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Results of physical function after resistance training and nutritional support on osteosarcopenia in older, community-dwelling postmenopausal Korean females (ERTO-K study)

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Introduction

Osteosarcopenia is geriatric syndrome defined as the concomitant occurrence of osteopenia/osteoporosis, and sarcopenia. Osteosarcopenia is a relatively new concept in geriatric medicine. It may increase the risk of fragility fractures, several morbidities and mortalities, and socioeconomic costs.

Although resistance exercises and nutritional support including protein, calcium, and vitamin D are potential non-pharmacological management, evidence is still lacking.

The objective of this study was to evaluate the effect of combined resistance exercise and nutritional support on the quality and quantity of bone and muscle in postmenopausal females with osteosarcopenia.

Methods

This study was the prospective, randomized, single-blinded two-armed randomized controlled trial. Thirty-four post-menopausal female participants with osteosarcopenia was recruited and randomly divided into intervention (n=17) and control groups (n=17). Both groups received nutritional supplements (protein, 40 g; vitamin D, 1600 IU; calcium, 600 mg) daily. The intervention group undergo 12 weeks of resistance exercise of increasing intensity (Figure 1). Skeletal muscle index (SMI), bone mineral density (BMD), and various physical performance index were evaluated.

Fig. 1. Circuit resistance training machines

Results

Table 1. Basal demographics of participants

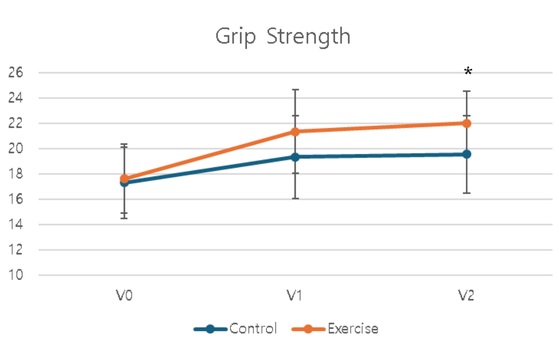
Basal demographics	Control Group (S.D.)	Exercise Group (S.D.)	P-value
Age (yrs)	76.82 (5.44)	77.00 (5.77)	0.943
Weight (kg)	46.56 (3.72)	47.13 (4.56)	0.762
Height (m)	1.50 (0.04)	1.52 (0.04)	0.364
BMI (kg/m^2)	20.69 (1.67)	20.46 (2.04)	0.785
FRAX_major (%)	12.52 (5.78)	9.80 (4.29)	0.257
FRAX_hip (%)	4.68 (3.24)	3.42 (2.07)	0.327
PBF (%)	32.14 (6.72)	30.62 (6.06)	0.607
SMI (kg/m^2)	5.09 (0.40)	5.30 (0.21)	0.172
WB-PA (degree)	4.26 (0.89)	4.56 (0.55)	0.171
Lumbar T-score	-1.98 (0.80)	-1.44 (1.20)	0.247
Hip neck T-score	-2.23 (0.75)	-1.94 (0.79)	0.421
Hip Total T-score	-1.70 (0.82)	-1.22 (0.58)	0.157
Albumin (g/dl)	4.03 (0.21)	4.14 (0.21)	0.228
Pre-albumin (mg/dl)	24.61 (3.91)	25.38 (3.52)	0.653
Calcium (mg/dl)	9.08 (0.38)	9.12 (0.23)	0.782
PTH (pg/mL)	33.96 (11.05)	32.33 (11.76)	0.753
25-OH-Vit D (ng/ml)	41.75 (17.48)	45.23 (18.30)	0.669

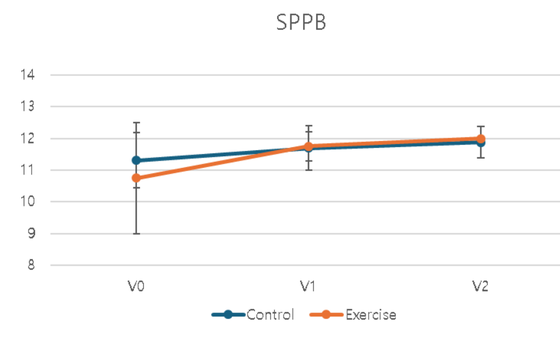
Table 2. Changes of SMI and BMD (Lumbar, Hip neck, Hip total)

Difference (0-6months)	SMI	P-value	Lumbar T-score	P-value	Hip Neck T-score	P-value	Hip Total T-score	P-value
Control	0.011	**0.036**	0.050	0.945	0.181	0.550	-0.100	0.112
Exercise	0.310		0.412		0.088		0.171	

