Functional Tasks Exercise Versus Resistance Exercise to Improve Daily Function in Older Women: A Feasibility Study

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ABSTRACT. de Vreede PL, Samson MM, van Meeteren NL, van der Bom JG, Duursma SA, Verhaar HJ. Functional tasks exercise versus resistance exercise to improve daily function in older women: a feasibility study. Arch Phys Med Rehabil 2004;85:1952-61.

Objective: To evaluate the feasibility of a new functional tasks exercise program, designed to improve functional performance of community-dwelling older women, by comparing it with a resistance exercise program.

Design: A 12-week, randomized, single-blind pilot study.

Setting: A community leisure center.

Participants: Twenty-four community-dwelling, medically stable women (mean age, 74.6±4.8y) were randomized to the functional tasks exercises (function group) or the resistance exercises (resistance group). Three participants withdrew from the study.

Interventions: Exercises were given 3 times weekly for 12 weeks. The functional tasks exercise program aimed to improve daily tasks in the domains first affected in older adults, whereas the resistance exercise program focused on strengthening the muscle groups that are important for functional performance.

Main Outcome Measures: Participant satisfaction with the exercises, Assessment of Daily Activity Performance (ADAP), and, as a secondary outcome, muscle strength and power.

Results: Exercise adherence was 81% in the function group and 90% in the resistance group. Participants reported greater satisfaction with the resistance exercises than with the functional exercises. The ADAP total score improved with time ($P=.001$; mean change function group, 7.5U; 95% confidence interval [CI], 2.1–12.8; resistance group, 2.8U, 95% CI, −0.4 to 5.9), as did isometric knee extensor strength ($P=.001$; mean change function group, 6.4%; 95% CI, −1.6 to 14.5; resistance group, 14.4%; 95% CI, 6.4–22.2). Testing for differences in outcomes between the 2 groups showed no statistically significant differences.

Conclusions: The functional tasks exercise program is feasible and shows promise of being more effective for functional performance than a resistance exercise program. A randomized controlled trial with a larger sample size is needed to test the difference between the 2 programs.

Key Words: Elderly; Exercise; Muscles; Rehabilitation.

AGING IS STRONGLY ASSOCIATED with impaired mobility and decreased physical functional performance.[1,2] As a consequence, there is a loss of independence and quality of life, and the risk of falls and fractures increases.[3,4] Approximately 20% of people between 65 and 75 years of age need assistance performing activities of daily living (ADLs), and this increases to 48% in people older than 85.[5] Climbing stairs, shopping, rising out of a chair or bed, house cleaning, and washing and dressing oneself are the first ADLs to be affected.[5] The decline in functional task performance is partly caused by the aging process and is accelerated by a sedentary lifestyle. Although aging is an irreversible process, the effects of decreased physical activity can be reversed in most people.[1]

Many studies[3,6-8] have shown that regular exercise is beneficial to basic physical function in older adults, increasing muscle strength, balance, endurance, and flexibility. However, the effects of exercise programs on the performance of daily tasks have not been proven indisputably.[9-12] This may be because most exercise interventions aim to enhance performance of functional tasks by improving just 1 basic physical function, mostly muscle strength, flexibility, or balance. The performance of functional tasks, however, is more complex and involves an interplay of cognitive, perceptual, and motor functions and is closely linked to the individual's dynamic environment.[13] That is, increasing muscle strength to improve the performance of complex activities violates the principles of training specificity, one of the most important principles for exercise training.[14] Training specificity implies that the performance of any given activity is maximized by training in that given activity.[14,15] Thus, to elicit the greatest effect, exercise training should simulate, as closely as possible, the conditions of daily tasks. Further, the exercises should be feasible, in terms of participant acceptance, drop-out, and side effects. The primary aim of the present pilot study was to evaluate the feasibility and the ability to affect physical functional performance of our functional tasks exercise program compared with a resistance exercise program. Feasibility was determined by information on participant satisfaction, drop-out, and attendance, as well as occurrence of adverse events. Physical functional performance was measured with the Assessment of Daily Activity Performance (ADAP), a method of assessing physical function that was patterned after the Continuous-Scale Physical Functional Performance (CS-PFP) test.[16]

