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Validation of segmental bio-electrical impedance analysis to assess sarcopenia in older adults

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Rationale

Sarcopenia is an age-related decrease of muscle mass and strength and is assessed by dual energy X-ray absorptiometry (DXA) using appendicular fat free mass (aFFM). Besides DXA, an easy, cheap and feasible technique to measure aFFM is bio-electrical impedance analysis (BIA). The aim of this study was to validate aFFM measurements of BIA with DXA.

Methods

Appendicular FFM in older adults was assessed by BIA (Tanita MC-780 MA; 8-polar) and DXA (Hologic A). Participants were included in the VITAMIN trial. Pearson-correlation was used to determine correlation between the aFFM of the BIA and DXA. Paired t-test was used to compare the two techniques. Agreement between the two techniques was assessed by the Bland-Altman plot.

Table 1. Characteristics of population

Characteristics of population	Total (n=45)
Age, mean (SD), years	72 (6.7)
Sex, n (%)	
- Women	39 (86.7)
- Men	6 (13.3)
Ethnicity, n (%)	
- Caucasian/white	44 (97.8)
- Black	1 (2.2)
Weight, mean (SD), kg	71.8 (9.5)
Height, mean (SD), cm	165.1 (7.8)

Results

Table 1 shows the characteristics of 45 older adults with a mean age of 72 ± 6.7 years. Table 2 shows data analysis of aFFM assessment for BIA and DXA. Significant association was found for aFFM of BIA with aFFM of DXA ($r = 0.934$, $p < 0.0001$). Appendicular FFM by BIA was significant lower by 2.2% compared to DXA (19.94 ± 2.81 vs 20.38 ± 3.33 , $p = 0.019$).

Table 2. Data analysis of appendicular FFM assessment of DXA - BIA

	DXA	BIA	Δ BIA-DXA	Dependent t-test (p)	Pearson (ρ)
aFFM ¹	20.38 ± 3.33	19.94 ± 2.81	- 0.44 ± 1.22	0.019	0.934*
aFFM right arm ¹	2.50 ± 0.48	2.43 ± 0.39	- 0.07 ± 0.22	0.035	0.897*
aFFM left arm ¹	2.35 ± 0.49	2.49 ± 0.41	+ 0.14 ± 0.25	0.001	0.866*
aFFM right leg ¹	7.80 ± 1.23	7.53 ± 1.07	- 0.26 ± 0.50	0.001	0.914*
aFFM left leg ¹	7.73 ± 1.27	7.48 ± 1.01	- 0.25 ± 0.55	0.004	0.910*

¹ aFFM values in mean kg ± SD

* $p < 0.0001$

BIA underestimated aFFM with a mean difference of 0.44 ± 1.22 kg according to the Bland-Altman plot (Figure 1). The positive regression line showed a significant proportional bias ($\beta = 0.430$, $p = 0.003$), suggesting that BIA underestimated aFFM in older adults with a high FFM. Bland-Altman plot showed wide limits of agreement (LoA -1.96, 2.84).

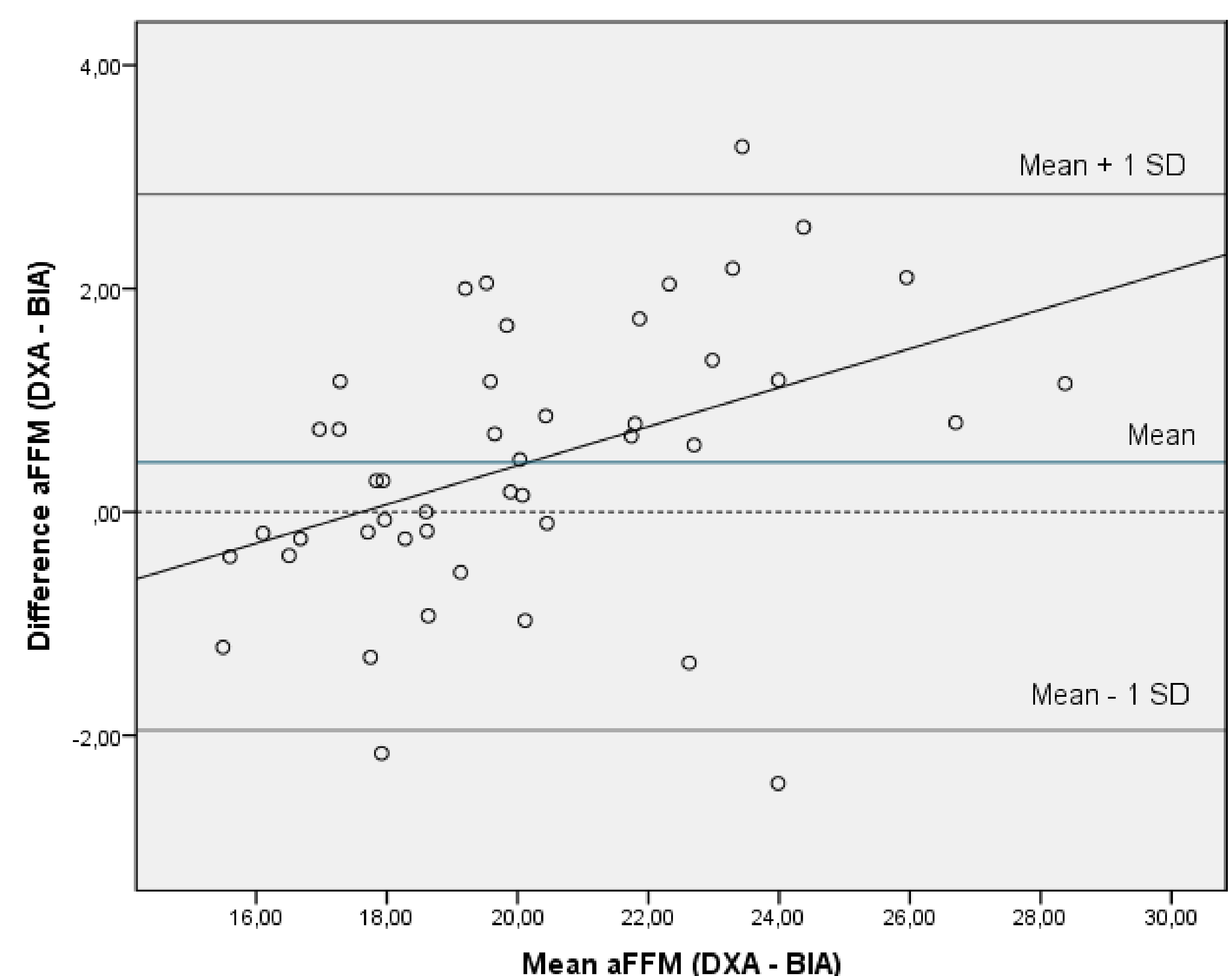


Figure 1. Bland - Altman plot Appendicular FFM DXA - BIA

Conclusion

On a group level, the BIA may be accurate to assess aFFM in older adults. On an individual level, however, the variation between BIA - DXA to assess aFFM is high. More research is necessary with a larger sample size.

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