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THE IMPACT OF PROGRESSIVE RESISTANCE TRAINING ON THE PHYSICAL HEALTH OF ADULT INDIVIDUALS

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ABSTRACT

Background: *Physical training can be considered a therapeutic strategy to prevent the deleterious effects of aging.* ***Objective:*** To investigated the lean mass gain, improved muscle strength and functional capacity, obtained through Progressive Resistance Training (PRT) of large muscle groups. ***Method:*** Longitudinal prospective study with adult individuals of both genders, over 50 years of age. The following variables were studied: anthropometry, bioelectrical impedance, the sit and stand test, handgrip strength and Progressive Resistance Training (PRT) of large muscle groups. Simple and multiple linear regression analyzes and the Wilcoxon test were used. ***Results:*** There was a statistically significant difference for handgrip strength, sit-to-stand test, bioimpedance and PRT in all exercises ($p \leq 0.0001$). In the simple linear regression analysis for the study of PRT variation, the largest variation was associated with the younger age in the PRT Twin. In the PRT Leg Extension Machine and Leg Curl Machine, the male gender presented greater variation. In Abdominal PRT, shoulder comorbidity accounted for 11.52% of the variability. In the single and multiple linear regression analysis for PRT Chest Press and Seated Rowing, the largest variation was associated with younger age and male gender. ***Conclusion:*** This study showed the importance of PRT in promoting physical health.

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INTRODUCTION

Sarcopenia is a syndrome characterized by progressive and widespread age-associated loss of skeletal muscle mass and strength (Rosemberg, 1997). It has become increasingly relevant in clinical practice due to the progressive aging of the population and chronic diseases (Adisson et al., 2018) such as heart failure (Fulster, 2013) and renal failure (Pattel, 2013), chronic obstructive pulmonary disease (Dubé, 2018), cancer (Barkhudaryan, 2017), rheumatoid arthritis (Uutela, 2018), diabetes *mellitus* (Trierweiler, 2018), peripheral vascular diseases (Adisson, 2018) contributing to its growing prevalence. Muscle loss results in metabolic dysregulation, increased insulin resistance and dyslipidemia, loss of bone mass, structural changes in muscle fibers, reduced neuromuscular functions and decreased maximum oxygen volume, leading to fragility, increased fall episodes and decrease in Daily Life Activities (DLA) (Adisson, 2018). On average, lowering of the muscle mass is 5 to 13% in individuals over 60 years, reaching 50% in individuals over 80 years (Scherbakov, 2018). In Brazil, sarcopenia occurs in 16% of the population over 60 being 20% in women and 12% in men (Trierweiler, 2018). According to the European Working Group on Sarcopenia in Older People (EWGSOP), the methods and cutoffs that have been set for the Diagnosis of sarcopenia is mass, muscle strength and functional capacity (Cruz-Jentoft, 2010). Thus, Progressive Resistance Training (PRT) has been considered a relevant strategy to prevent muscle wasting, contributing to the increase of muscle strength and stimulating hypertrophy (Yoo, 2018 and Johnston et al., 2008). In view of the above, the objective of the present study was to investigate lean mass gain, improvement of muscle strength and functional capacity, obtained through Progressive Resistance Training (PRT) of large muscle groups.

METHODS

Characteristics and type of study, ethical approval and inclusion and exclusion criteria: This is a longitudinal prospective study conducted with adult individuals of both genders in a private clinic in a large city in the state of São Paulo, Brazil. The study was initiated after approval by the institution's Ethics and Research Committee (Opinion No. 2.958.342, CAAE No. 97864918.2.0000.5481) and after the signature of the free and informed consent form by the participants. In the population to be studied, the following were considered eligible: individuals over 50 years of age, hemodynamically, mentally and clinically stable who maintained their weight in the last four months, with good general conditions and regular training frequency for thirty sessions. The following were considered exclusion criteria: use of medications that alter skeletal muscle homeostasis such as corticosteroids, insulin synthesizers and testosterone blockers. Thus, the study population consisted of 51 individuals (n = 51).

Methodological procedures: Survey participants were evaluated before and after 30 twice a week basic PRT sessions. The following Biodelta by Pórtico Fitness Equipment weight training gears were used: Chest Press, Seated Rowing Machine, Leg Curl Machine, Leg Press and Abdominal.

