



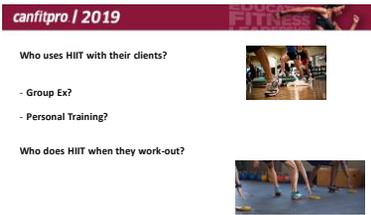
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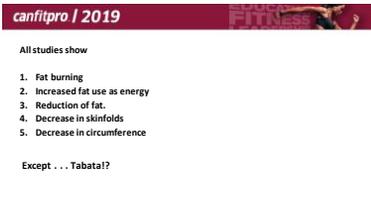
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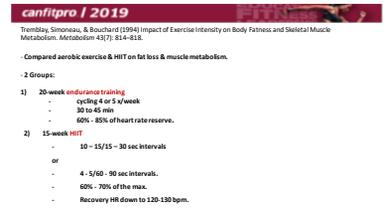
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Tremblay

- Total energy cost:
 - Endurance = 28,757.04 kcals
 - HIT = 13,829.17 kcals
 - Difference = 14,927.87 kcals.
- Decrease in sum of 6 skinfolds in HIT program was **3x-4x fold** less than endurance group.
- MICT decrease - 79.2 – 74.7 mm (4.5 mm)
- HIT decrease - 94.2 – 80.3 mm (13.9 mm)
- Significant increase in enzymes promoting fat being used as energy for muscle contraction.

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Angelo Tremblay

Practical application –

- 60-70% for 10 – 15 intervals, 15 – 30 sec. Recovery HR 120 – 130.
- 60 – 70% for 4 – 5 intervals, 60 – 90 sec. Recovery HR 120 – 130.

Benefits - HIT group decreased sum of 6 skinfolds nine times less than endurance program.

Remarkable benefits considering total work time =

Protocol 1 = 1:40 – 3:45
Protocol 2 = 4:00 – 7:30

Intensity of 60 – 70% can be well tolerated by clients.

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Mehrdad Heydari

Heydari, Tronick, and Boutcher, (2012). The effect of high-intensity intermittent exercise on body composition of overweight young males. J Obes. 2012;2012:480467. doi: 10.1155/2012/480467.

12-week high intensity intermittent exercise (HIE) : - [source overweight males](#)

- total body fat
- abdominal fat
- trunk fat
- visceral fat mass (stored in abdominal cavity around internal organs - liver, pancreas and intestines)
- fat free mass

Exercise or control group (no exercise).

HIE sprinting - 8-sec work, 12-sec active recovery for 20 mins

3x/week for 12 weeks.

HIT work 80-90% of peak heart rate at a cadence between 120 and 130 rpm

Recovery - same resistance at 40 rpm

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Mehrdad Heydari

Results for HIE... 12 weeks

- Aerobic power improved 15%
- Weight loss - reduced 3.3 lbs
- Total fat mass - reduced 4.4 lbs - DEXA & CT Scans
- Adiponectin - reduced 22 lbs
- Trunk fat - reduced 3.3 lbs
- Visceral fat - reduced 17%
- Waist circumference - decreased by week six - 3.5 cm
- Fat free mass - increased .88 lbs for the legs
- Fat free mass - increased 1.5 lbs for the trunk.

No change in levels of insulin or blood lipids.

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Whyte, Gill, & Cathcart

Whyte, Gill, & Cathcart (2010). Effect of 2 weeks of sprint interval training on health-related outcomes in sedentary overweight/obese men. Metabolism, 59(10):1421-8.

10 overweight/obese sedentary men.

2 week HIT, 6 sessions, 4 to 6 – 30 sec Wingate sprints, 4.5-min recovery.

Results:

- VO2max and Wingate power increased.
- Insulin sensitivity & resting fat oxidation rate higher (24 hrs post-work-out)
- Systolic blood pressure and resting carbohydrate oxidation were lower (24 hrs post-work-out).
- Waist and hip circumferences decreased - Waist 2.4 cm (.95 inches) and Hip 1.1 cm (.43 inches)

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Whyte, Gill, & Cathcart

Whyte, Gill, & Cathcart (2010). Effect of 2 weeks of sprint interval training on health-related outcomes in sedentary overweight/obese men. Metabolism, 59(10):1421-8.

