ADVANCED BALANCING

Getting the right mix of training and recovery is essential to peak performance

By Pete Pfitzinger and Scott Douglas
Every time you do a hard workout, you provide a stimulus for your body to improve in some way, such as your lactate threshold, fat-burning ability, VO2 max, and so on. Any one workout, though, provides only a mild stimulus for improvement; it’s the sum of your workouts over time that determines the total stimulus to improve a specific component of your fitness. For example, if you do one tempo run in the few months before a marathon, you provide a mild stimulus for your lactate threshold to improve. If you do six tempo runs in eight weeks, you provide a strong repetitive stimulus for your lactate threshold to improve.

The training stimulus, however, is only half of the formula for performance improvement. To improve, your body must recover from training and adapt to a higher level. By learning to manage your recovery, you’ll optimize your training. If you manage your recovery so that you can do hard workouts more frequently or so that the quality of your hard workouts consistently improves, then you’ll provide a greater stimulus for your body to improve its capacities.

Recovery from training is important, both day to day and over the course of your marathon preparation program. Poor management of your recovery can lead to overtraining, which simply overwhelms your body’s ability to respond positively to training. Let’s look more closely at how to optimize your recovery for racing success.

**Recovery and Supercompensation**

One of the realities of running is that if you do a hard workout today, you won’t be a better runner tomorrow. In fact, tomorrow you’ll just be tired. Hard training causes immediate fatigue, tissue breakdown, dehydration, and glycogen depletion. Depending on the difficulty of the training session and other factors, you’ll require from two to 10 days to completely recover from a workout.

At some point, however, the fatigue of each workout dissipates and you adapt to a higher level. To optimize your training, you need to find the correct balance between training and recovery for you. Training provides the stimulus for your body to adapt, but recovery is when you allow your body to adapt and improve. Well-designed training sessions also provide a stimulus for your body to adapt to a higher level, which is called supercompensation.

**Effectively managing your recovery means answering two questions:**

1. How many days after a workout do you reap the benefits of that workout?
2. How much time should you allow between hard workouts or between a hard workout and a race?

Let’s try to answer those questions.

**Turning Genes On and Off**

The intensity, duration, and frequency (number of sessions per week) of your training all influence the rate at which your body adapts. The adaptations in hormone levels, fat-burning ability, capillarity density, and so on that result from endurance training occur because of repeated training bouts rather than as a result of one workout in isolation. It’s as though your body must be convinced that you’re really serious about training before it makes the physiological adaptations that let you reach a new level.

The process of adaptation begins with your genes. Training provides stimuli (e.g., glycogen depletion) that turn specific genes on or off. By altering the expression of genes, training changes the rates at which your body makes and breaks down specific proteins. For example, endurance training turns on genes for the production of mitochondrial protein. More endurance training leads to more mitochondria in your muscles so that you can produce more energy aerobically. Your muscles and cardiovascular system adapt over days, weeks, and months to the cumulative effects of your repeated training.

**Factors Affecting Recovery Rate**

Runners vary greatly in how long it takes them to recover from and adapt to a workout. Differences among runners in recovery time and rate of improvement are determined by genetics, age (you tend to recover more slowly with age), training history, gender (women tend to recover more slowly because of lower testosterone levels), and lifestyle factors. Your genetics determine your predisposition to adapt to training; some of us are programmed to adapt more quickly than others. Lifestyle factors, such as diet, quantity and quality of sleep, general health, and various life stressors (such as work, finances, and relationships), all influence how quickly you recover from and adapt to training.

Because so much variation exists among runners in how many workouts they can tolerate in a given period, you shouldn’t copy your training partner’s running program. Only through experience will you learn how much training you can handle.

Through trial and error you will know how much training your body can positively adapt to in a given time. To reach your potential, you must go through this self-discovery process intelligently and systematically. Determining this balance can be tricky because it can be hard to isolate variables. For example, if your job is now much more stressful than the last time you trained for a marathon, your current rate of recovery might be slower. You must find the correct balance of training stimulus and recovery for your specific circumstances over the long weeks that constitute marathon training.

**Time Required for Recovery and Supercompensation**

Unfortunately, the scientific literature doesn’t provide clear evidence of the amount of time required to realize the benefits of an individual training session. Personal experience and discussions with many runners and coaches indicate that eight to 10 days is an adequate amount of time to recover from and reap the rewards of most hard training sessions. Given that any one workout provides only a small fitness benefit — on the order of a magnitude of less than 1 percent — but that a workout can cause severe short-term fatigue, it’s wise to err on the side of caution.

