength was assessed using the 30-second chair stand test, as part of the Fullerton Physical Fitness Test Battery (Rikli and Jones, 1999), performed with a standardized chair approximately 43 cm in height, without armrests, and positioned against a wall to ensure greater stability. Participants performed the test with their arms crossed over the chest, following a brief explanation and demonstration of the procedure, and without a specific prior warm-up.

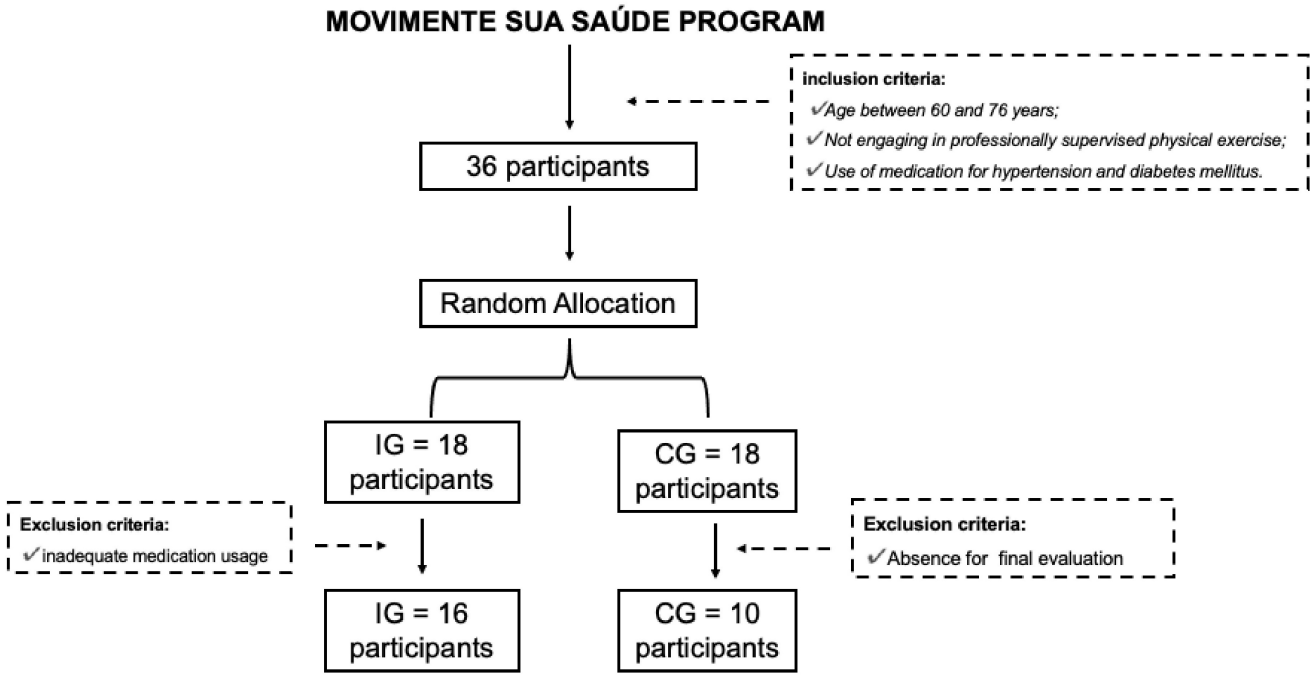

Figure 1. Description of the sample selection for the present study. IG = intervention group; CG = control group.

Cardiorespiratory functional capacity was evaluated using the six-minute walk test, conducted on a flat, demarcated, and outdoor course with a predefined length and regular markings along the path, in accordance with the American Thoracic Society protocol. Participants were instructed to walk as far as possible during the six-minute period, maintaining a comfortable and continuous pace without speed bursts; they were allowed to slow down or temporarily stop walking if necessary (ATS, 2002).

The anthropometric assessments and tests were conducted by trained and qualified Physical Education professionals.