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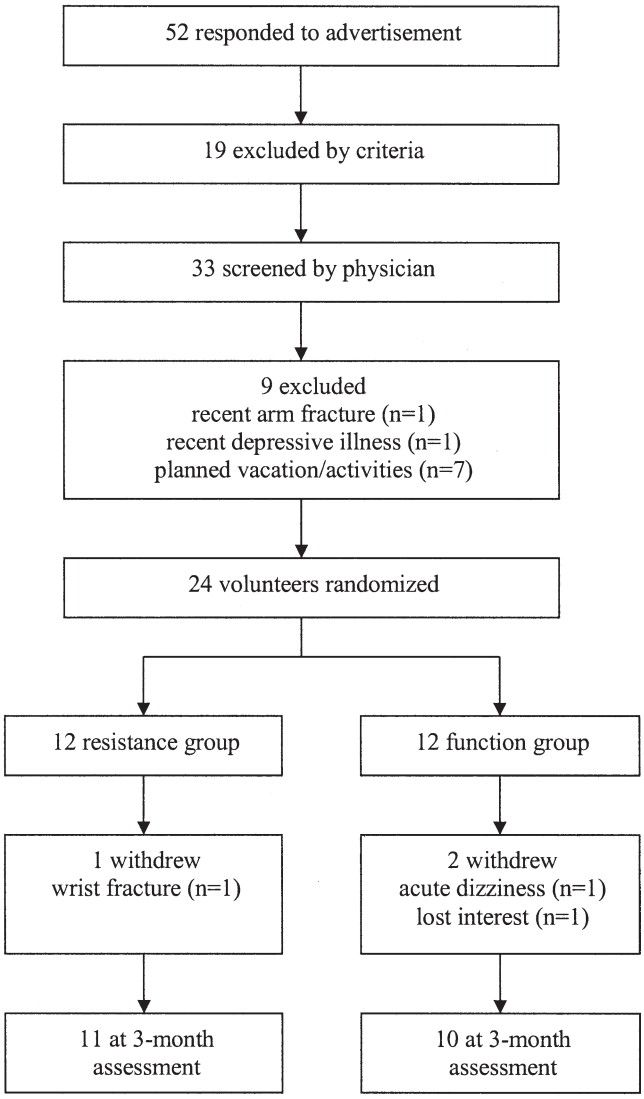

Fig 1. Trial profile.

METHODS

Design

This study is a single-blind, randomized pilot trial and was approved by the Medical Ethics Board of the University Medical Center Utrecht, the Netherlands. Exercise sessions were held at a local leisure center in the Utrecht region from September 2000 to December 2000, and assessments were performed at the Mobility Laboratory of the Department of Geriatric Medicine at the University Medical Center Utrecht. Written informed consent was obtained from all participants after they had read the information brochure on the study.

Study Population

Twenty-four community-dwelling women older than 70 years were recruited through local newspapers from the Utrecht region. Figure 1 shows the flow of participants through the trial. Participants had to be medically stable, as assessed by a validated questionnaire for participation in an exercise program for older adults.[17] A physician screened potential participants by using their medical history and a physical examination. Exclusion criteria included recent fractures, unstable cardiovascular or metabolic diseases, severe airflow obstruction, recent depression or emotional distress, or any reason for a loss of mobility for more than 1 week in the previous 2 months. Participants exercising at a sports club 3 times a week or more were also excluded. After inclusion, participants were randomly assigned to either the functional tasks exercise program (function group) or the resistance exercise program (resistance group).

Interventions

Both exercise interventions were given 3 times weekly in 1-hour sessions for 12 weeks, with sessions separated by a day of rest. Group size varied from 8 to 11 participants for the functional tasks exercise program and from 9 to 12 participants for the resistance exercise program per session. Training sessions were supervised by at least 2 experienced instructors (a physical therapist, a human movement therapist, or a physical education teacher). A physician visited the exercise location regularly, and, if necessary, answered health-related questions.

During exercises, participants of both programs recorded their exercise performances in a personal file, to provide both themselves and their instructors with feedback about their progress. Sessions were divided into a 10-minute warm-up period consisting of aerobic exercises, a 40-minute period of core exercises, and a 10-minute cool-down period consisting of flexibility exercises for limbs and trunk. The core exercises were specific to the group assignment; all other components of the intervention were consistent across groups. The warm-up and cool-down periods were group activities and accompanied by music. The core exercises of both programs were performed in training pairs (dyad training),[18] with an emphasis on interaction and enjoyment. Training partners took turns observing and doing the exercises (dyad-alternate). Exercise intensity in both programs was set at 6 to 8 on a 10-point rating of perceived exertion (RPE) scale (1, very, very light; 10, very, very hard).[19] Several studies[19,20] have shown that these RPE scales can validly provide information about the intensity of resistance exercise. Further, use of the RPE correlates with blood lactate, heart rate, pulmonary ventilation, and oxygen consumption responses to exercise.[21] If an exercise was rated only "somewhat hard," participants in the function group were instructed to increase the weight carried, the number of repetitions, or the distance traveled. Additionally, resistance could also be increased by putting on a weighted vest (1–10kg) during the tasks. The participants in the resistance group were instructed to increase the load if an exercise was rated only "somewhat hard."

Functional Tasks Exercise Program

Appendix 1 gives an overview of the exercises of the functional tasks exercise program (FUNTEX) program. The aim of the 40-minute core exercises was to improve daily tasks in the domains first affected in older adults,[5] namely, moving with a vertical component, moving with a horizontal component, transporting an object, and changing between the lying-sitting-standing position. During each exercise class, participants performed tasks for at least 2 of these domains in 3 sessions of 5 to 10 repetitions. The 12-week program was divided into a practice phase (2wk), a variation phase (4wk), and a daily tasks phase (6wk).

Exercises in the practice phase consisted of short, simple tasks. Weight transported and repetitions were noted. In the variation phase, participants applied these basic tasks to vari-

ous training conditions, such as environment, attributes, and interaction between participants. Trainers registered the time it took to complete a task in this phase. Participants were encouraged to perform the tasks as quickly as possible and to increase the weight carried, the number of repetitions, and the distance walked. The daily tasks phase consisted of a combination of the 5 domains, in order to make the tasks as similar to daily tasks as possible. Once more, time, weight, distance traveled, and number of repetitions were noted.

