What is the metabolic consequence of regular resistance training? Do you really know the answer? Or should you be questioning yourself? Tony Lycholat explains.
Typically, resistance training is viewed as an activity that involves modest energy expenditure (compared with whole-body aerobic exercise, such as running, rowing or swimming). While all additional energy expenditure is of value in terms of weight management, resistance training for weight loss – despite its other health benefits (i.e., muscular strength development; endurance, power and posture improvement; injury prevention) – is more usually seen as a way of improving total muscle mass which, in turn, leads to greater resting metabolic rate and energy expenditure.

However, is the metabolic consequence of regular resistance training as simple as this? Increasingly, scientists are questioning this simplistic view, largely since resistance-training studies, while accepting that resting energy expenditure over the following 24 hrs (24-hr EE) may well be elevated, have usually been limited to looking at isolated bouts of resistance exercise. What is the body’s response to repeated bouts of resistance exercise over a period of months?

**New research**

In essence, this was the question posed by Kirk and colleagues who, in a recent study, set themselves the task of “evaluating the impact of a supervised six-month minimal resistance training programme (i.e., one set, three days per week, nine exercises, 3-6 repetition maximum) in sedentary young adults on 24-hr EE, resting metabolic rate (RMR), sleep metabolic rate (SMR) and substrate oxidation”.

Sixty-three overweight young adult men and women volunteered for this study. These subjects were then matched for fat-free mass and randomly assigned to a resistance-training
group (RT) or a non-exercise control group (C). All subjects were asked to maintain their normal diet and activities of daily living throughout the study period.

The research protocol was essentially quite simple. Baseline measures of 24-hr EE, RMR, SMR, substrate oxidation, muscular strength and body composition were assessed using documented laboratory procedures and a room calorimeter. A room calorimeter is a small room entered via an airlock containing everything that an individual would require for a 24-hr stay. Because an individual’s oxygen consumption and carbon dioxide production can be measured accurately within this room, total 24-hr EE, RMR, SMR and substrate oxidation can be accurately determined. At the end of the six-month study period, the baseline measurements were repeated.

The resistance-training programme comprised one set of nine exercises designed to train all the major muscle groups, using a resistance of three-to-six repetitions maximum (3-6 RM): this was equivalent to approximately 85-90% 1RM. According to the authors, “we selected the higher intensity resistance training to maximise the potential effect on fat-free mass and therefore on RMR, SMR and 24-hr EE”. Training was performed on three non-consecutive days per week for six months using selectorised weight stack equipment.

Progression was determined when more than six repetitions could be completed (with good technique) and the resistance increased appropriately to reduce the maximum number of repetitions to between three and six. To remain in the study, participants were informed that an adherence rate of greater than 90% was required.

Dietary intake was assessed monthly using 24-hr dietary recalls and three-day food records performed randomly.

Results

Thirty-nine subjects completed the study. Of these, 22 (16 males, six females) were in the training group and 17 (11 males, six females) were in the control group. Adherence to training was excellent, with 96% of the total prescribed exercise sessions being completed. Note that the average time to complete the resistance-training session was 11 minutes.

Significant changes in strength measurements pre- and post-study were seen in the RT group, with chest strength increasing by 47.5% and leg strength increasing by 53.7%. No changes were seen in the control group.

Both groups saw significant changes in body mass and BMI. With the RT group increasing weight by 2.9% and BMI by 2.9%, while the control group saw increases in weight and BMI of 2.9% and 2.5% respectively. However, RT had a significant impact on body composition, in that the increase in fat-free mass in the RT group was 2.7%, compared with a decrease of 0.6% in the control group.

In terms of 24-hr EE, while there was no difference between the groups for the change in 24-hr EE, the increase in 24-hr EE in the RT group was double that of the increase in the control group. The RT group also showed a significant increase in RMR and SMR, with the change in fat-free mass being positively associated with changes in 24-hr EE, RMR and SMR. With respect to substrate oxidation, changes in respiratory quotient in the RT group suggested increased fat oxidation compared with the control group.

What is interesting about this study is that the results of following a low-volume resistance-training programme show a “favourable impact on body composition corresponding to a chronic adaptation of both energy expenditure and fat oxidation” and that a six-month minimal programme such as this may have a significant impact on daily energy expenditure. This leads the authors to comment that, “the fact that even a low-volume RT programme can provide a sustained increase in energy expenditure may be important for weight management”.

Practical application

The authors make the following practical conclusion: “these findings suggest that a minimal RT programme may provide a sufficient stimulus to impact energy balance and to prevent long-term weight or body fat gain in sedentary, overweight young adults. Further, the minimal RT protocol described in this study may provide an attractive alternative to either aerobic or multiple set RT programmes for weight management in busy young adults because of the minimal time commitment”.

A note of caution

In a related study that also used a room calorimeter and 24-hr EE to evaluate the relationship between exercise, fat metabolism and fat oxidation, Melanson et al report that exercise recommendations made for the general public that high levels of physical activity and exercise would induce an increase in fat oxidation and therefore negative energy balance. Our studies would suggest that energy and macronutrient intake is a more important modulator of daily fat balance and therefore that exercise recommendations made for the sake of regulating fat mass cannot be made without also considering energy and macronutrient intake”.

In other words, if you don’t consider energy intake, you may well fail to lose weight through exercise alone. Melanson et al conclude that, “we must educate the public that participation in moderate doses of exercise will not burn more fat unless changes are made to energy or fat intake”.

For a list of references visit www.fitpro.com/fitpro/references