Blood pressure measurements, including systolic (SBP) and diastolic (DBP) blood pressure, were taken before and after the intervention by healthcare professionals using the auscultatory method with a manual sphygmomanometer (BIC DE APARELHOS MÉDICOS LTDA, São Paulo, Brazil). Regular calibration checks were performed. Resting heart rate (resting HR) was measured using a pulse oximeter (Model MD300C1, Beijing, China) after a 10-minute rest period. In the present study, blood pressure levels were measured before and after each training session by the researcher.

STATISTICAL TREATMENT

Data are presented as descriptive statistics (mean, standard deviation, and 95% confidence interval (CI). Normality was assessed using the Shapiro–Wilk test. Independent-samples t-tests were conducted to compare groups for the following dependent variables: BMI, SBP, DBP, waist circumference, hip circumference and waist-to-hip ratio. A two-way repeated-measures ANOVA was used to examine the main effects of time and the condition × time interaction for all dependent variables. When baseline (pre-intervention) differences were identified, analysis of covariance (ANCOVA) was performed to compare post-intervention outcomes, with baseline values included as covariates. Statistical significance was set at $p < 0.05$. Effect sizes (ES) were calculated using eta squared (η^2) and interpreted as no effect (≤ 0.04), minimal effect (0.05–0.25), moderate effect (0.26–0.64), or strong effect (≥ 0.64), in accordance with Ferguson (2009).

RESULTS

The baseline characteristics of the participants and the comparison between the groups are presented in Table 1. It was noted that strength in the lower limbs (Mean difference [MD]; 95% confidence interval [95%CI]: 4.08; 2.35 to 5.81) and strength endurance (MD: 98.75, 95% CI: 44.94 to 152.55) were higher in the intervention group.

No significant differences were observed for the anthropometric variables BMI (time effect: F = 0.014, p = 0.908, η^2: 0.00 and power: 0.051; interaction effect: F = 0.056, p = 0.814 η^2: 0.001 and power: 0.056), waist circumference (time effect: F = 0.012, p = 0.914, η^2: 0.00 and power: 0.051; interaction effect: F = 0.165 p = 0.686 η^2: 0.003 and power: 0.068); hip circumference (effect of time: F = 0.05 p = 0.823 η^2: 0.001 and power: 0.056; interaction effect: F = 0.091, p = 0.765, η^2: 0.002 and power: 0.06) and waist-hip ratio (time effect: F = 0.205, p = 0.653, η^2: 0.004 and power: 0.073; interaction effect: F = 0.038, p = 0.847, n^2: 0.001 and power: 0.054).Similarly, blood pressure measurements were not different, SBP (time effect: F = 0.169, p = 0.683, η2: 0.004 and power: 0.069; interaction effect: F = 0.169, p = 0.683, η2: 0.004 and power: 0.069) and DBP (time effect: F = 0.006, p = 0.938, η2: 0.000 and power: 0.051; interaction effect: F = 0.006, p = 0.938, η2: 0.000 and power: 0.051).For functional physical performance, the ANCOVA revealed a statistically significant difference between the post conditions for the number of repetitions of the chair stand test (F = 7.987, p=0.010, η2: 0.258 and power: 0.77); and in the six-minute walking distance covered, (F = 11.999, p=0.002, η2: 0.34 and power: 0.912) (see Table 2).

Table 1. Characteristics of participants in both groups.