During each phase, the instructors could complicate or simplify motor, environment, and cognitive aspects of the tasks in correspondence to the capability of each participant. Each aspect could be changed in a stable or a variable way. For instance, during the task "rise from a chair, step onto a raised platform (20cm), and take different objects from a high shelf" from the daily tasks phase, the motor aspects could be altered by collecting more objects (stable) or transporting the objects in different manners (variable). The environment could be adapted by changing the height of the raised platform (stable) or by letting 2 participants of different training pairs step together onto the raised platform (variable). The cognitive aspects could be altered by collecting the objects in a certain sequence (eg, by color) (stable) or letting 2 participants collect the objects in a certain combination (eg, if 1 person takes a green object, the next person has to collect a red object) (variable). Detailed description of the exercises can be obtained from the authors.

Resistance Exercise Program

The 40-minute core resistance exercises were designed according to the American College of Sports Medicine position stand on exercise and physical activity for older adults[8] and based on the exercises of the Fit For Your Life resistance training program of Morris et al.[22] Exercises were aimed to strengthen the muscle groups that are important for daily tasks, namely, the wrist flexors and extensors; elbow flexors and extensors; shoulder abductors, adductors, and rotators; trunk flexors and extensors; hip flexors, extensors, abductors, and adductors; knee flexors and extensors; and ankle dorsi- and plantarflexors. In a typical progressive resistance training protocol, 3 to 4 muscle groups were trained in 3 sets of 10 repetitions in each exercise class. Dumbbells (0.5–8.0kg) and elastic tubing (3 resistances of elastic bands) were used for resistance during wrist, elbow, shoulder, ankle, and trunk exercises. Ankle weights (0.25–10.00kg) were used for resistance during hip and knee exercises. To strengthen ankle plantarflexors, the body weight was used for resistance by raising the body up as high as possible on the toes. The participants were instructed to increase the load if an exercise was rated only "somewhat hard" by using heavier dumbbells, by putting more weights in the ankle weights, or by using an elastic band with a higher resistance level. The elastic bands could also be shortened for more resistance. Participants alternated upper- and lower-body exercises to prevent overuse injuries, with approximately 2 minutes of rest between sets. The number of repetitions and the resistance level of each set were registered in the personal files. The exact set of exercises can be obtained from the authors.

Measurements

Primary outcome measures were the feasibility of both exercise programs and physical functional performance. Feasibility was determined from information on participant satisfaction, drop-out, attendance, and the occurrence of adverse events. Physical functional performance was assessed by using the ADAP. Secondary outcome measures included the Timed Up & Go (TUG) test and muscle function tests. Participant satisfaction was assessed postintervention. During the interventions, attendance and adverse events were registered in program diaries by the exercise instructors. Physical functional performance, the TUG test, and muscle function tests were assessed at baseline and at 12 weeks by an experienced examiner who was blinded for the training conditions. Participants were specifically instructed not to reveal the type of exercise program followed.

Primary Outcome Measures

Participant satisfaction. Participant satisfaction was determined postintervention with a 22-item, anonymously completed questionnaire. Information was obtained on general satisfaction with the program, intensity, duration, and pace of the program, exercise location, transport to the location, and planned continuation of an exercise program. The motivation to attend classes during the first, second, and third months was asked retrospectively.

Physical functional performance. Physical functional performance was assessed quantitatively by using the ADAP. The ADAP allows the participant to perform at maximal ability by maximizing the weight carried and working at the fastest speed possible or reaching the greatest distance and was patterned after the CS-PFP test as shown by Cress et al[16,23] to be reliable, valid, and sensitive to change in function. The CS-PFP was modified to Dutch dimensions for bed size (190×200cm; height, 60cm vs 134×192cm; height, 50cm), height of the kitchen counter (114cm vs 88cm), and height of the washing machine (88.5cm vs 91cm). The vertical reach was replaced by a standing forward-reach test, because the combination of a forward standing reach and a sit-and-reach task (putting a Velcro-closed strap over the shoe) is a more familiar method in the literature to determine upper-body flexibility than the combination of the vertical reach test and a sit-and-reach task as proposed by others.[16,24,25] Measurement protocols and participant instructions were standardized. For the standing forward reach the protocol of Duncan et al[24] was followed. The ADAP test includes 16 common tasks, such as transferring laundry and boarding a bus, performed at maximal effort. The ADAP test provides a total score and 5 physical domain scores: upper-body strength, lower-body strength, flexibility, endurance, and balance and coordination. In general, scores on a specific task can contribute to 1, 2, or 3 domains. Tasks quantified by both weight transported and time are carrying a weighted pan, pouring water from a jug into a cup, carrying weight up and down a bus platform, and carrying groceries. Tasks quantified by time alone are transferring laundry from a washer to a dryer, putting on and removing a jacket, floor sweeping, vacuuming, making a bed, climbing stairs, getting down and up from the floor, pulling open a door, putting a Velcro-closed strap over the shoe, and picking up 4 scarves from the floor. Tasks quantified by distance are the 6-minute walk and standing forward reach.

