CASE STUDY

DOI: 10.54392/ijpefs2623

IJPEFS International Journal of PHYSICAL EDUCATION, FITNESS AND SPORTS

Effects of A Period of Home-Based Resistance Training on Functional Capacity, Anthropometric Measurements, and Blood Pressure in an Older Adult: A Retrospective Case Report

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DOI: https://doi.org/10.54392/ijpefs2623

Received: 12-01-2026; Revised: 20-03-2026; Accepted: 01-04-2026; Published: 04-04-2026

Abstract: Population aging is a growing phenomenon worldwide, particularly with a significant increase in the population aged 80 and over, a group characterized by a greater predisposition to sedentary lifestyles and marked physiological declines. In this context, low-cost strategies, such as home-based strength training, can help maintain health and functional autonomy. The study aimed to verify the effects of a period of home-based strength training on functional capacity, anthropometric measurements, and resting blood pressure in an octogenarian. This is a retrospective case report involving an 84-year-old male participant who is hypertensive and sedentary. Anthropometric measurements, resting blood pressure, and functional capacity were assessed using the Senior Fitness Test. The training protocol was conducted at home, three times a week, for 24 weeks, using full-body circuit training exercises with resistance bands, dumbbells, and ankle weights. Following the intervention period, improvements in functional fitness were observed, with increased performance in strength, flexibility, agility, and aerobic endurance tests, as well as a reduction in anthropometric measurements and resting blood pressure. In conclusion, this case study showed that home-based strength training was associated with improvements in functional, anthropometric, and cardiovascular parameters in an octogenarian. However, these findings should be interpreted with caution, as they refer to a single participant.

Keywords: Aging, Functional Capacity, Hypertension, Strength Training

1. Introduction

Aging is a phenomenon that occurs on a large global scale (OPAS/OMS). It is estimated that by the year 2050, approximately 2 billion older people will inhabit the world (OPAS/OMS).

Evidence indicates that with advancing age there is a progressive decrease in the ability of physiological systems to adapt to the environment, and when this process is associated with inadequate lifestyle habits, adverse health consequences may occur (Lazarus *et al.*, 2019; Alghatrif *et al.*, 2024; Cai *et al.*, 2024). For example, in the muscular system, a progressive reduction in levels of muscle strength and muscle mass is observed (Buford *et al.*, 2010; Wroblewski *et al.*, 2011; Cai *et al.*, 2024). The rate of muscle mass loss may vary depending on lifestyle and genetic factors, but it is estimated that there is a reduction of 1 to 2% per year after the age of 50, with another 40% typically lost between the age of 50 and 80 (Buford *et al.*, 2010; Wroblewski *et al.*, 2011). The loss of muscle mass, strength, and function is known as sarcopenia, and its development occurs mainly due to a lack of muscle stimulation resulting from physical inactivity (Buford *et al.*, 2010). These data are concerning, as the population aged 80 years and older is increasing significantly, shows a strong predisposition to sedentary lifestyles, and the declines are more pronounced. Research has shown a negative correlation between low levels of muscle strength/power and increased mortality, demonstrating the importance of being active and presenting adequate levels of muscle strength (Gale *et al.*, 2007; Artero *et al.*, 2011; Araújo *et al.*, 2025).

Another aggravating factor is that the Brazilian healthcare systems are not prepared for this accelerated increase in the older population, necessitating additional measures to address this issue. In this context, strength training plays an important role in preventing and combating the negative effects of aging. Evidence shows that this type of physical training promotes many benefits, such as improvements in cardiovascular health, combating obesity, reduction of joint pain symptoms, increased functional capacity, a sense of psychological well-being, among others (Moraes *et al.*, 2012; Jubrias *et al.*, 2001; Kelley *et al.*, 2011; Casilhas *et al.*, 2011; Cardozo *et al.*, 2019; Cardozo, 2025).

Specifically in the musculoskeletal system, an increase in bone mineral density, strength levels, muscle mass and power is observed, which promotes improvement in the development of activities of daily living and consequently help maintain autonomy (Fragala *et al.*, 2019; Cardozo *et al.*, 2019; Khodadad Kash *et al.*, 2023; Cardozo and Destro, 2023). Therefore, given the rapidly increasing number of octogenarians, the present study aimed to evaluate the effects of a home-based strength training period on functional capacity, anthropometric measurements, and resting blood pressure in an octogenarian.

2. Materials and Methods

2.1. Experimental Design

The sample consisted of an 84-year-old man with hypertension, a sedentary lifestyle, a higher level of education, and who maintains his professional activities. The participant was intentionally included for convenience, based on a personalized home training service, characterizing this study as a retrospective case report based on professional practice.

The participant's selection is justified by their clinical and functional characteristics, especially their advanced age, hypertensive condition, and home environment, aspects that make the case relevant for investigating the applicability of low-cost resistance training programs in older individuals.

