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Effect of Combined Exercises on Gait and Physical Function in Sarcopenic Elderly Patients

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ABSTRACT

Background: A gradual, widespread skeletal muscle disease called sarcopenia is typified by a decrease in muscular mass and strength. It is linked to more negative outcomes, such as falls, fractures, physical impairment, and death, especially in older people.

Objective: To determine the effect of combined exercises on gait and physical function in sarcopenic elderly patients.

Patient and Methods: A total 50 sarcopenic elderly women participated in this study their ages ranged from (65:75 years) were chosen from Agouza Police Hospital and outpatient clinic, they were referred by the physician. They were randomly assigned into 2 equal groups. Study Group (A): included 25 patients (Women) who received combined (Resisted, aerobic and balance exercise) for successive 12 weeks, 2 times per week, 55 minutes for each session. Control group (B): included 25 (Women) who received (Resisted exercise for successive 12 weeks, 2 times per week, 20 minutes for each session). The SARC-F questionnaire was used to assess the physical function of the patients in form of (strength, assistance, rise from a chair, climb stairs and falls), while the ability of the patients to modify gait in response to changing task demands was assessed by Dynamic gait index (DGI) before and after the intervention.

Results: Post 12weeks of intervention, the study group had a sig. lowering in SARC-F score by 1.96±1.2 points contrasted to the control group 3.32±0.98 points ($P<0.05$). The DGI was significantly increased by 20.9±1.8 points in the study group contrasted to 18.4±1.8 in the control group ($P<0.05$).

Conclusion: In older adults with sarcopenia, the combined exercise had the upper hand in improving gait, balance, and physical function more than the resistance exercise alone.

Keywords: Sarcopenia, Combined Exercise, Risk of falling, Balance Exercise, Geriatric.

INTRODUCTION

A condition known as sarcopenia is characterized by a loss in skeletal muscle mass as people get elderly [(1)]. One of the most significant health issues affecting the age is sarcopenia, which has a high likelihood of negative consequences. The frequency of sarcopenia worldwide has been the subject of several researches, although the findings have been incontrast [(2)].

Since age-related muscle loss is seen to be a natural aspect of aging, it is frequently identified later [(3)]. For younger persons, the prevalence of sarcopenia was shown to range from 8%-36%, and for elderly, it varied from 10%-27%, depending on the diagnosis [(4)].

Sarcopenia is caused by a complex pathophysiological process that includes inflammation, hormone dysregulation poor diet, reduced physical activity, hereditary factors, and lowering of vitamin D level[(5)].

People aging by producing more catabolic factors like myostatin (MSTN) and cortisol (Cort) and anabolic factors like insulin-like growth factor-1 (IGF-1), folistatin (Fstn), and growth hormone (GH). This disrupts the muscles' homeostasis and results in a number of diseases, including persistent inflammation and the gradual loss of muscle mass and function [(6)].

The risks of hospitalization, falls, accidents, reduced daily functioning, and death are all increased by sarcopenia [(7)]. One of the main causes of death for elderly is falling. Falls were more common among older adults with sarcopenia, according to many investigations [(8)].

There are currently no pharmacological treatments for sarcopenia up to the present time. [(9)].

Significant physiological and health advantages were obtained from exercise, which also prevent or postponed the onset of sarcopenia [(10)]. In order to resist age-related sarcopenia, researchers have shown that physical exercise has a favorable influence on improving body composition, muscular strength, and physical performance [(11)].

Since exercise greatly increases strength, mass, and balance, there is compelling evidence to support it as the main therapy for sarcopenia [(12)].

Although a number of resistance, aerobic, balance, and combination exercise programs have been proposed, it is still unclear which one would be most effective [(13)].

The WHO and the American College of Sports Medicine advise older adults to engage in resistance training two to three times a week in addition to one hundred and fifty minutes of moderate-intensity aerobic exercise or seventy-five minutes of high-intensity aerobic activity each week [(10)].

