

Module 7 Exercise is Ineffective for Fat Loss

Summary

The exercise component of weight loss/weight management is overemphasized and misunderstood by conventional wisdom. While the calories in-calories out equation is literally true, the variables of appetite, energy level, and hormonal function make the calorie balance equation a peripheral or incidental component of the weight management challenge, rather than the end-all.



The greatest benefits of exercise relate simply to the movement of muscles and joints, and the optimization of adaptive hormones, not to the burning of calories. General everyday low-level movement promotes optimal health, immune function, fat metabolism, and brain function. Brief, high intensity strength and sprint workouts deliver an anti-aging effect by enhancing organ function, optimizing body composition, elevating mood and cognitive function, and developing total body, functional fitness.

In contrast, a pattern of chronic exercise in pursuit of extreme or narrowly-focused fitness goals can trigger increased cravings for quick energy carbohydrates, inhibit fat metabolism, compromise immune function, exhaust the body's stress management mechanisms, and break down lean muscle tissue. As a component of the fight-or-flight response (responding to the exhausting nature of chronic exercise), chronic exercise can stimulate hormonal changes in the body that actually promote fat storage the body's attempt to recover from exercise stress and pack away energy to survive future stressful exercise sessions.

Overview

Our genes require frequent everyday low-level movement and aerobic conditioning for optimal health, fat metabolism, and protection against common sedentary-related health problems. This basic requirement for daily movement can be met through a

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combination of structured aerobic workouts at or below the aerobic maximum heart rate ($180 - \text{age}$ in beats per minute), general efforts to increase everyday movement, and flexibility/mobility exercises like yoga, Pilates, tai chi and properly executed stretching.

A pattern of frequent medium-to-difficult intensity sustained workouts, with insufficient rest between sessions, can be classified as chronic cardio. Chronic cardio abuses the body's fight-or-flight stress response mechanisms, which promote illness, injury, fat storage, accelerated aging, declining cognitive function, and ultimately burnout. The US government's official recommendation to engage in 60 minutes of moderate-to-vigorous intensity activity on most days of the week is effectively promoting a chronic cardio exercise pattern.

Maximum aerobic heart rate ($180 - \text{age}$ in beats per minute) is where you achieve optimal aerobic, fat-burning benefits without triggering the fight-or-flight response. Sustained workouts over maximum aerobic heart rate burn a greater percentage of glucose instead of fat and trigger the production of stress hormones and lactic acid (aka the burn sensation) in muscles.

The concept that muscle burns more calories than fat that is touted as a weight loss benefit of exercise is flawed. It's literally true, but to a far lesser extent than generally believed. Muscle burns about six calories per pound daily, while a pound of fat burns around two calories. Hence, dramatic changes in body composition will alter basal metabolic rate only slightly.

Facts

Dangers of sedentary modern life:

The most profound benefits of exercise are not on the caloric expenditure side, but rather on the overall effect of increasing daily movement in an age in which sedentary influences are predominant and have a destructive effect on health. Scientists report a strong connection between prolonged sedentary periods and assorted health problems and musculoskeletal imbalances. Statistics referenced by James Levine, MD, PhD, a Mayo Clinic researcher, international expert on obesity, and author of *Get Up! Why Your Chair is Killing You and What You Can Do About It*, suggests that the average

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Westerner working in an office environment sits for some 13 hours per day (at work and at leisure), sleeps for 8 and moves for only 3.

Musculoskeletally, prolonged sitting weakens your gluteal muscles by deactivating them from supporting body weight and essentially putting them into a prolonged static stretch. Sitting also compromises your hamstrings and hip flexors such that they shorten and tighten from prolonged inactivity in a seated state. The glutes, hamstrings, and hip flexors comprise the foundation of all manner of daily activity, from basic leaning or crouching all the way through the movements involved in competitive sports.

Inactivity leads to metabolic and hormone imbalances that inhibit glucose metabolism, elevate triglyceride levels, promote excess body fat storage, and elevate blood pressure. In particular, leptin signaling is known to be disturbed by inactivity. Compromised leptin signaling causes an increase in appetite, an up-regulation of fat-storage genes, and a down-regulation of fat-burning genes.

People with lifestyle patterns featuring prolonged periods of sitting each day experience chemical changes in their brains that promote inactivity, while people in the habit of moving have brain wiring that encourages regular movement. These differences in metabolic function can be quantified by the term Non-Exercise Activity Thermogenesis, which is the measure of caloric expenditure outside of sleeping, eating, and exercising. Lower readings might indicate a more sluggish functional state, while someone with higher readings enjoys more thermogenesis due to an elevated basic energy level and disposition. Study subjects who are obese reveal an unfortunate catch-22: they are not motivated to move because they don't move enough, and because they don't move, they get fat.