By using Excel software,[a] each task was scaled 0 to 100 according to the formula:

$$\text{observed score} = (\text{observed score} - \text{lower limit}) / (\text{upper limit} - \text{lower limit}) \times 100$$

If the observed score was equal to the lower limit, the score was 0. For an observed score equal to the upper limit, the score was 100. Unattempted tasks were scored 0. Time was converted to speed as $1/t$, so that higher numbers reflect a better

function for each of the dimensions (weight, distance, speed) measured. Cress et al[16,23] showed this test to be valid and responsive to change. Unpublished work (DeVreede, 2000) showed the ADAP test to be a reliable instrument. By using a test-retest design, 10 community-living women (mean age, 73.8±3.1y) were tested by the examiner at a 1-week interval. The intraclass correlation coefficient (ICC) was .96 for the ADAP total score.

Secondary Outcome Measures

TUG test. In the TUG test, the time an individual needs to rise from a standard arm chair (seat, 46cm high), walk 3m, turn around, return to the chair, and sit down again is measured.[26] The test was performed 3 times as quickly as possible. The quickest time, recorded in seconds, was used for analysis. Samson et al[27] showed that the TUG test is reliable and valid and Skelton and McLaughlin[28] found this test to be responsive to change in older adults.

Muscle function tests. Maximum voluntary isometric knee extension strength was measured in both legs with a fixed strain gauge.[27,29,b] Participants were seated in an adjustable straight-back chair with the pelvis fixed by an adjustable strap and the strain gauge attached by a strap just proximal to the ankle. The participants extended the fixed leg isometrically to a maximum with the knee flexed to 90°. The highest score of 5 attempts with approximately 1 minute of rest between attempts was recorded in newtons. Peak values for the left and right legs were averaged and used for analysis. Isometric knee extension strength has been shown to be reliable, valid, and responsive to change in older adults.[27,30]

Maximum voluntary isometric elbow flexor strength was measured in both arms with a hand-held dynamometer (MicroFET[c]).[31] Participants were positioned supine on a table with arms slightly abducted, elbow flexed at 90°, and the wrist in neutral position. The MicroFET device was placed on the anterior surface of the forearm, just proximal to the wrist. The participants pulled as hard as possible by flexing the elbow while the examiner kept the dynamometer in place by matching the force of the participant with 2 hands. The highest score of 3 attempts with approximately 1 minute of rest between attempts was recorded in newtons. Peak values for the left and right arms were averaged and used for analysis. Unpublished work (Heefer et al, 2000) showed isometric elbow flexor strength to be reliable (ICC=.96) when tested in 15 women age 80.4±6.5 years.

Handgrip strength was measured with a mechanical handgrip dynamometer.[27,32,d] Grip size was adjusted to fit each subject's hand, and the same grip size was used at all visits. Participants were instructed to stand up straight with the dynamometer in 1 hand and close to their body while holding their arm vertical and the wrist in a neutral position. The best score of 5 attempts with approximately 1 minute of rest between attempts was recorded in kilogram force (kgF). Peak values for the left and right hands were averaged and used for analysis. Handgrip strength is reliable, valid, and responsive to change in older adults.[27,30]

Explosive leg extension power was measured with the Nottingham power rig[e] in both legs.[33] Participants, seated with arms folded, delivered power by pressing a footplate as hard and quickly as possible through a distance of .165m, setting a flywheel in motion. Seat position was adjusted so that the knee angle at the start was 90°. The measurements were repeated until no further improvement was seen, up to a maximum of 10 pushes.[27] The highest recorded power output was recorded in watts. Peak values for the left and right legs were averaged and used for analysis. Bassey[33] and Skelton[34] and colleagues showed that this test is reliable, valid, and responsive.

Statistical Analysis

All data were analyzed with SPSS statistical software.[f] Intention-to-treat analyses were used to compare outcomes. Baseline differences in group characteristics were analyzed by univariate analyses of variance. The nonparametric Mann-Whitney *U* test was used to compare the outcomes of the satisfaction questionnaire between the function group and the resistance group. To compare the motivation item of the questionnaire within the groups, the nonparametric Friedman test was used. General linear model repeated-measures analyses were used to analyze the effect of time, treatment, and time by treatment interactions for all outcome variables at baseline and 12 weeks, with significance set at *P* equal to .05. Effect size between the groups was determined as follows:

$$\text{Effect size} = (\Delta\text{function group} - \Delta\text{resistance group}) / \text{pooled standard deviation (SD)}$$

Effect sizes of 0.2, 0.5, and 0.8 are considered to be small, moderate, or large, respectively.[35]

RESULTS

Participants

Of the 52 respondents to the advertisement in the newspaper, 44 were considered potentially eligible after screening by telephone. Those eligible to participate received information brochures by mail. Thirty-three of these participants were willing to participate after reading the information and were invited for the medical examination. Two participants failed the examination, one because of an arm fracture 1 week earlier and the other because of a recent depressive illness. Seven participants were not able to participate due to planned vacations or activities conflicting with the 12-week training period (fig 1).

