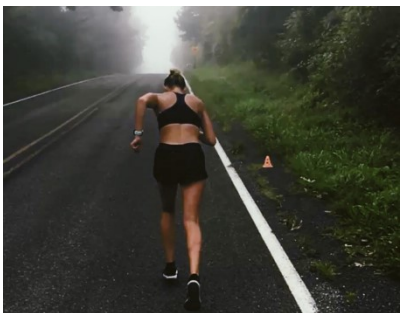
Aerobic Exercise Vs High Intensity Interval Training (HIIT): Which is best for your health and weight loss. The shocking truth behind the lay press headlines. An in depth analysis.



by Joe Centrone

NOTE: The below references to HIIT refer to cardio type HIIT workouts such as running or cycling. This is not to be confused with so called "HIIT" workouts regarding weight resistance training, which is a whole different physiological animal.

Main Points of this Article

When compared to vigorous intensity cardio, HIIT does not save you time.

HIIT is no more effective at fat loss than steady sate cardio.

Unlike steady state cardio which causes feelings of euphoria and energy, HIIT causes feelings of irritability, anxiousness, and exhaustion.

Unlike steady state cardio, the effects on mortality rate are unknown for men and likely worse for women.

It seems not a week goes by when I don't see another headline in my news feed proclaiming the HIIT is is the greatest thing in exercise since sliced bread. A number years ago I decided to try HIIT training after I kept

reading about all the great benefits. After all the numerous articles quoted research so it must be a good thing right? I normally did regular cardio. It gave me energy, made me mentally alert and generally gave me a feeling of well being. To my surprise HIIT did none of these things for me. It gave me headaches and left me feeling drained and moody. At the time I chalked it up to HIIT not being suitable someone my age or that I was in a small percentage of people that didn't respond well. After I started researching the subject I found that my negative experience was common and that most of the purported benefits of HIIT were at best misleading. In addition I never see mentioned some of the negative aspects of HIIT that researchers found. Let's look at each supposed benefits of HIIT:

TIME SAVINGS and FAT LOSS

The health news headlines often proclaim "HIIT training is more effective at fat loss than steady state training or HIIT training gives you the same benefits of standard cardio training in a fraction of the time. But when you carefully examine the studies they refer to and other studies you soon come to a very different conclusion. First let me quote the conclusions from a 2017 meta-analysis combining 31 studies: (Note HIIT is high intensity interval training, SIT is sprint interval training and MICT moderate intensity continuous training

"Both HIIT/SIT and MICT were equally beneficial for eliciting small reductions in total body fat (ES: 1.26% in HIIT/SIT and 1.45% MICT) and in fat mass (ES: 1.38 kg in HIIT/SIT and 0.91 kg in MICT). However, when comparing studies that employed HIIT/SIT interventions that incorporated less time and/or less energy expenditure than MICT, there was tendency to favor MICT for total body fat reduction."

Another 2017 meta-analysis concluded: *"Both HIIT and MICT elicited significant ($p < 0.05$) reductions in whole-body fat mass and waist circumference. There were no significant differences between HIIT and MICT for any body composition measure, but HIIT required ~40% less training time commitment. Running training displayed large effects on whole-body fat mass for both HIIT and MICT (standardized mean difference 0.82 and 0.85, respectively), but cycling training did not induce fat loss.*

Now you might be saying that's great, same benefits but 40% faster! But pay attention to one key word *moderate* as

in moderate intensity continuous training. Normally that is defined as 50% to 70% of your max heart rate as opposed to ***vigorous*** intensity which is normally defined as 70% to 85% HRM. As an example jogging or running around 5 mph or more is considered vigorous intensity. Moderate would be moderate to fast pace walking . So saying that HIIT can produce the same results in 40% less time is like me telling someone that does power walking that I have a great new exercise for them to get the same results in a fraction of the time, it's called RUNNING!

