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High-speed resistance training Vs Low-speed resistance Training on Functional Capacity and Muscle Performance Among Post Menopausal Women

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ABSTRACT
Objective: To examine the effects of 12 weeks of high-speed resistance training (RT) versus low-speed RT on muscle strength [one repetition of maximum leg-press (1RMLP) and bench-press (1RMBP), plus dominant (HGd) and non-dominant maximum isometric handgrip], power), ball throwing (BT) and, functional performance [8-foot up-and-go test (UG) and sit-to-stand test (STS)], and perceived quality of life in older women.
Methods: 90 older women were divided into a high-speed RT group [EG, n = 30], a low-speed RT group [SG, n = 30] and a control group [CG, n = 30]. The SG and EG were submitted to a similar 12-week RT program [3 sets of 10 reps at 40–75% of the one-repetition maximum (1 < RM) and BT] using slow, controlled (3 s) concentric muscle actions for the SG and using fast, explosive (< 1 s) concentric muscle actions for the EG (20% less work per exercise without BT).
Results: The dependent variable improved in both RT groups over the course of the 12-week training period in small to large clinically significant ways, however there was a significant difference between the EG and SG for the performance changes in BT and UG (28% vs 23%, 21%vs 13% p<0.01 respectively). for the CG, no notable alteration were noted.
Conclusion: While a high-speed RT program produces larger improvements in muscular power and functional task performance, both low-speed and high-speed RT therapies are successful in enhancing functional capacity, muscle performance and quality of life in older women.

KEY WORDS: Functional capacity, High speed resistance training, Low speed resistance training, Menopausal women

INTRODUCTION
The degree to which older subjects struggle with everyday tasks and age-related disabilities is correlated with their maximum strength. [1] However, muscle power may be more strongly linked to everyday living performance and life-threatening dangers, including falling, which are particularly high in women, than muscle strength [2]. The purpose of the study was to compare the effect of high resistance training Vs low speed resiatance training on finctional capacity and muscle performance among post menopausal women. particularly within this group. Furthermore, compared to muscle strength, muscle power decreases more quickly with age, and older women have lower levels of muscle power than older men.[3] These findings imply that therapies that affect muscle power should be taken into consideration, particularly for older women. It has been questioned how standard low-speed RT therapies affect muscular power, particularly for functional tasks[4]. Actually, it has been suggested that older persons should get resistance training (RT) programs that emphasize muscle power over peak strength. An intriguing strategy for helping older women build muscle power could be unconventional high-speed RT. But some research has raised concerns about how this training approach affects this age group's functional task performance, muscle strength, and power.[5] Additionally, while it is generally acknowledged that exercise improves quality of life for menopausal women, there is little data to draw firm conclusions. An improved understanding of the muscular, functional, and quality of life adaptations in older women exposed to various RT strategies is therefore required, as only a few researchers have compared the effects and efficiency of different RT strategies on these variables. Some have found similar results following low-speed vs. high-speed RT, while others have shown higher training-related

adaptations with high-speed RT. High-speed RT may be more effective than conventional low-speed RT in fostering notable improvements in muscle strength, functional ability, and quality of life, according to our hypothesis.

METHODS

Ninty elderly women of Hispanic heritage first met the requirements to be included in the study. We selected subjects with comparable levels of physical exercise.[6] Older women were satisfied the following requirements for inclusion: (a) self-reporting as healthy (i.e., having completed the updated physical activity readiness questionnaire for older adults), (b) not having a history of heart disease, osteoarthritis, severe visual impairment, neurological disorders, pulmonary conditions requiring oxygen, uncontrolled hypertension, hip fractures, or lower extremity joint replacement within the last six months, and (c) either currently participating in structured exercise or previously participating in RT within the last six months A doctor conducted a comprehensive screening of all applicants before to their inclusion in the trial, which included determining how many daily prescriptions the ladies were taking for EG, SG, and CG, respectively. Three groups were randomly selected from among the women: a speedy a low-speed resistance training groupA control group and a resistance training group collective. Participants had to finish all of the training sessions, familiarization sessions, and assessments in order to be included in the final analysis, which produced 60 older women. incorporated into the final analyses. In addition to daily duties, the EG and SG participated in a three-session weekly RT program over 12 weeks. The CG didn't engage in any particular kind of exercise. Before any tests were conducted, all subjects signed an informed permission form after being properly briefed about the experimental protocols, potential hazards, and advantages of taking part in the study. The ethics committee of the relevant department gave its approval for the study, which was carried out at Mahatma Gandhi Medical Hospital. The changes in peak muscular power performance in a group of older individuals who underwent the identical high-speed RT program used in this study were used to calculate the sample size. Eight individuals per group would result in a power of 80% and $\alpha = 0.05$, according to a statistical power analysis.