The baseline characteristics of the 24 participants randomly assigned to the FUNTEX program (function group) or the resistance exercise program (resistance group) are shown in table 1. The mean age of the function group was 75.3±6.4 years (range, 70–91y) and of the resistance group, 74.0±2.6 years (range, 70–77y). No differences were found between the groups for baseline scores for physical functional performance or muscle function.

Primary Outcomes

Attendance and adherence. In the function group, 2 participants dropped out during the first 2 weeks: one suffered from acute dizziness and the other lost interest. In the resistance group, 1 participant dropped out after 4 weeks because of a wrist fracture after a fall at home. No significant difference in attendance was found between the exercise groups (*P*=.359; 95% confidence interval [CI], −13.2 to 34.0). Participants in the function group attended, on average, 81%±35.9% of the exercise classes (range, 0%–100%); participants in the resistance group attended, on average, 90%±12.6% of the exercise classes (range, 58%–100%). The large SD for the function group was caused by the 2 participants who dropped out during the first 2 weeks of the intervention period. Without drop-outs, the participants in the function group attended, on average, 96%±4.6% of the exercise classes (range, 86%–100%), and participants in the strength group attended, on average, 94%±7.8% of the exercise classes (range, 78%–100%).

Table 1: Baseline Characteristics of Functional Tasks Exercise Program Group and Resistance Exercise Program Group

Characteristics	Function Group (n=12)	Resistance Group (n=12)	P
Age (y)	75.3±6.4	74.0±2.6	.54
Height (m)	1.6±0.1	1.6±0.1	.79
Weight (kg)	67.2±8.5	63.9±12.5	.46
ADAP test			
Total score	43.4±16.2	43.2±12.9	.98
Upper-body strength	41.5±16.8	40.1±9.2	.80
Lower-body strength	38.4±17.3	38.3±14.4	.99
Flexibility	45.4±18.8	45.0±15.7	.96
Balance and coordination	42.2±15.9	42.6±16.8	.95
Endurance	44.3±16.6	44.5±15.6	.98
TUG test (s)	6.2±2.2	5.8±1.6	.61
Muscle function			
IKES (N)	249.9±102.6	238.2±66.9	.74
HGS (kgF)	20.0±6.4	20.5±5.2	.85
IEFS (N)	142.9±29.7	146.6±17.4	.71
LEP (W)	104.3±38.8	85.4±37.3	.25

NOTE. Values are mean ± SD.
Abbreviations: HGS, handgrip strength; IEFS, isometric elbow flexor strength; IKES, isometric knee extension strength; LEP, leg extension power.

Adverse events. Adverse events were monitored by the instructors at the end of each exercise class. Further, every week participants filled in a form on which adverse events could be registered. No significant difference in adverse events was seen between the exercise groups. Five participants in the function group and 4 in the resistance group reported muscle pains after the exercise sessions, but the pain was gone after 2 days. During exercises, 3 participants in the function group reported joint pain: 2 in an osteoarthritic knee and 1 in a prosthetic hip joint. Five complaints of joint pain were reported in the resistance group: 2 in an osteoarthritic wrist, 2 in an osteoarthritic knee, and 1 in an osteoarthritic shoulder, which necessitated adaptation of their personal training regimen. Three participants in the function group and 1 in the resistance group complained of lower back pain, also necessitating changes to their training regimen. In the function group, 1 participant sprained an ankle, but not while exercising. No cardiovascular complications occurred during any testing or training session.

Program evaluation. Table 2 shows the results of the participant satisfaction questionnaire. All participants of the resistance group (including the drop-out) returned the questionnaire. The 2 participants who withdrew from the function group did not to return the questionnaire. Overall, the exercise program was judged better by the resistance group than by the function group. The resistance exercise program also tended to be rated better on a 10-point scale (1, very bad; 10, excellent) than the functional tasks exercise program. Although not significant, the intensity and pace of the functional tasks exercise program were considered better than the same aspects of the resistance exercise program. The resistance group rated the supervision of the instructors better than did the function group. During the first month of the intervention, the resistance group seemed more motivated than the function group. However, during the third month, motivation in the resistance group decreased, whereas motivation in the function group did not change significantly. Most (83%) participants of the resistance group experienced a subjective exercise effect, whereas only 40% of the function group did (P=.040). Mostly, participants noted an effect after 6 weeks of exercise (56% in resistance group, 67% in function group). All participants in the resistance group wanted to continue participation in an exercise program, although most (67%) preferred a different type of exercise. In the function group, 80% wanted to continue participation in an exercise program, of whom 60% wanted to continue with the functional tasks exercises. Alternative exercises mentioned by the resistance group were exercises at home and flexibility exercises. In the function group, fitness and aerobics were mentioned as alternative exercises.

Internal training progression. The personal training files of the participants provided feedback about the progression during the exercise programs. For example, during the 12-week training program, participants in the function group increased the weight transported per repetition by 87% (range, 0%–230%). The weight carried during climbing a short stair was increased by 77% (range, 0%–110%). The participants in the resistance group, for example, increased exercise resistance during wrist exercises on average by 111% (range, 0%–400%), during elbow exercises by 73% (range, 0%–200%), during shoulder exercises by 74% (range, 0%–300%), during trunk exercises by 70% (range, 17%–200%), during hip exercises by 108% (range, 0%–600%), during knee exercises by 66% (range, −100% to 200%), and during ankle exercises by 65% (range, 14%–233%).