The participant is under pharmacological treatment with a beta-blocker (propranolol, 80 mg/day) and a calcium channel blocker (amlodipine, 10 mg/day), with regular follow-up by a cardiologist. He lives with his partner, who is also older, and remains professionally active, working as a doctor. He had a history of a sedentary lifestyle at the start of the follow-up, but is completely independent in his activities of daily living. Food intake was not controlled during the intervention period.

The inclusion criteria for the study were: a) be authorised by a doctor to practice physical exercise, and b) not have severe musculoskeletal limitations that could interfere with the exercise program.

This study was conducted in accordance with the ethical principles established in the Declaration of Helsinki of 1964 and its subsequent revisions, ensuring respect for the dignity, integrity, and rights of the participant (World Medical Association 1964/2013). The participant provided informed consent for the use of their data for scientific purposes.

2.2. Anthropometric Measurements

The measurements collected were: weight, height, waist circumference, abdomen circumference (measured using a Cercorf measuring tape), and skinfold thickness (chest, thigh, and abdomen) was measured using a clinical calliper, Sany, Brazil.

Skinfold measurements were taken in duplicate, and the average of the two readings was considered. All assessments were performed by the same evaluator, both before and after the intervention.

2.3. Blood Pressure

Blood pressure was measured after 10 minutes of sitting at rest. Two readings were taken with a 5-minute interval between them, and the average of the values was considered the resting blood pressure. All procedures are in accordance with established technical guidelines (Pickering *et al.*, 2005; Brandão *et al.*, 2025).

2.4. Functional Tests

The functional tests followed the Senior Fitness Test battery, which evaluates the physiological capacity to perform activities of daily living (Rikli and Jones, 1999; Cardozo *et al.*, 2019). The tests performed were:

a) 30s Chair Stand: Stand up and sit down from a chair as many times as possible in 30 seconds.

b) Arm Curl: Perform as many arm curls as possible within 30 seconds.

C) Chair Sit and Reach: Reach the greatest possible distance using the hamstring muscles of one extended leg and hold the position for two seconds. Measurements were recorded in centimeters.

d) Back Scratch: Measure the distance between the middle fingers, using the fingertips as the zero mark. A positive distance is considered to be any distance beyond the zero mark, and a negative distance is any distance remaining to reach the fingertips. Measurements were recorded in centimeters.

e) Foot Up-and-Go: Stand up from a chair, walk quickly to a cone positioned 2.44 meters away, walk around the cone, and return to the starting position in the shortest possible time. Measurements were recorded in seconds.

f) 2-minute step test: March in place for two minutes, raising your knees to a height marked on the wall. The total number of times your right knee reached the marked level on the wall was recorded.

The volunteer performed a general warm-up of 5 minutes before the tests. All tests were performed twice, and the best result was recorded, except for the 2-minute step test.

2.5. Training protocol

The participant underwent a circuit-based strength training protocol consisting of three sequences of eight exercises. Intervals of 35 to 40 seconds were used between exercises, and 2 minutes between sequences. The repetition range was established between 12 and 15 for most exercises, with the exception of abdominal and calf exercises, which were performed between 20 and 25 and between 15 and 20 repetitions, respectively. The intensity of the training was controlled using the OMNI-RES scale of perceived exertion, with a target range between 5 and 6. The load was increased whenever the participant was able to perform three sets of 15 repetitions (the upper limit of the established zone), to maintain the intensity within the proposed range.The progression of training volume occurred in the initial weeks as follows: in the first week, one set per exercise was performed; in the second and third weeks, two sets; and, from the fourth week onwards, three sets per exercise.

The program included exercises for the upper limbs, lower limbs, and core region, performed with resistance bands, dumbbells, and ankle weights. The exercises were organized to alternate body segments throughout the circuit, and the sessions were held three times a week, lasting approximately 40 minutes.

After three months of training, the selection of exercises was modified. At the end of six months, the participant underwent reassessments. A detailed description of the exercises performed in each phase is presented in Table 1.

3. Results

Table 2 presents the results between the pre- and post-training periods. After 24 weeks of the training protocol, numerical differences were observed, reflecting improvement in all measures evaluated.

4. Discussion

This retrospective case report aimed to evaluate the effects of a home-based strength training period on functional capacity, anthropometric measurements, and resting blood pressure in an octogenarian. The results demonstrated that the training protocol promoted notable improvement in functional capacity, reducing anthropometric measurements, and lowering resting blood pressure. It is known that with aging, physical capabilities decline progressively, and when associated with a sedentary lifestyle and other diseases, this process can be accelerated. Estimates indicate that after the age of 50, muscle mass declines by 1% to 2% per year, and by the age of 80, total losses can reach 40% per decade (Buford *et al.,* 2010; Wroblewski *et al.,* 2011). The reduction in muscle mass, in addition to leading to a state of frailty, also contributes to reductions in metabolism and consequently to increases in the amount of body fat, further aggravating the condition.