"Practical" application:

- 6 exercise sessions
- 4 to 6 intervals
- 30 sec Wingate anaerobic sprints
- 4.5 minute recovery



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Trapp, et al., (2008)

E.G. Trapp, D. Cholewicki, J. Freund, and S.H. Boutcher, The effects of high-intensity intermittent exercise training on fat loss and fasting insulin levels of young women, International Journal of Obesity (2008) 32, 684-691

Effects of a 15-week high-intensity intermittent exercise (HIE) on subcutaneous and trunk fat and insulin resistance of young women.

3 groups: HIE (n=15), steady-state exercise (n=15) or control (n=15).

HIE protocol - 8-sec all-out sprinting and 12-sec of pedaling slowly for a maximum of 60 repeats a session - 20 min

Subjects started with as little as 5-min in the conditioning phase and gradually increased work time to 20-min.

SEE training - 5-min warm-up then exercised at 60% VO2peak

- Subjects started exercising for 10-20 min.
- Duration of the exercise was gradually increased to a maximum of 40-min of exercise per session.

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Trapp, et al., (2008)

- Both groups significant improved cardiovascular fitness.
- Only HIE had a significant reductions in:
 - total body mass
 - fat mass
 - trunk fat
 - fasting plasma insulin levels.
- There was significant fat loss in legs compared to arms in the HIE group only.
- Lean, compared to overweight women, lost less fat after HIE.

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Grimaux, et al.

Grimaux, et al., Long-term Lifestyle Intervention with Optimized High-Intensity Interval Training Improves Body Composition, Cardiometabolic Risk, and Exercise Parameters in Patients with Abdominal Obesity. Am J Phys Med Rehabil 2012 Jul 30

62 overweight and obese subjects

9-month program - nutritional counselling, high-intensity interval exercise, and resistance training 2 – 3 x/week.

Weekly energy expenditure of 1582 kcal.

Significant improvements:

- body mass - -3.5kg
- body mass index - -1.5
- waist circumference - -5.8cm

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Grimshaw, et al

Other Improvements:

- Decreased total fat mass
- Decreased trunk fat mass
- Improved lipid profile

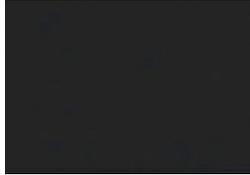
- At end of program, prevalence of metabolic syndrome was reduced by 32.5%.

"This intervention (interval training) seems safe, efficient, and well tolerated and could improve adherence to exercise training in this population."

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If your client doesn't like to run . . .



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Hazell, et al.

Hazell, et al., 2014, Running sprint interval training induces fat loss in women. *Appl Physiol Nutr Metab.* Aug;39(8):944-50.

15 recreationally active women, 22.9 yrs.

6 weeks of sprint interval training

4 to 6, 30 sec "all-out" sprints on treadmill

4 min of rest between sprints

3 x/week

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Hazell, et al.

Sprint Interval Training

Decreased:

- body fat 8.0% (ROD POD)
- waist circumference 3.5%.

Increased:

- Fat-free mass 1.3%
- Max oxygen consumption 8.7%
- Peak running speed 4.8%

Time-efficient training for decreasing body fat . . . increasing aerobic capacity, peak running speed, and fat-free mass in healthy young women.



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Zhang, et al., (2017)

Zhang, H.A., (2017), Comparable Effects of High-Intensity Interval Training and Prolonged Continuous Exercise Training on Abdominal Visceral Fat Reduction in Obese Young Women, *Journal of Diabetes Research*, 2017:2071740, doi: 10.1155/2017/2071740. [pub 2017 Jan 1.

- HIT, MCT, or no training for 12 weeks.

- HIT - 4-minute cycling at 90% VO2max, 3-min passive recovery until 300 kJ of work was achieved.

HIT exercise times:

- Weeks 1 - 4 = 29.4-min

- Weeks 5 - 8 = 37.8-min

- Weeks 9 - 12 = 36.4-min

- MCT cycle ergometer at an intensity of 60% VO2max until 300 kJ of work was achieved.

MCT exercise times:

- Weeks 1 - 4 = 51.2-min

- Weeks 5 - 8 = 74.4-min

- Weeks 9 - 12 = 62.6-min

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Zhang, et al., (2017)

Results

HIT and MCT had the same reductions in:

- abdominal visceral fat area (-8.1 cm)
- abdominal subcutaneous fat area (-35 cm), and
- combined abdominal visceral and abdominal subcutaneous (-44.7 cm).