Physical functional performance measures. Physical functional performance at baseline and 3 months is presented in table 3. Both the function and the resistance groups increased scores for ADAP test total score (P=.001), functional upper-body strength (P=.009), functional lower-body strength (P=.001), upper-body flexibility (P=.008), balance and coordination (P=.009), and endurance (P=.001) at 3 months. No significant difference between the exercise groups was seen in total ADAP score (P=.101), functional upper-body strength (P=.453), functional lower-body strength (P=.229), upper-body flexibility (P=.099), balance and coordination (P=.117), and endurance (P=.056). Except for the small effect size (effect size, .34) for upper-body strength, effect sizes were moderate (lower-body strength effect size, .54) to large (endurance effect size, .83) in favor of the functional tasks exercise program.

Secondary Outcomes

Muscle function test results are given in table 4 and TUG test results are shown in table 3. No time or group by time interaction was seen for TUG (table 3). Isometric knee extensor strength increased in the function group and in the resistance group over the intervention period (P=.001). No change over time was seen for isometric elbow flexor strength (P=.819), handgrip strength (P=.436), and leg extension power (P=.161). There were no statistically significant differences in changes of muscle function between the 2 groups. Except for the small effect sizes for TUG and isometric elbow flexor strength (effect size, −.16; −.21, respectively), effects were moderate (isometric knee extension strength effect size, −.59 in favor of the resistance group) to large (leg extension power effect size, .82 in favor of the function group).

DISCUSSION

Our newly developed functional tasks exercise program appears feasible and is well tolerated by women over the age of 70 years living in the community. The drop-out rate of both exercise programs (17% in the function group, 8% in the resistance group) was comparable to that of other exercise studies involving older community-living subjects.[11,12] The

Table 2: Evaluation of the Exercise Programs by Members of the Functional Tasks Exercise Program Group and Resistance Exercise Program Group

Questions	Function Group (n=10) n (%)	Resistance Group (n=12) n (%)	*P*
What is your overall judgment on the exercise program?			<.001
Fairly good	1 (10)	0 (0)	
Good	9 (90)	3 (25)	
Very good	0 (0)	9 (75)	
How would you rate the core exercises?			.153
Light	0 (0)	3 (25)	
Fairly heavy	7 (70)	7 (58)	
Heavy	3 (30)	2 (17)	
How would you rate the intensity of the exercises?			.172
Too light	0 (0)	1 (8)	
Light	1 (10)	0 (0)	
Fairly heavy	5 (50)	10 (83)	
Heavy	4 (40)	1 (8)	
How would you rate the duration of the program?			.619
Too short	0 (0)	1 (8)	
Short	1 (10)	1 (8)	
Ideal	9 (90)	10 (83)	
How would you rate the pace of the exercises			.142
Slow	1 (10)	2 (17)	
Fairly fast	4 (40)	8 (67)	
Fast	5 (50)	2 (17)	
How would you rate the supervision of the instructors?			.040
Good	6 (60)	2 (17)	
Very good	4 (40)	10 (83)	
How motivated were you to attend classes?			
During the first month			.078
Considered quitting	1 (10)	0 (0)	
Motivated	3 (30)	1 (8)	
Very motivated	6 (60)	11 (92)	
During the second month			.089
Considered quitting	1 (10)	0 (0)	
Motivated	4 (40)	2 (17)	
Very motivated	5 (50)	10 (83)	
During the third month			.691
Considered quitting	0 (0)	1 (9)	
Motivated	6 (60)	4 (36)	
Very motivated	4 (40)	6 (55)	
Did you experience an exercise effect?			.040
Yes	4 (40)	10 (83)	
No	6 (60)	2 (17)	
When did you experience the effect?			.833
After 2 weeks	1 (33)	3 (33)	
After 6 weeks	2 (67)	5 (56)	
After 12 weeks	0 (0)	1 (11)	
How would you rate the overall organization?			.102
Good	5 (50)	2 (17)	
Very good	5 (50)	10 (83)	
Do you wish to continue following exercises?			.112
Yes	8 (80)	12 (100)	
No	2 (20)	0 (0)	
Similar exercise program	5 (60)	4 (33)	
Different exercise program	3 (40)	8 (67)	
How would you rate the exercise program on a scale from 1 to 10 (1 = very bad, 10 = excellent)?	7.9±1.0	8.7±0.8	.062*

NOTE. Values are n (%) or mean ± SD. The nonparametric Mann-Whitney *U* test was used to compare the outcomes of the satisfaction questionnaire between the function and the resistance groups.
*The *t* test was used to compare the rating between the function and the resistance groups on a scale from 1 to 10.