TESTING PROCEDURE

Both groups underwent all assessment procedures both prior to the experimental period (T1) and following a 12-week training period (T2).Prior to testing, the subjects underwent a 90-minute familiarization session to lessen the impact of any learning disparities. The uniform Two sessions, separated by 48 hours, were used to complete the exams. The examinations were carried out under supervision at the same time and place. both prior to and right after the 12-week intervention period, conducted by the same researchers. The subjects' body mass was measured on the first day.

standing height, resting heart rate, and quality of life during menopause as well as the sit-to-stand and functional 8-foot up-and-go tests. In The subjects were evaluated for maximum isometric in the second session. muscle power (maximum walking speed, vertical leap, and medicine ball throwing ability), handgrip strength, and maximum dynamic strength (maximum leg and bench press repetitions) Prior to this, every test was given in the same order and following exercise, while the subjects were dressed in sports attire. During performance evaluations, every individual was encouraged to put up their best effort.

ANTHROPOMETRIC

Cardiovascular and anthropometric measurements In accordance with worldwide anthropometric assessment standards, body mass (kg) and standing height (m) were measured . stadiometer/mechanical scale was used to measure height and body mass, with accuracy of 0.1 cm and 0.1 kg, respectively. Before any actual performance test, these factors were evaluated. The subjects wore light clothing during the test (shoes were taken off). A body mass index (BMI) in kilograms per square meter was computed. An accordance with a previously established practice for older women, the women were given ten minutes of calm repose in the supine position prior to taking two readings with an automatic heart rate measuring device, separated by one minute.

STRENGTH TESTS

Maximum leg-press and bench-press repetitions Using a previously established technique, each participant was assessed for maximal bilateral concentric one-repetition leg-press (1RMLP) and bench-press (1RMBP) . In short, the 1RMLP The machine and the subjects' shoulders were in contact. The initial angle of the knee was 100°. When instructed, the individual carried out a concentric extension of the leg muscles (knee, hip) as quickly as feasible and extensor muscles of the ankle) beginning in the flexed position, to arrive at the complete 180° extension against the resistance as established by the plates of weight. The bar was positioned 1 cm above the 1RMBP.

subject's chest and was held up by the measurement tool's bottom stops. The individual was told to execute a purely concentric action as quickly as possible from the beginning position. Five repeats at 40–60% of the perceived maximal load made up the warm-up. After that, four to five independent, one-off attempts were made until The subject couldn't reach her arms or legs to the necessary length. 1RM was found to be the final allowable extension with the maximum load.

MAXIMUM ISOMETRIC HANDGRIP

Maximum handgrip that is isometric An adjustable digital hand dynamometer was used to measure the maximum isometric strength of the forearm muscles (handgrip test) in both hands (based on a previously outlined technique. In short, women were told to make an effort to maximum grip when sitting upright on a chair, with the hip, knee, and elbow flexion at a 90° angle, the shoulder adducted and neutrally rotated, the forearm neutral, and the wrist slightly extended (0°—30°). Each hand's three grip-strength measurements were taken, and the best outcome is selected for examination.

POWER TEST

Throwing medicine balls A 2 kg medicine ball was used to measure ball throwing performance (BT) in accordance with earlier guidelines. In short, Women seated themselves in a chair with their backs against the chair back and used both hands to hold the ball in front of them, and then They were told to toss the medicine ball as quickly and far as they could. Three attempts with one-minute rest intervals were permitted in between every try. For following steps, just the best effort was used.

PRACTICAL DUTIES

UP-AND-GO TEST (UG)AT 8 FEET

The exam included walking 2.44 meters, getting out of a chair, and reversing direction and sitting down again. The test was given in accordance with the guidelines previously mentioned. [6]Test of sit-to-stand (STS). The exam required getting out of a chair and going back to the starting while seated, performing as many repetitions as you can in 30 seconds. The test was given in accordance with the guidelines previously mentioned.[7]

LIFE QUALITY

The Quality of Life Questionnaire tailored to menopause (MENQOL)

During a structured interview, participants fill out the MENQOL, using The questionnaire's Spanish translation was approved for use with Chilean women.[8] There are 29 questions in the MENQOL, broken down into four Vasomotor, psychological, physical, and sexual domains of well-being. question explores the intensity of a perceived symptom, quantified with an integer rating scale between 0 (no discomfort) and 6 (great discomfort). For scoring purposes, if the subject had no symptom for a question, her score was 1. If the subject had the symptom with a rating of 1, her score was 2 and so on, for a maximum score of 8 where subjects declared symptom with a rating of 6. The mean score for each area was used for analysis.

