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## Measuring abdominal and visceral adipose tissue: comparison of data from simpler techniques with MRI

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The relationship between increasing body mass index (BMI) and an increased risk of morbidity and premature mortality is well established<sup>(1)</sup>. However, attention is now focused on the amount of fat and its distribution within the body, with visceral adipose tissue (VAT) more strongly associated with metabolic risk than subcutaneous abdominal adipose tissue (SAAT)<sup>(2)</sup>. Accordingly there is a need for simple techniques that can discriminate regional fat.

This study compared regional and total body fat measures obtained from simpler techniques, with the gold standard, MRI. One hundred and twenty participants, aged 18–79 years, stratified by gender and BMI were recruited, with measures made on two visits, within 7 d. At the first visit, weight, height, waist circumference (WC), dual energy x-ray absorptiometry (DXA) (Lunar Prodigy, GE Healthcare, Wisconsin, USA) and bioelectrical impedance (BIA) (Tanita Corp, Tokyo, Japan) measurements were made. Total and regional fat measurements were made with DXA (trunk and L2–L4), and with three BIA devices including the new abdominal BIA device (trunk and 'visceral fat level'). At the second visit, MRI was performed quantifying SAAT, VAT and total abdominal adipose tissue (TAAT) area. Data were analysed using Pearson's correlation coefficients (Table 1).

**Table 1.** The relationship between simpler and MRI measurements

	VAT		SAAT		TAAT	
	Men	Women	Men	Women	Men	Women
BMI	0.64	0.58	0.84	0.86	0.92	0.91
WC	0.71	0.74	0.85	0.76	0.96	0.88
DXA total body fat (%)	0.65	0.58	0.84	0.86	0.92	0.91
DXA trunk fat (%)	0.69	0.63	0.77	0.82	0.89	0.89
DXA abdominal fat (%)	0.70	0.62	0.77	0.83	0.90	0.90
BIA (AB-140) 'visceral fat level'	0.65	0.64	0.87	0.86	0.94	0.92
BIA (AB-140) trunk fat (%)	0.65	0.61	0.85	0.83	0.93	0.89
BIA (AB-140) waist circumference	0.63	0.57	0.86	0.84	0.92	0.88
BIA (BC-420) body fat (%)	0.71	0.65	0.76	0.71	0.90	0.81
BIA (BC-420) 'visceral fat level'	0.80	0.64	0.64	0.47	0.87	0.61
BIA (MC-180) body fat (%)	0.69	0.61	0.80	0.71	0.92	0.80
BIA (MC-180) trunk fat (%)	0.64	0.81	0.80	0.65	0.89	0.71
BIA (MC-180) 'visceral fat level'	0.82	0.61	0.67	0.45	0.90	0.58

Most of the simpler measurements show better correlations with TAAT and SAAT than with VAT. DXA L2–L4 fat, WC and AB-140 'visceral fat level' show similar relationships with TAAT. Of the three BIA devices, the specific abdominal BIA device (AB-140) shows stronger correlations with TAAT than the two whole-body BIA devices but none assessed VAT accurately.

This study suggests that the simpler measures are better proxies for TAAT than VAT. BMI, WC and BIA methods provide similar correlations with MRI indices compared to the more complex DXA measure, suggesting the additional cost and radiation exposure to the participant associated with the DXA measurement may not be warranted in large-scale studies.

1. Willett WC, Dietz WH & Colditz G (1999) *N Engl J Med* **341**(6), 427–434.

2. Fox CS, Massaro JM, Hoffmann U *et al.* (2007) *Circulation* **116**, 39–48.