While familial genetics and personality characteristics might make certain people more naturally active or even more hyper than others, the good news is that by making a concerted effort to move frequently and avoid prolonged periods of sitting or other stillness (yep, even prolonged stints at your standup desk) you can rewire your brain to become more naturally and spontaneously active. Furthermore, adding more daily movement and developing these efforts into habits can reprogram your genes to burn fat rather than store fat. A simple and immediate step to take in the proper direction might be to make a practice of walking for 5-15 minutes after every meal to mute that prolonged post-meal blood sugar spike and consequent insulin release.

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Sedentary office work is hazardous to your health, even if you work out every day! While fitness enthusiasts might skim over the dire headlines warning against the health hazards of sedentary patterns, they are not immune from the dangers of excessive stillness. Scientists have observed a phenomenon called the active couch potato syndrome in which even people devoted to daily workouts but with otherwise strong sedentary lifestyle patterns (long commutes, desk jobs, evening digital entertainment on the couch) suffer from a similar level of risks for obesity, cancer, and heart disease as those who don't exercise at all. While a devoted exercise regimen offers assorted benefits, it's simply not enough to protect you from the health hazards of prolonged sitting. These hazards include impaired cognitive function, as circulation to the brain is compromised by prolonged stillness.

Even minimal movement efforts can help protect against the hazards of prolonged sitting. One Mayo Clinic study revealed that a leisurely (one mph) 15-minute walk after a meal lowered by half the 2-hour-long blood sugar spike that occurs after a typical meal. Levine cites research that performing an activity as simple as standing up at your desk instead of sitting increases caloric expenditure by 10 percent, while taking frequent movement breaks during the day can add up to an additional 1,000 calories burned or more, as well as hormonal changes that encourage fat burning instead of fat storage.

The key to overcoming the health hazards of sedentary modern life is to strive for constant movement and variation in your daily routine. Be wary of the endless modern comforts and conveniences that allow you to move less, ease physical labor tasks, lift lighter loads, and generally be lulled into the allure of constant stimulation from a digital screen. A dynamic workplace entails at least a few different options that are easy to switch back and forth to during the day. Of course you will have to respect the confines and restrictions of your workplace, but most everyone can request or rig up a standing setup option, or take phone calls or conduct personal meetings while walking through the office courtyard instead of chained to a desk.

However cool your computer station is, it's also essential to take frequent breaks from prolonged sitting and focusing on cognitive peak performance tasks. Ideally, breaks would get you outside for some fresh air, open space, and a refreshed perspective when you return to the confinement of an office. Even your eye muscles can benefit

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from taking breaks from focusing on a screen at a fixed distance to gazing at distance objects.

Understanding aerobic exercise:

A workout conducted in the aerobic heart rate zone (heart rate of 180-age or below) will optimize fat metabolism both during the workout and throughout the day. Even at this very comfortable intensity level, aerobic exercise stimulates the metabolic action of the body at a level more than twice that of normal resting rate. The body learns through the stimulation of exercise how to operate more efficiently at rest. For example, the familiar metric of resting heart rate correlates strongly with one's fitness level. Elite endurance athletes commonly have resting heart rates of 40 beats per minute or even lower. Through devoted exercise, their hearts pump vastly more blood per beat (known as stroke volume) than an untrained or casually trained heart. This is evidenced by the average resting heart rate of the general population of 72 beats per minute. An individual who is extremely unfit, smokes cigarettes, or is morbidly obese might register a resting heart rate of over 100 beats per minute a sign of tremendous inefficiency and relentless stress on a poorly functioning, poorly trained heart.

Numerous other health benefits accrue from obtaining sufficient aerobic exercise and general movement. Cardiovascular function is optimized as capillary perfusion is increased, muscle mitochondria multiply and also function more efficiently, stroke volume of the heart increases (amount of blood pumped with each beat), and lung capacity improves as a function of receiving more oxygen from the cardiovascular system.

A strong base of low-level aerobic conditioning strengthens bones, joints, and connective tissues, thereby enhancing performance and recovery, minimizing injury risk, and making the body more resilient for the high intensity workouts that complement a complete fitness program. Aerobic exercise also boosts the immune system by optimizing the flow of anti-aging hormones and by building a more efficient circulatory system.

In contrast, chronic exercise at heart rates above aerobic maximum train the body to prefer glucose as fuel, both during exercise and throughout the day. A chronic cardio pattern also has been shown to obstruct immune system function, destroy white blood cells, elevate cortisol levels, suppress testosterone levels, and trigger chronic/systemic

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inflammation. While high intensity workouts are critical for peak performance and longevity, the key is to make them brief, interspersed with extensive recovery, and conducted only in the presence of a strong aerobic conditioning base.

