Body composition and physical function after progressive resistance and balance training among older adults after stroke

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Disclosures: None

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Abstract

Purpose: To study the effects of a progressive resistance and balance (PRB) exercise program on body composition with regard to its associations with physical function among individuals approximately one year after stroke.

Method: A total of 43 individuals from the community (age 73 years (SD 5.0), 73% men) were randomly assigned either to an intervention group (IG, *n*=20) that received a PRB exercise program twice weekly for three months or a control group (CG, *n*=23). The primary objectives were to correlate potential changes in the fat-free mass (FFM (kg) and FFM index (FFMI) (kg/m^2), and fat-mass (FM (kg), (%) of body weight, FMI (kg/m^2)), as measured by bioelectrical impedance analyses (Tanita®), with physical function, including walking capacity; i.e., the 6 Min Walk Test; 6MWT, balance and mobility.

Results: At three months, a complete case analyses revealed a significant reduction in fat mass per cent in the intervention group when compared with the control group; -1.5 vs. 0.13 % respectively; effect size, ES=0.62 standard error (SE), 0.80; *P*=0.0.39). No between-group differences in FFM were observed. There was a between-group difference in the 6MWT (25 vs. -10 m) at three months in favor of the IG (r=0.47, *P*=0.04). Changes in FMI were associated with improved walking capacity in the IG.

Conclusions: Three months of PRB training might reduce fat mass in older adults approximately one year after stroke. This exploratory study indicated an association between improvements in physical performance and changes in body fat mass.

Keywords: body composition, functional performance, stroke, elderly

BACKGROUND

Muscle wasting might contribute to reduced muscle strength, i.e. sarcopenia, that may affect balance and walking capacities of elderly patients after stroke [1, 2]. Muscle abnormalities are common after hemiparetic stroke, and a specific type of stroke-induced sarcopenia has been proposed [2]. Long-term muscle changes in combination with the reduction of the fiber cross-sectional area and increased intramuscular fat deposition emerges up to 6 months after stroke in all extremities [2-4]. Muscle wasting might also be associated with increased fat mass (FM) [5], a state known as sarcopenic obesity [6]. A significant increase in whole body FM one year after stroke was recently reported [5]. Sarcopenic obesity that is observed in up to 10% of individuals older than 80 years [6] confers a major health risk, and features functional limitations and metabolic dysregulations [6].

--To prevent disability and improve lipid and glucose metabolism after stroke, exercise interventions might be useful [7, 8]. The control of cardio-metabolic risk factors, such as the levels of high- and low-density lipoprotein cholesterol (HDLs and LDLs, respectively), is usually considered insufficient after stroke [9]. Moderately intense physical activity can reduce the risk for additional cardiovascular incidents and increase mobility [10, 11]. Resistance training can increase muscle mass. Muscle contractions increase glucose uptake and improve insulin sensitivity in muscle cells, and likely improve the plasma lipoprotein profile [12]. We showed, in a recent study of a progressive resistance and balance (PRB) exercise program, improvements in walking capacity, walking speed and balance among a post-stroke population (Vahlberg, submitted). However, there is a lack of data on the effects of PRB training on body composition and cardio-metabolic risk factors, especially beyond the convalescent period [7].

--The aims of the current explorative study were to (1) investigate whether a program of PRB exercise could increase muscle mass, reduce FM, and affect cardio-metabolic risk markers and indicators of growth and nutrition among elderly participants one year after stroke; and (2) evaluate whether changes in physical function are correlated with changes in body composition.

METHODS

Participants

Data were recently reported on a single-blind randomized controlled trial that examined the outcome of a PRB exercise program for individuals with chronic stroke (Vahlberg, submitted). Briefly, potential study participants aged 65 to 85 years were identified and recruited after reviewing the Swedish quality discharge register (RIKS-stroke) at Uppsala University Hospital. The eligibility criteria are presented elsewhere (Vahlberg, submitted). In the current study, participants with pacemakers or systolic blood pressure levels >180 mmHg as well as those who were unable to perform a bioelectric impedance analysis (for any reason) were excluded; see the flow chart in Figure 1.

Study design

This was a 3-month randomized controlled study. One independent assessor, i.e. an experienced physiotherapist who was blinded to the participant allocation, conducted the measurements prior to the start of the intervention and at three months. The data were collected from October 2009 to April 2011.