Variable	General (n=26)	IG (n = 16)	CG (n = 10)	T	p-values	Effectsize
Age (years)	64.96 ± 4.37	65.37 ± 4.31	64.30 ± 4.62	0.601	0.553	0.242
Weight (kg)	68.51 ± 12.50	69.45 ±13.49	67.00 ± 11.27	0.48	0.636	0.193
Height (cm)	150.23 ± 6.17	150.62 ± 5.26	149.60 ± 7.69	0.405	0.689	0.163
BMI (kg/m^2)	30.39 ± 5.55	30.47 ± 4.81	30.25 ± 6.86	0.095	0.925	0.038
SBP (mmHg)	125.03 ± 6.19	123.87 ± 7.72	126.90 ± 5.21	-1.088	0.287	-0.439
DBP (mmHg)	83.57 ± 7.03	83.75 ± 7.18	83.30 ± 7.14	0.156	0.878	0.063
Waist (cm)	90.65 ± 8.77	90.12 ± 8.83	91.50 ± 9.08	-0.382	0.706	-0.154
Hip (cm)	104.73 ± 9.08	105.12 ± 9.40	104.10 ± 9.02	0.275	0.786	0.111
WHR	0.86 ± 0.05	0.85 ± 0.05	0.87 ± 0.06	-0.913	0.37	-0.368
Chair stand test (rep)	12.11 ± 2.87	13.68 ± 2.27	9.60 ± 1.71	4.875	<0.001	1.965
Six-minute walk test (m)	380.76 ± 80.09	418.75 ± 65.5	320.00 ± 63.24	3.788	0.001	0.615

IG = Intervention Group; CG = Control Group; BMI = Body Mass Index; SBP = Systolic Blood Pressure; DBP = Diastolic Blood Pressure; WHR Waist-Hip Ratio.

Table 2. Anthropometric data, blood pressure and functional capacity of older women.

Variable	IG		IG	
	Pre	Post	Pre	Post
BMI (km/m^2)	30.47± 4.81	29.90 ± 4.65	30.25 ± 6.86	30.44 ± 6.88
Waist (cm)	90.12 ± 8.83	89.37 ± 8.01	91.50 ± 9.08	92.80 ± 9.90
Hip (cm)	105.12 ± 9.40	103.75 ± 9.00	104.10 ± 9.02	104.30 ± 9.21
WHR (cm)	0.85 ± 0.05	0.86 ± 0.05	0.87 ± 0.06	0.89 ± 0.07
SBP (mmHg)	123.87 ± 7.72	122.31 ± 7.04	126.90 ± 5.21	126.90 ± 5.21
DBP (mmHg)	83.75 ± 7.18	83.43 ± 6.51	83.30 ± 7.14	83.30 ± 7.14
Chair stand test (rep)	13.68 ± 2.27	15.00 ± 2.36	9.60 ± 1.71	9.50 ± 1.77
Six-minute walk test (m)	418.75 ± 65.51	496.87 ± 82.60	320.00 ± 63.24	317.27 ± 53.32

IG = Intervention Group; CG = Control Group; BMI = Body Mass Index; WHR = Waist-Hip Ratio; SBP = Systolic Blood Pressure; DBP = Diastolic Blood Pressure.

DISCUSSION

To the best of our knowledge, this is one of the few studies to have implemented a calisthenics-based intervention specifically designed for older women receiving care at the BHU. This study aimed to analyze the effects of a calisthenics-based physical exercise program on the anthropometric, blood pressure, and functional profiles of older women assisted by Primary Health Care services. We hypothesized that the intervention would lead to improvements in these parameters. The results partially corroborate this hypothesis, as positive effects were observed in functional capacity, particularly in the chair stand test, although no significant changes were found in all anthropometric and blood pressure variables. These findings reinforce the relevance of promoting physical exercise within primary health care, especially for older populations with limited access to resistance training facilities or individualized exercise programs.

The positive impact observed in the chair stand test results can be explained by gains in lower-limb muscle strength, particularly in the hip and knee extensor muscles, which were systematically stimulated throughout the intervention protocol (Fragala et al., 2019). The calisthenics program was conducted twice weekly, with sessions lasting approximately 45 minutes, maintained at a moderate to moderately vigorous intensity and featuring gradual progression based on increases in the number of repetitions. In addition, the exercises involved multi-joint and functional movements, such as squats, step-ups, and postural transitions, which replicate the demands of activities of daily living and promote specific functional overload of the lower limbs. The continuous and progressive execution of these movements favored not only improvements in muscle strength but also enhancements in motor coordination and balance, factors directly associated with better performance in the chair stand test (Lee and So, 2023).