Table 3: Physical Functional Performance at Baseline and 3 Months, by Group

Performance Tests	Function Group (n=10)	Resistance Group (n=11)	Time *P*	Group × Time *P*	Function vs Resistance Effect Size
ADAP test					
Total score			.001	.101	.72
Pre	44.3±16.6	42.5±13.3			
Post	51.8±12.1	45.3±13.2			
Upper-body strength			.009	.453	.34
Pre	42.0±17.7	38.6±8.0			
Post	47.8±10.2	41.9±8.6			
Lower-body strength			.001	.229	.54
Pre	40.0±18.1	36.9±14.3			
Post	46.8±15.2	40.5±13.1			
Upper-body flexibility			.008	.099	.72
Pre	45.3±18.8	44.4±16.3			
Post	57.7±13.4	47.6±15.0			
Balance and coordination			.009	.117	.69
Pre	43.6±16.6	42.4±17.6			
Post	52.5±16.0	44.8±18.3			
Endurance			.001	.056	.83
Pre	45.3±17.3	44.1±16.3			
Post	54.3±14.6	47.1±16.4			
TUG test (s)			.398	.733	−.16
Pre	6.0±2.2	5.8±1.7			
Post	5.8±1.5	5.7±1.4			

NOTE. Values are mean ± SD.

high attendance and the results of the satisfaction questionnaire showed the high acceptance for both programs. Overall, the resistance exercise program was rated better by the participants than the functional tasks exercise program. Additionally, although all participants were informed about the exercise programs before inclusion, several participants in the function group stated that the functional tasks exercise program did not meet their expectations. The lower rating of the functional tasks exercise by the participants may be because resistance training programs are widely used and thus more familiar.

This failure to meet participant expectations could also explain the diminished motivation of the function group during the first month. However, motivation in the resistance group decreased in the third month, whereas that of the function group was stable. Most participants in the function group who wanted to continue participating in an exercise program preferred the functional tasks exercise program. In the resistance group, 67% of the participants wanted to continue to exercise but in a different way. Another reason for the changed motivation of the function group could be that the simple, basic tasks during the start of the exercise program were boring, and it was only when the complexity and variation increased during the variation and daily tasks phase that the participant motivation increased.

This study suggests that, over a 12-week period, the functional tasks exercise and the resistance exercise programs may positively change functional task performance in older, community-living women. Although group by time analyses showed no significant differences between exercise groups, the changes in ADAP total and domain scores were consistently higher in the function group. Given an estimated effect size of .72, power of 80%, and 2-tailed α of .05, the sample sized needed to detect a difference between groups was 30 in each intervention group.

Although changes in ADAP scores in the resistance group were somewhat small, changes in scores of the function group (7.5-U increase for ADAP total score) were comparable to those reported by Cress et al[23] after a 6-month exercise program of combined stair climbing and resistance training in older adults (7.8-U increase for CS-PFP total score). With a focus on endurance and strength domains, Cress found no change in flexibility or balance and coordination domains.

Isometric knee extensor strength improved by 14.4% in the resistance group and by 6.5% in the function group. The improvement in the resistance group is in agreement with the effect of resistance training regimens in other studies.[9,12] Even though the resistance group continued to show improvement during the program, changes in elbow flexor strength were somewhat disappointing. Other studies[12,36] have shown a positive effect of resistance exercise on elbow flexor strength. These studies, however, trained fewer muscle groups. Therefore, a change in the resistance exercise program, to focus on fewer muscle groups, may increase the effect on elbow flexor strength. A possible explanation for the lack of effect of exercise on handgrip strength in the strength group is that the hand muscles were not trained specifically. Leg extension power tended to increase more in the function group than in the resistance group, which is consistent with the findings of Skelton et al,[12] who found leg extension power to be more representative than isometric strength as a functional measure in older adults.

The results of this pilot study suggest that the quantitative assessment of functional task performance with the ADAP test can detect a change in daily task performance in a relatively healthy group of older adults, with a small therapeutic window. Because of the substitution of the vertical reach with a forward standing reach, the domain upper-body flexibility was determined by the tasks putting on and removing a jacket, putting a Velcro-closed strap over the shoe (sit-and-reach), and the forward standing reach. A combination of tests has been proposed in other studies.[24,25] Furthermore, Schenkman et al[37] showed a relation between spinal flexibility and forward standing reach.

Table 4: Muscle Function at Baseline and 3 Months, by Group

Muscle Function Tests	Function Group (n=10)	Resistance Group (n=11)	Time *P*	Group × Time *P*	Function vs Resistance Effect Size
IKES (N)			.001	.187	−.59
Pre	256.6±111.2	237.0±70.0			
Post	271.5±122.9	269.2±75.0			
HGS (kgF)			.819	.094	.74
Pre	20.4±6.8	19.9±5.0			
Post	21.5±5.3	19.0±4.4			
IEFS (N)			.436	.654	−.21
Pre	153.4±25.9	146.9±18.4			
Post	154.4±21.4	150.6±22.0			
LEP (W)			.161	.063	.82
Pre	109.1±38.0	89.2±37.1			
Post	121.2±42.8	87.4±35.5			

NOTE. Values are mean ± SD.

The current feasibility study has some weaknesses. First, a control group should be included in further studies to understand fully the impact of the exercise programs. Second, the ADAP test needs more extensive investigation of its reliability. And last, the increase of 7.5U for total ADAP with a 12-week functional tasks exercise program appears to be relevant and important. Cress et al[23] suggested that an increase of 7.8U on the CS-PFP might mean that an individual carries 14% more weight, while moving 10% more quickly. However, further research is necessary to determine the actual clinical importance of the changes in ADAP scores induced by the functional tasks exercise program.