Randomization procedure

A computer-generated printout was used to randomly assign the participants to one of two groups. Participants were informed of group allocation after baseline assessment. A senior researcher who was not involved in the assessments did the assignment.

Intervention

The intervention group (IG) (n=20) received PRB exercise training, and the control group (CG) (n=23) was encouraged to not change their lifestyles. As previously described, training was performed within circuit classes that were held twice weekly for three months. These classes consisted of functional exercises that targeted improvements in lower extremity functioning [13] (Vahlberg, submitted). After the circuit class ended, the training group spoke with the physiotherapist for 20 minutes regarding physical activity behavior and risk factor modifications (see supplementary data in Appendix 1 for descriptions of the PRB exercise program and the group discussion). One or two questions were asked at each session from an individualized perspective. Identified activity goals resulted in one tailored home exercise (to be performed daily) with the intention to support participation in the PRB exercise training and increasing the level of physical activity. The progression of the home training was evaluated weekly.

Measurements

Body composition, i.e., the fat-free mass index (FFMI, kg/m^2), fat-mass index (FMI, kg/m^2) and the relative fat mass in percent of body weight (FM%), was measured as previously described by bioelectrical impedance analysis (BIA; Tanita®, Vahlberg, submitted). Sarcopenic obesity was defined accordingly; i.e., an FFMI below the 25th percentile and an FMI above the 50th percentile of a Swiss reference population [14]. Body weight and height were measured while the participants wore light indoor clothing and no shoes. BMI was calculated as weight (kg) divided by height (m) squared. BMI values ≥30 kg/m² were used to indicate obesity. FM% above the suggested reference values; i.e., 20% in men and 30% in women, were also used to indicate obesity [15].

--Total cholesterol as well as LDL and HDL cholesterols were analyzed as cardio-metabolic risk markers. Serum insulin-like growth factor-I (IGF-1), plasma albumin, and C-reactive protein (CRP) were analyzed as indicators of nutritional status and on-going inflammation.

--Supine blood pressures were measured manually under standardized conditions at baseline and at 3 months. Normal blood pressure was categorized as systolic values ≤139 or diastolic values ≤89 mm Hg.

--In this study, the cardiovascular disease risk score (CRS; a cumulative score where higher scores denote greater risks of future cardiovascular events) was calculated at base-line and after three months using a prediction algorithm based on age, resting blood pressure, smoking status at the time of stroke, diabetic status, total cholesterol and HDL [17]. Smoking status and diabetes were considered unchanged at three months. High CRS score (e.g. a 10 year increased risk of a cardiovascular disease risk > 20%) require stronger risk factor modification. This model has also been used among individuals with stroke and transient ischemic attack (TIA) to evaluate the effect of using a cardiac model of rehabilitation [9, 18, 19].

--Physical function was measured as mobility (using the Short Physical Performance Battery; SPPB) [20], balance (using the Berg Balance Scale; BBS) [21], walking capacity (using the 6-Minute Walking Test; 6MWT) [22], and physical activity (using the Physical Activity Scale for the Elderly; PASE) [23] as previously described (Vahlberg, submitted). One item in the SPPB, i.e. time for five chair rise stands (s), was used to evaluate thigh muscle strength [20]. The 6MWT measures participants' longest possible walking distance at a usual pace over a 30 m course across 6 minutes [22]. The test was standardized according to the recommendations of the American Thoracic Society [22].

--The Short Portable Mental Status Questionnaire (SPMSQ) was used to assess cognition. SPMSQ consists of 10 questions and has a maximum score of 10 [24].

Statistics, data analysis and ethical concerns

In the original study (Vahlberg, submitted) a sample size of 67 individuals was determined to be large enough to detect changes in balance (which was the primary outcome for that study). Because the major objective of this study was to evaluate whether potential improvements in physical function were related to changes in body composition, no specific a priori power analyses were performed. This study should be regarded as explorative, and its data might be useful for meta-analyses and for sample size calculations.