STASTISTICAL ANALYSIS

The mean plus standard deviation (SD) is used to report all values, 90% confidence limits (CL) are used to indicate the relative change (%) in the dependent variable and effect size (ESs). The shapiro - Wilk and Leuene's tests were used to verify the normality and homoscedasticity assumptions for all data prior to and follwing assumption for all data prior to and following the intervention, respectively. The two way ANOVA with repeated measurements (Groups × Time) was used to evaluate the training related effects.

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Table:1 12 weeks High speed resistance training protocol and traditional low- speed resistance training protocol.

Exercises	EG	SG
	Bench press Standing up row Leg press Leg extension	
stes×Reps	3×10	3×10
Intensity (% 1RM)	35-45	45
Eccentric velocity(S)	5	5
Concentric velocity (S)	2 or less	5
Rest between sets (Min)	2-3	3-5

To find the pairwise difference between the mean value. Tukey's post hoc Techniques were used when a significant F wave was obtained across time or between groups. Tukey's post hoc techniques were used to identify the pairwise differences between the mean values, and the a thershold was set at $P< 0.5$ for statistical significance attained throughout time or between groups. In addition of this null hypothesis testing these data were evaluated for clinical significance using a method based on the magnitudes of changes, with the a thershold set at $P\leq 0.05$ for stastical significance. Thershold settings fpor evaluating ES magnitudes (Changes expressed as a multiple or fraction of the baseline SD) For the various performance metrics, we found high intra- class correlation coefficient that ranged from 0.87 to 0.99.

No significant differences ($p >0.05$) were observed among the groups for the descriptive and dependent variables at baseline .
At baseline, there were no discernible differences ($p >0.05$) between the groups for either the dependent or descriptive variables. Between T1 and T2, neither group's height, body mass, or BMI changed significantly ($p >0.05$). Likewise, neither group's resting heart rate changed significantly ($p > 0.05$) between T1 and T2. The EG and SG both showed a clinically significant ($p < 0.05$) increase in 1RMBP (63%, 2.1 ES), 1RMLP (45%, 1.7 ES), HGd (13%, 0.9 ES), and HGnd (23%, 0.9 ES) in comparison to muscle performance from the pre- to post-training period (58%, 1.9 ES; 38%, 0.9 ES; 9%, 0.3 ES; 11%, 0.7 ES; respectively). However, Te no appreciable differences between the EG and SG in terms of performance changes in strength metrics. Both the EG and the SG (14%, 0.9 ES; 21%, 0.9 ES; respectively) demonstrated a clinically significant (p b 0.05) improvement in UG (−19%, −1.03ES) and STS (25%, 1.2 ES) performance in both functional tasks; the EG and SG's performance changes in UG and STS were significantly ($p <0.05$) higher than the CG. The EG achieved a significantly higher performance change in the UG test than the SG. For every metric, there were significant group × time interactions ($p <0.05$), and the EG significantly outperformed the SG in every testing performance parameter. For all RT groups, there were no discernible changes in the CG between T1 and T2 in terms of cardiovascular indicators, functional activities, or muscular performance ($p > 0.05$). Their psycho social (−39%, −1.3 ES) and physical (−29%, −1.1 ES) quality of life improved clinically significantly (p b 0.05) from T1 to T2, as did the SG (−36%, −0.7 ES; −32%, −0.8 ES; respectively). In contrast, the CG showed no clinically significant changes (Table 4). Table 4 shows that the EG's (but not the SG's) changes (%) in the psychosocial and physical subscales were substantially ($p< 0.05$) greater than the CG's. Regarding the changes (%) in quality of life, there were no discernible differences between the EG and SG. Psychosocial quality of life changes ($r = -0.49$, $p < 0.01$; $r = 0.37$, $p < 0.05$; $r = -0.39$, p b< 0.05; respectively) and physical quality of life changes ($r = 0.37$, $p < 0.05$) were shown to be significantly correlated with changes in performance on the HGnd, UG, and STS tests.