So, it is conceivable to speculate that various forms of training, such as aerobic, resistance, or a mix of both, might enhance older adults' physical function and gait balance. Thus, this investigation aims to determine the effect of combined training on gait balance and physical function.

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MATERIALS AND METHODS

The investigation was designed as randomized control trial. It was conducted in the outpatient clinic of Agouza Police Hospital. The patients were referred by the physician. They were randomly assigned into 2 groups (A, B). Group A (study group) included 25 patients (women) who received combination of (Resisted exercise, aerobic exercise and balance exercise) for successive 12 weeks, 2 times per week, 55minutes for each session, Group B (control group) included 25 women who received resisted exercise only for successive 12 weeks, 2 times per week, 20 minutes for each session. All patients within the two groups were assessed by SARC-F questionnaire and Dynamic gait index (DGI) before and after 12 weeks of the intervention.

Inclusion criteria: 50 sarcopenic elderly women their age ranged from 65 to 75 years, and their BMI ranged from 27 to 35 kg/m^2. The DGI score was from 12 to 19**,** and the SARC-F Questioner score was from 4 to 6.

Exclusion criteria: Orthopedic or surgical problems influencing gait, amputation of lower extremities, Uncontrolled Diabetes, Uncontrolled Hypertension, Any diseases affected muscles, Dementia, Unable to cooperate, understand and/or complete the questionnaires, Major surgery less than 3 months.

Evaluating procedure:

All the following evaluations have been done for all patients enrolled in the study and including: name, age, sex, history and history of falling were recorded in the recording data sheet.

METHODS

Evaluating procedures:

Every patient who took part in the trial had their name, age, height, weight, and BMI documented on a recording data sheet. In order to identify any other pathological diseases that could have an impact on the study, a thorough history was taken.

SARC-F questionnaire:

It was used to examine the strength, help in walking, standing from a chair, ascending stairs, and falling. All patients were obliged to answer the scale's questions during a personal interview, after which the therapist calculated their overall score.

The SARC-F questionnaire is a five-items that asked about strength (how difficult is it for you to lift or carry ten pounds?). Assistance with walking (how hard is it for you to walk across a room?). Rise from a chair (how difficult is it for you to transfer from a chair or a bed?) Climb stairs (how hard do you find ascending a flight of ten stairs?) and Falls (how many times have you fallen in the last year? Every item has a score of zero if the answer is "none," one if it is "some" (with the exception of the fifth one, which is worth one point if the patient has fallen one to three times), and two if it is "a lot" or "unable" (with the exception of the fifth one, which is worth two points if the patient has fallen four or more times in the previous year). Four is the cut-off mark for sarcopenia prediction; a higher score indicates a higher chance of sarcopenia [(14)].

Dynamic gait index:

It was used to measure falling and evaluate movements with gait tasks. Before the therapist determined each patient's overall score, each patient had to complete the scale's activities during a face-to-face interview.

The DGI has features including walking with turns, standing up, and navigating through and around obstacles while changing speeds and rotating the head[(15)].

The DGI is an outcome measure consisting of eight items that evaluate gait, functional mobility, and balance. Every DGI item has a 4-point rating system. No gait dysfunction is indicated by a score of 3, minimum dysfunction is shown by a score of 2, moderate dysfunction is indicated by a score of 1, and severe dysfunction is indicated by a score of 0. The exam takes around ten minutes to conduct, and the maximum score is twenty-four [(16)].

Older adults who scored 19/24 are at danger of falling, but those who scored >22/24 are regarded as safe ambulators [(17)].

The eight abilities evaluated include walking steadily, walking while altering gait speed, walking while shifting weight both vertically and horizontally, walking over and around obstacles, walking while turning for length, and ascending stairs [(18)].

