Metabolic Training: Do We Really Need Cardio?

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Trainers and our clients are obsessed with "Cardio, Cardio, Cardio." There is a perception that MICT must be part of an exercise program in order to make training complete, to burn more calories, to lose more weight, or to be completely fit. With more high intensity interval training (HIIT) research studies being done and showing reduced skin folds, total body mass, fat mass, trunk fat, and fasting plasma insulin levels it is time to ask the question: Which type of exercise is better for fat loss – continuous or interval training?

What do "the guidelines" say?

American College of Sports Medicine - Moderate-intensity cardio exercise for ≥30 min/day ≥5 days/week for a total of ≥150 min/week. Vigorous-intensity cardio exercise for ≥20 min/day ≥3 days/week for total of ≥75 min/week. Or a combination of moderate- and vigorous-intensity exercise.

American Heart Association - 150 min/week moderate exercise or 75 min/week vigorous exercise (or combination of moderate and vigorous. 30 minutes a day, five times a week is an easy goal to remember. You will also experience benefits if you divide your time into 2 or 3 segments of 10 -15 minutes per day.

American Diabetes Association - Exercise doesn't necessarily mean running a marathon or bench pressing 300 pounds. The goal is to get active and stay active . . . gardening to playing tennis to walking with friends.

Canadian Society for Exercise Physiology - To achieve health benefits, adults 18-64 yrs should get at least 150 min's moderate- to vigorous-intensity aerobic physical activity/week, in bouts of 10 minutes or more.

U.S. Department of Health & Human Services: Physical Activity Guidelines for Americans
Baseline activity - light-intensity activities of daily life, such as standing, walking slowly, and lifting lightweight objects. Health-enhancing physical activity - produces health benefits. Brisk walking, jumping rope, dancing, lifting weights, climbing on playground equipment at recess, and doing yoga. Some people (such as postal carriers or carpenters on construction sites) may get enough physical activity on the job to meet the Guidelines.

What Is "Cardio?"

- "Exercise that increases the demand of oxygen to the muscles."
- ACSM – "large muscle groups . . . 30 – 60 min's . . .
- LSD . . . Long slow distance

- Cardiovascular exercise - an activity that raises your heart rate to a level where you're working, but can still talk.
- "Exercise that increases the demand of oxygen to the muscles?"
- Weight training?
- Boot Camp?
- Yoga?
- HIIT?
- Pilates?

What is Metabolic Training?

- complex network of hormones and enzymes that convert food into fuel and affect how efficiently we burn the fuel.

- "The process of metabolism establishes the rate at which we burn calories and . . . how quickly we gain weight or how easily we lose it." Robert Yanagisawa, MD

- Metabolism: amount of energy the body burns to maintain vital functions.

- "exercises that improve or enhance the body's energy systems." secretstolivingahealthylifestyle.com

- "conditioning muscles to better use what's being delivered to them by improving the efficiency of the different metabolic pathways." baye.com

- "exercise that utilizes science of endocrinology and performance training to tax body's major energy systems . . . maximize use of stored adipose tissue as a fuel source, during and after exercise." t-nation.com

- "all energy pathways, enable you to burn the most fat, build lean, quality muscle and increase your aerobic capacity." ehow.com

Approximate Energy Use During <u>Continuous</u> Exercise

	Rest	10 min	30 min	60min	120 min
CHO's	50%	70%	40%	30%	20%
Fat	50%	30%	60%	70%	80%

Wilmore & Costill, 1994

Lactate accumulation causes an increase of hydrogen ions & acidosis.

Acidosis is thought to be a primary factor in muscle fatigue.

Acidic muscles aggravate nerve endings causing pain and increase irritation of the central nervous system (McKardle, Katch, & Katch, 2001)

Some research shows anaerobic exercise may condition your CV system to the same extent as aerobic exercise.

Metabolic training is a fancy way of describing anaerobic training . . . a.k.a. . . . HIIT . . . or just high intensity exercise.

Fat Burning During Exercise
Can we train the body to use fat as fuel?
"The intensity and the duration of your runs strongly influence the percentage of each fuel used during your workout."

Long slow distance or higher intensity exercise for "Fat Burn?"
No such thing as a "Fat Burning Zone" at lower intensities.
But . . . is there when using High Intensity Interval Training?

Free Fatty Acids
Fat in fat cells
Exercise & need for energy
Fatty acids that are freed into blood (free fatty acids)
Bind with albumin
Carried to muscle cell
Used as energy
Fat use is highest during moderate exercise (65% of VO2 max) . . . free fatty acids and muscle fat contribute equally.

"Energy for exercise does not simply result from activation of a series of energy systems that "switch on" and "switch off" but rather from a smooth blending, with considerable overlap of one mode of energy transfer to another."
Greenhaff & Timmons, Exerc Sport Sci Rev, 1998 and Spencer & Gastin, Med Sci Sports Exerc, 2001.

Excess Post-Exercise Oxygen Consumption (EPOC)
"…'disequilibriums' in physiologic function … operating to keep recovery metabolism elevated." (McKardle, Katch, & Katch, 2009).