Assessments performed

a) Handgrip strength assessment: Handgrip strength was assessed with the Jamar model portable Hydraulic Dynamometer (ADH, *Aparelho Dinamômetro Hidráulico*), considered the gold standard and a mortality predictor (Dodds, 2014). The patient remained seated in an office chair (without arms), with the spine erect, keeping the knee flexion angle at 90 degrees. The shoulder was positioned in adduction and neutral rotation, arm flexed to form an angle of 90 degrees in relation to the forearm, with half pronation and neutral wrist. Up to 30º extension movements were allowed and the greatest recorded attempt out of three attempts with each member was selected (Dodds et al., 2014 and Mendes et al., 2017).

b) Seat-to-stand test: Functional capacity and resistance of the lower limbs were assessed by the number of sitting and rising from the chair movement executions during 15 seconds. A stopwatch and a chair with backrest (without arms), with seat height of approximately 43 cm were used. At the signal to start, the volunteer rose to the maximum extent (vertical position) and returned to the sitting position. The score was obtained by the total number of correct executions within 15 seconds. If the volunteer was in the middle of the elevation movement at the end of 15 seconds, it was considered an execution. For safety reasons, the chair was placed against a wall or stabilized to prevent it from moving during the test (Afilalo, 2017 and Rickli et al., 1999).

c) Electrical bioimpedance (EBI):- Lean mass and body fat were evaluated by bioelectrical impedance using the Tetrapolar Biodynamics 450 (Bioimpedance Analyzer) using four electrodes applied to the hand, wrist, foot and right ankle according to standard procedures (Heyward, 2000).

d) Anthropometry:- Classic anthropometric indicators such as body weight, height, arm circumference (AC), triceps skin fold (TSF), body mass index (BMI), arm muscle circumference (AMC) and calf circumference (CC) were assessed. BMI (WHO, 1998 and Lipschitz, 1994) and body composition indicators (Frisanch, 1990 and Burr, 1984) (AC, AMC and TSF) were classified according to reference values and specific standardization. The CC was classified according to the criteria recommended by the World Health Organization, 1995.

Progressive Resistance Training (PRT): PRT using adapted weight training equipment was implemented with a system of levers and weights that provide joint stability, direct transmission and load variation and adequate force vectors for movement (Santarém, 2012). The two PRT sessions were held weekly during up to 1 hour, totaling 30 sessions of a single exercise for large muscle groups: back, chest, lower limbs and abdominals, 3 sets of 5 to 15 repetitions of each exercise, with an interval of 1 to 2 minutes. The loads used were defined by successive approximation, and the first series was lighter to allow the warm up and was performed using 50% of the weight of the third series. The second series used 75% of the maximum load. The third series was carried out with the maximum possible load and with a near-maximum effort level. The series was interrupted by 1 or 2 repetitions before the maximum muscle contraction, corresponding to 18 on the Borg scale (more than very difficult and almost extremely difficult), according to Santarém, 2012 (Santarém, 2012 and Borg, 1982).

Statistical Analysis: Data were tabulated using Excel® software and statistical analysis was performed using the Statistical Analysis System (SAS) (SAS, 2012) software. To characterize the sample, a descriptive analysis was performed using frequency tables for categorical variables and measures of position and dispersion for continuous variables. For comparison of measurements assessed before and after training, the Wilcoxon test for related samples was used. In the analysis of factors related to responses to PRT, linear regression analysis, single and multiple models with Stepwise variable selection criteria were used. The response variables were transformed into ranks due to the absence of normal distribution. The significance level adopted for the statistical tests was $p < 0.05$ (Conover, 1999; Tabachnick, 2001 and Conover, 1981).

RESULTS

The study population consisted of 51 individuals, 31 (61.54%) females and 20 (38.46%) males. The average age was 62.98±9.41 years (median=61 years) and the average height was 1.65±0.09 m. Among the comorbidities presented, knee pathologies represented 15.38%, shoulder 13.46%, lumbar spine 21.15% and heart diseases 11.54%. There was no statistically significant difference in the comparison of all anthropometric indicators (body weight, BMI, AC, TSF, AMC and CC) between the two evaluation time points (before and after the PRT). There was a statistically significant difference for handgrip strength, sit-to-stand test, bioimpedance and PRT (all exercises) (Table 1).

