Creating Amazing HIIT Work-Outs with no Equipment

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1. **Fat Burning with HIIT**
   Most studies show
   1. Increased fat used to produce energy/ATP
   2. Decrease in skinfolds
   3. Decrease in waist & hip circumferences
   4. Increase in enzymes that promote the use of fat to produce energy.

   Except Tabata . . . he didn't look at it.
   But . . . Michele Olson did.

2. **What is HIIT?**
   Incomplete recovery . . . physically, metabolically, & mentally.
   Different work to rest ratios.
   Physically & mentally demanding.
   But . . . it's fun . . . Goes quick . . . Creative . . . Applied in any situation.
   Little or no equipment.
   "Pain and suffering to enhance the human will" ????
   (*Juan Carlos Santana, 2010)*.

3. **History of HIIT**
   Hannes Kolehmainen , 1st elite athlete to use HIIT, Olympic Gold Medal 1912. Intervals at race pace, 5-10 repetitions of 3:05 min/1000m - a tempo of 74 sec/400m close to his 10k race speed .

   Swedish running coach Gosta Holmer , 1937 - Fartlek training for his runners.
   Fartlek = "speed play."
   Continuous running using bursts of speed - 50m to 3000m.

   Emil Zatopek , Gold Medalist & Olympic records in 5,000 & 10,000m -1952 Helsinki Olympics. Interval training and wind sprints with jog recoveries.

4. **Tabata**
   Tabata, *et al.* Effects of moderate-intensity endurance and high-intensity intermittent training on anaerobic capacity and VO_2max. *Med Sci Sports Exerc* 28 (10): 1327–30, 1996.

   HIIT group, 5 days/week for 6 weeks, 8 sets, 20 sec work at 170% of V02max, 10 sec rest.

   Benefits - HIIT group improved V02max by 7 ml/kg/min and anaerobic capacity increased by 28%.
   Remarkable benefits in 4 minutes. Remarkable benefits considering 2:40 min of work. Can we do "Tabata" HIIT with our clients 5 days/week, 3 days/week?

   Practical application – Japanese speed skating team.
   Decrease training volume.
   But maintain anaerobic capacity, VO2, skating speed … and medals.

Remarkable benefits considering total work-out time is 4 minutes.
Can we do "Tabata" HIIT with our clients 5 days/week?

Michele Olson, American College of Sports Medicine Annual meeting, May 2013
"Tabata Interval Exercise: Energy Expenditure and Post Exercise Responses."
Four minute Tabata routine of jump squats.
13.5 cals/min & doubled EPOC 30 minutes after.
Four minute x 13.5 = 54 kcals + EPOC . . . "Participants burned average of 135 calories in total (4-minute workout and 30 min after.)"

5. Fartlek Training

- Walking warm-up . . . 3 min's.
- Fartlek running work-out . . . 5 min's.

6. Tremblay

Tremblay, Simoneau , & Bouchard (1994) Impact of Exercise Intensity on Body Fatness and Skeletal Muscle Metabolism. *Metabolism* 43(7): 814–818.

Compared moderate-intensity aerobic exercise & HIIT on fat loss & muscle metabolism.

Benefits - HIIT group decreased sum of 6 skinfolds **nine times** less than endurance program.
10 – 15/15 – 30 sec intervals or 4 - 5/60 - 90 sec intervals. Intensity = 60% - 70% of max. Recovery HR down to 120-130 bpm.

Remarkable benefits considering total work time =
Protocol 1 = 1:30 – 7:30 min of work
Protocol 2 = 4:00 – 7:30 min of work
Intensity of 60 – 70% can be well tolerated by clients.

Work-out:
Intensity = 60 – 70%

1. 4 intervals, 30 sec.
   Recovery . . . 30 sec.

Exercise: forward bounds with run back

2. 3 intervals, 75 sec.
   Recovery . . . 30 sec.

Exercise: Squat Jacks

7. Sam Shepard

Shepard, et al., (2015) Low-Volume High-Intensity Interval Training in a Gym Setting Improves Cardio-Metabolic and Psychological Health, DOI: 10.1371/journal.pone.0139056
In a controlled laboratory environment, HIIT has same cardio & metabolic benefits continuous, low intensity training. But . . . is it the same in a real-world environment.

Instructor-led, group-based, gym setting HIIT . . . compared to medium intensity continuous training.

90 physically inactive volunteers (42 yrs), HIIT or MICT group exercise classes.