EPOC is dependent on:
- Intensity & duration of exercise.
- Training status & gender.

Incorporating HIIT into continuous exercise has been found to significantly increase EPOC (Kaminski & Whaley, 1993).
Some studies show EPOC persisting for 24 hours, other studies show EPOC levels returning to normal in less than 90 minutes.

What are the most important components of fitness?

What Kind of Fitness Do Our Clients Want?
- "Activities of Daily Living"
- Health Related Fitness
- Physical Fitness
- Recreational Athlete

- Elite Athlete

Do We Need to do Cardio?

Weight training, virgorous = 373 kcals/60 min

Vinyasa Yoga = 535 kcals/60 min

Calisthenics, vigorous = 494 kcals/60 min

Judo - martial arts = 616 kcals/60 min

Rock climbing = 672 kcals/60 min

Boxing - punching bag 364 kcals/60 min

Research on Alternative Forms of Exercise

Muscle Strength & Cardiovascular Disease, Artero, et al., Effects of Muscular Strength on Cardiovascular Risk Factors and Prognosis, *J Cardiopulm Rehabil Prev*, Aug 17, 2012.
Muscular strength has shown as a protective effect on all-cause and cancer mortality in healthy middle-aged men, as well as in men with hypertension and patients with heart failure. Inversely associated with age-related weight and fat, risk of hypertension, and prevalence and incidence of the metabolic syndrome. Higher levels of muscular fitness seem to counteract the adverse cardiovascular profile of overweight and obese individuals.

Yoga Training, Seo, et al. Yoga training improves metabolic parameters in obese boys. *Korean J Physiol Pharmacol*, 16(3):175 – 80, 2912.
Yoga can be an uncomplicated therapy for obesity. Effect of 8-weeks of yoga-asana on body composition, Lipid profile, and insulin resistance in obese adolescent boys (14 yrs). Yoga group performed exercises 3x/week 40-60% of heart rate reserve. After yoga training, body weight, BMI, fat mass, and body fat % were significantly decreased, and fat-free mass and resting metabolic rate were significantly increased than baseline

Resistance Training is Medicine, Westcott Resistance training is medicine: effects of strength training on health. *Curr Sports Med Rep*, 11(4):209-16, 2012.
Inactive adults experience a 3 - 8% loss of muscle mass per decade, accompanied by resting metabolic rate reduction and fat accumulation. Ten weeks of resistance training can increase lean weight by 3 pounds, increase resting metabolic rate by 7%, and reduce fat weight by 4 pounds. Benefits of resistance training include improved physical performance, movement control, walking speed, functional independence, cognitive abilities, and self-esteem. Resistance training can promote bone development, with studies showing 1 - 3% increase in bone mineral density. Resistance training can be effective for reducing low back pain and easing discomfort associated with arthritis and fibromyalgia and has been shown to reverse specific aging factors in skeletal muscle.

Comparing Weight Training vs Cardio, Wayne Westcott, Ph.D

Fat Reduction:
Cardio . . . only while you're doing the exercise.
10 to 12 calories/min running or cycling
8 to 10 calories/min lifting weights
Calorie for calorie, cardio has slight advantage.

Fat Reduction
Strength Training
EPOC for approximately 60 mins post work-out additional 25 % of the calories.
"For every 3 pounds of muscle you build, you'll burn an extra 120 calories a day . . ."
Muscle is metabolically active tissue . . . burn more kcals at rest.
Weight Training Has the Advantage

Body Changes
Strength Training
Body image can increase immediately after a work-out . . . blood engorged muscles . . . immediate pump.
Feel confident because you just pressed some major poundage.

Injury Prevention
Cardio
The repetitive nature of puts students at a higher risk of injury.

Injury Prevention
Strength Training has advantage.
"Functional strength training teaches your brain to allow muscle contractions that are quick enough to revent or minimize injuries."
Tim McGuine, Ph.D

Research Comparing MICT to HIIT

Tremblay, Simoneau, and Bouchard (1994), investigated the impact of exercise Intensity on skinfolds and muscle metabolism, by compared moderate-intensity aerobic exercise (MIAE) and HIIT. There were two groups: 1) performed 20-weeks of MIAE by cycling 4 or 5 x/week, 30 to 45 minutes at 60% - 85% of heart rate reserve and 2) a 15-week HIIT group who performed 10 – 15/15 – 30 sec intervals then 4 - 5/60 - 90 sec intervals at 60% - 70% of their maximum with a recovery heart rate being down to 120-130 beats per minute.