Table 1. Descriptive analysis of physical tests, bioimpedance, PRT and comparison of variables between the two time points

Variables	Category	N	M ± SD	Median	*p*-value *
Handgrip Strength					
	LUL 1	51	28.85 ± 10.11	28.00	
	LUL 2	51	32.41 ± 10.69	30.00	
	dif 1	51	3.56 ± 4.19	3.00	<0.0001
	RUL 1	51	30.39 ± 10.75	29.00	
	RUL 2	51	32.84 ± 10.56	31.00	
	dif 2	51	2.45 ± 3.88	2.00	<0.0001
Sit-to-Stand Test					
	STST 1	51	6.12 ± 1.24	6.00	
	STST 2	51	7.49 ± 1.01	7.00	
	dif 3	51	1.37 ± 0.85	1.00	<0.0001
Bioimpedance					
	LM 1	51	51.67 ± 10.07	49.60	
	LM 2	51	52.27 ± 10.00	50.20	
	dif 4	51	0.90 ± 1.92	0.80	0.0011
	FM 1	51	21.40 ± 7.69	20.30	
	FM 2	51	20.19 ± 7.46	19.50	
	dif 5	51	-1.21 ± 3.07	-0.70	0.0019
Progressive Resistance Training					
	LPS3 1	51	27.02 ± 18.46	25.00	
	LPS3 2	51	51.45 ± 21.34	50.00	
	dif 6	51	24.43 ± 9.47	20.00	<0.0001
	PPS3 1	51	10.78 ± 7.90	8.00	
	PPS3 2	51	17.63 ± 11.32	15.00	
	dif 7	51	6.84 ± 4.37	6.00	<0.0001
	SR3 1	51	10.68 ± 7.33	8.00	
	SR3 2	51	17.11 ± 9.89	14.00	
	dif 8	51	6.43 ± 4.80	6.00	<0.0001
	LEMS3 1	51	5.05 ± 3.24	4.00	
	LEMS3 2	51	8.31 ± 3.72	8.00	
	dif 9	51	3.26 ± 2.00	3.00	<0.0001
	LCMS3 1	51	5.53 ± 2.69	5.00	
	LCMS3 2	51	8.92 ± 3.79	8.00	
	dif 10	51	3.39 ± 2.26	3.00	<0.0001
	GMS3 1	51	26.00 ± 18.54	20.00	
	GMS3 2	51	50.25 ± 22.56	45.00	
	dif 11	51	24.25 ± 10.51	20.00	<0.0001
	ABDS3 1	51	9.61 ± 3.84	10.00	
	ABDS3 2	51	19.43 ± 6.66	20.00	
	dif 12	51	9.82 ± 5.65	10.00	<0.0001

* *Wilcoxon* Test. Values expressed as mean, standard deviation, median and p-value. LUL: Left Upper Limb; RUL: Right Upper Limb; dif: Difference; LM: Lean Mass; FM: Fat Mass; LP: Leg Press; CP: Chest Press; SR: Seated Rowing; LEM: Leg Extension Machine; LCM: Leg Curl Machine; GMS3: Series 3 Twin; ABD: Abdominal; S3: Series 3; STST: Sit to Stand Test. 1: initial; 2: final; dif: difference.

It was observed that the hand grip strength obtained initial result of 28.85±10.11 kg, increasing to 32.41±10.69 kg at the end of the training ($p<0.0001$), on the left side. The sit-to-stand test evolved with values of 6.13±1.24 executions at the beginning which increased to 7.49±1.01 executions at the end of the training (p<0.0001). For lean mass, the results measured by the initial bioimpedance were 51.67±10.07 kg increasing to 52.57±10 kg at the end (p=0.0011). For fat mass, the results were initially 21.40±7.69 kg, with a decrease to 20.19±7.46 kg at the end (p=0.0019). Regarding the PRT, it was found that the initial value of the Leg Press was 27.02±18.46 kg increasing to 51.45±21.34 kg (p<0,0001). Chest Press started at 10.78±7.90 kg, evolving to 17.63±11.32 kg (p<0,0001). In the seated rowing, the outcome values were 10.68±7.33 kg, increasing to 17.11±9.89 kg (p<0.0001). The evolution of the Leg Extension Machine outcome went from 5.05±3.24 kg to 8.31±3.72 kg (p<0,0001). The Leg Curl Machine outcome evolved from 5.53±2.69 kg to 8.92±3.79 kg (p<0,0001). In the initial Twin, there was a change in the value from 26.00±18.54 kg to 50.25±22.56 kg (p<0,0001). In the Abdominal, an evolution of the initial values from 9.61±3.84 kg to 19.43±6.66 kg (p<0.0001) occurred (Table 1). Table 2 presents the results of the simple linear regression analyses for the Sit-to-Stand Test study, calculated by the difference between the initial and final values. It was observed that only the gender was significant (p=0.0378) to compose the multiple model and 8.50% of the variability of the Sit-to-Stand Test was accounted for by the female gender. In Table 3, it was found that none of the variables influenced the gain in lean mass.