Chronic cardio also increases one's risk of injury and trauma to the joints and connective tissues, and jumpstarts an undesirable metabolic chain reaction. When heart rates outside the aerobic, fat-burning zone are sustained, the body begins to burn a greater percentage of glucose for fuel, which leads to sugar cravings after the workout, which leads to spikes in insulin production, which leads to more fat storage. Workouts at or below aerobic maximum heart rate ($180 - \text{age}$) are comfortable and energizing, and fine-tune fat metabolism.

Dr. Phil Maffetone has been a coach and advisor to several of the greatest triathletes in history and a pioneer in promoting the importance of aerobic heart rate zone training and balancing stress and rest. The author of *The Big Book of Endurance Training and Racing* and many other titles relating to health and fitness, Maffetone explains that the up-regulation of glucose burning during intense exercise can last for up to 24 hours after the session. As we'll discuss shortly in the compensation theory section, the calories burned during exercise are replenished and then some due to increased appetite, particularly for sugar, in the hours after exercise. This compensatory, glucose-burning effect of chronic exercise is the reason that millions of devoted fitness enthusiasts carry mild to significant amounts of extra body fat despite careful attention to burning calories and limiting calorie consumption.

Perhaps most relevant for devoted fitness enthusiasts is the frequent abuse of the testosterone-cortisol balance. Testosterone is a major adaptive, muscle building, mood elevating, cognitive performance enhancing, anti-aging hormone for both males and females, while cortisol is the primary catabolic stress hormone. These two hormones antagonize each other, so chronically elevated cortisol will suppress testosterone.

Abusing the body's inflammatory balance is also relevant for serious exercisers. While all workouts trigger a desirable immediate inflammatory response due to an elevation of body temperature and metabolic rate, chronic workout patterns promote chronic, or systemic, inflammation. This compromises immune function and hormone balance, and elevates the risk of many diseases, including heart disease. This is in sharp contrast to the desirable inflammatory response activated by a brief, intense workout, followed by

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an extensive rest and return to optimal inflammatory balance between intense workouts.

Benefits of aerobic exercise:

Following are some of the major benefits of blending more general everyday movement with carefully structured aerobic workouts into your lifestyle:

Fat metabolism:

The stimulation of aerobic exercise trains your body to efficiently utilize free fatty acids for fuel. This is a benefit that is realized 24 hours a day as your body learns from the exercise sessions to prefer fat to glucose for fuel. This benefit is contingent upon adhering to a low insulin-producing eating pattern.

Cardiovascular function:

Aerobic exercise builds more mitochondria in your muscles, an effect known as mitochondrial biogenesis (details follow). Mitochondria are known as the power plants inside each cell because energy is extracted from nutrients and converted into ATP (adenosine triphosphate) to power cellular function in the mitochondria. When you exercise aerobically, with plenty of oxygen available to make fat the preferred fuel source, mitochondria produce energy more efficiently than when glucose is the primary fuel source.

Building more mitochondria through aerobic exercise means that cells can handle a greater workload without getting overwhelmed, and that fewer free radicals are produced in the process of ATP energy production. The net result of sensible aerobic exercise is you burn energy more efficiently, minimize free radical damage, and consequently delay the aging process. When exercise turns chronic, cells get overwhelmed, free radical damage ensues, and aging is accelerated.

Sensible aerobic exercise also increases your capillary network (blood vessels that supply the muscle cells with fuel and oxygen), raises the stroke volume of your heart (more blood pumped with each beat) and improves oxygen utilization by your lungs.

Musculoskeletal strength and resilience:

Aerobic exercise strengthens your bones, joints, and connective tissue so you can absorb increasing stress loads without breaking down. This is critical to your ability to

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perform and recover from the occasional high intensity strength and sprint workouts that complement the Spartan Method exercise strategy.

Caloric compensation:

Recent scientific research suggests that calories burned through exercise are more than offset by increased caloric intake and reduced caloric expenditure in the aftermath. Exercise indeed burns stored energy, but it stimulates a corresponding increase in appetite, along with hormonal changes that promote fat storage after the workout is over. Exercise triggers a rise in HSL (hormone sensitive lipase), enabling both glycogen and fat to be mobilized from storage and dumped into the bloodstream to be used for fuel during the workout. Once the workout ends and your energy requirements diminish significantly, HSL levels drop and levels of LPL (lipoprotein lipase) elevate. This post-exercise elevation of LPL promotes the restocking of both glycogen and fat to speed recovery. When LPL levels are elevated, cells literally reel in nutrients circulating in the bloodstream and lock them away in storage.