Hypertension is another condition highly prevalent in older adults. Data indicate that the prevalence may reach 65.1% among individuals aged over 65 years (Brandão *et al.,* 2025). Hypertension is one of the main causes of early retirement and is considered a primary factor for cardiovascular diseases, in addition to contributing significantly to high public expenditures (Moura *et al.,* 2005; Nilson *et al.,* 2018). Conversely, strength training is extremely beneficial in increasing muscle mass, improving physical conditioning, reducing body fat and blood pressure, and consequently improving health in older adults (Fragala *et al.,* 2019; Cardozo *et al.,* 2019; Cardozo *et al.,* 2022; Paluch *et al.,* 2023). In this study, improvements were observed in upper limb strength (83.3% increase) and lower limb strength (12.5% increase), in agility to stand up from a chair and change direction (27.9% reduction in execution time), in upper limb flexibility (28.7% increase) and lower limb flexibility (48.8% increase), in aerobic endurance (23.8% increase in the 2-minute test), and in blood pressure (18.9% reduction in systolic blood pressure and 12.5% reduction in diastolic blood pressure). However, despite the improvements observed, the values obtained in the lower and upper limb strength tests remained below the reference values for the age group. According to Rikli and Jones (2013), men between 80 and 84 years old should perform approximately 13 repetitions in the 30-second chair stand test, 15 repetitions in the arm curl test, 71 steps in the 2-minute step test, and about 7.1 seconds in the foot up-and-go test.

Additionally, it was observed that performance in the 2-minute walk test reached values higher than the reference values for the age group, while the agility test (Foot Up-and-Go) showed exactly the indicated value. On the other hand, upper and lower limb strength tests remained below normative values. These findings suggest that, although the training promoted relevant functional improvements, the intervention time may not have been sufficient for the participant to reach the expected normative values, especially regarding muscle strength. Furthermore, the nature of the training protocol may have influenced these results, since circuit training, with short intervals and moderate intensity, tends to promote greater cardiovascular and metabolic stimulation, favoring adaptations related to endurance and agility, at the expense of maximum gains in muscle strength (Romeno-Arenas *et al.*, 2013; Lopez *et al.*, 2021).

It is worth highlighting that clinical conditions such as hypertension can negatively influence functional performance. Previous studies have shown that hypertensive older individuals perform worse in strength tests, such as the chair stand test, when compared to normotensive individuals (Cardozo *et al.*, 2021).

Table 1. Resistance training exercises

Training protocol from the 1st to the 3rd month			
Exercise	**Sets**	**Repetitions**	**Interval**
Sit-to-stand from a chair	1-3	12-15	35-40 seconds
Seated row with resistance band	1-3	12-15	35-40 seconds
Standing knee flexion with ankle weights	1-3	12-15	35-40 seconds
Seated chest press with resistance band	1-3	12-15	35-40 seconds
Step calf raises	1-3	15-20	35-40 seconds
Triceps extension with resistance band	1-3	12-15	35-40 seconds
Abdominal crunch	1-3	20-25	35-40 seconds
Biceps curl with dumbbells	1-3	12-15	35-40 seconds
2-minute rest before repeating the sequence			
Training protocol from the 4th to the 6th month.			
Exercise	**Sets**	**Repetitions**	**Interval**
Wall push-up	3	12-15	35-40 seconds
Bodyweight squat	3	12-15	35-40 seconds
Lat pulldown with resistance band	3	12-15	35-40 seconds
Glute bridge	3	12-15	35-40 seconds
Seated shoulder press with dumbbells	3	12-15	35-40 seconds
Seated hip abduction with miniband	3	12-15	35-40 seconds
Single-leg calf raise	3	15-20	35-40 seconds
Abdominal crunch	3	20-25	35-40 seconds
2-minute rest before repeating the sequence			

Table 2. Total values between pre- and post-training periods.