Table 2. Analysis of the results of the simple linear regression for the study of the variation of the Sit-to-Stand Test

Partial R^2	Variable	Categories	*p*-value
0.0197	Age		0.3258
0.0001	BMI1		0.9389
0.0851	Gender	1=F x 0=M	0.0378
0.0075	Knee Pathologies	1=yes x 0=no	0.5456
0.0577	Lumbar Spine Pathologies	1=yes x 0=no	0.0896
0.0003	Shoulder Pathologies	1=yes x 0=no	0.9015
0.0270	Cardiac disorders	1=yes x 0=no	0.2489

R^2:- *determination coefficient*. partial R^2: proportion of response variability explained exclusively by the predictor in question. Response variable transformed into ranks due to absence of normal distribution.

Table 3. Analysis of simple linear regression results for the study of lean mass variation

Partial R^2	**Variable**	**Categories**	***p*-value**
0.0026	Age		0.7217
0.0694	BMI1		0.0618
0.0081	Gender	1=F x 0=M	0.5296
0.0001	Knee Pathologies	1=yes x 0=no	0.9390
0.0018	Lumbar Spine Pathologies	1=yes x 0=no	0.7692
0.0001	Shoulder Pathologies	1=yes x 0=no	0.9426
0.0004	Cardiac disorders	1=yes x 0=no	0.8855

R^2:- *determination coefficient*. Partial R^2: proportion of response variability explained exclusively by the predictor in question. Response variable transformed into ranks due to absence of normal distribution.

Thus, it can be deducted that the gain occurred through the PRT. Table 4 presents the results of the simple linear regression analysis for the PRT Leg Press and Twin variation study. In the case of the Leg Press, it was found that none of the variables studied influenced the training variation, and none of these variables were significant at the 5.00% level to compose the multiple model. Regarding the Twin analysis, only age was significant with 12.26% variability, with the largest variation related to younger age in PRT Twin (Table 4). Table 5 presents the results of the simple linear regression analyses for the study of the PRT Leg Extension Machine and Leg Curl Machine variation. Only gender was significant with 8.11% variability, and men showed the highest variation in PRT Leg Extension Machine. Regarding the Leg Curl Machine, it was observed that only the gender was significant with 8.73% of the variability, and men showed the highest variation in the PRT Leg Curl Machine. Table 6 presents the results of the single and multiple linear regression analyses for the study of PRT Chest Press and Seated Rowing variation. Age and gender explain 48.84% of the response variability, with the largest variation associated with younger age and male gender. In the simple analysis, the shoulder showed no results that could impact the multivariate analysis. Regarding PRT Seated Rowing, the variables age and gender together explain 25.17% of the response variability, with the largest variation associated with younger age and males. Table 6 also shows the results of the simple linear regression analysis for the Abdominal PRT variation study. Shoulder comorbidity was responsible for 11.52% of variability and was associated with Abdominal PRT.

Table 4. Analysis of simple linear regression results for the PRT study - Leg press and Twin variation

	Partial R^2	Variable	Categories	*p*-value
Leg Press	0.0629	Age		0.0758
	0.0005	BMI1		0.8792
	0.0311	Gender	1=F x 0=M	0.2157
	0.0579	Knee	1=yes x 0=no	0.0890
	0.0057	Lumbar Spine	1=yes x 0=no	0.5991
	0.0077	Shoulder	1=yes x 0=no	0.5407
	0.0154	Cardiac Disorders	1=yes x 0=no	0.3859
Twin	0.1226	Age		0.0118
	0.0010	BMI1		0.824
	0.0531	Gender	1=F x 0=M	0.1039
	0.00001	Knee	1=yes x 0=no	0.9794
	0.0005	Lumbar Spine	1=yes x 0=no	0.8821
	0.0548	Shoulder	1=yes x 0=no	0.0982
	0.0403	Cardiac Disorders	1=yes x 0=no	0.1579

Partial R^2: proportion of response variability explained exclusively by the predictor in question. Response variable transformed into ranks due to absence of normal distribution.

