

INTERVAL TRAINING AND FAT LOSS: DECONSTRUCTING A MODERN MYTH

THE performance-enhancing benefits of interval training have long been known to athletes and their coaches.

In fact, when Roger Bannister became the first man in history to run a mile in less than four minutes one blustery afternoon in May 1954, a large part of his speed and stamina was built using interval training.

But it wasn't until an article called *HIIT and Run*, written by Shawn Phillips and published in the August 1998 issue of the now defunct *Muscle Media* magazine, that interval training started to attract interest as a way to lose fat.

However, despite its popularity, you might be surprised to learn that there are just a handful of published studies to show that interval training leads to a faster rate of fat loss than regular cardio. And there are some big problems with all of them.

Read on and I'll reveal exactly what interval training can and can't do for fat loss. I'll also explain why, despite what the "gurus" might tell you, it's NEVER been proven to be "nine times better" than regular cardio.

In fact, most studies of interval-style workouts have looked at changes in performance and fitness, rather than weight loss. Published studies to track changes in body composition are extremely rare.

In this review I've focused purely on the research that compares interval training with steady-state cardio in terms of its impact on fat loss.

One of the first trials to look at the effect of interval training on body composition was published by researchers based at Canada's Laval University³. This is the study where the claim that interval training is "nine times more effective than steady-state cardio" comes from.

A group of 27 men and women started the study. They were assigned to one of two groups. The first group completed a 20-week aerobic exercise program, consisting of 30-45 minutes of cycling 4-5 times per week.

The second group followed a high-intensity interval training program (HIIT) lasting 15 weeks. This involved 25 30-minute sessions of steady-state cycling. They also performed 35 interval training sessions.

The researchers used skinfold calipers to measure the loss of subcutaneous fat, which is the fat stored directly underneath your skin. This involves pulling a fold of skin and fat away from the underlying muscle and measuring the thickness of that skinfold. Then you add up the numbers from several sites around the body.

In total, the steady-state group lost 4.5 millimeters of fat. The HIIT group, on the other hand, lost 13.9 millimeters of fat. Using these figures, the HIIT program was about three times better than the regular aerobic exercise program.

The "nine times more effective" claim comes from a calculation where changes in subcutaneous fat were corrected for the total energy cost of the training. This was done by expressing changes in subcutaneous fat per megajoule of energy expended in each program.

The first thing I want to point out is that of the 60 workouts

performed by subjects in the HIIT group, almost half (25) of them consisted of steady-state cardio. Anyone who claims this study “proves” that HIIT is inherently superior to steady-state cardio probably needs to read it again.

But that’s really only the tip of the iceberg.

When I took a closer look at the skinfold measurement results, the main reason for the greater loss of subcutaneous fat in the HIIT group was a greater reduction in the limb measurements (the triceps, biceps and calves).

Limb skinfolds actually increased by 1.9 millimeters in the steady-state group. But they decreased by 5.2 millimeters in the HIIT group. When you look at the changes in the three skinfold measurements taken from the trunk, there wasn’t that much difference between the steady-state group (- 6.3 millimeters) and the HIIT group (- 8.7 millimeters).

In other words, much of the difference in subcutaneous fat loss between the groups wasn’t because the HIIT group lost more fat, but because the steady-state group actually *gained fat* around the calf muscles, and didn’t lose any fat from the arms.

Probably the most surprising result is that neither group lost a significant amount of weight. On average, the steady-state group lost one pound, while the HIIT group lost just one-quarter of one pound. And that’s after 15 weeks of exercise.

Given that both groups lost subcutaneous fat, you’d expect them to have lost weight. But they didn’t, which is a finding that’s extremely

difficult to explain.

After all, fat has mass (i.e. it weighs something). And unless the subjects in this study were gaining muscle at precisely the same rate as they were losing fat, they should have lost weight.

All in all, the results from this study are damn peculiar. We have skinfold data showing that subjects lost fat. But the scales show that they lost virtually no fat at all.

Given that nobody taking part in the study did any resistance exercise, it's highly unlikely that they gained enough muscle to offset the loss in fat that you'd expect based to see based on the skinfold measurements.

A second trial comparing interval training with regular cardio, this time from a group of Australian researchers, generated a lot of media interest when it was first published ².

News reports called it a revolution. People on forums spent many hours talking about it. But when I took a closer look at the study for myself, the results were nowhere near as exciting as they first appeared.

The researchers assigned a group of overweight women to one of three groups. Group one served as a control group and did nothing, while group two performed regular steady-state cardio.

Group three (the interval group) were put through a 20 minute cycling regime in which they sprinted on a stationary bike for 8 seconds followed by 12 seconds of cycling lightly. The women performed the workout three times a week.