--Statistical analyses are based on complete case analysis. Descriptive analyses were performed based on the type and distribution of variables. To check for normal distribution, the Shapiro-Wilk W test was used. Mean differences between the groups were assessed using Student's t-test for continuous, normally distributed variables, and the Mann-Whitney U test was applied for ordinal variables. Categorical variables were compared using Pearson's chi-squared test (χ^2). To analyze within-group changes over time, the paired-samples two-tailed t-test was performed for normally distributed variables; otherwise, the Wilcoxon sign rank test was used. Cohen's d was used as a measure of the within-group effect size. Correlation strength was calculated using Spearman's rho. All analyses were examined using two-tailed test with a significance level set at $P<0.05$. All analyses were performed using SPSS version 19 (IBM, Armonk, NY, USA).

RESULTS

A total of 43 individuals, 12 women and 31 men, could perform the BIA and were included. Figure 1 summarizes the recruitment and participant flow. At baseline, no significant between-group differences were noted with regard to the demographic data or other measurements (Table 1).The median cognitive function was the maximum of 10 points at baseline (IQR range 7-10 p). The median attendance rate for the exercise classes of the IG was 91%. No adverse events occurred during exercise. All individuals in the IG wore a weighted belt while exercising, with a mean weight increase of 2.6 kg over the exercise period. All of the participants were able to perform the given exercises.

Effects by exercise on body composition

FFM did not change in any group over the observation period. However, fat mass percentage (FM%) showed a significant decrease in the IG group at three months, i.e. -1.5 vs 0.13 % in the CG, ES=0.56, *P*=0.023. FM decreased by 1.47 kg in the IG, but this decrease was not significantly different compared to the CG. As described previously, the 6MWT distance significantly improved for the IG after three months compared with the CG (25 vs. -10 m, respectively, ES=0.69, *P*=0.039). At baseline, the prevalence of sarcopenic obesity was 9% (4/43), i.e. two in each group. At three months still the two individuals in the CG, but none in the IG, displayed sarcopenic obesity.

--A significant correlation was observed in the IG between changes in the 6MWT and changes in the FMI (r= 0.47, *P*= 0.04), the FM percentage (r=0.48, *P*=0.038) and the FM (r=0.47, *P*=0.041) after the PRB exercising for three months. A similar correlation could not be observed when all study participants were combined (data not shown).

Effects on cardio-metabolic risk

The CRSs were high for both sexes and groups; at baseline, the median score was 24±3 indicating an increased risk by >30% (to have a cardiovascular event in 10 years) in both men and women. No reductions in CRSs (median change 0) or blood pressure were observed within or between groups at three months. Table 3 shows that there were no significant between-group changes in total cholesterol, HDL or LDL cholesterol. Serum IGF-1 decreased in the IG (-12 vs. 4 μg/l, ES= 0.62, *P* = 0.019) compared with the CG, whereas serum levels of CRP and albumin were stable (Table 3).

DISCUSSION

Our findings suggest that PRB exercise among chronic stroke patients for three months reduce FM, whereas there were no effects in FFM. As previously reported, improvements were observed in walking capacity after training. However, this improvement (in this cohort of post-stroke older individuals) was most likely not conferred by changes in muscle mass. Interestingly, the improvement was rather associated with the reduction in FM. As previously reported, muscle function might be improved regardless of changes in its mass [1]. Muscle strength and power are determined by many factors except the mass of myofibrillar proteins. Oxygenation, cellular fitness, nutrition, substrate availability, fat infiltration of the muscle, inflammation, or endocrine status are some examples [25]. It is difficult to speculate over which specific factor(s) that mediated the effect in this study group. Nevertheless, muscle mass is important for mobility and strength as well as for energy, lipid and glucose metabolism [26].

--Despite weight loading, half of the exercises employed by the IG in the current study were mainly directed toward improving balance and less so at gaining muscle mass and strength. Balance exercises are important and recommended because falls, fear of falling and balance limitations are common among older individuals post-stroke and can lead to reduced functional capacity during daily activities [28, 29].

--At baseline, IGF-1 levels were within the given reference values for both groups. A decrease in IGF-1 was observed in the IG at three months. This finding was somewhat unexpected because resistance training usually stimulates IGF-1 production, which might be beneficial for muscle anabolism [30]. In obese, older sedentary individuals one year after stroke, however, a decrease of IGF-1 after training might rather be a reflection of an improved insulin sensitivity due to reduced FM [31]. We were unable to detect between-group differences regarding changes in total cholesterol, HDL or LDL cholesterol. In contrast to a previous study, the CRSs in the present study were not significantly reduced within or between groups at three months [9]. However, the risk scores in the current sample revealed a ≥20% increased risk for future cardiovascular events [17]. Changes in the cardio-metabolic risk markers among the IG were similar to studies reporting on the effects of cardiac rehabilitation programs featuring aerobic exercise in combination with lifestyle counseling after stroke or TIA [19, 32].

