

Predicting muscle mass of adults from anthropometry, using magnetic resonance imaging as reference: a systematic review

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Identification and management of sarcopenia is hampered by the lack of reliable simple approaches to accurately assess muscle mass. Magnetic resonance imaging (MRI) is considered the gold standard to assess body composition, including muscle mass⁽¹⁾: anthropometric measurements are widely used field methods but can be susceptible to error⁽²⁾. In a systematic review we have assessed published studies to quantify muscle mass/volume measured by MRI (reference method) using a prediction equation from anthropometric measures. A total of 257 studies were identified from primary search terms, of which twelve met inclusion criteria, assessed by two researchers.

Reference	Anthrop	N (M/F)	Variables	R ²
Whole Body MRI				
Lee, 2000 (d, v)	calf, arm, thigh.	150F/ 174M	1.BW, HT, AGE, SEX, RACE 2.HT, CAG, CTG, CCG, SEX, AGE, RACE	d:0.86,v:0.79 d:0.91,v:0.83
Ross, 1994 (d)	arm, thigh, calf , hip	40F 17M	1.BW,HC 2.BW,WC,TC	0.62 0.89
Limb Regions MRI				
Chen, 2011 (d)	thigh	36 F 33M	1.age, BW, TC 2.age, BW, TC, WC	0.62 0.68
Knapik, 1996 (d, v)	thigh	9F/9M	CTG + thigh length	0.92
Housh, 1994 (d, v)	quadriceps hamstring total thigh	43M	1. CTG 2. CTG 3. CTG	d:0.72,v:0.64 d:0.52,v:0.29 d:0.74,v:0.77
Fuller, 1999 (d)	thigh, calf	8M/8F	CTG CCG	0.35 0.69
Tothill, 2002 (d)	thigh	9M/10F	CTG	0.80
Mathur, 2008 (v)	quadriceps hamstring	22F/ 18M	1. CTG 2. CTG	0.06 0.08
Tonson, 2008 (v)	arm	46M	CAG	0.90
Nakamura, 2006 (v)	thigh	16F	TC	0.12
Bamman, 2000 (v)	calf	39F	CCG	0.45
Baumgartner, 1992 (v)	arm, thigh	17F/8M	CAG CTG	0.69 0.43

BW: body weight, TC: thigh circumference, WC: waist circumference, HC: hip circumference, HT: height, SF: skin fold,CAG: SF corrected arm girth, CTG: SF corrected thigh girth, CCG:SF corrected calf girth, CC: calf circumference, UAC: upper arm circumference, MTC mid thigh circumference, v: validation study, d: derivation.

Most studies assessed only regional MRI muscle mass/volume. The majority used limb circumference adjusted for skin-fold thickness which limits practical application. Although regional muscle has been suggested as a marker of whole body muscle⁽³⁾, only Lee (2000) and Ross (1994) examined associations between regional anthropometry and whole body muscle mass/volume. These two rather different approaches have not been compared directly and their value for assessing change in total muscle mass is uncertain.

1. Heymsfield, SB, Gallagher D, Visser, M *et al.* (1995). *J Gerontol Series A* **50**, 23–29.
2. Knapik JJ, Staab JS, Harman EA. (1996). *Med Sci Sports Exerc* **28**(12), 1523–1530.
3. Lee S, Janssen I, Helymsfield S, Ross R. (2004). *AJCN* **80**(5), 1215–122.