At the end of the 15-week study, the interval-training group had lost, on average, 5.5 pounds of fat. The steady-state group gained just over a pound.

The amount of fat lost in the interval training group wasn't all that great — 5.5 pounds over 15 weeks, which averages out at just 0.4 pounds of fat lost per week.

What about diet? How did that affect the results?

Calorie intake was monitored using 3-day diet diaries that were completed at the start and end of the study. According to these diaries, the steady-state group reported a decrease in their calorie intake over the course of the study. Yet despite this reduction in calorie intake, the women in this group actually **GAINED** weight.

The problem here is that 3-day diet diaries are not a very accurate way to estimate what someone is eating. The researchers themselves point out that their estimates of calorie intake “lack sufficient precision.”

“Our estimates of energy expenditure and intake lack sufficient precision to comfortably conclude that energy balance was unaffected in the interval training group. Thus, it is feasible that the change in fat mass that occurred in the interval group may have been influenced by unreported changes in diet.”

Study number three comes from a team of Danish researchers based at the University of Copenhagen ¹. They recruited a group of 36 healthy but untrained men with an average age of 31 and divided them into four groups - interval training, strength training, continuous running, as well as a control group that did no exercise

For all training groups there were three scheduled training sessions per week. Interval training consisted of a 5-minute warm-up with light jogging, which was followed by five 2-minute intervals of near-maximal running. Including the warm-up, each training session lasted about 20 minutes. Subjects in the running group ran for one hour at 80% of their maximum heart rate.

Other than the exercise routine, the men were told to continue with their normal lifestyle and dietary habits.

After 12 weeks, interval training led to the biggest improvement in VO₂max, which rose by twice as much in the interval group (+14%) as it did in the running group (+7%). This is despite the fact that the total training time in the interval group was less than one third of the time completed by the runners.

VO₂max is a way of measuring aerobic power. It tells you how much oxygen your body can use at a maximal level of effort, and gives you a rough idea about how good your cardiovascular fitness is.

What about weight loss?

The interval training group lost 3 pounds in weight, compared to a 2.2 pound loss in the running group. However, fat loss was greatest in the runners, who lost 3.7 pounds of body fat, compared with a 1.8 pound drop in the interval group.

Although there were three scheduled workouts per week, due to injuries or absence for other reasons, the participants in the interval group completed an average of only 2 sessions per week. This corresponds to a

total training time over the 12-week study of 480 minutes.

In the running group, the average number of completed training sessions was 2.5 per week, giving a total training time of roughly 1800 minutes.

All things considered, this is still a good result for the interval group – they did less than one third of the exercise but lost half the fat of the runners. And the gains in cardiovascular fitness were also very impressive, confirming the results of other studies showing that HIIT is a very effective way to get fit fast.

However, despite the views of some that steady-state cardio should be considered “defunct,” the fact remains that the running group lost more fat than the interval group.

A similar trial, this time from a group of Norwegian researchers, also shows greater fat loss with steady-state cardio.

They compared interval training (4 x 4-minute intervals at 90% of maximum heart rate with a 3-minute recovery) with steady-state cardio (70% of maximum heart rate) in a group of 32 metabolic syndrome patients.

Subjects trained three times a week for a total of 16 weeks. Each workout in the interval training group lasted for a total of 40 minutes compared to 47 minutes in the steady-state group.

Although both exercise programs led to a reduction in weight, it was the steady-state cardio group that came out on top, losing an average of 8 pounds — over 50% more than subjects in the interval group, who lost just

5 pounds.

In the most recent study to compare intervals with steady-state cardio, researchers from the University of Western Ontario in Canada took a group of 12 men and 8 women (average age of 24) and assigned them to either an interval or steady-state cardio group ⁴.

The sprint interval group performed 30-second “all out” sprints on a manually driven treadmill. There were just 4-6 sprints per session (2 weeks at 4 sprints, 2 weeks at 5 sprints, 2 weeks at 6 sprints), with 4 minutes of recovery between each sprint.

The endurance group trained at 80% of their maximum heart rate for 30-60 minutes (2 weeks at 30 minutes, 2 weeks at 45 minutes, 2 weeks at 60 minutes). Both groups trained three times a week for six weeks.

Despite the fact that the interval group spent less time training, improvements in VO₂max were similar in both groups (sprint interval training: +11.5%; steady-state cardio: +12.5%).

On average, the loss of body fat was also greater in the sprint interval group (- 3.7 pounds) versus the endurance group (- 1.8 pounds).