--At baseline, the prevalence of sarcopenic obesity was approximately 9%. Considering the type of study group this is an unexpectedly low figure, which may indicate that the study group is selected among fairly healthy and active individuals that have had a previous stroke. Still, the mean PASE score was 98±65 which is approximately 61% of that in a healthy population [33]. Sarcopenic obesity usually reflects a combination of low levels of physical activity and a relatively high energy intake. Interestingly, sarcopenic obesity was no longer present in the IG after PRB exercising.

--In the current study, exercise intensity was related to the individual's capacity and performed with low-to-moderate intensity with >10 repetitions of each exercise, for example progressively increasing the number of weight lifts [12]. This protocol corresponds to approximately 50-70% of the one-repetition maximum [12]. High intensity exercise among older individuals improves lower-limb strength more than low intensity exercise; however, it might not be required to improve functional performance [34]. The exercise intensity in the current study should have been high enough to induce increases in fat-free mass.

--The current study has limitations that need to be addressed. This exploratory study was not based on sample size calculation regarding the main objectives of these post-hoc analyses, thus it might have been underpowered with risk of type II errors. Furthermore, the Hawthorn effect must be considered, meaning that the individuals in the CG might have started to exercise although not encouraged to do so. In addition, self-reports of physical activity might not be considered an accurate measurement compared with accelerometers [35]. Self-reports of physical activity (e.g., the PASE) tend to overestimate physical activity [23]. The strengths of this study are its randomized controlled design, the predefined exercise protocol and the limited age range of participants.

--In conclusion, the findings of this exploratory pilot study indicate that improved walking capacity induced by a PRB exercise program among older adults after stroke was associated with a decrease in fat mass, but not an increase in muscle mass. The reduction of fat mass might have caused reduced IGF-1, possibly indicating improved insulin sensitivity. Additional studies are needed to investigate both short-term and long-term exercise treatment effects on body composition in post-stroke patients, in order to further elucidate the potential importance of changes in body composition, i.e. FFM and FM, respectively, for improvements in physical function.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest

-Insert Appendix 1 about here-

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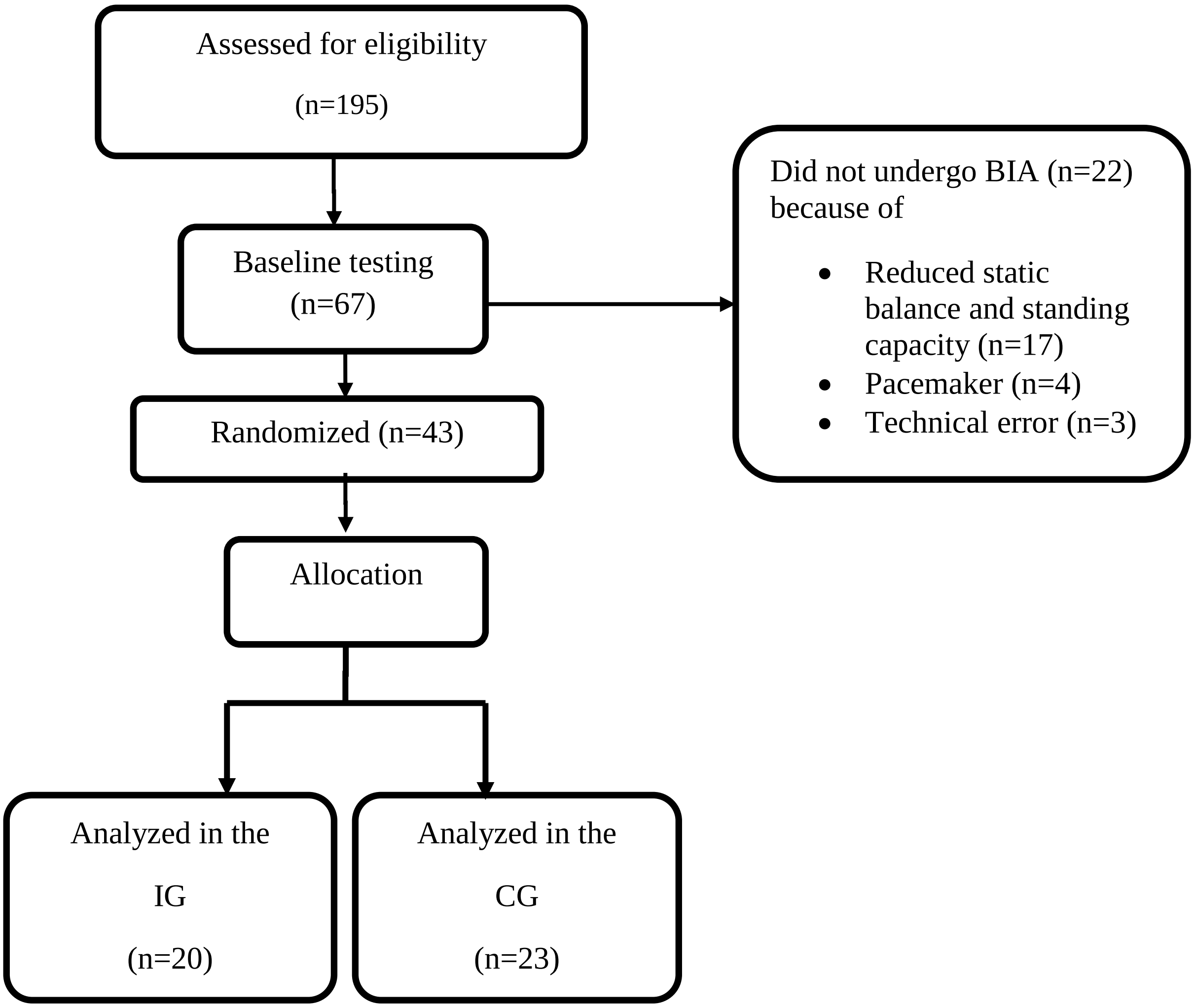
FIGURE LEGEND:

Figure 1. Flow chart of the participants



Abbreviations: BIA, bioelectric impedance analysis; CG, control group; IG, intervention group

Table 1. Baseline demographic and clinical characteristics of individuals approximately one year after stroke who were allocated to the intervention (IG) or control group (CG).

Characteristic	**IG (n=20)**	**CG (n=23)**	**P-value**
Men, n (%)	17 (81)	16 (67)	0.3
Age (years), mean (SD)	72.7 (5.5)	73.7 (5.4)	0.4
Time (months) since stroke onset, median (IQR)	14 (4)	14 (3)	
BMI, kg/m^{2}, n (%)			0.26
<22 (moderate underweight)			
22-29.9 (normal/overweight)	15 (71)	14 (58)	
>30 (obese)	6 (29)	10 (42)	
Blood pressure:			
SBP, median (IQR)	145(23)	145 (24)	0.9
DBP, median (IQR)	85 (10)	75 (10)	0.07
Cerebral infarction	17 (81)	20 (83)	0.8
Intra-cerebral hemorrhage	4 (19)	4 (17)	0.8
CRS, median (IQR)	24 (3)	24 (1)	0.6
CCI, n (%)			0.6
0	11 (52.4)	13 (54.2)	0.9
1	6 (28.6)	8 (33.3)	0.7
2	4 (19.0)	2 (8.3)	0.4
3	0	1 (4.2)	0.1
Risk factors for stroke, n (%)	n=19	n=23	
Earlier stroke	4 (26.1)	6 (21.1)	0.5
TIA	1 (5.3)	5 (22.7)	0.2
Atrial fibrillation	3 (15.8)	4 (17.4)	0.6
Smoking	2 (11.1)	1 (4)	0.4
Hypertension	13 (68.4)	17 (73.9)	0.7
Diabetes	3 (15.8)	4 (17.4)	

Abbreviations: CCI, Charlson Comorbidity Index based on weighted conditions, 0-4; CG, control group; CRS, cardiovascular disease risk score; DBP, diastolic blood pressure; IG, intervention group; SBP, systolic blood pressure; TIA, transient ischemic attack

Table 2. Within-group and between-group differences of body composition and physical function at the start of intervention and after 3 months*.