But what if we compare calories burned in HIIT to vigorous intensity continuous training (VICT) and we averaged 75% HRM (heart rate max) to find out how much more time we'll have to exercise to achieve the same caloric burn. This is about what the average jogger/runner averages and is in the "aerobic zone" of 70% to 85 % HRM. This is generally considered the best zone to be in for maximum health benefits. One study looked at the caloric burn of HIIT using the traditional Tabata protocol (Tabata is the generally credited with inventing HIIT) and found the subjects burned an average of 15 calories a minute for a 20 minute training

session. When I plug in the relevant subjects' data from this study into a calories burned heart rate calculator the result was very close to the measured calories in the study. When I plugged the same stats in but changed the average heart to 75% (instead of the 85% they got with HIIT) it shows that you would have to exercise for an additional 4 minutes to obtain the same results. That's right the time you save with the standard tabata protocol compared to vigorous cardio is a mere 4 minutes. Another way to look at the time difference is to look at what this major study said is the speed runners should run to produce the lowest mortality rate. That speed is anywhere between 5 mph to 7.5 mph. If I plug these numbers into a calories burned running calculator the time saved using the above tabata protocol is anywhere from 9 minutes at 5 mph to 0 minutes at 7.5 mph. If you look at the medium running speed between the fastest and slowest, you get 6.25 mph which would take a whopping 3 minutes longer. So even at the slowest running speed you save a mere 8 minutes on your workout. But wait even those 8 minutes might not be real. In this study the researchers also looked at the recovery time needed

after each type of exercise to resume normal activities and concluded:

"However, the experience during the study was that both the steady-state and Meyer subjects (note: Meyer is moderate intensity interval training) *were fully recovered and ready to 'return to normal life' immediately following the conclusion of the cool-down period. On the other hand, subjects in the Tabata protocol were still visibly distressed at the end of the cool-down period and often required an extended period of time to recover to the point where they could again pursue normal activities. Viewed from the perspective that the time efficiency of training must be evaluated based on the preparation + training + recovery time, the Tabata protocol (which we take as broadly representative of the currently popular HIIT training models) cannot be considered to be particularly time efficient."*

So you may not even save that little bit of time if you include recovery time.

There is still one more disadvantage to HIIT regarding fat loss. Even most advocates of HIIT say to limit HIIT workouts to 2 days a week due to it being so physiologically taxing. So you will be severely limited in regards to the total number of calories you could burn each week using HIIT when compared to cardio.

But the lay press aren't the only ones to blame. Sometimes the conclusions of the researchers themselves are misleading. For instance in one of the few studies comparing the effects of HIIT to **vigorous** intensity cardio in young obese women over 5 weeks the researchers concluded:

"The mild-HIIT protocol seems to be useful for at least maintaining the body weight among sedentary individuals."

The only problem is the HIIT women actually *gained* a small amount of fat 0.66 pounds while the cardio group *lost* fat 2.64 pounds for a difference of over 3 pounds between groups. The

cardio group worked out more than twice as long as the HIIT group and burned more than twice as many calories. So the conclusion here should have been "burn more calories, lose more weight" (quite a revelation) not "HIIT is useful for maintaining body weight". How many obese women would be interested in an exercise routine that doesn't make them lose weight? There were also several unusual things about this study. One was that they chose to call the HIIT routine "mild-HIIT" even though the subject's average HRM was about the same as others that follow the traditional TABATA protocol. The other unusual thing was the steady state cardio group exercised at an average of 84% HRM which is very close to what is considered the aerobic threshold of 85%. This high of an average heart rate is in itself unusual when looking at the effects aerobic exercise. But in addition the researchers called this "moderate to vigorous intensity". Most others would call this *very* vigorous intensity. Nevertheless it is actually a great opportunity to

see that there is nothing magical about the calorie burning effects of HIIT. The HIIT grouped only burned less than 1 calorie a minute more than the steady state group on average. Showing once again that its the average HRM percentage that matters in terms of calorie burn, not some magical effect of speeding up and slowing down.

BUT WAIT! WHAT ABOUT THE EPOC (AFTERBURN) EFFECT

You may have heard or read about the superior afterburn effect of HIIT compared to MICT. Exercise physiologists call this excess post-exercise oxygen consumption (EPOC). That is the calories you burn after you stop working out due to a rise in your metabolic rate. It seems that the afterburn is directly related mostly to the intensity and somewhat to length of the exercise. If your heart rate doesn't exceed a certain threshold then the afterburn effect is negligible. That is why HIIT has a higher afterburn than *moderate* intensity cardio. However the amount of EPOC is too small to have any significant effect on fat loss. Below is the conclusion of this study on HIIT vs **vigorous** cardio on EPOC (note: SSE is steady state exercise, HIE is high

intensity interval exercise, and SIE is sprint interval exercise).