Regarding the improvement observed in the six-minute walk test, this result should be interpreted as an indirect indicator of cardiorespiratory functional capacity, reflecting general adaptations to regular exercise practice rather than direct evidence of reduced cardiovascular risk. Although performance in this test is associated with functionality and exercise tolerance, further investigations using specific clinical and physiological measures are required to determine potential effects of the intervention on cardiovascular outcomes and chronic disease risk.

The improvement observed in the six-minute walk test may be attributed to the greater mechanical and neuromuscular demands imposed by calisthenic exercises performed on an unstable sandy surface, which increase activation of the lower-limb and foot musculature and promote strength adaptations (Lee and So, 2023). Additionally, the resistance provided by the sand may elevate cardiovascular load, resulting in higher heart rate responses and subsequent improvements in aerobic capacity over time (Lejeune et al., 1998).

Previous studies have shown that regular exercise performed on sand is associated with improvements in cardiovascular endurance, respiratory capacity, and muscular endurance, particularly in the lower limbs (Zamparo et al., 1992; Silva et al., 2020). These effects are attributed to the greater effort required to move on an unstable surface, which more effectively stimulates the cardiovascular and respiratory systems (Cadore et al., 2013).

It is important to note that the ability to walk for prolonged periods is closely associated with cardiovascular health and is commonly linked to a reduced risk of cardiovascular disease (Watanabe et al., 2015). Consequently, improvements in performance on this test may contribute to lower cardiovascular risk and enhanced overall health among older women (Lejeune et al., 1998).

The improvements observed in both the chair stand test and the six-minute walk test indicate the positive effects of the exercise program on physical health and functional capacity in the older population, highlighting the importance of physical training in health promotion.

In this study involving older women, no statistically significant differences were observed after the calisthenics training intervention in BMI. These findings are consistent with previous studies (Keating et al., 2017; Sultana et al., 2019; Kelley et al., 2023; Ho et al., 2012; Santos et al., 2020). The absence of significant changes may be attributed to the lack of nutritional support during the intervention, suggesting that the incorporation of nutritional counseling alongside exercise is necessary to achieve more meaningful changes in body composition. Systematic reviews (Li et al., 2021; Hita-Contreras et al., 2018; Eglseer et al., 2023) indicate that the combination of physical exercise and nutritional guidance is effective in reducing fat mass and preserving lean mass. Regular physical activity combined with healthy dietary habits promotes body weight control and reductions in anthropometric measures, including BMI.

Furthermore, the present study did not identify statistically significant differences in blood pressure variables, a finding that contrasts with some previous investigations (Silva et al., 2019; Xi et al., 2021; Naci et al., 2019). Although session intensity met international guideline recommendations—being monitored through ratings of perceived exertion and maintained at a moderate to moderately vigorous level—and the use of antihypertensive medications was monitored throughout the intervention period, the total duration of the program and the length of the sessions may not have been sufficient to elicit more pronounced hemodynamic adaptations. Evidence suggests that significant reductions in blood pressure depend not only on exercise intensity but also on greater weekly exercise volume, higher frequency of aerobic stimuli, and longer intervention periods, particularly in older populations.

Intervention studies that have reported significant reductions in systolic and/or diastolic blood pressure in older adults have typically employed combined aerobic and resistance training programs, with a minimum frequency of three to five sessions per week, durations exceeding 12 weeks, and strict control of training intensity. Meta-analyses and systematic reviews demonstrate that continuous aerobic exercises, such as walking and cycling, are associated with clinically meaningful reductions in blood pressure, while resistance training, when performed as a complementary modality, enhances these effects (Cornelissen and Smart, 2013; Naci et al., 2019). In addition, interventions incorporating mind–body practices, such as yoga and tai chi chuan, have also shown positive effects on blood pressure modulation, particularly in older adults, through reductions in autonomic stress and improvements in respiratory control (Cramer et al., 2014; Hartley et al., 2014). These findings reinforce that programs with greater stimulus diversity and longer duration tend to produce more consistent effects on systolic and diastolic blood pressure.

