



## **Strength Training and RMR**

In a society constantly bombarded with images of what is attractive, where people feel pressure to conform to those images, it's not surprising that strength training often takes on such a prominent role in the gym. After all, lifting weights may be the quickest way to improve your clients' physical appearance and self image. Strength training also has many functional benefits including improved muscular strength, posture and coordination, reversal of muscle tissue losses that accompany aging and increased bone mineral density, reducing the risk of osteoporosis. Lately, I've been hearing a lot about how strength training increases resting metabolic rate (RMR).

Among fitness professionals, the often (over) used argument is that strength training will add muscle, which will increase people's RMRs and, over time, will help them to lose weight because muscles are "fat burning machines." However, a bit of grade school math shows that adding muscle mass from lifting weights doesn't have much of an effect on RMR. Each pound of fat free weight has been calculated to burn about eight to 15 calories per day, a negligible amount when you consider the 3,500 calorie deficit it takes to lose just one pound and much lower than what is often publicized in the fitness community. Therefore, if your 200 pound client lifts weights and gains two pounds of muscle, he or she will burn an extra 16 to 30 calories per day, taking 117 to 219 days to burn one pound's worth of calories. But since it takes a 3,500 calorie deficit compared to the number of calories consumed to lose one pound, not just a 3,500 calorie expenditure, it will actually take much longer to lose one pound from adding two pounds of muscle mass.

Although weight training can increase muscle mass if you provide your clients with the right stimulus (using at least 70 percent of the client's one-rep max and performing enough reps and sets to cause a significant amount of muscle breakdown and stimulate protein synthesis), research does not support the use of weight training alone or in combination with aerobic training for enhanced weight loss, but rather for the preservation of muscle mass while trying to lose weight. To burn fat, what really matters is not how much muscle one has but how metabolically active that muscle is. With an increase in muscle mass and an improved metabolic capacity obtained through aerobic exercise (which increases the number of enzymes involved in aerobic metabolism and increases the density of mitochondria, the real fat burning machinery), more fat can be burned over the long term.

While it is clear that metabolic rate is acutely elevated after a workout (referred to as excess post-exercise oxygen consumption, or EPOC), with high intensity and longer duration exercise causing a greater and longer boost to post exercise metabolic rate, it is not as certain that the pre exercise (resting) metabolic rate is raised significantly, as is often claimed by fitness professionals. Since the more intense the exercise, the more and longer the post workout metabolic rate is elevated and the more calories subsequently burned, supervising your clients' cardio workouts will

likely yield better weight loss results than having the clients struggle through the workouts on their own. While the post workout elevation in metabolism can certainly help your clients burn more calories over the long term, the elevated metabolism during their workouts (which is much higher than afterwards) has a greater impact on their overall calorie burn and subsequent weight loss. And in workouts of equal duration, cardiovascular exercise burns many more calories than does weight training.

People lose weight only when caloric expenditure is greater than caloric intake. This is referred to as being in "negative energy balance." Research has shown that, when people are in negative energy balance and losing weight, RMR actually decreases. This decrease in resting metabolic rate even occurs when muscle mass is maintained by weight training. Since no research has shown that RMR is maintained much less increased when people are in negative energy balance, how can fitness professionals suggest that weight training increases RMR, resulting in weight loss?

Contrary to what most people believe, resting metabolic rate does not differ much between people, including between those who are fat and lean, averaging about 200 to 250 milliliters of oxygen per minute, or about 3.5 milliliters of oxygen per kilogram of body mass per minute. In clinical practice, the RMR is commonly referred to as one MET (metabolic equivalent), with the exercise prescription made in terms of multiples of METs. Since approximately five calories are burned for every liter of oxygen consumed, the oxygen consumption value of one MET equates to about nine to 11 calories per pound of body mass per day. Thus, heavier people actually have slightly higher RMRs because they have more mass to support all day. If RMRs were vastly different between people, we would not be able to define a MET the way we do since there would be too much inter-individual variability.

While a few studies have shown that RMR (or total daily caloric expenditure) increases in response to either an aerobic or weight training program, many have shown that it does not, with one study reporting an increase only in men. Research has also shown that RMR is not significantly different between people of different aerobic fitness levels and is independent of training status. The few studies reporting an increase in RMR have often been conducted on older adults who are more likely to show increases in resting metabolic rate due to the attenuating effect of weight training on age-associated losses in muscle mass. Additionally, RMR can be increased partially as a result of increasing caloric intake that often accompanies the increase in caloric expenditure with exercise. So, while RMR can increase in response to strength training in an older population that has lost a significant amount of muscle mass over the years, it does not increase in the general population.

So next time one of your clients asks about strength training and weight loss, explain to him or her that, while strength training is important for a variety of reasons, it will not lead to weight loss by increasing RMR. If your clients want to lose weight, the best way to do so is to burn many calories during their workouts (that will not be replaced by what they eat) and use alternating days of high intensity and long duration exercise to maximize calorie burn during the workouts and to maximize the increase in post workout metabolic rate.