

Does Adding Muscle Increase REE in a Clinically Significant Way?

In a presentation Dr. Stephen Heymsfield (Professor of Medicine at Columbia University; researcher at St. Lukes-Roosevelt Obesity Research Center) gave at the American Dietetic Association's annual meeting and convention in 1996 he pointed out that the idea that skeletal muscle has a high REE is false, and that where the idea got started is unclear. While skeletal muscle and adipose tissue are the two largest fractions of body weight, their contribution to REE is considerably smaller than that of organs (see Figure 3).

Lean Body Mass Contribution to REE		
	% Body Wt.	% REE
Organs	5-6	60-70
Skeletal Muscle	30-40	16-22

Source: Elia⁷

Figure 3

More recently (2003) two researchers (John Jakicic PhD, Director of the University of Pittsburgh Physical Activity and Weight Management Research Center and Dixie Sanforth MS, kinesiology lecturer at the University of Texas) presenting at the American College of Sports Medicine's spring conference made similar points: while strength training has many benefits a clinically significant increase in REE isn't one of them, and that health and fitness professionals need to be careful to be accurate when conveying those benefits.

Leading researchers in this area believe that the best data we have on tissue metabolism indicates that the REE of skeletal muscle is just 13-kcal/Kg per day, while organs (heart, kidneys, liver and brain) have the highest REE (200- to 400 kcal/Kg per day). Adipose tissue adds just

4.5 calories/Kg per day to REE.⁷ According to Dr. Jakicic, he has yet to see clinical data supporting the notion that increasing skeletal muscle mass has a *clinically significant* effect on REE. It seems that the literature on this topic is wrought with methodological problems and conclusions not supported by the data they're based on. A meta-analysis of 22 studies found "no relationship between changes in REE and changes in FFM across studies."⁸ The Energy chapter from the National Academy of Sciences 2002 DRI's discusses several similar points.⁹

Based on the above noted REE for skeletal muscle and adipose tissue, a client who replaced 2 Kg of adipose tissue with skeletal muscle would have a net increase in REE of just 17 calories per day. A review of 45 studies on the effect of exercise on body composition (studies averaged 130 minutes per week of aerobic, strength or both activities) found that the average subject improved their body composition by ~1.4%, which consisted of changes in lean body mass and fat mass which were significantly less than 2 Kg each. While there was no difference in the overall change in body composition between activity types, the result was achieved by greater fat loss secondary to aerobic activities and greater lean body mass gain secondary to strength training. The reviewer concluded that, "formal exercise training in the absence of significant changes in diet does not result in substantial changes in body weight and body composition."¹⁰

It's important to note that the average weekly "dose" of activity in this review was far less than the latest recommendation of one hour of accumulated physical activity per *day* for the maintenance of a healthy body weight.⁹ It is no surprise to anyone familiar with the literature on activity and body weight that such a small dose of activity was associated with an equally small result.

Metabolism: Body Tissues

Contribution of Different Organs and Tissues to Body Weight and BMR

Tissue or Organ Weight (kg*)	Tissue or Organ Weight (kg*)			Tissue or Organ Weight (% body weight)			Organ Metabolic Rate (cal/kg/day)	Metabolic Rate (% total)		
	Reference male	Reference female	Child (0.5 y)	Reference male	Reference female	Child (0.5 y)		Reference male	Reference female	Child (0.5 y)
Liver	1.8	1.4	0.263	2.57	2.41	3.51	200.0	21	21	14
Brain	1.4	1.2	0.713	2.00	2.07	9.51	240.0	20	21	44
Heart	0.33	0.24	0.040	0.47	0.41	0.53	440.0	9	8	4
Kidneys	0.31	0.275	0.053	0.44	0.47	0.71	440.0	8	9	6
Skeletal muscle	28.00	17.00	1.875	40.00	29.31	25.00	13.0	22	16	6
Adipose tissue	15.00	19.00	1.50	21.43	32.75	20.00	4.5	4	6	2
Miscellaneous tissues by difference (e.g., bone, skin, intestines, glands)	23.16	18.885	3.056	33.09	32.58	40.74	12.0	16	19	24
Total	70	58	7.5	100	100	100		100 (1,680 cal/day)	100 (1,340 cal/day)	100 (390 cal/day)

* 1 kg=2.2 lbs.

Source: Elia, see reference 7.

Figure 4