Intervention procedure:

Resisted exercises for group A and group B [(19)]**:**

Every patient in both groups received 20 minutes of resistance trainingusing the Delorm Technique, which increased the load used during the exercise by utilizing percentages of an individual's one-repetition maximum (1RM) which is the maximum weight they can lift for one repetition of a particular exercise. The patients warmed up by performing at an intensity of 50% of 1 RM, then the resisted training, the 1st set was started at 85% of 1RM (6 repetitions), then the 2nd set was performed at 90% of 1 RM (3 - 4 repetitions), and the 3rd set was variad from 95 of 1RM (2 - 3 repetitions), to and reached 100 1RM.

Balance for group A (Study Group) [(19)]**:**

The patient started each session with a quick 5-minute warm-up, 20 minutes of focused balance training, and a 5-minute cool-down that included stretching. The balancing exercises comprised: Weeks 1–3 involved heel and toe lift and static balancing; weeks 4–6 had variable directional rapid stepping; weeks 5–6 involved reaching; and weeks 10–12 involved intricate cross-over stepping exercises and heel-to-toe walking from week 7 to 9.

Aerobic exercises for group A (study Group) [(20)]**:**

The mode of aerobic training in form of

walking, included a 3-5min. warm up and 3-5min. cool down, intensity increased gradually from 75% to 80% of maximum heart rate and the duration of exercise lasted for 15min.

Ethical approval:

This study was authorized by Cairo University's Faculty of Physical Therapy Research Ethical Committee (P.T.REC/012/003899). Each patient was given a thorough explanation of the goals and procedures of the study before filling out an informed permission form. The study adhered to the Helsinki Declaration throughout its execution.

Statistical analysis

To perform all statistical analyses, SPSS software version 22 was utilized. An unpaired Mean ($\bar{X}$) ± SD and t-test was used to compare the characteristics differences of the two groups, such as age and BMI. The variables were then compared between groups using MANOVA. For every statistical test, the significance threshold was set at $P < 0.05$.

RESULTS

Fifty participants in total were distributed into 2 equal groups at random, with 25 patients in every group. There wasn't sig. diff. in the participants' characteristics, including age or BMI ($p > 0.05$) (Table **1**).

Table (1): Comparison of characteristics between groups A and B.

	Group A (Study) (n:25)	**Group B (Control) (n:25)**	**t-value**	**p-value**
	$\bar{X}$ ± SD	**$\bar{X}$ ± SD**		
Age (years)	67.04±2.5	66.9±2.5	0.167	0.868
BMI (kg/m²)	31.1±3.3	31±2.7	0.094	0.926

The outcomes indicated that the DGI was significantly increased in both groups. Furthermore, before the intervention, there were no discernible differences between the two groups (P-values were 0.825) but after intervention, there was a sig. diff. ($P<0.05$). Group A revealed an elevated percentage of alteration (33.1%) compared with the group B (17.9%) (Table **2**). However, the results suggested that the SARC-F score was significantly decreased in both groups. Moreover, before the intervention, there were no discernible differences between the two groups (P-values were 0.332) but after intervention, there was a significant variation ($P<0.05$). Group A revealed a higher percentage of reduction (60.5%) than the group B (29.7%) (Table **2**).

Table (2): Comparison between groups A and B regarding DGI and SARC-F score.

		Group A (Study) (n:25)	**Group B (Control) (n:25)**	**Comparison between groups**	
		$\bar{X}$ ± SD	**$\bar{X}$ ± SD**	**F-value**	**P-value**
DGI	**Pre-intervention**	15.7±1.8	15.6±2	0.049	0.825
	Post-intervention	20.9±1.8	18.4±1.8	24.140	P<0.05*
	Comparison within group	P<0.05*	P<0.05*		
	Percentage of change (%)	33.1%	17.9%		
MANOVA overall main effect					
		P-value		Significance	
Group effect		0.014		S	
Time effect		P<0.05		S	
Interaction effect (group x time)		P<0.05		S	
SARC-F score	**Pre-intervention**	4.96±0.89	4.72±0.84	0.960	0.332
	Post-intervention	1.96±1.2	3.32±0.98	17.785	P<0.05*
	Comparison within group	P<0.05*	P<0.05*		
	Percentage of change (%)	60.5%	29.7%		
MANOVA overall main effect					
		P-value		Significance	
Group effect		0.046		S	
Time effect		P<0.05*		S	
Interaction effect (group x time)		P<0.05*		S	

*: significance

DISCUSSION

This study conducted to show the effect of combined exercise on gait and physical function in sarcopenic elderly women patients.