DISCUSSION

This study investigated prospectively the performance of resistance exercise in an adult and elderly population who underwent 30 sessions of PRT twice a week. In the studied population, there was an important and significant increase in hand grip strength and in the Sit-to-Stand test, in addition to lean mass gain and reduction of fat mass. These findings are in agreement with a few studies reported in the literature, showing similar results regarding the beneficial effects of resistance training (Vikberg, 2019; Papa, 2017; Bottaro, 2007; Candow, 2011). A recent study, developed by Vikberg *et al*, 2019, showed a significant improvement in the Sit-to-Stand test, lean mass gain and other beneficial outcomes using resistance training. Other significant effects of PRT in large muscle groups with similar series, repetitions, and periodicity equivalent to those of our study were reported by Papa *et al*, 2017. Another study (Bottaro, 2007) reported increased number of executions such as biceps flexion, increased muscle power and improvement in the Sit-to-Stand test for 30 seconds, with resistance exercise. PRT has also been shown to be sufficient to increase lean mass, muscle group size and lower and upper limb strength, in a study conducted by Candow *et al*, 2011 in a population of healthy older adults. The present study showed enhanced strength with PRT performance using the leg press, chest press and leg extension machine. Positive outcomes of PRT were also reported in a meta-analysis developed by Peterson *et al* (2011), describing a PRT positive effect on lean mass, upper and lower limb strength in Leg Press, Chest Press and Leg Extension Machines. Regression analysis showed that high training intensity was associated with increased muscle strength (Peterson, 2011). In a study of sarcopenia changes and related factors in the elderly (Lee, 2019), the authors showed that the decline in knee extensor muscle strength occurs prior to the knee flexor muscle's and that resistance exercise-induced hypertrophy is reduced in elderly people ≥75 years of age; when compared to the elderly between 65 and 74 years of age. The authors also reported that, in the case of hypertrophy and strength, it did not occur in the same way in the elderly aged ≥75 years, suggesting that resistance exercises increase muscle strength regardless of hypertrophy (Lee, 2019). In one study (Rolland, 2009) an increase in muscle mass after six to eight weeks of PRT was

Table 5. Analysis of simple linear regression results for the study of PRT variation – Leg Extension Machine and Leg Curl Machine

	Partial R^2	Variable	Categories	p-value
Leg Extension Machine	0.0299	Age		0.225
	0.0017	BMI1		0.7733
	0.0811	Gender	1=F x 0=M	0.0428
	0.0018	Knee	1=yes x 0=no	0.7661
	0.0448	Lumbar Spine	1=yes x 0=no	0.1359
	0.0643	Shoulder	1=yes x 0=no	0.0727
	0.0340	Cardiac Disorders	1=yes x 0=no	0.1953
Leg Curl Machine	0.0459	Age		0.1309
	0.0277	BMI1		0.2434
	0.0873	Gender	1=F x 0=M	0.0353
	0.004	Knee	1=yes x 0=no	0.6604
	0.0028	Lumbar Spine	1=yes x 0=no	0.7147
	0.0214	Shoulder	1=yes x 0=no	0.3051
	0.0002	Cardiac Disorders	1=yes x 0=no	0.9188

Partial R^2: proportion of response variability explained exclusively by the predictor in question.
Response variable transformed into ranks due to absence of normal distribution.