Variables	Pre-training	Post-training	Difference post-pre	% Change
Age (years)	84	-	-	-
Stature (cm)	181.0	-	-	-
Weight (kg)	84.500	82.500	-2.0	-2.3
BMI (kg/m^2)	25.79	25.18	-0.61	-2.3
Waist (cm)	101.3	98.2	-3.1	-3.0
Abdomen (cm)	102.7	101.3	-1.4	-1.3
Chest (mm)	25.0	23.0	-2.0	-8.0
Thigh (mm)	25.0	23.0	-2.0	-8.0
Abdomen (mm)	36.0	34.0	-2.0	-5.5
Total skinfold thickness	86.0	80.0	-6.0	-6.9
SBP (mmHg)	137.0	111.0	-26.0	-18.9
DBP (mmHg)	80.0	70.0	-10.0	-12.5
30s Chair Stand[1]	8.0	9.0	1.0	12.5
Arm Curl[1]	6.0	11.0	5.0	83.3
Chair Sit and Reach[2]	-33.0	-17.0	16.0	-48.4
Back Scratch[2]	-35.0	-25.0	10.0	-28.5
Foot Up-and-Go[3]	9.88	7.12	-2.76	-27.9
Step test 2-minute[1]	84.0	104.0	20.0	23.8

IBM = Body Mass Index; SBP = Systolic Blood Pressure; DBP = Diastolic Blood Pressure; 1 = Number of times; 2 = Measurements in centimetres; 3 = Measurements in seconds.

Despite this, the results suggest that the training protocol contributed to functional and cardiovascular improvements in an octogenarian, even without the use of sophisticated equipment. The program consisted of simple exercises using body weight, resistance bands, and ankle weights, which reinforces its applicability in home settings. Supporting these findings, Stojanović *et al.* (2021) found that 12 weeks of resistance training performed with elastic resistance promoted significant improvements in physical fitness and metabolic biomarkers in older women.

Resistance training with elastic bands has gained popularity due to its low cost and similar effectiveness to traditional resistance training (machines and free weights), making it an effective and accessible option for clinical practice (Andersen *et al.*, 2010; Ramos *et al.*, 2014; Lopes *et al.*, 2019). Cordeiro *et al.* (2018) found that circuit training performed in public spaces promotes a prolonged hypotensive effect in hypertensive older adults. Physical exercise is considered a powerful ally in controlling high blood pressure, as a reduction of mere 3 mmHg has a significant impact on reducing the development of coronary heart disease and cardiovascular events (Pescatello *et al.*, 2004).

Another important point is the role of the Personal Trainer in managing training. The training practice monitored by a Personal Trainer is effective when compared to training performed without supervision (without the Personal Trainer's guidance) (Mazzetti *et al.*, 2000; Coutts *et al.*, 2004; Gentil and Bottaro, 2010). Therefore, the results of this study suggest that home-based resistance training was associated with improvements in the health of the participant, and the physical education professional plays a key role in organizing training and motivating students, making personalized monitoring essential. Listening to the patient is also crucial: the volunteer reported feeling physically more energetic and healthier, and that his gait had improved exceptionally during activities of daily living.

Limitations of this study include, firstly, its single-case study design, which limits the generalizability of the results. Furthermore, the absence of a control group prevents comparison of the training effects with other conditions, hindering the causal attribution of the observed changes. Another relevant point is the impossibility of isolating the effects of training from other factors that may influence the outcomes, such as medication use. Additionally, there was no control of food intake during the intervention period, which may have influenced the anthropometric results.

The study also has limitations related to the absence of more detailed physiological measurements, such as heart rate variability, hormonal markers, blood lactate, and electromyography, as well as the lack of more sophisticated training equipment. Despite these limitations, the study has practical relevance by demonstrating the feasibility of applying a resistance training program in a home environment, using simple resources, for an older individual.

5. Conclusion

This retrospective case report suggests that a 24-week home-based strength training program may be a feasible and potentially beneficial strategy for an octogenarian with hypertension and a history of sedentary behavior. Over the intervention period, the participant showed improvements in functional fitness outcomes, including upper- and lower-body strength, flexibility, agility, balance, and aerobic endurance, together with reductions in selected anthropometric measurements and resting blood pressure. These findings indicate that resistance exercises performed at home with simple equipment, such as resistance bands, dumbbells, ankle weights, and body-weight movements, may support physical function and cardiovascular health in very old adults when appropriately prescribed and monitored. From a practical perspective, this approach may represent a low-cost and accessible alternative for older individuals who have limited access to gyms or structured exercise programs. Nevertheless, the results must be interpreted cautiously because they are based on a single retrospective case, without a control group, dietary control, or more detailed physiological measurements. Therefore, causal inferences cannot be made, and the findings cannot be generalized. Further studies with larger samples and stronger designs are needed to confirm the safety, applicability, and effectiveness of home-based strength training in octogenarians. Future research should also examine adherence and long-term maintenance.

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Acknowledgments

The author thanks the volunteer (T.S.R.F.) for participating in this study.

Ethics Approval Statement

The approval was sought from Institute Review Board. This study was conducted in accordance with the ethical principles established in the Declaration of Helsinki of 1964 and its subsequent revisions, ensuring respect for the dignity, integrity, and rights of the participant (World Medical Association 1964/2013).

Participant Consent

The participant provided informed consent for the use of their data for scientific purposes

Funding Source

This study received no external funding.

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