

Running Performance Improvement Workouts

Rev 1

This paper addresses the principal performance-improvement workouts that are the generally accepted standards for runners training for 5K through marathon road racing distances. It identifies the primary purpose for each workout by identifying the particular attributes that contribute to performance improvement.

It is generally accepted that the most effective training programs incorporate all, or certainly most of, these workouts. For example, only doing interval and LSD workouts is necessary, but woefully inadequate if one wants to realize their maximum innate ability. In general, there is a wide latitude of workout regimens which will yield essentially the same results. There are no, that I can find, scientific studies which demonstrate an optimal mix for a balanced training program that incorporates these workouts. And, there is very little research that even addresses an optimal manner to conduct any of the specific workout types.

Detailed regimens for particular workouts are beyond the scope of this paper. I suggest that a logical approach is to emphasize shorter distance intervals, 200m and 400m, and 15/60 drills if training for 5K to 8Ks and longer intervals, tempos, hills and long-slow-distance runs if training for ½ and full marathons.

Improved running and racing performance requires improvement of the following attributes:

- **Running economy** [cardiovascular and running mechanics fitness].
- **Biomechanics** [muscle strength and motor responsiveness [plyometrics, see footnotes]]
- **Mental adaptation** [fatigue resistance and motor control]

Obviously, there is considerable overlap among these attributes. This categorization is selected for emphasis and is helpful when describing the specific workouts that follow.

*This is a salient point. Specific workouts **efficiently** target each of these attributes. For example, running economy can be improved by simply running enormous distances, e.g., 100+ miles every other week. However, this requires an extraordinary amount of the runner's time and will not materially improve his/her race performance as it does little for biomechanics and motor control, etc. Keep this point in mind as the workouts are described.*

Important: All the following workouts require a suitable warmup and cool-down jog of about 8 to 10 minutes each.

Traditional interval sessions [200m, 400m, 800m, and up to 1600m or more, or anything in between].

Traditional interval workouts are the **keystone** for your training program. The primary purpose for these workouts is to improve your **running economy**. Obviously, **biomechanics** and **mental adaptation** will also be improved. In particular, motor control and responsiveness are best improved for the shorter interval distances. **Mental adaptation**, fatigue resistance and motor control, are improved for the longer interval distances.

I suggest that a logical approach is to tend toward shorter distance intervals, 200m and 400m, if training for 5K to 8Ks and longer intervals and tempo-runs if training for ½ and full marathons

Intervals are best done at your vVO₂max pace. Scientific studies have established that the most effective interval training involves stress levels equal to and above this pace. Thus, it makes sense to do intervals at that level. Stress levels much above vVO₂max are not significantly better and increase the risk of injury. See [vVO₂max Conversion Chart](#) for the method to determine your vVO₂max pace. Dr. Owen Anderson's blog, at his website [Educated Runner](#), has a good discussion "[Using Your vVO₂max for Interval Training](#)" which covers the basic principles. [The blog article is copied here, with permission].

Though I'm not aware of any research confirming this, I suggest mixing up your interval distances, e.g., within a workout session, say a couple of 200m's and 6x400m's and the next week maybe 4x200m, 2x400 and 2x800. Personally, I've found it helpful to start off with a couple of 200m's and then do the longer distances. Dr.

Anderson's article, referred to above, recommends moderation initially, especially if you are new to doing intervals or haven't done them for a while, and then progress to longer distances and the number of repeats.

General rules:

- Run fast periods at your vVO_{2max} pace
- Easy period times should equal the fast periods, e.g., 400m: 90sec fast; 90sec jog.
- Once per week; on rare occasions, say, when peaking for an important race and you are in excellent condition; you can do 2 per week, separated by at least 3 days.
- Change your regimen often. E.g., don't do 6x400m's week after week. Mix it up, one week do 400s, next week do 600s, next week do some 800s and 400s, etc. Mentally, it's easier and more fun.
- There is nothing sacred about 200, 400, 800m, etc. Use any distances you like in this general range. Just make certain your fast period is at vVO_{2max} .

Explosive Intervals, 15/60...60/30 [Seconds at nearly full speed / seconds easy jog]

The primary purpose for this workout is to improve your **running economy**, and **biomechanics**; especially high speed running [e.g., sprinting to the finish line], stride length, cadence, muscle strength, and neurological stabilization system when at full speed. And, importantly, your system for processing lactate will be materially improved. Explosive interval drills flood your system with lactate which is converted for use by your muscles. See "Lactate" in the Footnotes.

Note, explosive intervals are a relatively new quality workout that has been proven to produce dramatic results. The full details are beyond the scope of this paper. However, briefly, it works like this. The two key factors are intensity, during the work [fast] period, and lactate recovery during the rest [slow] period. To maximize lactate processing and energy production at speeds above your vVO_{2max} , use ultra-short, very high intensity work periods and long recovery periods for lactate processing. For example, 15sec at full speed and a recovery period of 60 seconds.