Besides the appetite and hormonal effects of exercise that negate the calorie-burning effects for weight loss efforts, there are additional behavioral effects involved too. We respond both consciously and subconsciously to a workout by being less active and eating more calories in the aftermath. Consciously, we reward ourselves for completing the effort by seeking more rest and relaxation options and indulging in foods we might not ordinarily eat if we didn't grant ourselves permission. For example, after a vigorous workout, we might be more likely to take the elevator instead of the stairs, and enjoy something from the dessert tray while dining out that evening.

The desired weight management benefits of calorie-burning exercise is negated by increases in caloric intake and altered hormone function. Subconsciously, the body compensates for the stress of exercise by seeking ways to conserve energy by slowing metabolic rate and generally moving slower and being a tiny bit lazier in the aftermath of a workout. Anyone who has experienced the afternoon blues following a vigorous morning workout, or experienced recurring periods of lingering fatigue in response to a pattern of chronic workouts, can attest to how the body compensates for ill-advised workouts by being sluggish. The body's effort to slow down and conserve or store energy is a genetically programmed mechanism to promote survival and avoid exhaustion.

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Caloric compensation is particularly relevant when the exercise pattern is chronic, because a depleted body will become even more inclined to consume additional calories, store them as fat, and conserve energy in every way possible throughout the day. Your brain directs you to overeat because it's thinking, 'I better be prepared if this clown tries this [chronic workout] again tomorrow!' In contrast, caloric compensation becomes less relevant in fat-adapted and primal-aligned exercisers. Those skilled at accessing internal energy stores through a low insulin-producing eating pattern, and who expertly balance stress and rest in workouts and avoid chronic exercise, have less appetite stimulation and need for immediate replenishment after workouts.

It's important to have a big picture view of this discussion and realize that sensible exercise delivers overwhelmingly positive benefits and can promote weight management by improving insulin sensitivity and regulating appetite. However, the idea of a direct relationship between calories burned and body fat reduction is deeply flawed. As Module 4 detailed, 80 percent of your body composition success is determined by diet, with exercise essentially serving as a finishing touch to a low insulin-producing diet.

In summary, the hormonal influences override any simple equation involving the readout on your exercise bike and the menu facts at Jamba Juice. Mark Sisson suggests that the calories in-calories out maxim should be restated to consider calories burned versus calories stored.

It should be noted that it is possible to achieve optimal body composition through a combination of extreme exercise and disciplined portion control. This approach has proven successful for elite athletes and fitness models, as evidenced by their impressive physiques. Unfortunately, numerous factors make this approach difficult to impossible to scale to the masses. For one, genetic advantages allow only a small percentage of the population to maintain the low body fat and exceptional muscle tone displayed by fitness personalities.

Even with portions carefully monitored (and often fat intake strictly limited due to its caloric density), a grain-based diet promotes excessive insulin production, making it impossible for most fitness enthusiasts to lose that last 5, 10, or 20 pounds that represent the ultimate goal. Secondly, the logistics of sustaining very time-consuming training programs put these routines out of reach for most people who have additional

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daily responsibilities and interests. Thirdly, the difficulty of pushing the body with a sustained pattern of extreme workouts makes this approach unappealing and unsustainable to all but the most motivated and disciplined candidates.

Aerobic vs anaerobic exercise:

The term aerobic means with oxygen and indicates an effort level in which sufficient oxygen is available to burn predominantly fat, since fat requires oxygen to burn for energy during exercise. The term anaerobic means without oxygen and indicates an effort level that is difficult enough to cause an oxygen shortage that prompts the burning of a greater percentage of glucose for fuel, since glucose does not require oxygen to burn.

The distinction is important because the metabolic effects of a workout vary by intensity level. An aerobic workout is comfortably paced, burns primarily fat, and is minimally stressful to the body. An anaerobic workout burns primarily glucose, stimulates the release of stress hormones into the bloodstream, and causes lactic acid production in the muscles a by-product of performing work efforts without adequate oxygen.

Any exercise effort that is brief and intense is anaerobic in nature and will burn primarily glucose for fuel. Since the benefits of brief, intense exercise are touted at length by the Spartan Method, it's important to recognize that the stressful nature of anaerobic workouts is not necessarily negative, but rather plays an important role in the development of total fitness. Exercising at high intensity and triggering the fight-or-flight response promotes optimal gene expression when the efforts are brief in duration and conducted in an optimal pattern that always balances stress with sufficient rest. The pulse of stress hormones and adaptive hormones triggered by intense exercise is over with quickly enough for the body to comfortably return to a rested state without becoming exhausted or experiencing fatigue or hormone imbalances in the hours and days after the workout.