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Training effects for all outcomes

	T1 Mean ± SD	T2 Mean ± SD	Changes (%)
Body mass (Kg)			
EG (n= 30)	70.3±11.1	71.0 ±10.8	0.1
SG (n= 30)	69.8±12.9	68.3± 12.2	-2.1
CG (n= 30)	66.0± 7.8	66.2± 7.5	0.3
Height (Cm)			
EG (n= 30)	153.2±5.7	153.0±5.7	0.1
SG (n= 30)	154.1±6.1	154.3±6.1	0.1
CG (n= 30)	150.2±5.5	150.2±5.3	0.0
Body mass index (Kg/㎡)			
EG (n= 30)	37.1±6.1	37.3±6.2	0.5
SG (n= 30)	36.8±6.7	35.8±6.5	-2.7
CG (n= 30)	32.4±4.1	32.7±4.0	0.9
Resting HR (B /min)			
EG (n= 30)	70.6±9.8	70.0±9.3	-0.8
SG (n= 30)	78.1±11.3	78.0±10.1	-0.1
CG (n= 30)	79.3±11.2	79.2±10.3	-0.1
One rep max leg - press(Kg)			
EG (n= 30)	79.1±18.9	130.0±20.8	64.3
SG (n= 30)	84.4±25.6	133.1±23.7	57.7
CG (n= 30)	82.8±24.9	100.7±20.0	21.4
One rep max bench-press(Kg)			
EG (n= 30)	19.8±6.9	25.3±6.8	27.7
SG (n= 30)	21.4±6.5	28.7±6.8	34.1
CG (n= 30)	20.1±5.2	20.3±5.1	-0.4
Dominant max isometric hand grip (Kg)			
EG (n= 30)	27.7±8.1	29.3±8.2	5.7
SG (n= 30)	28.3±8.2	31.0±8.1	9.5
CG (n= 30)	26.9±7.2	25.6±7.0	-4.8
Non-Dominant max isometric hand grip (Kg)			
EG (n= 30)	25.3±7.1	27.5±7.1	8.6
SG (n= 30)	27.2±7.3	29.6±7.2	8.8
CG (n= 30)	23.8±5.1	23.6±5.0	-0.8
Ball throwing (cm)			
EG (n= 30)	2.8±0.6	3.2±0.7	14.2
SG (n= 30)	2.9±0.2	3.1±0.3	6.8

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CG (n= 30)	2.9±0.6	2.9±0.2	0.0
8-foot-up and go test (S)			
EG (n= 30)	8.1±2.7	37.4±1.8	-8.6
SG (n= 30)	8.3±2.6	7.9±1.9	-4.8
CG (n= 30)	8.3±2.7	8.54±1.8	1.2
Sit to stand test (rep)			
EG (n= 30)	15.3±4.1	18.2±4.9	18.9
SG (n= 30)	15.0±5.3	17.9±4.8	19.3
CG (n= 30)	15.0±2.1	15.1±2.2	0.6

DISCUSSION

This study compared the benefits of a 12-week high-speed RT program with a low-speed traditional RT program on older women's muscle strength, power, and quality as well as their capacity to carry out functional tasks. In addition to clinically significant improvements in the psychosocial and physical quality of life, this study showed that 12 weeks of high-speed and low-speed RT produced significant and small-to-large improvements in 1RMLP, 1RMBP, HGd, HGnd, BT,walking test time, UG functional test, and STS performances. In contrast to the conventional low speed RT protocol, the high-speed RT program produced noticeably greater changes in BT and UG functional test performance. These findings are distinct and offer intriguing evidence that a high-speed RT enhances older women's muscular power and functional task performance. While the CG did not alter their performance in these strength measures, the EG and SG demonstrated comparable clinically significant improvements in 1RMBP (63%.2.1 ES; 58%, 1.9 ES; respectively), 1RMLP (45%, 1.7 ES; 29%, 0.8 ES; respectively), HGd (9%, 0.4 ES; 9%, 0.3 ES; respectively), and HGnd (23%, 0.9 ES; 14%, 0.6 ES;respectively). Our findings show that both high-speed and low-speed RT had a comparable beneficial impact on older women's maximal upper- and lower-body muscle strength.The difficulty older subjects have performing activities of daily living and their quality of life can be linked to maximal strength measures; this finding supports our findings that there is a connection between maximal strength and psychosocial quality of life. Furthermore, maximal strength may be a good indicator of old age disability and all-cause mortality). Maximal strength measurements, particularly handgrip strength, are reasonably simple to perform, making them a useful tool for prediction in the senior population. This study was smaller after RT using an intervention of similar duration. However, this discrepancy in training effect can be attributed to the training specificity, as the previous studies mentioned above used similar exercises as a training strategy. Although, the EG achieves a training effect similar to that observed previously in 60–70 y older women and sex-mixed groups submitted to explosive strength training. EG only showed a noticeably greater improvement in BT performance (28%, 1.4ES; SG: 14%, 0.9 ES), which is comparable to earlier findings for older women who underwent high-speed.