- fat percentage (-2.5%)

- total fat mass (-2.8 kg)

- fat mass of the android (trunk & upper body) (-0.3 kg)

- gynoid (hips, buttocks, thighs) (-0.3 kg)

- trunk (-1.6 kg).

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Zhang, et al., (2017)

Average Time of Training

- MCT = 62.73-min

- HIT = 33.84-min

- Difference of 28.87-min

MCT had no advantage compared with HIT in the reduction of abdominal visceral fat reduction.

Authors conclude:

"HIT appears to be the predominant strategy for controlling obesity because of its time efficiency."

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Gibala, et al. (2012)

Gibala, et al., (2012), Physiological adaptations to low-volume, high-intensity interval training in health and disease, *J Physiol*, 590(5): 1077-84

HIT an effective alternate to traditional endurance training . . . superior changes in physiological, performance, and health-related markers in both **healthy individuals and diseased populations.**

HIT shown to improve CV fitness in people with coronary artery disease, congestive heart failure, middle age adults with metabolic syndrome, and obese individuals.

HIT is important from a public health perspective, given that "lack of time" is the most commonly cited barrier to exercise.

Increase in cardiovascular fitness after HIT in many cases was superior to Medium Intensity Continuous Training (MICT)

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Gibala, et al. (2012)

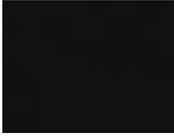
Recent work has shown as few as 6-sessions of Wingate-based HIT with constant load over 2 weeks improves insulin sensitivity in previously sedentary, overweight individuals.

Benefits of HIT show the weekly training time is much lower than "common" public health guidelines - 150 min of moderate to vigorous exercise per week to promote health.

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HIIT or No HIIT Get off the Couch!



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What is HIIT?

Low training volume, very high training intensity ... "Good news-bad news!?"

Tremblay - 60 - 70% of max. 2.5 - 7.5 min total training time.

Heydari & Trapp - 8-sec work, 12-sec active recovery for 20 mins.

Whyte, Gill, Cathcart - 2-week HIIT, 6 sessions, 4 to 6 - 30 sec Wingate sprints, 4.5-min recovery.

Hazell - 4 to 6, 30 sec "all-out" sprints ... 4 min of rest between sprints.

Zhang - 4-minute cycling at 90% VO2max, 3-min passive recovery

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What is HIIT?

Always incomplete recovery ... physically, metabolically, & mentally.

1:3 - 1:1 work to rest ratio.

Physically & mentally demanding.



But ... it's fun ... Goes quick ... Creative ... Applied in any situation.

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Psychological Adaptations to HIIT

Tolerating pain ... how much pain do we want our clients to have?



"Pain and suffering to enhance the human will."
(Juan Carlos Santana, 2010).

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What is HIIT?

Most research is done with bikes for a controlled environment.

But in real life...



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What is HIIT?

Real life ...



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HIIT Can Be Any Kind of Exercise



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Highest Calorie Burner?



Forestry – Fast Axe Chopping = 1050 kcals

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“Chopit” Patent Pending



“Chop the fat away!!”

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Fat Burning During Exercise



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Approximate Energy Use During Continuous 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)

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Fat Burn During Exercise

MICT ... takes a long time to use primarily fat to produce muscle contractions.
 No such thing as a “Fat Burning Zone.”
 But ... is there when using High Intensity Interval Training?
 Total calories burned ... right?
 HIT studies seem to show a trend.
 Enzymes to promote the use of fat to produce muscle contractions.

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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 (ATP)

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“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.

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Is HIIT “Metabolic Training,” or is it Just Hard Exercise?

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What is “Metabolic Training?”

Metabolism

A 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

Five Metabolisms

1. Sleeping
2. Resting / Sedentary work / Hanging around / Watching TV
3. Manual Labor / Gardening / Walking
4. Exercise
5. Post-Exercise

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What is "Metabolic Training?"

"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

"Metabolic Training"

Some research shows anaerobic exercise may condition your Cardiovascular system to the same extent as aerobic exercise ... Aka "Cardio."

Metabolic training is a fancy way of describing anaerobic training . . . a.k.a. . . . Interval Training

Thanks for coming to this session!

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