<table>
<thead>
<tr>
<th>MINIMUM TIME BETWEEN HARD WORKOUTS AND TUNE-UP RACES</th>
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<tbody>
<tr>
<td><strong>TYPE OF WORKOUT</strong></td>
</tr>
<tr>
<td>TEMPO RUN</td>
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<tr>
<td>VO2 MAX INTERVALS</td>
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<td>LONG RUN</td>
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</tbody>
</table>

MONITORING YOUR “RECOVER-ABILITY”

Monitoring your body provides valuable information on your adaptation to training, your risk of injury or illness, and your readiness for the next hard training session. There are many ways to monitor your recovery, but the simplest measures are often the most useful and the easiest to adhere to. In combination, these measures provide insight into your adaptation to training. Typically, when results on these measures decrease, running performance and recovery deteriorate a few days later. In addition to the details of your training, try recording the following details in your training log, and review your log periodically to find the patterns that predict overtraining, illness and injury.

**WEIGHT:** Decreases in weight over a few weeks can indicate that you are not eating enough calories, have an illness, or are overtraining.

**MORNING HEART RATE:** If your morning heart rate is more than five beats per minute higher than usual, this may be an indication of inadequate recovery or illness.

**ENVIRONMENTAL CONDITIONS:** There’s great variation in how runners are affected by heat. Your training log will reveal patterns that can help you make needed adjustments during a stretch of hot weather.

**HOURS OF SLEEP:** Your quantity of sleep is one of several measures that, in combination, can explain a lack of recovery and can indicate needed lifestyle changes to help prevent illness or injury.

**QUALITY OF SLEEP:** A reduction in quality of sleep is often associated with overtraining.

**DIET QUALITY:** Often, a lack of energy can be traced back to poor diet in the previous few days.

**HYDRATION LEVEL:** Dehydration has an immediate effect on running performance and slows recovery from training.

**MUSCLE SORENESS:** If increased general muscle soreness lasts more than four or five days, then it is likely that you are ill or overreaching.

**ENERGY LEVEL:** If your energy level is reduced for more than three days, it is important to determine the cause of the reduction.

and allow enough time to fully recover from training before a race. The longer the race, the more that’s the case. To really race a marathon, for example, complete recovery from training is critical.

The table [page 63] shows typical times to map the benefits of three major types of workouts. The third column indicates typical amounts of time to recover from a workout of each type. For example, the table indicates that you should allow at least four days between tempo runs or between a tempo run and a tune-up race. You don’t, however, need to allow four days between a tempo run and a long run or interval workout. That’s because each type of workout uses different combinations of energy systems, so complete recovery from one type of workout isn’t necessary before you do another type of workout.

Although you won’t see the benefits of this week’s workout in this weekend’s race, if you do the workout early enough in the week you should recover sufficiently for it not to have a detrimental effect on your race performance. The timelines in the table take into account the fact that we often do a tune-up race when the fatigue of previous training is reduced rather than when supercompensation has occurred. You generally can’t afford the time required to be optimally rested for tune-up races. If your focus is a marathon, allow only enough rest and recovery to obtain optimal results for the marathon itself and possibly for one tune-up race.

Of the major types of workouts, tempo runs are the easiest to recover from because they don’t break down the body as much as the other forms of hard training. Tempo runs are neither fast enough to cause substantial muscle damage nor long enough to totally deplete your muscles of glycogen. Long runs seem to cause the most variability in recovery time among runners, although replenishing glycogen stores generally requires only 24 to 48 hours. Some runners are able to recover relatively quickly from long runs, whereas others are wiped out for days after one.

The variability in recovery time depends on your training history, the genetic and lifestyle factors discussed previously, the type of courses you train on (downhill causes more muscle damage and require greater recovery time), and the weather (the same long run in a 85-degree weather will take longer to recover from than on a 50-degree day). Interval workouts put your muscles and cardiovascular system under the most stress and generally require the longest recovery time.

The Hard/Easy Principle

Regardless of the type of workout involved, the pattern of workout and recovery is basic to effective training. Conventional wisdom calls for following the hard/easy principle of training, which is typically interpreted to mean that a hard effort is always followed by one or more recovery days. A recovery day may consist of an easy run, a light cross-training session, or total rest. During your hardest periods of training, however, it’s sometimes best to violate this training pattern and do back-to-back hard days. Thus, a better interpretation of the hard/easy principle is that one or more hard days should be followed by one or more recovery days.

The hard day/easy day training pattern follows from the physiological dogma of stimulus and response — hard training provides a stimulus for your body to improve, but rest is then needed to allow your body to recover and adapt to a higher level. Three reasons to follow the hard/easy principle are to prevent total glycogen depletion, to prevent illness, and to minimize the effects of delayed onset muscle soreness (DOMS).

**Preventing Glycogen Depletion:** Your body can store only a limited amount of glycogen. With a typical runner’s high-carbohydrate diet, you probably have enough glycogen to get you through a 20- to 22-mile run or a hard interval workout. It takes about 24 to 48 hours to completely replenish your glycogen stores. When you do two hard workouts in a row, therefore, you risk going into the second workout...
with partially filled glycogen stores, becoming depleted, and having a bad workout. Although glycogen depletion is potentially a problem on the second hard day, with a bit of planning it needn’t be an insurmountable problem. Three hard days in a row, however, would very likely lead to glycogen depletion and a more prolonged recovery period. By following the hard/easy principle, you give your body time to build up your glycogen stores so you are prepared for the next hard workout.