HIIT – repeat sprints (15–60 seconds, >90% HR_{max}) with 45 – 120 min's of active recovery cycling 18 - 25 min/session, 3 sessions/week).

MICT - continuous cycling (70% HR_{max} 30–45 min/session, 5 sessions/week)

10 weeks

Week

1. 30 sec, 2 min recovery; repeat 4x 20:00
2. 15 sec, 45 sec recovery; repeat 8x 18:00
3. 30 sec, 90 sec recovery; repeat 5x 20:00 90% HR_{max}
4. 60 sec, 60 sec recovery; repeat 5x 20:00
5. 30 sec, 60 sec recovery; repeat 7x 20:30
6. 15 sec, 45 sec recovery; repeat 12x 22:00
7. 30 sec, 60 sec recovery; repeat 9x 23:30
8. 60 sec, 60 sec recovery; repeat 7x 24:00

10.30 sec, 60 s recovery; repeat 6x followed by 15 s HIE, 45 s recovery; repeat 5x 24:00
11.60 sec, 60 sec recovery; repeat 5x followed by 15 s HIE, 45 s recovery; repeat 5x 25:00

Adherence
Greater in HIIT group - 83% sessions attended.
MICT group – 61% sessions attended

Average weekly training time:
HIIT = 55 mins
MICT = 128 mins
Results – Both Groups Improved or Reduced:

- V02max.
- Insulin sensitivity.
- Feelings of energy (subjective vitality)
- Feelings of health perception
- Reduced fat mass.
- MICT reduced systolic BP

"HIIT performed in a real-world gym setting improves cardio-metabolic risk factors and psychological health."
" … reduced time … and greater adherence than MICT, HIIT … viable and effective exercise to target the growing incidence of metabolic disease and psychological ill-being associated with physical inactivity."

Work-Out

1. 30 sec, 2 min recovery – 5 hops forward, run back.
2. 15 sec, 45 sec recovery – Tuck Jumps
3. 30 sec, 90 sec recovery – Burpee w/Squat Jump 90% HR_{max}
4. 60 sec, 60 sec recovery – Bear Crawl forward 4x, back 4x.
5. 30 sec, 60 sec recovery – Burpee w/push-up

8. Mehrdad Heydari

Heydari, Freund, 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 (HIIE) exercise effect on:

- total body fat
- abdominal fat
- trunk fat

- visceral fat mass (stored in abdominal cavity around internal organs - liver, pancreas and intestines)
- fat free mass . . . young overweight males.

Exercise or control group.

HIIE sprinting - 8-sec work, 12-sec active recovery for 20 mins
3x/week for 12 weeks.

HIIE work 80–90% of peak heart rate at a cadence between 120 and 130 r.p.m.
Recovery - same resistance at 40 r.p.m.

Results for HIIE:

- Aerobic power improved 15%
- Weight loss - 1.5 kg (3.3 lbs)
- Total fat mass – reduce 2 kg (4.4 lbs) – DEXA & CT Scans
- Abdominal fat – reduce 0.1 kg (.22 lbs)
- Trunk fat - reduce 1.5 kg (3.3 lbs).
- Visceral fat – reduce 17%
- Waist circumference – decrease by week six - 3.5 cm
- Fat free mass increased 0.4 kg (.88 lbs) for the leg
- Fat free mass increased 0.7 kg (1.5 lbs) for the trunk

Work-Out

1. 8 sec squat jumps
   12 sec march in place
2. 8 sec squat jumps
   12 sec march in place
3. 8 sec squat jumps
   12 sec march in place
4. 8 sec squat jumps
   12 sec march in place
5. 8 sec squat jumps
   12 sec march in place
6. 8 sec squat jumps
   12 sec march in place
7. 8 sec squat jumps
   12 sec march in place
8. 8 sec squat jumps
   12 sec march in place

9. Jenna Gillen

Gillen, et al., (2014) Three Minutes of All-Out Intermittent Exercise per Week Increases Skeletal Muscle Oxidative Capacity and Improves Cardiometabolic Health.

Overweight/obese but otherwise healthy men and women (n = 7)
3x/week – 6 weeks - 18 training sessions – cycle ergometer
2 min warmup
3 x 20 sec ‘‘all-out’’ sprints with 2 min recovery

Results:
Peak oxygen uptake increased by 12%
Resting blood pressure decreased by 7%
Skeletal muscle oxidative capacity increased, but primarily in men.