Table 6. Analysis of single and multiple linear regression results for the study of PRT variation - Seated Rowing, Chest and Abdominal Press

	Partial R^2	Variable	Categories	p-value	p-value
				Simple	Multiple
Seated Rowing *	0.1552	Age		0.0042	0.0038
	0.0126	BMI1		0.4320	
	0.1075	Gender	1=F x 0=M	0.0188	0.164
	0.0057	Knee	1=yes x 0=no	0.5985	
	0.0589	Lumbar Spine	1=yes x 0=no	0.0863	
	0.0675	Shoulder	1=yes x 0=no	0.0656	
	0.0069	Cardiac Disorders	1=yes x 0=no	0.5619	
Chest Press **	0.0633	Age		0.0749	0.0364
	0.004	BMI1		0.6603	
	0.0439	Gender	1=F x 0=M	<.0001	<0.0001
	0.0275	Knee	1=yes x 0=no	0.2451	
	0.0008	Lumbar Spine	1=yes x 0=no	0.8471	
	0.0764	Shoulder	1=yes x 0=no	0.0495	
	0.0059	Cardiac Disorders	1=yes x 0=no	0.5916	
Abdominal ***	0.0309	Age		0.2176	
	0.0015	BMI1		0.7862	
	0.0063	Gender	1=F x 0=M	0.5793	
	0.0362	Knee	1=yes x 0=no	0.1814	
	0.0124	Lumbar Spine	1=yes x 0=no	0.436	
	0.1152	Shoulder	1=yes x 0=no	0.0148	
	0.0001	Cardiac Disorders	1=yes x 0=no	0.9392	

* R^2 model = 0.2517: selected by the stepwise process. Partial R^2 = proportion of the variability of the answer explained exclusively by the predictor in question. R^2 model (coefficient of determination) = proportion of explanation of the dependent variable by the variation of the independent variables left in the model. Rank changed response due to absence of normal distribution.
** R^2 model = 0.4884: selected by the stepwise process. Partial R^2: proportion of the variability of the answer explained exclusively by the predictor in question R^2 model (coefficient of determination): proportion of explanation of the dependent variable by the variation of the independent variables left in the model. Rank changed response due to absence of normal distribution.
*** Partial R^2 = proportion of response variability explained exclusively by the predictor in question. Response variable transformed into rank (ranks) due to absence of normal distribution.

observed while muscle strength increased after a few days of training. Another study (Rabelo, 2011) with 24 weeks PRT, showed that strength gain was proportionally greater than muscle mass gain, suggesting a significant neural component in muscle strength gain. Resistance training for a period of 3 months was also sufficient to increase knee extension strength and lean mass (Peterson, 2010). These findings in the literature corroborate those of the present study, which also pointed to increased muscle mass, strength gain and increased lean mass after 15 weeks of PRT. Other studies published in recent literature have pointed out the relevance of PRT in increasing muscle strength, increasing balance time, improving the Sit-to-Stand test and gait speed, and decreasing sarcopenia (Cervantes, 2019). Another prospective study (Lee, 2019) has also suggested that sarcopenia can be reversed through an exercise program and increased muscle mass and gait speed. An investigation of the impact of PRT (Hassan, 2016) on the elderly, there was an increase in handgrip strength after the intervention and a reduction in BMI; a meta-analysis (Lai, 2018) suggested that PRT could be the first exercise recommended for older people to increase muscle strength and physical performance. The findings in this study led to the conclusion that after 30 sessions, PRT promoted lean mass gain, reduced fat mass, improved upper and lower limb muscle strength, improved functional capacity and handgrip strength. These findings reinforce the importance of maintaining physical exercises and therapeutic strategies in order to promote the improvement of physical function, reducing the risk of falls, hospitalization and consequently death of the elderly. The limitations of this study refer to the sample size, the difficult follow up of participants and the lack of a control group.

CONCLUSION

There was an improvement in lean mass gain, muscle strength and functional capacity. The findings in this study allowed us to point out the relevance of PRT as a therapeutic strategy to prevent, mitigate or reverse the deleterious effects of aging. This study showed the importance of PRT in promoting physical health.

Strong points and limitations of the study: Although the use of randomized controlled trials (RCTs) is often considered the “gold standard” in evaluating intervention programs, the greatest difficulty in using the RCT design in this investigation was the recruitment of participants who would have to be evaluated before and after 30 training sessions, twice a week. The design used responds not only to what participants achieve at the end of the intervention, but also how much they change during participation in the intervention. In some practical situations, the design of a single pre- and post-test group is an appropriate research design, providing interim insights into an intervention. As exploratory approaches, these studies can be a cost-effective way to discern whether a potential explanation deserves further investigation. Furthermore, it is simple to derive the results and can help readers better understand the survey results [41]. Despite these limitations, the present study has important implications on the role of progressive resistance training in adults over 50 years old, showing the importance of this training in promoting physical health.

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