Finally, it is worth emphasizing that good adaptation of the participants to the proposed exercises was observed throughout the intervention period, mainly due to the gradual progression of the sessions and respect for individual limits, which contributed to the safety and acceptability of the program. No sample attrition occurred during the study, a finding that may be explained by the profile of the participants, who were drawn from socially vulnerable communities with limited access to private physical activity services, such as gyms or personalized training programs. These results underscore the feasibility and social relevance of low-cost calisthenics-based exercise programs within the context of primary health care, highlighting their potential for adherence and long-term sustainability in resource-limited populations.

However, this study has some limitations. First, the sample consisted solely of older women attending a single BHU in Fortaleza, which limits the generalizability of the findings to the wider population of Fortaleza or Brazil. In addition, the relatively small sample size should be acknowledged, as it reflects the characteristics of a real-world intervention conducted in a primary health care setting, with a restricted pool of eligible participants and strict inclusion criteria. Despite this, no sample attrition was observed, and adequate statistical power was achieved for the main functional outcomes. Second, the effects of antihypertensive medications were not evaluated, which may have influenced blood pressure outcomes. These limitations underscore the need for caution when interpreting the results.

CONCLUSION

The Movimente Sua Saúde program, which introduced a calisthenic exercise program for elderly women receiving treatment at BHU, demonstrated a notable effect on the results of the chair stand test and walking tests. However, the project did not yield significant changes in BMI, SBP or DBP. As a result, it would be beneficial for future guidelines aimed at preventing and treating NCDs to advocate for the ongoing implementation of physical exercise and emphasize the importance of enhanced health monitoring and the adoption of a more active lifestyle.

FUNDING

Coordination for the Improvement of Higher Education Personnel (CAPES), for providing a doctoral scholarship.

CONFLICTS OF INTEREST

The authors have declared that no competing interests exist.

DATA AVAILABILITY

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

REFERENCES

ACSM: American College of Sports Medicine. American College of Sports Medicine position stand. Progression models in resistance training for healthy adults. Med Sci Sports Exerc. 2009;41(3):687-708. https://doi.org/10.1249/MSS.0b013e3181915670. PMid:19204579.

ATS: American Thoracic Society. ATS statement: guidelines for the six-minute walk test. Am J Respir Crit Care Med. 2002;166(1):111-7. https://doi.org/10.1164/ajrccm.166.1.at1102. PMid:12091180.

Brasil. Secretaria de Comunicação Social. Censo 2022: número de idosos na população do país cresceu 57,4% em 12 anos [Internet]. Brasília: SECOM; 2023 [cited 2024 Nov 11]. Available from: https://www.gov.br/secom/pt-br/acompanhe-a-secom/noticias/2023/10/censo-2022-numero-de-idosos-na-populacao-do-pais-cresceu-57-4-em-12-anos

Cadore EL, Rodriguez-Manas 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 Res. 2013;16(2):105-14. https://doi.org/10.1089/rej.2012.1397. PMid:23327448.

Cornelissen VA, Smart NA. Exercise training for blood pressure: a systematic review and meta-analysis. J Am Heart Assoc. 2013;2(1):e004473. https://doi.org/10.1161/JAHA.112.004473. PMid:23525435.

Cramer H, Haller H, Lauche R, Steckhan N, Michalsen A, Dobos G. A systematic review and meta-analysis of yoga for hypertension. Am J Hypertens. 2014;27(9):1146-51. https://doi.org/10.1093/ajh/hpu078.