So not only did the interval group improve their cardiovascular fitness to the same extent as the steady-state group with less training, they also lost twice as much fat.

Although this has led to the usual claims about how interval training “smokes” regular cardio, there are a few things worth considering.

Firstly, although the interval group lost twice as much fat as the

endurance group, we're still only talking about a couple of pounds over a 6-week period. In fact, the difference between groups wasn't large enough to reach statistical significance.

Second, much of the reason for the greater rate of fat loss in the interval group was because the men saw extremely good results, losing an average of almost 7 pounds. The women in the interval group actually **GAINED** just under a pound of fat, while those in the endurance group lost a little over 3 pounds.

While it may have worked better for the men, the women who did interval training finished the study with more fat than when they started.

This brings me neatly on to the subject of diet. One of the big problems with all of these studies is the total lack of any meaningful dietary control.

Although some of the trials used food diaries, this kind of "self-reporting" is a notoriously inaccurate way to estimate calorie intake. Some studies show that people underestimate their calorie intake by up to 50%. In other words, someone who says they are eating 1000 calories per day may really be eating 2000 calories.

Exercise has the potential to muddy the waters still further. When some people increase the amount of exercise they do, they experience a much more intense level of hunger. This leads them to eat more, which ends up reducing the calorie deficit created by exercise.

But the effect that exercise has on hunger and food intake is neither consistent nor predictable.

In one study, 16 days of exercise generated a 30% compensation in calorie intake ⁶. That is, for every 100 calories burned off via exercise, test subjects ate an average of 30 calories more than normal. But that number was only an average, and the degree of compensation varied considerably from person to person.

This is something that's shown up in other trials on the same subject, where researchers have identified both compensators (people who compensate for the calories burned during exercise by eating more) and non-compensators (people who don't) ⁸.

How much exercise does it take to trigger the compensatory response?

Researchers from Pennington Biomedical Research Center found no compensation in subjects averaging 72 and 134 minutes of low-intensity cardiovascular exercise per week, distributed across 3-4 weekly workouts ¹⁴. The amount of weight lost in both groups was almost exactly what was predicted based on the amount of exercise they did.

It was only in participants who averaged 194 minutes of exercise per week that the compensatory response kicked in and weight loss was roughly half what it should have been.

But even in this group, there was a large degree of individual variation. Almost 3 out of 10 subjects were able to complete the longer workouts without eating more.

What this means is that changes in calorie intake might have been primarily responsible for much of the difference in fat loss seen in the studies comparing intervals with steady-state cardio. Or they might have

had nothing to do with it. Without more accurate ways to track calorie intake, there's no way to tell with any degree of confidence one way or the other.

THE AFTERBURN EFFECT

One of the big selling points of interval training is that it creates a much bigger “afterburn effect” than exercise of a lower intensity.

The term refers to the fact that your body continues to burn calories at an accelerated rate even after your workout is over. You might also see it called oxygen debt, recovery energy expenditure, or excess post-exercise oxygen consumption (EPOC).

For a given workout duration, interval training — or for that matter any form of high-intensity exercise — has a much bigger impact on post-exercise metabolism than low or moderate-intensity cardio ^{3,5}.

Successful weight loss is all about creating a calorie deficit. And it doesn't really matter if those calories are burned during the workout itself or after it's finished. As long as you're burning more calories than you take in, you should be losing weight.

However, the size of the afterburn effect following a bout of interval training, as well as the extent to which it contributes to weight loss, have both been highly exaggerated.

Researchers from Colorado State University, for example, found that interval training led to 200 extra calories being burned over the course of the day ¹³. And that's not just the calories burned after the workout. It's the calories burned both during and after exercise.

For a relatively short workout lasting 25 minutes, that's a lot of extra calories. But it's still much less than you can expect to burn during longer bouts of steady-state cardio.

By way of comparison, an Appalachian State University study shows that 45 minutes of cycling at 85% maximum heart rate burned a little over 700 calories – 519 during the workout itself and 190 after it had finished

¹².

One of the other issues with most of the research on EPOC is that it's looked at subjects in a state of energy balance. In other words, the people taking part in the studies were given more food to compensate for the extra calories they burned during the workout itself.

Why does this matter? If you're in a calorie deficit, which you'll need to be if you want to lose fat, the afterburn effect is going to be a lot lower than it otherwise would be. In one study, two days of dietary restriction lowered the post-exercise calorie burn by 40-50% ¹¹.

THE BOTTOM LINE

“The great enemy of the truth,” said John F. Kennedy, “is very often not the lie — deliberate, contrived and dishonest, but the myth, persistent, persuasive, and unrealistic. Belief in myths allows the comfort of opinion without the discomfort of thought.”