Preventing Illness: Moderate training makes your immune system stronger. Various studies have found that people who get regular exercise have 20 to 50 percent fewer colds than do sedentary folks. After high-intensity and prolonged exercise, however, the immune system is temporarily suppressed, creating an “open window” during which you’re at increased risk of infection. Although immune function varies greatly among individuals, studies indicate that the immune systems of healthy, well-trained runners are typically suppressed only after exercise lasting more than one hour at about marathon race pace or faster. Immune system suppression after high-intensity running has been found to last from 12 to 72 hours. Interestingly, there is evidence that immune system suppression is linked to carbohydrate depletion and that restocking carbohydrate quickly may help restore your immune function to full strength in less time. The clear implication is to not do another hard training session until your immune function recovers from the previous hard session or race. Allowing at least one easy day before the next hard workout typically provides enough time for your immune system to return to full strength.

Minimizing the Effects of DOMS: Contrary to many runners’ beliefs, high levels of lactate (lactic acid) in your muscles aren’t what make you sore for several days after a hard effort. Essentially, all the lactate you produce in a race or workout is eliminated from your body within a few hours. DOMS is caused by microscopic muscle damage that occurs primarily from eccentric (lengthening) muscle contractions, such as when you run downhill.

During downhill running, your quadriceps muscles contract eccentrically to resist the pull of gravity and keep your knees from buckling. The resulting muscle damage leads to inflammation, which causes soreness. It takes one to two days for this process of muscle damage, inflammation, and pain to reach a peak, and the effects can last for up to five days. While you’re experiencing DOMS, your muscles need time to repair. The damaged muscles are also weaker, so any workout done before the soreness goes away not only will be painful, but also will likely not be intense enough to improve your marathon fitness.

The physiology of DOMS favors an approach of two hard days followed by two easy days, because it takes one to two days for DOMS to kick in, then it takes another couple of days for the soreness to dissipate. By doing back-to-back hard days, you may sneak in your second workout before soreness and muscle weakness develop. You would then have two days to recover before the next hard effort.

When to Do Back-to-Back Hard Days

We’ve seen several reasons why you should follow the hard/easy principle in your training and that a hard day doesn’t always have to be followed by an easy day. A pattern of two hard days in a row followed by two (or more) recovery days may actually allow you to handle, and recover from, more high-quality training. Let’s look at two specific situations in which you should do back-to-back hard days.

During weeks that you race, you need to train but also to rest for the race. Renowned exercise physiologist and coach Jack Daniels, Ph.D., recommends back-to-back hard days during race weeks rather than alternating hard and easy days. If, for example, you do back-to-back harder workouts on Tuesday and Wednesday, you would still get your hard sessions in but would have an extra day to recover for a Saturday race. Although this modification still doesn’t provide the optimal amount of time to recover for the race, it’s an intelligent compromise that allows you to get your high-quality training while also racing reasonably well.

Another time when you might do two hard days in a row is if your weekly schedule is dictated by the Monday-to-Friday workweek. If you’re too busy or fatigued during the week to get in regular high-quality training, then you’ll want to take advantage of the weekend and squeeze in two hard days. Adding another hard workout on Wednesday, four of the five weekdays become recovery days, and you still get in three hard training sessions per week.

This brings us to the time-honored tradition of racing on Saturday and doing your long run on Sunday. If you race 10K or less, you’ll dip into your carbohydrate stores, but (assuming that, like most runners, you generally eat a lot of carbohydrates) will most likely not come close to fully depleting your glycogen stores. By eating your normal high-carbohydrate diet, you’ll be reasonably topped up with glycogen and ready to handle your long run on Sunday morning.

After a tune-up race, your long run should be at a more relaxed pace. If Saturday’s race is longer than 15K, however, you’ll likely have severely depleted your glycogen stores and may find yourself at less than your best for Sunday’s long run. If you race more than 15K on Saturday, skip the long run on Sunday. In that situation, you’ll be better off by postponing your long run until you’ve recovered from the race.

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AVOID BOREDOM. AVOID OVERTRAINING

In 1996, exercise physiologist Carl Foster, Ph.D., presented an interesting concept to help avoid overtraining. The concept is based on the idea that increases in training are more efficient if there is an increase in the training load.

The hypothesis is that overtraining is related to both the difficulty of training the training program, and the “monotony” of training. Monotony of training is a lack of variety in the training program. The “monotony” of training varies depending on the difficulty of training from day to day. Monotony training typically consists of one moderately hard day after another, whereas varied training consists of a mix of hard days, easy days, and the occasional rest day.

The concept is that training stress is the combined effect of the training load and the training monotony. Foster found that training stress can predict overtraining-related illness and injury, with both load and monotony as contributing factors. This further evidence that missing recovery days into your training program is necessary for optimal improvement without breaking down. A good training log can help you here. If you can gain an awareness of the combination of training load and monotony that you do over the edge, then you can try to adjust these elements for optimal training and optimal performance.

RUNNINGTIMES / 65