These findings imply that high-speed RT might have a greater muscle power training impact for the upper- and lower-body muscles than conventional low-speed RT.[9]

In older women, training for muscle power with a highspeed RT program may be a more effective way to improve functional performance in daily tasks because muscle power is more closely linked to the performance of activities of daily living than muscle strength.[10] Although the performance change in the EG was considerably ($p < 0.05$) higher. Both the EG (−17%, −0.5ES) and the SG (−9%, −0.5 ES) achieve a significant performance boost in Walking is a vital component of daily life, and even a 0.1 m/s performance boost may be linked to an improvement in older persons' longevity, particularly for women. Elderly women may find it easier to complete this functional task with RT, which could lead to better walking habits, better health, and increased enjoyment of everyday activities.[11] Indeed, we saw a considerable improvement in RT women's physical and psychological well-being. Additionally, we find a significant association ($r = 0.37$, $P < 0.05$) between the change in physical quality of life and the change in sit to stand test performance. According to this finding, high-speed RT is a better training method for improving a basic functional task that could be linked to an improvement in important facets of quality of life. Walking performance improvements can be sustained for extended periods of time.[12] The benefits of RT, particularly high-speed RT, can be sustained for extended periods of detraining even if RT is stopped. This is particularly crucial for older women who are enrolled in training programs that are interrupted for a while (due to illness or the summer).[13] The EG and SG both experienced significant reductions in UG test time

(−19%, −1.3 ES, and −14%, −0.9 ES, respectively); however, the EG's performance change was significantly higher, comparable to that previously documented for older adults who were subjected to high-speed and traditional low-speed RT, respectively.[14] This suggests that high-speed RT might be a better RT strategy to improve functional performance in older women. The EG and SG both have comparable gains at maximum strength, but superior Performance in both lower-body and upper-body muscle power was attained in the EG. These findings may help explain the larger UG test performance decrease seen in the EG since muscle power is more directly linked to functional task performance and fall risk in older women than maximum strength. The elderly's quality of life may be negatively impacted by aging-associated neuro muscular wasting, which might be linked to difficulty getting out of a chair. Both the EG and the SG experience a significant and comparable performance change in the STS test, which evaluates the functional state of older women (25%, 1.2 ES respectively). Neuromuscular and morphological alterations brought on by ST in the lower limbs may be linked to variations in older women's performance on the STS test. Indeed, both high-speed and low-speed RT regimens have the potential to significantly enhance lower limb neuromuscular and morphological adaptations.[15]

Although only muscle power is independently correlated with the ability to repeatedly stand and sit in a chair, changes in muscle strength and power may help explain the performance increase seen in both RT groups. This suggests that muscle power is more crucial for the functional tasks older women perform on a daily basis. This is consistent with our findings, which show that only the EG significantly ($p > 0.05$) improves performance in the STS test when compared to the CG. Additionally, the clinical significance analysis used to determine the magnitudes of ES shows that the EG has a moderate clinical significance and the SG has a small significance. With the benefit of highspeed RT producing higher clinically relevant results, our results may thus support the idea that RT can be helpful in reversing the neural and morphological aging-associated wasting processes and that it can significantly increase an important daily living functional performance task, like sitting and getting out of a chair, in older women, assisting them in becoming more independent. The lack of further physiological data to better understand the underlying mechanism of training-induced adaptations to both high-speed RT and low-speed RT was one potential drawback of the current study.

CONCLUSION

While a high-speed RT program produces larger improvements in muscular power and functional task performance, both low-speed and high-speed RT therapies are successful in enhancing functional capacity, muscle performance, and quality of life in older women.A high-speed RT intervention is a safe, effective, and efficient way to improve older women's quality of life while also producing notable and clinically important improvements in their neuromuscular and functional task performance related to everyday activities. When creating suitable RT programs for senior citizens, these findings should be taken into account. A conflict of interest There are no conflicts of interest for the writers.

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