Respecting aerobic maximum heart rate:

It's imperative to be strict about limiting workout intensity to the aerobic maximum, and to use an heart rate monitor instead of relying on perceived exertion. The reason is because when you drive above your 180-age aerobic maximum, you don't feel much strain or lactic acid burn until you work much much harder. You also cannot discern the

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transition away from burning mostly fat to an increasing percentage of glucose.

Unfortunately, when we default to perceived exertion, we are inclined to exercise in a slightly uncomfortable zone, beyond aerobic maximum, because this is where we feel we are accomplishing something--getting a workout.

It requires patience and a belief in the process of aerobic development to accept the 180-age limit when it feels too easy. Alas, when you build your aerobic system properly, you become more and more efficient (faster) at that same low heart rate. Proper aerobic training demands a big picture perspective that analyzes exercise patterns over weeks and months. Over time, limiting heart rate to 180-age or below during sustained workouts will help steadily improve fitness with minimal risk of fatigue, burnout, or injury. Exercisers complete these aerobic workouts feeling invigorated instead of fatigued.

In contrast, a pattern of sustained workouts that exceed 180-age leaves exercisers feeling exhausted, craving sugar, and generally more stressed instead of refreshed. This approach to fitness can easily compromise recovery rates, immune function, energy levels, and weight loss and fitness goals.

Calculating maximum aerobic heart rate:

Quantifying maximum aerobic heart rate (defined as the point where maximum aerobic benefits occur with a minimal amount of anaerobic stimulation) may not be an exact science, and there is a range of opinion on the matter from leading exercise physiologists, coaches, and elite athletes.

After extensive research on the matter, the Spartan Method position is to strongly support Dr. Phil Maffetone's 180-age = maximum aerobic heart rate formula. The Maffetone formula has been field tested by thousands of athletes over decades, can be calculated without laboratory testing and without needing an accurate maximum heart rate value, and is on the conservative side. Training with a conservative number still supports excellent aerobic development and lessens the risk of the disastrous chronic cardio patterns that occur from exceeding aerobic maximum routinely. Keep in mind that as you improve your fitness, your speed at maximum aerobic heart rate will improve, but there is never a justification to increase your maximum aerobic heart rate beyond your 180-age calculation. What this means is that while a fitter athlete performs

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at a higher level than a novice at the same heart rate, the relative difficulty of the workout is similar with all exercisers. It feels easy!

Maffetone 180-age formula adjustment factors:

The Maffetone formula offers some adjustment factors to the calculation based on your current state of health and fitness. Take 180 minus your age as your baseline number, and then adjust it accordingly if appropriate:

Subtract 10:

Recovering from illness, surgery, disease, or taking regular medication.

Subtract 5:

Recent injury or regression in training, get more than two colds/ u annually, allergies, asthma, inconsistent training, or recently returning to training.

No Adjustment:

Training consistently (4x/week) for two years, free from aforementioned problems.

Add 5:

Successful training for two years or more, success in competition.

Measuring exercise intensity with heart rate allows you to individualize your workout plan. For example, an elite marathon runner might be able to maintain a pace of 5 minutes, 30 seconds per mile for over an hour and still remain at aerobic maximum heart rate. A mere mortal attempting to run with the elite at that pace might last only a few minutes running at maximum anaerobic intensity and burning up glucose like crazy, while the elite runner burns mostly fat and feels very comfortable. The pace at aerobic maximum heart rate is relative to the fitness level of the individual, but the effort level, the metabolic effects, and the intended benefits of the workout are similar for everyone regardless of skill. For any exerciser, an aerobic session is one in which the effort level is comfortable and a conversation can easily be conducted without becoming winded.

What constitutes an aerobic workout?:

While 180-age represents the upper limit of the aerobic workout zone, the question arises about what is the lower limit of a so-called aerobic exercise zone. While expert opinion varies on the matter, with many resources citing a lower limit as percentage of

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maximum heart rate, the Spartan Method suggests that there really isn't any lower limit value to concern yourself with. Any form of low-level movement contributes to your aerobic development, so getting up and walking to the mailbox, or walking the dog around the block, can be considered beneficial aerobic activity.

Exercise mentality:

Regardless of fitness level, the key element of aerobic workouts is that they feel easy, plenty of oxygen is available, the stress response is muted, and the net result is a refreshed and energized feeling rather than one of fatigue. For those in the unfit category, keeping heart rate below 180-age might entail brisk walking instead of jogging, or taking occasional rest breaks from the synchronized movement of a group exercise class so that heart rate doesn't drift out of the aerobic zone.

For many exercisers conditioned to pushing the pace on the roads or during high-energy group workouts, it takes a significant adjustment in mindset to accept that workouts at only 180-age or below are actually effective. Many enthusiasts are conditioned to associate the mild discomfort of exercising above aerobic maximum with getting fit. When a mild to significant amount of discomfort and suffering is experienced during a workout, exercisers obtain a corresponding sense of accomplishment, a feeling that they did something productive. It's important to reflect on the idea that this sense of accomplishment might be due to harmful cultural programming (No pain, no gain!), and that vigorous workouts can actually be counterproductive to fitness progress and weight management when they drift into a chronic pattern.