	Intervention Group (n=20) Male (n=16), Female (n=4)				**Control Group (n=23)** Male (n=14), Female (n=8)				**Difference Between Intervention – Control 3 months**	
Assessment occasion	**Base-line**	**3-mo follow-up**	**Absolute Change**	**P-value**	**Base-line**	**3-mo follow-up**	**Absolute Change**	**P-value**	**Mean/Median difference in change (95% CI)**	**P-value**
FFM, kg, median (IQR)										0.70
All individuals			-0.7 (7.8)	0.14			-1.1 (4.6)	0.18	0.50 (-2.0 to 4.2)	
Male	61.30 (11.1)	59.82 (7.6)	-0.80 (9.1)		56.20 (15.7)	56.5 (8.9)	-0.95 (3.0)			
Female	43.10 (14.2)	42.57 (3.7)	0.75 (6.6)		47.15 (3.8)	43.2 (7.0)	-2.60 (7.2)			
FFMI, kg/m², median (IQR)										
All individuals			0.26 (1.2)	0.53			0.02 (1.3)	0.93	-0.16 (-0.87 to 0.44)	0.53
Male	19.95 (2.6)	20.09 (2.3)	0.13 (1.4)		20.50 (3.2)	20.75 (2.0)	-0.16 (1.0)			
Female	16.83 (1.4)	17.11 (1.1)	0.44 (0.7)		17.8 (3.3)	17.51 (1.8)	0.06 (1.9)			
FM, kg, mean (SD)										
All individuals			-1.47 (2.6)	0.021			-0.019 (2.2)	0.97	1.45 (-0.5 to 2.94)	0.057
Male	23.96 (6.4)	22.30 (7.4)	-1.66 (2.8)		25.23 ((7.1)	24.95 (6.2)	0.31 (2.2)			
Female	30.30 ((5.7)	27.47 (7.0)	-0.69 (2.0)		33.80 (12.9)	33.21 (13.0)	-0.59 (2.2)			
FM%, mean (SD)										
All individuals			-1.50 (2.7)	0.023			0.13 (2.6)	0.80	1.63 (0.01 to 3.26)	0.048
Male	27.01 (4.9)	25.51 (5.9)	-1.51 (2.9)		28.52 (34.8)	28.22 (3.7)	0.41 (2.3)			
Female	39.68 (3.3)	37.57 (5.2)	-1.45 (2.3)		40.78 (8.7)	40.41 (9.0)	-0.38 (3.0)			
FMI, kg/m², mean (IQR)										
All individuals			-0.40 (0.9)	0.053			-0.20 (1.1)	0.38	0.20 (-0.41 to 0.81)	0.51
Male	7.55 (2.1)	7.11 (2.4)	-0.44 (0.9)		8.20 (2.2)	8.07 (1.9)	-0.18 (1.2)			
Female	11.07 (1.9)	10.58 (4.9)	-0.27 (0.8)		12.94 (8.4)	12.70 (5.2)	-0.24 ((0.9)			
BMI, kg/m², mean (SD)				0.42				0.36	0.007 (-0.76 to 0.77)	1.0
All individuals			-0.23 (1.3)		29.07 (4.6)		-0.23 (1.2)			
Male	27.4 (6.0)	27.1 (3.3)	-0.34 (1.4)		28.3 (3.1)	28.2 (5.7)	-0.21 (1.4)	-0.21		
Female	28.4 (2.5)	27.9 (2.9)	0.24 (0.6)		30.6 (6.7)	30.3 (6.6)	-0.27 (0.6)	-0.27		
PASE (≥0 points) median (SD)	100 (72)	110 (85)	16 (74)	0.51	90 (86)	95 (79)	2 (108)	0.78	0.5(-34.0 to 36.0)	1.0
BBS (0-56 points), median (IQR)	51.5 (7)	53.5 (5)	1 (3)	0.013	52.5 (6)	52.0 (4)	1 (1)	0.34	-1 (-2 to 0)	0.2

6MWT (meters), median (SD)	390 (109)	420 (181)	25 (65)	0.067	395 (141)	385 (170)	-10 (45)	0.29	-25 (-55.0 to 0.0)	0.039
SPPB (0-12 points), median (IQR)	9 (5)	11(4)	0 (3)	0.25	9 (3)	10 (2)	0 (1)	0.12	0 (-1 to 1)	0.9
Chair rise (sec), median (IQR)	14.0 (6.1)	13.5(6.4)	0.5 (4.7)	0.78	17.0 (8.1)	15.0 (5.2)	0.05 (2.6)	0.64	-0.3 (-1.9 to 1.9)	0.7

*Data are presented as the means (SD) or medians (IQR) and 95% CIs based on the complete-case analysis. The Hodges-Lehmann test was used to estimate the median. P-values were obtained using non-parametric analyses for ordinal and not normal distributed data. The significance level was set at P<0.05.

