

Association Between Ultrasound-Derived Muscle Parameters and Skeletal Muscle Mass in Elderly Korean Women

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Introduction

Sarcopenia is a common condition in the elderly population, characterized by decreased muscle mass, muscle strength, and physical performance. Recently, ultrasound has been widely used to assess muscle mass in sarcopenia, with various muscles serving as diagnostic targets. Among them, rectus femoris thickness and cross-sectional area are the most commonly used parameters. Additionally, other ultrasound markers, including muscle thickness, cross-sectional area, pennation angle, fascicle length, and echogenicity, have been utilized in the diagnosis of sarcopenia. This study aimed to evaluate the relationship between ultrasound-derived muscle parameters and muscle mass in elderly Korean women.

Methods

This study was conducted on community-dwelling women aged 65 years or older. Skeletal muscle mass was measured using bioimpedance analysis (S10, InBody Korea). Ultrasound measurements were performed while participants were in a supine position, avoiding exercise for at least 2–3 hours before the examination. A linear probe (8–13 MHz) was used, and all measurements were taken from the right lower limb three times, with the average value recorded. The following ultrasound parameters were assessed: rectus femoris thickness (RT) and cross-sectional area (RCSA), as well as total anterior thigh thickness (TAT), measured at 50% of the anterior thigh length. For the vastus lateralis, thickness (VLT), pennation angle (VLPA), and fascicle length (VLFL) were measured at 35% of the distance from the greater trochanter to the upper pole of the patella. Echogenicity was analyzed using ImageJ software based on rectus femoris images. Pearson's correlation analysis was used to examine the relationship between skeletal muscle mass and ultrasound parameters. Additionally, participants were classified into two groups: a low muscle mass group (skeletal muscle index <5.7 kg/m²) and a normal muscle mass group, and comparisons were made using an independent t-test.

Results

Table 1. Basal demographics of participants

F (n=66)	Values (S.D)
Age (Yrs)	72.88 (5.88)
Weight (Kg)	58.66 (8.39)
Height (cm)	155.28 (4.30)
BMI (Kg/m ²)	24.28 (3.11)
HTN	28 (42.4%)
Dyslipidemia	37 (56.1%)
Diabetes	13 (19.7%)
Low muscle mass	14 (21.2%)
SMM (Kg)	20.17 (2.23)
SMI (Kg/m ²)	6.22 (0.61)

BMI, Body Mass Index; HTN, Hypertension; SMM, Skeletal Muscle Mass; SMI, Skeletal Muscle Index

Table 2. Comparison of Muscle ultrasound Between Low Muscle Mass and Normal Muscle Mass Group.

	Normal muscle mass (n=52)	Low muscle mass (n=14)	P-values
RT	15.38 (2.74)	11.76 (3.05)	<0.001
TAT	29.75 (5.40)	22.44 (5.15)	<0.001
VLT	17.72 (2.94)	14.43 (3.01)	<0.001
VLPA	14.98 (2.88)	12.58 (2.91)	0.008
VLFL	70.14 (13.37)	68.40 (15.06)	0.675
RCSA	4.83 (1.08)	3.73 (1.11)	0.001
Echogenicity	142.53 (20.61)	154.30 (28.06)	0.085

RT, Thickness of rectus femoris thickness; cross-sectional area of rectus femoris, RCSA; Total anterior thigh thickness, TAT; Thickness of vastus lateralis, VLT; pennation angle of vastus lateralis, VLPA; fascicle length of vastus lateralis, VLFL

Table 3. Correlation of Results Bioimpedance Analysis and Muscle Ultrasound

	1	2	3	5	6	7	8	9
1. SMM								
2. SMI	0.920 ^b							
3. RT	0.456 ^b	0.498 ^b						
5. TAT	0.447 ^b	0.471 ^b	0.823 ^b					
6. VLT	0.399 ^b	0.439 ^b	0.202 ^a	0.248 ^a				
7. VLPA	0.284 ^b	0.342 ^b	0.291 ^b	0.364 ^b	0.522 ^b			
8. VLFA	0.087	0.066	-0.113	-0.158	0.388 ^b	-0.566 ^b		
9. RCSA	0.491 ^b	0.495 ^b	0.831 ^b	0.621 ^b	0.231	0.164	0.054	
10. Echogenicity	-0.348 ^b	-0.308 ^a	-0.294 ^a	-0.267 ^a	0.021	-0.109	0.124	-0.221

SMM, Skeletal Muscle Mass; SMI, Skeletal Muscle Index; RT, Thickness of rectus femoris thickness; cross-sectional area of rectus femoris, RCSA; Total anterior thigh thickness, TAT; Thickness of vastus lateralis, VLT; pennation angle of vastus lateralis, VLPA; fascicle length of vastus lateralis, VLFL

a: p < 0.05, b: P < 0.01

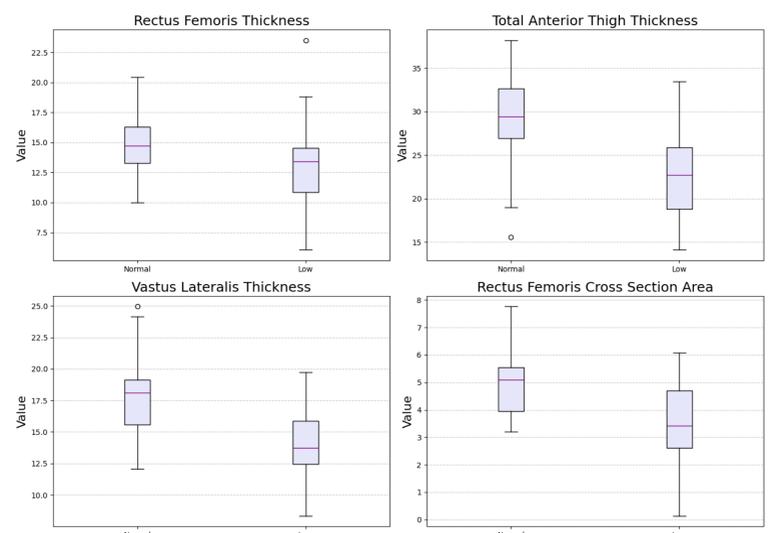


Figure 1. Comparison of US parameters between normal and low muscle mass

Conclusions

Most commonly used ultrasound parameters, including RT, TAT, VLT, VLPA, RCSA, and echogenicity, demonstrated a significant correlation with muscle mass, suggesting their potential utility in sarcopenia assessment. However, fascicle length did not show a significant difference.