Crump C, Freeman B. Benefits and risk associated with physical exercise during the antenatal period [monografia]. St. Paul: Bethel University; 2021 [cited 2024 Nov 11]. Available from: https://spark.bethel.edu/etd/146/

Eglseer D, Traxler M, Embacher S, Reiter L, Schoufour JD, Weijs PJM, et al. Nutrition and exercise interventions to improve body composition for persons with overweight or obesity near retirement age: a systematic review and network meta-analysis of randomized controlled trials. Adv Nutr. 2023;14(3):516-38. https://doi.org/10.1016/j.advnut.2023.04.001. PMid:37028708.

Ferguson CJ. An effect size primer: a guide for clinicians and researchers. Psicol Prof Pesq Prat [Internet]. 2009 [cited 2024 Nov 11];40(5):532. Available from: https://psycnet.apa.org/doi/10.1037/a0015808

Figueiredo AEB, Ceccon RF, Figueiredo JHC. Doenças crônicas não transmissíveis e suas implicações na vida de idosos dependentes. Cien Saude Colet. 2021;26(1):77-88. https://doi.org/10.1590/1413-81232020261.33882020. PMid:33533865.

Fragala MS, Cadore EL, Dorgo S, Izquierdo M, Kraemer WJ, Peterson MD, et al. Resistance training for older adults: position statement from the national strength and conditioning association. J Strength Cond Res. 2019;33(8):2019-52. https://doi.org/10.1519/JSC.0000000000003230. PMid:31343601.

Hartley L, Dyakova M, Holmes J, Clarke A, Lee MS, Ernst E, et al. Yoga for the primary prevention of cardiovascular disease. Cochrane Database Syst Rev. 2014;2014(5):CD010072. https://doi.org/10.1002/14651858.CD010072.pub2. PMid:24825181.

Hita-Contreras F, Bueno-Notivol J, Martínez-Amat A, Cruz-Díaz D, Hernandez AV, Pérez-López FR. Effect of exercise alone or combined with dietary supplements on anthropometric and physical performance measures in community-dwelling elderly people with sarcopenic obesity: a meta-analysis of randomized controlled trials. Maturitas. 2018;116:24-35. https://doi.org/10.1016/j.maturitas.2018.07.007. PMid:30244776.

Ho SS, Dhaliwal SS, Hills AP, Pal S. The effect of 12 weeks of aerobic, resistance or combination exercise training on cardiovascular risk factors in the overweight and obese in a randomized trial. BMC Public Health. 2012;12(1):704. https://doi.org/10.1186/1471-2458-12-704. PMid:23006411.

Keating SE, Johnson NA, Mielke GI, Coombes JS. A systematic review and meta-analysis of interval training versus moderate-intensity continuous training on body adiposity. Obes Rev. 2017;18(8):943-64. https://doi.org/10.1111/obr.12536. PMid:28513103.

Kelley GA, Kelley KS, Stauffer BL. Effects of resistance training on body weight and body composition in older adults: an inter-individual response difference meta-analysis of randomized controlled trials. Sci Prog. 2023;106(2):368504231179062. https://doi.org/10.1177/00368504231179062. PMid:37302150.

Lee SS, So YS. The effects of sand exercise program on balance capability, extremity muscle activity, and inflammatory markers in older women. Exerc Sci. 2023;28(2):131-40. https://doi.org/10.15857/ksep.2019.28.2.131.

Lejeune TM, Willems PA, Heglund NC. Mechanics and energetics of human locomotion on sand. J Exp Biol. 1998;201(Pt 13):2071-80. https://doi.org/10.1242/jeb.201.13.2071. PMid:9622579.

Li Z, Cui M, Yu K, Zhang XW, Li CW, Nie XD, et al. Effects of nutrition supplementation and physical exercise on muscle mass, muscle strength and fat mass among sarcopenic elderly: a randomized controlled trial. Appl Physiol Nutr Metab. 2021;46(5):494-500. https://doi.org/10.1139/apnm-2020-0643. PMid:33216623.

Lohman TG, Roche AF, Martorell R. Anthropometric standardization reference manual. Champaign: Human Kinetics Books; 1988.

