

# Relationships Between Fat Mass and Lean Mass

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**Keywords:** Adipose tissue; fat mass; lean mass; fat-free mass

**Running title:** Fat and lean masses

**Word count:** 499

**Funding:** None

**Disclosure:** The author declared no conflict of interest.

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## Relationships Between Fat Mass and Lean Mass

TO THE EDITOR: The recent ‘Perspective’ of Abe et al. (1) is a valuable contribution to the topic of quantitative relationships between the fat and the fat-free components of the body. They utilized published data relating to six different programs of dietary restriction, mostly combined with exercise. My aim here is to link their approach to those of related studies on adults in which exercise programs are not involved (2,3). These concern the influence of fat mass (FM) on lean (i.e. fat-free) mass (LM), quantified by the ratio  $\Delta LM/\Delta FM$ , where  $\Delta$  denotes difference or change.

From mean changes in LM and FM, in kg, Abe et al. calculated changes in mean LM that excluded the masses of the fat-free components of adipose tissue, denoted FFAT (1). On the assumption that 85% of adipose tissue is fat, FFAT was calculated as  $(1 - 0.85) \times FM/0.85$ , i.e.  $0.176.FM$ . Finally  $\Delta\{LM - FFAT\}$  was calculated as the difference between that and the LM, i.e.  $\Delta\{LM - 0.176.FM\}$ . The results for the six programs constitute the last column of their Table 1.

With the programs designated as in their Table 1, the corresponding values of  $\Delta LM/\Delta FM$ , not tabulated, are: ‘Diet+Life’ 0.23; ‘Diet+Aerobic’ 0.07; ‘Control’ no value; ‘Aerobic’ 0.43; ‘Combined’ 0.24 and ‘Resistance’ 0.14.

Facilitating comparisons of the two approaches when individual data are unavailable is the fact that  $\Delta\{LM - FFAT\}$  and  $\Delta LM/\Delta FM$  are closely related. Indeed, over a realistic range of values,

$$\Delta\{LM - FFAT\} \approx 1.20 - 6.60 \times \Delta LM/\Delta FM.$$

Table 1 of Burton (2) records mean values of  $\Delta LM/\Delta FM$  calculated for obese individuals on restricted diets with no exercise program. For 12 groups of women the values—of varied reliability—range from 0.14 to 0.61, averaging 0.28. For six groups of men they range from 0.25 to 0.56, averaging 0.37. According to the above formula,  $\Delta\{LM -$

FFAT} ranged from 0.28 to -2.83. Values of  $\Delta\text{LM}/\Delta\text{FM}$  obtained for three groups of overfeeding men were 0.50, 0.54 and 0.65, with  $\Delta\{\text{LM} - \text{FFAT}\}$  being calculated respectively as -2.1, -2.4 and -3.1.

If the fat content of adipose tissue is again taken as a constant 85%, with FFAT equal to 0.176.FM, then  $\Delta\text{FFAT}/\Delta\text{FM}$  is 0.176. In theory this should be less than  $\Delta\text{LM}/\Delta\text{FM}$ —because of adjustments in other components of LM—and this is true of most of the values in the previous paragraph. Nevertheless, it is clear that changes in the fat-free component of adipose tissue (FFAT) are responsible for significant parts of the changes in whole-body LM, as emphasized by Abe et al. (1).

The papers of Burton (2,3) are mainly concerned with relating LM and FM for ‘ordinary’, non-experimental, population samples. The later paper (3), involving a novel regression method, produced estimates of  $\Delta\text{LM}/\Delta\text{FM}$  of 0.40-0.53 (for women and men of three U.S. ethnic groups). As four of the five values calculated for the data tabulated by Abe et al. (1) are substantially lower (see above), one may speculate that FM and LM might eventually have adjusted over time to conform to the above more typical non-experimental relationships.

**Acknowledgments:** None

## References

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