



The role of home-based exercise in maintaining muscle quality during preoperative pancreatic cancer treatment

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Participating in a home-based aerobic and resistance exercise program during preoperative treatment for pancreatic cancer was favorably associated with changes in skeletal muscle *index* and *gauge*, but there is insufficient evidence for benefit to skeletal muscle *density*.

Background:

- Pancreatic cancer is typically diagnosed among older adults who frequently present with loss of skeletal muscle as a sequela of both age and disease.
- Preoperative treatment is increasingly used to manage early stage pancreatic cancer and may contribute to physiologic and nutritional deficiencies that accelerate loss of skeletal muscle.
- Low skeletal muscle and loss of skeletal muscle are associated with poor postsurgical outcomes and shorter survival among individuals with pancreatic cancer.
- We previously demonstrated that participating in a home-based exercise program (EP) was associated with maintenance of skeletal muscle *quantity* (skeletal muscle index, SMI) during preoperative pancreatic cancer treatment. Changes in measures incorporating muscle *quality* (skeletal muscle density, SMD, and gauge, SMG) have not been examined.
- SMD has been a better predictor of physical function than SMI among individuals with cancer, but the impact of exercise intervention on SMD is less clear.

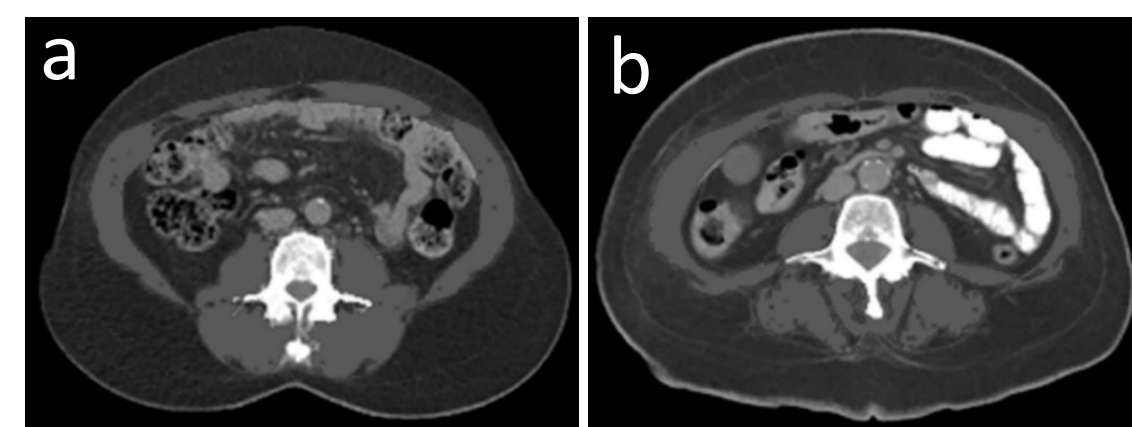


Figure 1. CT scans demonstrating difference in SMD (a > b) in CT scans from individuals with similar BMI and SMI. Adapted from Shachar et al., *Clinical Cancer Research*, 2017.

Objective:

We aimed to compare changes in SMD and SMG during preoperative pancreatic cancer treatment between EP participants and a usual care (UC) comparison group.

Hypothesis:

We hypothesized that EP participation would be favorably associated with maintenance of SMD and SMG relative to UC.

Methods:

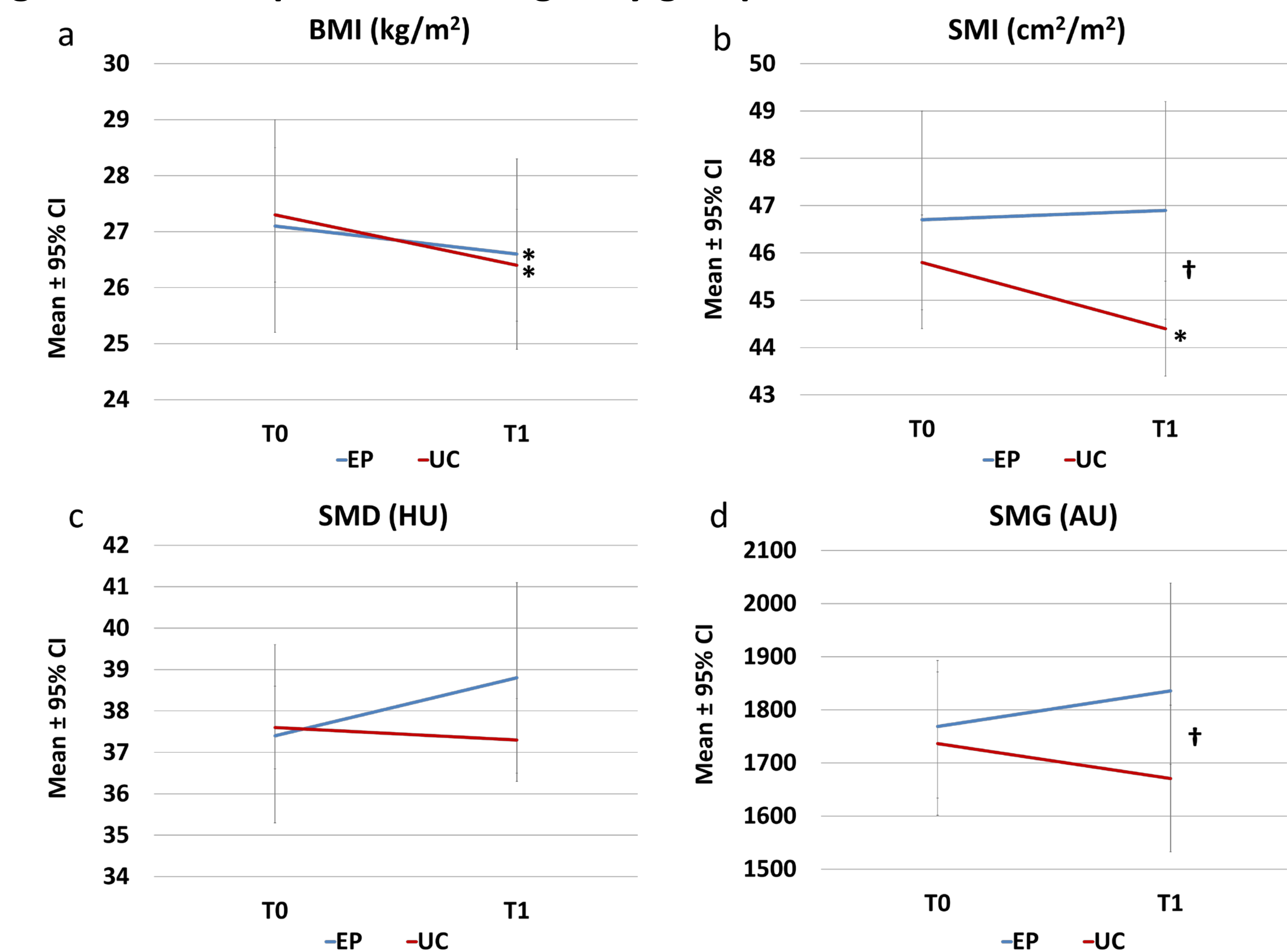
- EP recommendations included moderate-intensity aerobic exercise and resistance training (≥60 min/week each) during preoperative therapy.
- UC patients had no formal exercise program.
- The following muscle measures were collected from L3 vertebra “slices” from abdominal CT scans at presentation/treatment planning (T0) and following preoperative treatment (T1) using Tomovision SliceOmatic software.
 - SMI (standardized to stature; cm²/m²)
 - SMD (Hounsfield units, HU)
 - SMG (calculated as SMI*SMD; arbitrary units, AU)
- Rates of change in muscle measures (per week) were computed and compared between EP and UC using linear regression models adjusted for baseline value of the muscle measure, age, sex, treatment sequence relative to T0 and T1 CT scans, and change in BMI.



Results:

Table 1. Clinicodemographics by group	EP (n=33)	UC (n=64)	p
Age, years ± SD	67.7 ± 6.8	65.0 ± 8.9	.12
Sex, n (%)			.57
	Female 14 (42.4)	31 (48.4)	
	Male 19 (57.6)	33 (51.6)	
Sarcopenia at baseline, n (%)	21 (64)	40 (63)	.91
Treatment sequence relative to CT scans, n (%)			.04
T0 CT, chemotherapy, chemoradiation, T1 CT	12 (36.4)	33 (51.6)	
Previous chemotherapy, T0 CT, chemoradiation, T1 CT	4 (12.1)	6 (9.4)	
T0 CT, chemoradiation, T1 CT	12 (36.4)	8 (12.5)	
T0 CT, chemotherapy, T1 CT	5 (15.2)	17 (26.6)	
Duration between T0 and T1 CT scans, weeks ± SD	19.2 ± 10.3	22.3 ± 9.5	.15
Surgery type, n (%)			.46
Pancreaticoduodenectomy (Whipple)	29 (87.9)	50 (78.5)	
Distal pancreatectomy	3 (9.1)	12 (18.5)	
Total pancreatectomy	1 (3.0)	2 (3.1)	

Figure 1. Anthropometric changes by group



*Significant change from T0 to T1 ($p < .05$)

†Significant difference in T0-T1 change between groups ($p < .05$)

Table 2. Linear regression models

Rate of change from T0 to T1	β	t	p
SMI (cm ² /m ² /wk)	.10	2.32	.02
SMD (HU/wk)	.10	1.26	.21
SMG (AU/wk)	8.34	2.01	.048

UC is the reference group in all models. All models adjusted for baseline value of muscle measure, age, sex, treatment sequence, and change in BMI.

Conclusions:

Participation in a home-based EP during preoperative pancreatic cancer treatment was associated with maintenance of SMG, which incorporates both muscle quantity and quality. There is insufficient evidence for benefits regarding maintenance of SMD, which may be an important predictor of physical function and risk for impairments. More research is needed to understand potential benefits for SMD from exercise interventions during cancer treatment.