Despite the many persistent, persuasive but unrealistic myths about interval training, it's a long way from being a magic bullet as far as fat loss is concerned. There are many different ways to do cardio. All of them have their place at different times and for different people.

Don't be duped by the HIIT propaganda machine into believing that interval training is the only way, or even the best way, to drop fat. Reports of the "death" of steady-state cardio have been highly exaggerated.

ABOUT THE AUTHOR

Christian Finn holds a master's degree in exercise science, is a certified personal trainer and has been featured on BBC TV and radio, as well as in Men's Health, Men's Fitness, Fit Pro, Zest, and Perfect Body magazine. For unbiased reviews on the latest "hot topics" in the world of fitness, along with science-based strategies for helping you burn fat, build muscle and get strong, [click here to check out Muscle Evo](#).

References

1. Nybo, L., Sundstrup, E., Jakobsen, M.D., Mohr, M., Hornstrup, T., Simonsen, L., Bülow, J., Randers, M.B., Nielsen, J.J., Aagaard, P., & Krstrup, P. (2010). High-intensity training versus traditional exercise interventions for promoting health. *Medicine and Science in Sports and Exercise*, 42, 1951-1958
2. Trapp, E.G., Chisholm, D.J., Freund, J., & Boutcher, S.H. (2008). The effects of high-intensity intermittent exercise training on fat loss and fasting insulin levels of young women. *International Journal of Obesity*, 32, 684-691
3. Tremblay, A., Simoneau, J.A., & Bouchard, C. (1994). Impact of exercise intensity on body fatness and skeletal muscle metabolism. *Metabolism*, 43, 814-818
4. Macpherson RE, Hazell TJ, Olver TD, Paterson DH, Lemon PW. (2011). Run sprint interval training improves aerobic performance but not maximal cardiac output. *Medicine and Science in Sports and Exercise*, 43, 115-122
5. Treuth, M.S., Hunter, G.R., & Williams, M. (1996). Effects of exercise intensity on 24-h energy expenditure and substrate oxidation. *Medicine and Science in Sports and Exercise*, 28, 1138-1143
6. Whybrow S, Hughes DA, Ritz P, Johnstone AM, Horgan GW, King N, Blundell JE, Stubbs RJ. (2008). The effect of an incremental increase in exercise on appetite, eating behaviour and energy balance in lean men and women feeding ad libitum. *British Journal of Nutrition*, 100, 1109-1115
7. Talanian, J.L., Galloway, S.D., Heigenhauser, G.J., Bonen, A., & Spriet LL. (2007). Two weeks of high-intensity aerobic interval training increases the capacity for fat oxidation during exercise in women. *Journal of Applied Physiology*, 102, 1439-1447
8. King NA, Caudwell P, Hopkins M, Byrne NM, Colley R, Hills AP, Stubbs JR, Blundell JE. (2007). Metabolic and behavioral compensatory responses to exercise interventions: barriers to weight loss. *Obesity*, 15, 1373-1383
9. Gibala MJ, McGee SL. (2008). Metabolic adaptations to short-term high-intensity interval training: a little pain for a lot of gain? *Exercise and Sport Sciences Reviews*, 36, 58-63

10. Tjønnå AE, Lee SJ, Rognmo Ø, Stølen TO, Bye A, Haram PM, Loennechen JP, Al-Share QY, Skogvoll E, Slørdahl SA, Kemi OJ, Najjar SM, Wisløff U. (2008). Aerobic interval training versus continuous moderate exercise as a treatment for the metabolic syndrome: a pilot study. *Circulation*, 118, 346-354
11. Fukuba Y, Yano Y, Murakami H, Kan A, Miura A. (2000). The effect of dietary restriction and menstrual cycle on excess post-exercise oxygen consumption (EPOC) in young women. *Clinical Physiology*, 20, 165-169
12. Knab AM, Shanely RA, Corbin KD, Jin F, Sha W, Nieman DC. (2011). A 45-minute vigorous exercise bout increases metabolic rate for 14 hours. *Medicine and Science in Sports and Exercise*, 43, 1643-1648
13. http://www.eurekalert.org/pub_releases/2012-10/aps-moh101112.php
14. Church TS, Martin CK, Thompson AM, Earnest CP, Mikus CR, Blair SN. (2009). Changes in weight, waist circumference and compensatory responses with different doses of exercise among sedentary, overweight postmenopausal women. *PLoS One*, 4, e4515
15. Heydari M, Freund J, Boutcher SH. (2012). The effect of high-intensity intermittent exercise on body composition of overweight young males. *Journal of Obesity*, 2012, 480467