This study provides robust evidence supporting the efficacy of combined exercise (aerobic, resistance, balance) and resisted exercise alone in sarcopenic elderly women patients and enhancing their balance and decrease recurrent falling.

The results in the study group (A) showed a significant increase in (DGI) with percentage of changes (33.1%), and a significant decrease in SARC-F with percentage of reduction was (29.7%).

Graungaard *et al.* [20] who concluded that combined exercise (balance and strength) for elderly for twelve weeks of 3 weekly private workouts at home were associated with a 22% reduction in SARC-F–identified sarcopenia risk, reflecting improved self-perceived functional health.

Agreed with **Pedersen *et al.* [21]** who showed effects of a twelve-week combination of resistance and balance training on older adults' gait and physical function, 44 out of 68 participants (64.7%) demonstrated a clinically meaningful improvement of ≥3 points in their DGI) scores. There were notable associations found between DGI scores and both relative and allometric muscular power.

In contrast with **Keogh *et al.* [22]** who used significant baseline relationships were found between SARC-F total scores and lower-body muscular function in elderly who received progressive resistance and balancing training ($r=-0.62$ to0.57; $p\leq0.002$), confirming its validity as a functional screening tool. Three dimensions—walking ability/falls, vertical mobility, and overall sarcopenia diagnosis—accounted for 48.5% of the variation, according to MCA. Improvements in walking speed and chair stand ability brought about by training were substantially linked to changes in SARC-F scores, even though 56.5–79.2% of participants did not exhibit any change in SARC-F diagnosis or item scores after the intervention. These findings demonstrate that SARC-F is still responsive to functional improvements after exercise programs, even if it may not be as good at identifying diagnostic alterations.

The results in the control group (B) showed a significant increase in (DGI) with percentage of changes (17.9%), and a significant decrease in SARC-F with percentage of reduction was (60.5%).

This is in line with the findings of **Kwak *et al.* [23]** who found that doing weight training for the lower limb for 12 weeks targeting the older adult can show a significant increase in DGI with 3.6 points from pre 16.07 point to post 19.67 points.

In contrast to **Hassan *et al.*[24]** who observed most participants said that neither their overall SARC-F diagnosis (79.2%) nor their individual SARC-F item scores (56.5–78.0%) had changed.

In contrast, **Kipp *et al.* [25]** found that resistance training may help preserve sarcopenia-related QoL, while no significant differences were observed in SARC-F scores between groups ($p = 0.16$).

In Consistent with **Padte *et al.* [26]** who studied the effect of resisted exercise vs. functional task exercises on the gait and physical function on elderly patients, and found that the FTE leading to greater improvements in gait performance compared to resisted exercises alone. Group B showed significantly better outcomes in step length, stride length, and step width ($p<0.05$), along with a meaningful improvement in DGI scores ($p = 0.0265$). These findings suggest that FTE is more effective than resisted exercises in enhancing dynamic balance and spatial gait parameters in elderly.

LIMITATIONS

First, it is important to take into account the participant's past physical activity. Second, individuals' psychological characteristics have to be assessed. Additionally, the limited age range also was a limitation for this study.

CONCLUSION

Combined exercise (aerobic, strength, and resistance exercises) and resistance exercise alone can significantly improve balance, gait, and physical function in older adults. Nonetheless, our study's results showed that combination exercise was more effective than resistance training by itself.

Conflict of interest: None.
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