Abbreviations: BBS, Bergs Balance Scale; BMI, Body Mass Index; CIs, confidence intervals; FFMI, fat-free mass index; FMI, fat-mass index; FM, fat mass; FM%, fat mass percent; PASE, Physical Activity Scale for the Elderly; 6MWT, Six-Minute Walking Test; SPPB, Short Physical Performance Test

Table 3. Within-group and Between-group differences of nutritional status and cardio-metabolic risk markers at the start of intervention and after 3 months*

	Intervention Group			**Control Group**			**Difference Between Intervention – Control 3 months**	
Assessment occasion (mo)	**0 (n=20)**	**3 (n=18)**	**P-value**	**0 (n=24)**	**3 (n=21)**	**P-value**	**Median 95% CIs**	**P-value**
Plasma albumin (g/l), median (IQR)	38.0 (3.8)	38.0 (4.2)	0.1	37.0 (2.5)	38.0(6.5)	0.4	2 (0 to 3)	0.09
Reference: >34 g/l								
Plasma total cholesterol, median (IQR)	4.7 (0.9)	4.2 (1.0)	0.09	4.7 (1.4)	4.6 (1.9)	0.2	0.1 (-0.3 to 0.6)	0.7
Reference: <5.0 mmol/l								
Plasma HDL cholesterol, median (IQR)	1.2 (0.4)	1.2 (0.3)	0.06	1.2 (0.5)	1.2 (0.5)	0.2	0 (-0.1 to 0.1)	0.5
Reference: >1.1 mmol/l in men, >1.2 mmol/l in women								
Plasma LDL cholesterol, median (IQR)	2.4 (0.7)	2.3 (0.6)	0.5	2.4 (1.4)	2.5 (0.9)	0.4	0.2 (-0.2 to0.4)	0.3
Reference: <3 mmol/l								
Serum IGF-1*, median (IQR)	126 (48)	118 (43)	0.023	119 (51)	129 (61)	0.4	17.5(3 to 32)	0.019
Reference 64-188 μg/l								
Plasma CRP, median (IQR)	1.4 (2.0)	1.1 (2.6)	0.7	3.0 (6.2)	2.9 (6.5)	0.8	-0.07 (-2 to 1.02)	0.9
Reference: <5.0 mg/l, median (IQR)								

*Data are presented as medians (IQR) and 95% confidence intervals (CIs) based on the complete-case analysis. The Hodges-Lehmann test was used for median estimates. For non-normal variables, P-values were obtained using non-parametric analyses. The significance level was set at $P<0.05$.

Abbreviations: CIs, confidence intervals; CRP, C-reactive protein; HDL, high density lipoprotein; IGF-1, insulin-like growth factor-1; LDL, low density lipoprotein. * Reference values according to the Department of Clinical Chemistry for individuals aged 71-75 years (based on the median age of this population).

Appendix : Descriptions of the progressive resistance and balance exercise program and the group discussion.

Warming up: Stationary cycling or walking	
Progressive resistance and balance exercises:	
Squat in a parallel or walking stance	A1
Body weight transfer in a parallel or walking stance	A2, A3
Standing up from sitting in parallel or walking stance	A4, A5
Side and forward lunge	A6, A7
Step-up	A8
Walking forward in tandem gait	B1
Walking in various directions	B2
Walking with turns	B3, B8
Walking over obstacles	B4
Step onto and over boxes	B5
Walking on a soft surface	B6
Questions concerning physical activity:	
"What is a physical activity to you?"	
"What are the barriers and facilitators for you to be physically active?"	
"What reasons do you perceive for increasing your physical activity level in your daily life?"	
"How ready are you to make changes to your physical activity level in the near future?"	
"What pro and cons do you perceive with being physically active?"	
"How much time do you spend sitting each day?"	
"What are your future plans to be physically active?"	

A: static (fixed base of support) and dynamic (changing base of support) balance exercises in combination with strength exercises

B: dynamic balance exercises while walking