The vaunted endorphin rush experienced at the end of a sustained medium-to-difficult intensity workout is an indication that the stress response has been activated. The morphine-like effect of stress hormones flowing after vigorous workouts may be a pleasant sensation, but the long-term effects of tapping into the stress response too frequently in pursuit of an endorphin rush can result in chronic cardio burnout.

What's more, fat metabolism can be compromised even when exercising for brief periods above the aerobic maximum. Once a bit of lactic acid enters the bloodstream and glucose burning is up-regulated in response to the increasing workout intensity, it's difficult to transition back into a predominantly fat-burning state, even if the pace slows back down into the aerobic range. For these reasons, serious exercisers who engage in a significant level of cardiovascular exercise should be strict with their heart rate parameters during the entire workout in order to optimize their ability to burn fat, both during the workout and at rest.

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Chronic cardio drawbacks:

Chronic cardio describes a pattern of overly stressful cardiovascular workouts (heart rate over 180-age) that last for too long and are conducted too frequently, with insufficient rest periods in between. Unfortunately, this seems to be the general population's predominant exercise pattern, as we have been conditioned to associate suffering and struggling with getting fit. This is the case for exercisers of all fitness and experience levels. Novices are often thrust into overly stressful situations as they struggle to keep up with the exhortations of a personal trainer or a peppy group exercise instructor, or attempt to hang with a pack of exercisers in a group training program targeting a distant goal event. Experienced athletes with high competitive aspirations routinely overtrain, as evidenced by the high rate of overuse injuries and performance ruts caused by crossing over the line of peak performance and into breakdown.

It's safe to speculate that our ancestors, because they were under constant life or death selection pressure, never engaged in exhausting, sustained workouts just for the fun of it or for arbitrary goals like a staged competitive event, and never experienced a state of chronic overtraining and the associated hormone and immune imbalances. It's also been asserted by anthropologists who study modern day hunter-gatherers that our ancestors did the bare minimum of physical work necessary in order to survive (granted, in some cases this was quite a bit of work!) and rested as much as possible. This allowed them to be ever-ready for the next life or death challenge without the risk of fatigue and exhaustion that might come from exercising independently of life or death environmental stressors.

Today, not only are we free from life or death selection pressure, but modern comforts and routines have also made it possible to do almost no physical activity and still survive and prosper in an economic sense. We are thus compelled to orchestrate from scratch an ideal exercise routine to promote health, fitness, and longevity. While many modern humans err on the side of inactivity, many devoted fitness enthusiasts err on the side of excess. Point blank, chronic exercisers compromise their general health, weight loss goals, and longevity by doing too much too often and ignoring the importance of rest. For many dedicated fitness enthusiasts who tend toward chronic exercise patterns, conducting workouts that are easier, shorter, and less frequent can lead to fitness and health improvements.

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Metabolism:

Being a chronic glucose burner (by exercising in chronic patterns and eating a high carbohydrate diet) results in post-exercise carbohydrate cravings, excessive insulin production, and a prevailing metabolic pattern of fat storage. While some chronic exercisers burn enough calories and have the genetic good fortune to maintain low body fat levels, many high volume exercisers struggle to reduce excess body fat despite arduous weekly training regimens.

Inflammation:

As previously mentioned, a chronic exercise pattern promotes systemic inflammation due to excessive and chronic production of the fight-or-flight response and the stress hormone cortisol. Furthermore, a chronic exercise pattern requires large amounts of dietary carbohydrates to sustain, an eating pattern that promotes systemic inflammation and accelerated oxidation and free radical damage in the body.

Injuries:

Recurring muscle fatigue, repetitive impact, and chronic inflammation from excessive catabolic hormones released in response to chronic cardio traumatizes joints and connective tissue, leading to increased incidences of both acute and overuse injuries.

Stress:

Excess cortisol production and excessive exercise stress in general promote systemic inflammation (a driving factor in cancer, heart disease, and many other serious health problems) and increase oxidative damage (via free radical production) by a factor of 10 to 20 times normal. Chronic stress has also been observed to suppress immune function and compromise bone density.

Fitness:

Chronic cardio gets you good at chronic cardio, while compromising the development of a more balanced state of fitness. Chronic cardio diminishes power, speed, strength, and lean mass, and also leads to muscle imbalances, inflexibility, and recurring stiffness and soreness.