The total energy cost of the two programs was MIAE = 28,757.04 kcals and HIIT = 13,829.17 kcals, a difference of 14,927.87 kcals. The results show the HIIT group decreased sum of 6 skinfolds nine times less than MIAE program. The MIAE group decreased sum of 6 Skinfolds 79.2to 74.7 mm (4.5 mm) and

HIIT decreased sum of 6 Skinfolds 94.2 to 80.3 mm (13.9 mm). There was also significant increase in enzymes promoting fat being used as energy for muscle contraction in the HIIT group**.**

Trapp, et al., (2008) investigated the effect of high-intensity intermittent exercise training (HIIE) and steady state exercise (SSE) on fat loss and fasting insulin levels of young women. Forty-five women with a mean BMI of 23.2 (20.2 years) were put into one of three training protocols: HIIE, SSE, or a control group. HIIE and SSE groups did 15 weeks of exercise on Monark cycle ergometers.

The HIIE protocol was: 8-seconds all out sprinting and 12- seconds pedaling slowly (20 - 30 rpm's) for a maximum of 60 repeats per session. The subjects started with a resistance of 0.5 kg and worked as hard as they could during the sprinting phase. Subjects started with as little as 5 min in the conditioning phase and gradually increased work time to a maximum of 20 min. Once an individual could complete 20 min of HIIE at 0.5 kg, resistance was increased by increments of 0.5 kg. The women adapted to the training stimulus rapidly so that by the end of 2 weeks (six exercise sessions), all women were able to complete the full 20 min of exercise. Steady state training consisted of a 5-minute warm-up then exercised at 60% V02peak starting for 10–20-minutes and gradually increasing to a maximum of 40-minutes per session.

The results show both groups significant improved cardiovascular fitness. Only HIIE had a significant reduction in total body mass, fat mass, trunk fat and fasting plasma insulin levels. There was significant fat loss in legs compared to arms in the HIIE group only.

Zhang, et al., (2017) compared the effects of HIIT to prolonged continuous exercise training (PCET) on abdominal visceral fat reduction in obese young women. Forty-three subjects were divided into a HIIT, PCET, or no training control group for 12 weeks.

The HIIT protocol consisted of repeated 4-minute cycling bouts at 90% of V̇O2max, followed by 3-minute passive recovery until 300 kJ of work was achieved. The HIIT exercise times were as follows: weeks 1-4 = 29.4-min, weeks 5 – 8 = 37.8-min, weeks 9 – 12 = 34.4-min. PCET performed continuous exercise on a cycle ergometer at an intensity of 60% V̇O2max until the targeted 300 kJ of work was achieved. The PCET exercise times were as follows: weeks 1-4 = 51.2-min, weeks 5 – 8 = 74.4-min, weeks 9 – 12 = 62.6-min.

The results showed the HIIT and PCET groups had the same reductions in abdominal visceral fat area (−9.1 cm), abdominal subcutaneous fat area (−35 cm), and combined abdominal visceral fat area and abdominal subcutaneous fat area (−44.7 cm). The HIIT and PCET groups had the same reductions in fat percentage (−2.5%), total fat mass (−2.8 kg), and fat mass of the android (trunk & upper body) (−0.3 kg), gynoid (hips, buttocks, thighs) (−0.5 kg), and trunk (−1.6 kg).

Of interest is the PCET average training time was 62.73-min compared to the HIIT training time of 33.86, a difference of 28.87-minutes. The authors conclude that PCET had no quantitative advantage compared with HIIT in the reduction of abdominal visceral fat reduction, and that HIIT appears to be the predominant strategy for controlling obesity because of its time efficiency.

Ross, de Lannoy, and Stotz (2015) wanted to investigate the effect of different intensity and duration on improvements in V02max on a treadmill. They wanted to see if it is possible to eliminate "non-responders." There were 121 middle-aged (53.2 yrs) subjects, 75 females and 46 males, all of whom were abdominally obese. All subjects completed 90% of the 5-weekly work-outs over 24 weeks.

Subjects performed one of three training protocols: 1) low-amount, low-intensity, 30 minutes at 50% of peak V02 designed to burn 180 – 300 kcals/session, 2) high-amount, low-intensity, 60 minutes at 50% of peak V02, designed to burn 360 – 600 kcals/session 3) high-amount, high-intensity, 40 minutes at 75% of peak V02, designed to burn 360 – 600 kcals/session.

The results show that the number of non-responders at end of study was as follows: 38.5% (15 of 39) in low-amount low-intensity group, 17.6% (9 of 51) in high-amount low-intensity group, 0% in high-amount high-intensity group. The authors show that low-intensity exercise amounting to 150 minutes/week was insufficient to improve cardiovascular fitness for 38.5% of subjects. This is what most physical activity guidelines recommend for all adults to do.

Art and Creativity

Bill Kraemer, JSCR, February 2006

"While the practice of strength and conditioning will always rely on the art and creativity of the professional to implement the science, a factual basis for practice is needed similar to the process a physician uses in patient treatment decisions ..."

What is Fitness?

1. Improved fitness is catabolism followed by anabolism.
2. Overload – Compensation - Improved Fitness
3. Improved fitness is finding the correct balance of training & recovery.
4. Make time for recovery, regeneration and adaptation.
5. Acute Rest and Chronic Rest are important.
6. Sleep. Going through all stages of sleep.
   Hormone release during sleep = improved fitness.

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