Canadian Study

Impact of Exercise on Body Fatness and Skeletal Muscle Metabolism

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Calorie burning comparison between high-intensity aerobic/anaerobic exercise and medium intensity pure aerobic exercise. High intensity exercise excelled impressively.

9 Times as much fat (calories) burned with 4 minute high intensity aerobic/anaerobic exercise than with 30 to 45 minutes on a treadmill at 70% $VO_{2max.}$

Study Conducted at Laval University, Quebec, Canada

Dr. Angelo Tremblay, Ph.D., and his colleagues at the Physical Activities Sciences Laboratory, Laval University, Quebec, Canada, challenged the common belief among health professionals that low intensity, long duration exercise is the best program for fat loss. They compared the fat loss results from medium intensity aerobic exercise and interval high-intensity aerobic/anaerobic exercise.

The Testing Parameters

The Canadian scientist divided 27 inactive, healthy, non-obese adults (13 men, 14 women, 18 to 32 years old) into two groups. They subjected one group to a 21-week endurance training (ET) program of uninterrupted cycling 4 or 5 times a week for 30 to 45 minutes; the intensity level began at 60% of heart rate reserve and progressed to 85%. (For a 30 year old, this would mean starting at a heart rate of about 136 and progressing to roughly 170 bpm, which is more intense than usually prescribed for weight or fat loss.)

The other group did a 15 week program including mainly high intensity interval training (HIIT). Much like the ET group, they began with 30 minute sessions of continuous exercise at 70% of maximum heart rate reserve, but soon progressed to 10 to 15 bouts of short (15 seconds progressing to 30 seconds) or 4 to 5 long (60 seconds progressing to 90 seconds) intervals separated by recovery periods allowing heart rate to return to 120-130 bpm. The intensity of the short intervals was initially fixed at 60% of the maximal work output in 10 seconds, and that of the long bouts corresponded to 70% of the individual maximum work output in 90 seconds. Intensity on both was increased 5% every three weeks. The total energy cost of the ET program was substantially greater than the HIIT program.

The researchers calculated that the ET group burned more than twice as many calories during the exercise than the HIIT group, but no extra calories were burned after the exercise. Skinfold measurements showed that the HIIT group lost 9 times as much subcutaneous fat during 15 weeks than the ET group lost during 21 weeks. When the difference in the total energy cost of the program was taken into account, the subcutaneous fat loss for the HIIT group was NINEFOLD that of the ET group. Even though the HIIT group burned less than half the calories during the short bursts of exercise, the metabolism was raised substantially so that the HIIT group metabolized 9 times as many calories as a result of the exercise than the ET group burned during the exercise. The ET group experienced next to no additional calorie metabolism after the exercise.

Conclusions Drawn by the Researchers

Dr. Tremblay's group took muscle biopsies and measured muscle enzyme activity to determine why high intensity exercise produced so much more fat loss. They concluded: "Metabolic adaptations resulting from HIIT may lead to a better lipid utilization in the post exercise state and thus contribute to a greater energy and lipid deficit." Therefore, high intensity intermittent training (HIIT) raises total muscle metabolism to higher levels than endurance training (ET). Even though HIIT consumes fewer calories during the 4 minutes of ET, the total calories "burned" during a 24 hour period resulting from 4 min HIIT is far greater than from 60 min of ET (treadmills, bikes, steppers, etc.)

CONCLUSION: More fat loss per 24 hour period with 4 min ROM exercise than with 60 min endurance training on treadmill, bike or stepper.