Liu CJ, Latham NK. Progressive resistance strength training for improving physical function in older adults. Cochrane Libr. 2009;(3):CD002759. https://doi.org/10.1002/14651858.CD002759.pub2.

Naci H, Salcher-Konrad M, Dias S, Blum MR, Sahoo SA, Nunan D, et al. How does exercise treatment compare with antihypertensive medications? A network meta-analysis of 391 randomised controlled trials assessing exercise and medication effects on systolic blood pressure. Br J Sports Med. 2019;53(14):859-69. https://doi.org/10.1136/bjsports-2018-099921. PMid:30563873.

Oliveira VHD, Azevedo KPMD, Medeiros GCBSD, Knackfuss MI, Piuvezam G. Desafios do profissional de educação física nos Núcleos Ampliados de Saúde da Família e Atenção Básica: uma revisão sistemática da literatura brasileira. Cad Saude Colet. 2022;30(1):108-14. https://doi.org/10.1590/1414-462x202230010340.

Rikli RE, Jones CJ. Development and validation of a functional fitness test for community-residing older adults. J Aging Phys Act. 1999;7(2):129-61. https://doi.org/10.1123/japa.7.2.129.

Ribeiro AS, Picoloto A, Nunes JP, Bezerra ES, Schoenfeld BJ, Cyrino ES. Effects of different resistance training loads on the muscle quality index in older women. J Strength Cond Res. 2022;36(5):1445-9. https://doi.org/10.1519/JSC.0000000000003667.

Santos G, Resende A No, Silva Chaves L, Correira de Jesus L, Barranco-Ruiz Y, Monteiro M, et al. Effects of bodyweight and traditional resistance training on the functionality of elderly people: a randomized clinical trial. Rev Bras Fisiol Exerc. 2020;19(3):214-25.

Silva DG, Monteiro WD, Marin DP, Figueiredo TR. Comparison of Cardiovascular Responses to Walking on Sand and Hard Surfaces in Older Adults. J Aging Phys Act. 2019;27(6):910-5.

Silva DSM, Assumpção D, Francisco PMDB, Yassuda MS, Neri AL, Borim FSA. Doenças crônicas não transmissíveis considerando determinantes sociodemográficos em coorte de idosos. Rev Bras Geriatr Gerontol. 2021;25(5):e210204.

Silva ESD, Borges JWP, Moreira TMM, Rodrigues MTP, Souza ACCD. Prevalência e fatores de risco associados ao acidente vascular cerebral em pessoas com hipertensão arterial: uma análise hierarquizada. Referência. 2020;5(3):e20014. https://doi.org/10.12707/RV20014.

Sultana RN, Sabag A, Keating SE, Johnson NA. The effect of low-volume high-intensity interval training on body composition and cardiorespiratory fitness: a systematic review and meta-analysis. Sports Med. 2019;49(11):1687-721. https://doi.org/10.1007/s40279-019-01167-w. PMid:31401727.

Watanabe Y, Tanimoto M, Oba N, Sanada K, Miyachi M, Ishii N. Effect of resistance training using bodyweight in the elderly: comparison of resistance exercise movement between slow and normal speed movement. Geriatr Gerontol Int. 2015;15(12):1270-7. https://doi.org/10.1111/ggi.12427. PMid:25598234.

WHO: World Health Organization. The top 10 causes of death [Internet]. Geneva: WHO; 2020 [cited 2024 Nov 11]. Available from: https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death

Xi H, He Y, Niu Y, Sui X, Zhang J, Zhu R, et al. Effect of combined aerobic and resistance exercise on blood pressure in postmenopausal women: a systematic review and meta-analysis of randomized controlled trials. Exp Gerontol. 2021;155:111560. https://doi.org/10.1016/j.exger.2021.111560. PMid:34560198.

Zamparo P, Perini R, Orizio C, Sacher M, Ferretti G. The energy cost of walking or running on sand. Eur J Appl Physiol Occup Physiol. 1992;65(2):183-7. https://doi.org/10.1007/BF00705078. PMid:1327762.