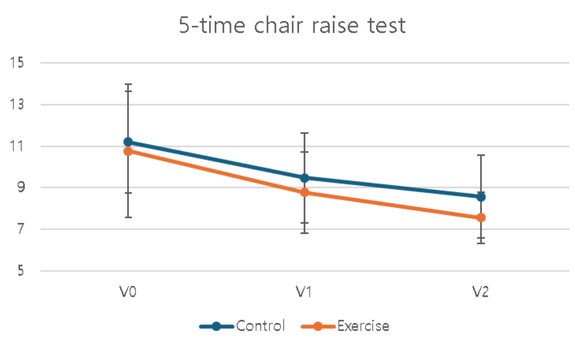
Table 3. Physical performance of participants

		0-month (SD)	1.5-month (SD)	3-month (SD)		F	P-value
Grip	Control	17.31 (2.82)	19.35 (3.28)	19.56 (3.07)	Time	45.25	**<0.001**
Strength (Kg)	Exercise	17.62 (2.74)	21.35 (3.31)	22.04 (2.54)	Time*Group	4.46	**0.016**
SPPB	Control	11.31 (0.87)	11.69 (0.70)	11.88 (0.50)	Time	8.83	**<0.001**
	Exercise	10.75 (1.75)	11.75 (0.46)	12.00 (0.00)	Time*Group	0.66	0.522
5-time	Control	11.20 (2.45)	9.47 (2.16)	8.57 (1.99)	Time	21.51	**<0.001**
chair raise (s)	Exercise	10.77 (3.20)	8.77 (1.95)	7.55 (1.23)	Time*Group	0.21	0.812
Gait	Control	1.07 (0.20)	1.19 (0.16)	1.25 (0.16)	Time	22.36	**<0.001**
Velocity (m/s)	Exercise	1.06 (0.20)	1.23 (0.24)	1.31 (0.27)	Time*Group	0.74	0.481
BBS	Control	55.06 (1.65)	55.81 (0.40)	55.50 (1.21)	Time	1.02	0.365
	Exercise	55.65 (0.79)	55.29 (1.26)	55.70 (0.99)	Time*Group	4.66	**0.013**





Comparison between exercise and control group
* P=0.034 after Bonferroni correction



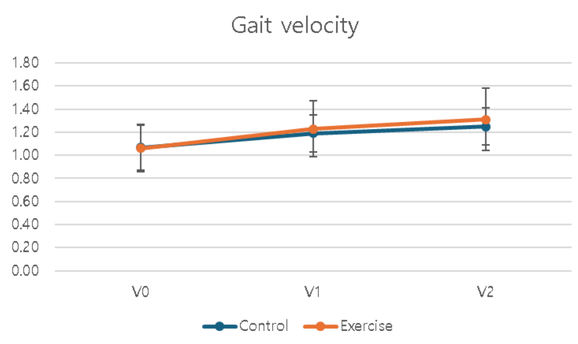
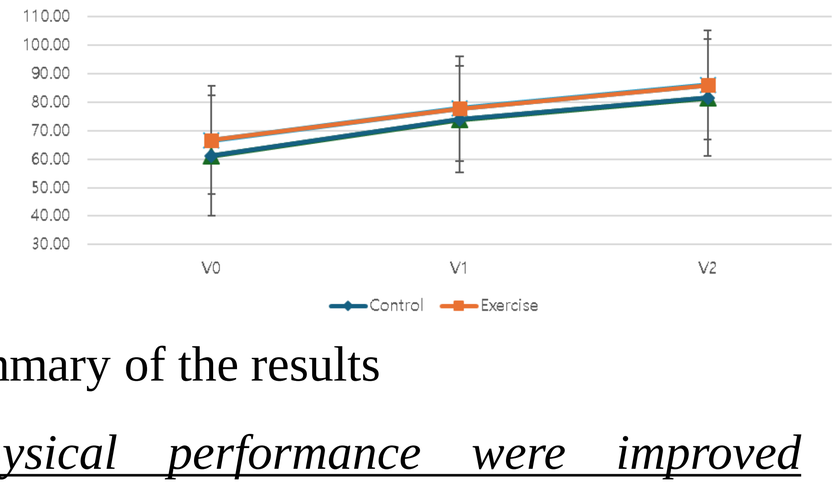


Table 4. Muscle quality index of participants

MQI	0-month (SD)	1.5-month (SD)	3-month (SD)		F	P-value
Control	61.11 (21.11)	73.91 (18.67)	81.53 (20.51)	Time	12.20	**<0.001**
Exercise	66.66 (18.93)	77.70 (18.42)	86.01 (19.00)	Time*Group	0.31	0.738

MQI = ((leg length - 0.4) × body mass × gravity × 10) / time of sit-to-stand.



- Summary of the results

All physical performance were improved after the intervention in both the exercise and control groups.

Grip strength measured at 12 weeks was statistically higher in the exercise group than in the control group.

Muscle quality index was also improved in both groups, but the difference between groups was not statistically significant.

Conclusions

Nutritional support alone could improve the physical functions in patients with osteosarcopenia. However, adding resistance exercise could have a greater impact on improving grip strength compared to nutritional support alone.

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