CONCLUSIONS

We showed that the newly designed functional tasks exercise program was feasible and associated with an improvement in functional performance. In comparison to a resistance exercise program, the impact on functional performance was larger, with effect sizes in the range of moderate to large. A study with an adequate sample size is needed to draw more definitive conclusions.

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APPENDIX 1: THE FUNCTIONAL TASKS EXERCISE PROGRAM

Practice phase (2wk)

1. Step forward onto a raised (20cm) platform, or step.
2. Step sideways onto a step.
3. Step on and off a step. Repeat for 1 minute.
4. Step forward over the step.
5. Step sideways over the step.
6. Step over the step. Repeat for 1 minute.
7. Walk for 2 minutes.
8. Walk though an obstacle course.
9. Walk through an obstacle course carrying a tray.
10. Lift a weighted box (from knee high).
11. Lift (from knee high) and carry a weighted box.
12. Lift a weighted box (from the floor).
13. Lift (from the floor) and carry a weighted box.
14. Get up out of a chair and carry a small object.
15. Get out of bed and carry a small object.

Variation phase (4wk)

16. Walk over carpet tiles.
17. Walk over carpet tiles, picking up an object from the floor.
18. Walk along a straight line (painted on the floor).
19. Walk along a straight line carrying a tray.
20. Get up from hands and knees and carry an object.
21. Rise from a chair while holding an object. Put the object on a low shelf.
22. Climb a short flight of stairs (5–7 steps) holding a small object in 1 hand.
23. Climb a short flight of stairs sideways.
24. Climb a short flight of stairs while carrying a plastic bottle of water on a tray.
25. Climb a short flight of stairs while carrying a plastic bottle of water on a tray carried by 2 people.
26. Walk along a curved line (painted on the floor).
27. Move different objects between shelves of different height (1 hand).
28. Move different objects between shelves of different height (2 hands).
29. Walk along a straight line and reach forward/sideways.
30. Carry and pack a box for 2 minutes.
31. Walk through an obstacle course carrying a weighted bucket.
32. Get up from the floor and carry an object.
33. Get up from the floor and carry an object for 2 minutes.
34. Climb stairs (12–17 steps) while carrying a small object.
35. Climb stairs sideways.
36. Climb stairs while carrying a plastic bottle of water on a tray.
37. Push a ring a over the floor with a stick through an obstacle course.
38. Pick up sandbags from the floor and put them in a bucket.
39. Walk along a straight line with obstacles.
40. Rise from a chair while carrying a plastic bottle of water on a tray.
41. Rise from a bed and carry an object.
42. Step on and off a step. Repeat for 1 minute.
43. Step sideways on and off a step. Repeat for 1 minute.
44. Step onto a step raised as high as possible.
45. Carry a weighted bucket (1 hand) through an obstacle course.
46. Carry 2 weighted buckets through an obstacle course.
47. Carry a weighted bucket with 2 hands through an obstacle course.

Daily tasks phase (6wk)

48. Walk over carpet tiles, picking up items from floor and putting them in a bucket.
49. Pick up an object from the floor while sitting and then put the object on a shelf.
50. Rise from a chair and pick up an object from the floor. While sitting, throw the object in a basket.
51. Get up from the floor and move different objects onto different shelves.
52. Climb stairs (12–17 steps) holding a small object in 1 hand.
53. Fill a bucket with weights and then climb stairs carrying the weighted bucket.
54. Take clothes and sandbags from a low shelf, carry them in a basket through an obstacle course, and put them back on the shelf.
55. Take different objects from shelves and carry them in shopping bags through an obstacle course.
56. Lift (from knee high) and carry a weighted box.
57. Walk and pick up objects from the floor and throw them in a basket. Repeat for 3 minutes.
58. Walk over different surfaces (plain floor, mattress, sandbags). Repeat for 3 minutes.
59. Rise from a bed (or a chair), pick up an object from the floor, and throw it into a basket.
60. Complete obstacle course, stepping on and off the step (4 times), and stepping over the step (2 times) (relay).
61. Rise from a chair, step onto the step, and take different objects from a high shelf.
62. Get up from the floor and carry a weighted bucket.
63. Lift (from the floor) and carry a weighted box. Repeat for 2 minutes.
64. Walk through an obstacle course while carrying a plastic bottle of water on a tray. Repeat for 3 minutes (relay).
65. Carry weighted bags through an obstacle course.
66. Rise from a chair (or a bed), walk along a straight line, and kick a ball into a goal.
67. Step on and off the step. Repeat for 1 minute.
68. Step sideways on and off the step. Repeat for 1 minute.
69. Carry different objects with a box, shopping bag, and tray and bucket.
70. Rise from a chair and carry an object over the step.
71. Complete an obstacle course involving rising from a chair (3 times) and rising from a bed (3 times) while carrying a plastic bottle of water on a tray (relay).
72. Climb stairs carrying a weighted bucket (relay).
73. Carry a weighted bucket through an obstacle course (including stepping on and off the step [4 times] and stepping over the step [2 times]).
74. Push a ring over the floor with a stick through an obstacle course.

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Suppliers

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