It's easy to drift into chronic patterns, even for casual exercisers who are just trying to keep up with their slightly fitter exercise partners

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Because the 180-age level is so comfortable, great care should be taken to ensure workouts are aerobic and that the upper limit is respected. Over time, through a combination of actual heart rate monitoring and perceived exertion, one should become skilled at sensing the point at which maximum aerobic benefits occur with a minimal amount of anaerobic stimulation, and the point at which this maximum moves into overly stressful workouts that promote chronic patterns.

Heart rate zones:

A description of various heart rate zones and what they mean follows:

Resting heart rate:

Athletes have a higher stroke volume (more blood pumped per beat) than an unfit person does. Hence, a fit person will have a lower resting heart rate (fewer beats per minute) than an unfit person to sustain normal body function at rest. A fit person might have a resting heart rate around 40 beats per minute, or around 20 to 30 percent of maximum heart rate. The average resting heart rate for adults is 72 beats per minute. Smokers and highly unfit folks can have resting heart rates that exceed 100 beats per minute. In these examples, resting heart rate could represent 40-50 percent of maximum heart rate.

Aerobic maximum heart rate of 180-age:

180-age is the upper limit for exercise intensity that is minimally stressful and burns primarily fat for energy. For an unfit person, the most basic movement like walking to the mailbox can easily elevate heart rate up to aerobic maximum. A fit person can perform at a respectable pace at 180-age, perhaps climbing hills comfortably on a bike or maintaining a steady pace during a run.

The Black Hole:

Above 180-age and up to about 85 percent of maximum is an effort level for sustained workouts that is too difficult to be aerobic in nature, but not difficult enough to be categorized as a high intensity interval workout or competitive effort. When going really hard, it's easy to realize you are in anaerobic metabolism and scoring very high on rate of perceived exertion. The Black Hole range is not overly strenuous, and thus more difficult to realize the severity of the error of ditching aerobic metabolism for anaerobic/glucose burning/stress hormone stimulation. Consequently, and very

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unfortunately, the Black Hole heart rate range is where a great many casual to serious exercisers spend the majority of their exercise time. Chronic exercise in the Black Hole results in an excessive production of stress hormones, suppression of immune function, increase in injury risk, and promotion of carbohydrate dependency instead of fat adaptation.

High intensity zone:

90 percent of maximum heart rate and beyond is the optimal zone for occasional brief, all-out efforts. These workouts build muscle, support enhanced organ function, accelerate metabolism, and delay aging via the use it or lose it axiom.

- For explosive bursts under eight seconds, the body actually burns primarily ATP (adenosine triphosphate).
- For efforts between 8 and 30 seconds, lactate is the preferred fuel.
- For medium to high intensity efforts over 30 seconds and lasting up to several minutes, glucose is the preferred fuel. Note: Dr. Phil Maffetone argues that even serious athletes need never exceed 90 percent of maximum heart rate during intense workouts, because the additional stress of going above 90 percent (that's around 20 beats below absolute max heart rate for most people) does not offer sufficient return on investment. You can perform high quality efforts at 90 percent that will prepare you for occasional competitive efforts going up to 100 percent, but with less potential for breakdown and with faster recovery time than a training session exceeding 90 percent.

Body composition and metabolic rate:

A popular myth in the exercise world is that muscle burns vastly more calories than fat does, and hence by building muscle through resistance training you can significantly increase your metabolic rate. In a 2007 presentation, Dr. Mehmet Oz said, muscle burns 50 times more calories than fat. Despite the gross inaccuracy of this notion, it remains a recurring theme in fitness books and magazines that adding muscle mass and reducing body fat turbocharges your metabolic rate. The truth is that a lean, muscular body burns only slightly more calories than a body with higher fat content but the same weight. By the way, it's a pretty safe bet to not believe hype coming from celebrity TV doctors.

A pound of muscle burns approximately six calories per day, while a pound of fat commonly believed to burn nothing actually burns two calories per day. Our organs

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account for most of the calories burned in our basal metabolic rate, so even major reductions in body fat and additions of lean muscle have a relatively minimal impact on metabolic rate.

Consider a 200-pound man with a basal (resting) metabolic rate of 2,000 calories a day. We know that the brain uses about 20 percent of the daily calories burned by the body (400). The heart uses another 20 percent (400); the liver another 15-20 percent (300-400); and the rest of the organs another 15-20 percent (300-400). That allocates only about 20-30 percent of total daily caloric expenditure (400-600 calories) to skeletal muscle. If our example man has 90 pounds of muscle, that works out to about 6 calories per pound, each day. Even if someone were overweight and were to dramatically alter body composition by dropping 40 pounds of fat ($40 \times 2 = 80$ calories per day subtracted from basal metabolic rate) and gaining 20 pounds of muscle ($20 \times 6 = 120$ calories added), their total daily caloric expenditure would only increase by 40 calories. So it's true, muscle burns more than fat...to the tune of two macadamia nuts per day!