Work-Out

3 x 20 sec ‘‘all-out’’ *sprints* with 2 min recovery

1. 20 sec Squat Jumps
   2 min recovery . . . passive then active
2. 20 sec Burpees
   2 min recovery . . . passive then active.
3. 20 sec Lunge Jump
   2 min recovery . . . passive then active.

10. Talanian

Talanian, J.L., et al. (2007) Two weeks of high-intensity aerobic interval training increases the capacity for fat oxidation during exercise in women. *J Applied Physiology, 102* (4), 1439 – 47.

8 women, 7 HIIT sessions/2 weeks, 10 x 4 min intervals at 90% V02, 2 min rest.
Total exercise time = 58 min. “Marked increases in whole body and skeletal muscle capacity for fatty acid oxidation during exercise.”

11. Perry

Perry, Heigenhauser, Bonen, Spiet, High-intensity aerobic interval training increases fat and carbohydrate metabolic
capacities in human skeletal muscle, *Appl Physiol Nutr Metab*, 33(6):1112, 2008.

6 weeks of HIIT – Untrained men & women.
10 x 4 min intervals at 90% VO2 peak, 2 min rest, 3 days/week.
VO2 peak is the highest value of VO2 attained on test.

Major adaptations during exercise:
- Reduced break down of glycogen (more fat being used)
- Reduced lactate accumulation
- Increased fat oxidation at 60% of pre-training VO2 peak.
- Training power output increased by 21% and VO2 peak increased by 9%.

This study demonstrated that 6 weeks of HIIT (3 days/week) can increase whole-body and skeletal muscle fat and carbohydrate use in untrained.

Practical application –
10 x 4 min intervals at 90% VO2 peak. Could say 90% of max.
2 min rest.
Increased fat oxidation . . . FAT, FAT, FAT!!
- 40 min work . . . This is a lot.
- 18 min rest.
- Can our clients adapt to 58 min of interval training?

Perry Work-Out
Intensity = 90%
1 - 2 intervals, 4 min.
"Recovery" = 2 min.
Exercises, 30 sec x 8 . . . With a partner.

1. 30 sec Dry Skating
2. 30 sec Plank Arm Wrestle W/Shuffle
3. 30 sec Side Shuffle with Squat Jump
4. 30 sec Alternate Crawl Under

. . . Repeat 2 x

12. Whyte

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 HIIT, 6 sessions, 4 – 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 decrease.

"Practical "application – 6 work-outs, 4 - 6 intervals, 30 sec Wingate anaerobic sprints, 4.5-minute recovery.

13. Trapp

E G Trapp[1], D J Chisholm[2], J Freund[1] 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 (HIIE) on subcutaneous and trunk fat and insulin resistance of young women.
3 groups: HIIE (*n*=15), steady-state exercise (SSE) (*n*=15) or control (*n*=15).

HIIE protocol – 8-sec all out sprinting and 12-sec of pedaling slowly (20 - 30 rpm's) for a maximum of 60 repeats a session = 20-mins
Subjects started with as little as 5 min and gradually increased work time to 20 min.

- SSE training - 5-min warm-up then exercised at 60% V02peak
- Subjects started exercising for 10–20 min.
- Duration of the exercise was gradually increased to a maximum of 40-min of exercise/session.

- Both groups significant improved cardiovascular fitness.
- Only HIIE had a significant reduction in:

- total body mass
- fat mass
- trunk fat
- fasting plasma insulin levels.

- Same protocol as Heydari, Freund, and Boutcher, (2012) and similar results.
- No work-out.

14. Gunnarsson and Bangsbo

Gunnarsson, T.P. and Bangsbo, J. The 10-20-30 training concept improves performance and health profile in moderately trained runners. *Journal of Applied of Physiology,* 113, 1, 1624, 2012.

1) 10 – 20 – 30 Group
2) Control Continuous Group

Each interval =

a. 30 sec @ 30% max
b. 20 sec @ 60% max
c. 10 sec @ 90–100% max . . . repeated for 5 min's

Major findings:

- 7 wks of 10-20-30 training, with 50% reduction in training volume:
- $\dot{V}o_{2max}$ improved
- 1,500-m & 5-km run improved by 21 and 48 sec, respectively.
-

Work-Out

30 sec – *30%* - Skip fwd run back. 20 sec - *60%* - Squat Jacks. 10 sec - *90-100%* - Tuck Jumps
Repeat for 5 mins.

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