"Corresponding values for HIE (high intensity interval exercise) *were not significantly different from SSE* (steady state exercise)*or SIE* (sprint interval exercise)*. Excess post-exercise oxygen consumption after SIE and HIE is unlikely to account for the greater fat loss per unit EE* (energy expended) *associated with SIE and HIE training reported in the literature."*

In another [study](#) **the researchers concluded:**

"However, even those studies incorporating exercise stimuli resulting in prolonged EPOC durations have identified that the EPOC comprises only 6-15% of the net total oxygen cost of the exercise. and went on to say "This is further reinforced by acknowledging that the exercise stimuli required to promote a prolonged EPOC are unlikely to be tolerated by non-athletic individuals. The role of exercise in the maintenance of body mass is therefore predominantly mediated via the cumulative effect

of the energy expenditure during the actual exercise."

So in the above example of a 20 minute HIIT exercise burning 15 calories a minute for a total of 300 calories EPOC would probably burn at most 10% more (due to the short length of exercise) and add just 30 more calories for a total of 330 calories.
In still a third study one of the comparisons researchers made was a full **90 minutes** of steady state cardio at 50% vo2 max (about 69% max heart rate) to **90 minutes of HIIT** with equal exercise energy expenditures and found **no difference** in EPOC between the two. **But the worse news about HIIT is still to come.**

EFFECT ON MOOD and ENERGY

As I mentioned above, when I tried HIIT it left me drained and moody, but I thought it was because of my age. Then I came across this groundbreaking study done in Finland entitled."**Opioid Release after High-Intensity Interval Training in Healthy Human Subjects"** comparing standard cardio to HIIT and their effect on your feeling of well being and the chemicals each produces in your brain. This report from thedailyburn.com and numerous other websites sums up the findings nicely.

"Researchers at the University of Turku in Finland studied the effects of different types of exercise on endorphin release and mood. As your body's natural opioid, endorphins are

neurotransmitters that activate your brain's reward system *and minimize pain. Participants of the study underwent three position emission tomography (PET) scans to illustrate brain functioning before and after exercise. They did one at rest, one after an hour of moderate-intensity exercise and another one after a high-intensity interval training (HIIT) session. What they found was that HIIT significantly increased the flow of endorphins in the brain, particularly to the areas that control pain and emotions. But interestingly, moderate-intensity aerobic session didn't. Tina Saanijoki, one of the researchers of the study, says, this is one of the first studies of its kind. "No studies have compared opioid release after moderate and high-intensity exercise at the brain level." She says, "The finding that HIIT led to* opioid release *didn't surprise us, but we were somewhat surprised that in the group level, we didn't observe opioid release after one-hour of aerobic exercise."* ***Surprisingly, researchers discovered that the moderate-intensity aerobic***

work left participants feeling euphoric, even though there wasn't a flood of the neurochemicals in the brain. Meanwhile, while the HIIT participants showed a measurable endorphin rush, they experienced a rush of negative feelings, too. Participants reported exhaustion, irritation and lack of energy. Instead of the typical post-workout glow, the intense bout of exercise caused the exact opposite effect. *The findings suggest that endorphins can have a dual effect on your body and mind, depending on the intensity of your workout. "[Endorphins] appear to be involved in positive emotions at* moderate intensities *and in modulating negative emotions and perhaps pain at very high intensities," Saanijoki says. "The opioid release after HIIT likely is the body's protection response to this physically and emotionally stressful situation."*

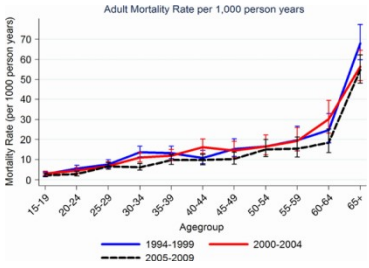
In still another study on HIIT and mood among **professional soccer players** researchers concluded: "*HIIT caused a significant increase in TMD* (total mood disturbance)*, unlike the SSG (soccer game*

players) which resulted in no-change. performing 15s-15s hiiT causes not only an increase in fatigue as seen in the SSG, but also a significant increase in tension and a significant decrease in vigor. This indicates that intense interval training elicits an increase in negative statements and decreased positive mood. The results are in line with studies that have examined the relationship of the exercise modality with the mood state in different sports. Other works have shown that fatigue following intense exercises causes mood disturbance and decreased level of force. Berger and owen have also indicated that high training load causes deterioration in the mood with higher scores for anxiety, fatigue and decreased energy."