Mitochondrial biogenesis:

Mitochondrial biogenesis is essential for health, longevity, and optimal energy levels. Moving, lifting, and sprinting transform previously sluggish metabolisms into efficient fat-burning machines, thereby optimizing mitochondrial function.

Mitochondria synthesize the important sex hormones testosterone and estradiol, they regulate insulin and calcium levels in cells, and they metabolize fat, protein, and glucose into usable energy. Mitochondria's primary role is to extract energy from nutrients to produce adenosine triphosphate (ATP). ATP is used as energy for virtually every cellular process, from pumping blood through the cardiovascular system, to sprinting a 100-meter dash.

The downfall of ATP production is that it generates free radicals, which accelerate the aging process by increasing oxidative stress. As long as there are a sufficient number of healthy mitochondria and naturally produced antioxidants such as glutathione to counteract free radical damage, cells remain intact. However, if mitochondrial function is compromised, or if the number of mitochondria is too low, free radicals escape and wreak havoc on the body. Chronic cardio and overtraining have a degenerative effect on mitochondria, causing gene mutations that damage mitochondria. This is known as

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mitochondrial myopathy. Essentially, the more the mitochondria, the more cleaner and more efficiently the body produces and burns energy.

Sprinting for mitochondria:

Slow twitch muscle fibers contain the most mitochondria. Endurance training, such as a slow, long distance jog or cycle increases mitochondria, but recent research suggests that sprinting, or high-intensity interval training (HIIT) as termed in scientific studies, is just as effective, if not more effective, at activating mitochondrial biogenesis than is steady state endurance training.

Review

The majority of the modern world lives sedentary lives, and not even fitness enthusiasts are safe from the assorted health risks of sedentary living. Exercising for an hour a day every day doesn't counteract the eight or more hours spent at a desk, commuting, or lying on the sofa in the evening. Risks include musculoskeletal, metabolic, and hormone imbalances including higher blood pressure and the propensity to store instead of burn fat, an increase in appetite, and a tendency toward obesity, cancer, and heart disease.

To counteract the dangers of sedentary living, move more frequently, avoid prolonged moments of stillness, both when sitting and standing at your standup desk, vary your body positions, and add more movement, such as a 5-15 minute walk after meals to regulate the insulin response.

To optimize cardiovascular function, increase stroke volume of the heart so that more blood is pumped with each beat, and improve lung capacity, aim for exercising in the fat-burning aerobic heart rate zone of 180-age or below. Low-level aerobic conditioning maximizes fat burning during the workout and throughout the rest of the day. Aerobic exercise also strengthens bones, joints, and connective tissues, and boosts the immune system with a cascade of anti-aging hormones.

Occasionally exercising above this aerobic heart rate zone and into the glucose-burning anaerobic heart rate zone (up to 90 percent of maximum heart rate, but no need to exceed that) can be beneficial. High intensity exercise, such as that inspired by sprint workouts, promotes optimal gene expression and closely mimics the

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movements of our primal ancestors. High intensity efforts build muscle, support enhanced organ function, and accelerate metabolism, as long as they are coupled with sufficient periods of rest and recovery.

However, participating in chronic cardio too high intensity, too often elevates cortisol levels so you're locked in fight-or-flight response, maxes out your adrenal glands, impairs immune function, suppresses testosterone, and encourages chronic/systemic inflammation. Chronic cardio teaches your body to prefer burning glucose to fat, increases sugar cravings, and traps you in fat-storing mode.

In order to monitor your heart rate and make sure you are staying aerobic, it's essential to track your progress with a wireless heart rate monitor. Relying on perceived exertion is ineffective because the effort at aerobic max is too easy. Exercisers who are not disciplined about monitoring aerobic heart rate can easily drift into the Black Hole zone--not too difficult but nevertheless stimulating stress hormone production and a greater percentage of glucose instead of fat. A good barometer of fitness is your resting heart rate the general idea being that the fewer times your heart beats per minute the healthier you are.

When examining weight loss and fitness goals, it can be helpful to realize that while it is beneficial to add muscle and burn fat, it is not so much from a caloric standpoint as from a hormonal standpoint. Building muscle improves insulin activity, helps rid the body of abdominal fat, and thereby optimizes hormone function and improves health.

A consistent program incorporating moving frequently, lifting, and sprinting occasionally, optimizes mitochondrial biogenesis by impacting metabolism and promoting superior energy burning. The more mitochondria produced, the more efficiently fat is burned. Just be sure to follow an optimal pattern of volume, intensity, and frequency of workouts, and you're guaranteed to keep your physical age dramatically younger than your chronological age.

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