Now let me ask you, how many people are going to stick to an exercise routine that leaves them feeling irritable, anxious, and exhausted? Especially compared to an exercise that leaves them feeling euphoric and energetic. Now next

time you go into a gym a see how many people are doing normal cardio and how few are doing HIIT you'll understand why everyone isn't jumping on the HIIT bandwagon.

HIIT AND MORTALITY RATE



The long term effect of HIIT on mortality rate is unknown because large scale long term studies have not been performed. Also note that there is a difference in heart adaptation between HIIT and steady state cardio: on one hand there is a Concentric Hypertrophy of the Heart in HIIT (due to anaerobic stresses), vs the Eccentric Hypertrophy of the Heart for SS, which increases the stretch reflex (less energy used per beat). According to some sources, concentric hypertrophy is the less appealing type of hypertrophy, because it increases wall thickness without increasing the chamber radius, which can "impair filling and lead to diastolic dysfunction". The life extending effects of steady state cardio has been well documented by many decades of large scale, high quality, long term studies with tens of thousands of people. However no such research on HIIT exists. While many of HIIT physiological benefits are similar to steady state cardio, the body is complex biological system and only after long term similar studies on HIIT will we know if it has the same effect on mortality as steady state cardio.

As I was doing research for my next topic, I came across an ASTOUNDING study which *should have* made headlines. It looked at the effects the intensity of aerobic exercise had on the mortality rate of both men and women. In fact it was a pooled analysis of 6 different studies involving over 369,000 women and

291,000 men and separated them into vigorous intensity and moderate intensity exercisers *for each sex.* What I found shocked me. As all of the studies I had previously read on aerobic exercise indicated that vigorous intensity had a greater effect on the mortality rate than moderate intensity. But this was the first study I ever saw which looked at the difference between the 2 intensities among men and women *separately.* What this study showed was that women who did MODERATE intensity aerobic exercise had a significantly greater improvement in lowering their mortality rate than the women who did vigorous intensity. This improvement held across ALL volume categories. In fact even females in the lowest volume moderate intensity group had lower mortality rates than females in the highest volume vigorous intensity group. For men the reverse was true, the vigorous intensity group had lower mortality rates. So if moderate intensity exercise lengthens the lives of women more so than vigorous intensity, the likelyhood that it would do the same or better when compared to HIIT is very high, since HIIT is a super vigorous exercise. I will go into more details and reveal the link to this amazing study in my next column, since the relevance of this study has more to do with my next subject than this one.

If you want an exercise that doesn't really save you any time (when compared to vigorous

cardio), has little or no increase on EPOC (the afterburn), leaves you tired and moody, and whose long term benefit on mortality is unknown for men and is probably worse for women, then by all means give HIIT a try. Now, if your already doing HIIT, like it and are having success with it, then by all means continue but limit your HIIT workouts to no more than 2 a week. But, you should at least be aware of the above research. If the research is to be believed, people like this are a small percentage of the population. For the rest of us if you've tried HIIT and had some of the experiences above, don't think that it's just you or that it's because you're out of shape. It should be comforting to know that that's just what researchers say that most people are experiencing. *Just don't expect to hear about it from the lay press.* HIIT may be the perfect example why you should listen to what your body is telling you, no matter what the headlines say about how great something is for you.

As I was writing this article (March 2019) a news report appeared in my news feed you may have seen with the headline **What's Best for Weight Loss: Sprints, HIIT, or Steady-State Cardio?** With a subtitle that read: **Interval training could help you lose more weight than a continuous moderate-intensity workout, according to a new review and meta-analysis published in the British Journal of Sports Medicine.** While this meta-analysis, like the ones I mentioned above, also compares **moderate** intensity cardio (they defined as 55 to 70 percent of max heart rate) with HIIT, the researchers actually found and clearly state "*no*

significant differences between interval training and MOD (moderate intensity continuous training) *for total body fat percentage reduction."* So how could the press report claim that HIIT could help you lose more weight? Because the researchers also found that HIIT had a greater effect on total absolute fat mass reduction. The only way both could be true is if the average hiit participant started with more fat mass the average steady state group participant. It's like comparing a 150 pound man doing steady state to a 300 pound doing HIIT, who do you think is going to lose more fat? If the ***percentage*** of fat loss is the same between exercise groups than the amount of fat any individual would expect to lose would be the same with either HIIT or steady state. That's 6th grade math. The lay press strikes again.