By varying the work/recovery [fast/slow] ratio you can target your particular energy systems. If training for shorter races and great sprints near the finish of races, you need to work on your $> vVO_{2max}$ energy system, e.g., consider something like 15sec/60sec. If training for longer races, say 10K to marathons, work on your sub- vVO_{2max} energy system; e.g., 60/60s or even 60/30s. If you are interested in more detail, here is a copy of Dr. Billat's article "[Anaerobic Interval Training Not Understood](#)" [title is misleading]

A personal note: I've seen explosive intervals to produce extraordinary results. Recently, I coached a 30-year-old woman who needed to pass a special running fitness test [3 miles in 12 minutes] in 8 weeks. She was not a runner, did some jogging 2 years prior. We used, primarily, explosive drills and hills, no long runs etc. In the 6th week I had her do her first race ever, a 5K. She came in 3d in her age group! On her 8th week I had her run 10 miles with the club. Her longest run ever was 5 miles on the 4th week. She finished with ease and was able to materially to pick up her pace at mile 9 ½.

General rules:

- Nearly full speed for your work interval
- Jog easily for your recovery interval
- Do not over do it, quit when you start slowing or feel fatigued.
- 10 to 15 reps is plenty
- Limit the number to a handful if you are new to this drill

Tempo Runs [Generally 2 to 4 miles about at 10mile race pace]

In my opinion, the primary purpose for these workouts is to improve your **mental adaptation** [fatigue resistance and motor control]. There is considerable debate about the physiological benefits of doing tempo runs. The renowned coach Dr. Jack Daniels is a strong proponent for them. Dr. Timothy Noakes, the world-renowned sports physiologist claims they serve no practical physiological purpose. Prof. and world-record-holder Peter Snell conducted controlled studies that demonstrated tempo training was inferior to interval training for race performance improvement.

I think both Daniels and Noakes are correct. Daniels has great results as a coach of elite runners and Noakes is correct about the physiological benefits. In my opinion, the primary benefit for tempos is **mental adaptation**. [Unquestionably, interval workouts are a more efficient way to boost **running economy** and improve **biomechanics**.]

A race is the best tempo run. If you race at least once a month, consider it may be sufficient.

Your tempo runs should be difficult enough so you feel fatigued; but, force yourself to “push” on farther and harder. Remember, the goal is to teach your brain that it is safe for you to run when it wants you to stop.

General rules:

- Fast periods at about your 10mile race pace; this is about 85% of your vVO₂max pace.
- Easy period times should be a slow jog for about 4 to 6 minutes.
- Once every 2 weeks, when not racing. On rare occasions, say, when peaking for an important race and you are in excellent condition; you can do 1 per week.
- Change your regimen often. E.g., don't do 2 miles week after week. Mix it up, one week do 2 miles, two weeks later, do some 4 milers, etc. Mentally, it's easier and more fun.
- Be very careful when doing tempos, they are essentially like a race and thus can cause considerable muscle damage. Treat them as such and back off all quality training [regular and explosive intervals, hills, etc.] for at least 2 or 3 days, etc.

Hills [Short and Long]

The primary purpose for hill workouts is to improve your **running economy** [cardiovascular and running mechanics fitness], **biomechanics** [muscle strength and motor responsiveness] and **mental adaptation** [fatigue resistance and motor control]. Hill workouts are particularly valuable when training for races which include hills.

Short hills emphasize the cardio attribute of running economy, both attributes of **biomechanics** and the motor control aspect of mental adaptation. Longer hills, which are run slower, enhance mechanics fitness, muscle strength and fatigue resistance. Consider using short hills when training for 5K to 10K races and long hills for ½ and full marathons.

General rules:

- Uphill, depending on the grade, aim for about 90% of your max if you only ran it one time. Assuming you generally use the same hill(s) for your workouts, you'll soon learn the 90% speed.
- Downhill, contrary to the obsolete rule of jogging down, run down fast. **Important**, there are 3 reasons for this: You don't jog downhill in races; it greatly improves your motor control and responsiveness. Recent studies have shown conclusively that just a few downhill fast runs will materially improve your quads' injury resistance. Be careful, running fast down hill causes extraordinary demands on your eccentric quad muscles. Take it very easy the first few times.
- At the top and bottom, jog very easy for a time about equal the fast periods
- When possible, use training hills which are similar to those you expect on your upcoming races.
- If practical, use a mix of different hill grades.

LSD [Long Slow Distance][12 to 30 miles]

The primary purpose for LSD workouts is to improve your **Mental adaptation**, i.e., fatigue resistance and motor control. Fatigue is primarily a mental response; it is your brain's way to protect you. Motor control improvement helps you maintain efficient running near the end of long races, e.g., the last few miles of a marathon.

Generally, if you only plan on racing 10Ks and shorter, 12mile LSDs are adequate. I highly recommend a few 30 mile LSDs when training for marathons. **Mental adaptation**, fatigue in long races is primarily mental [The so-called wall at 20 miles is a mental reaction caused by training with 20mile LSD runs]. Thirty mile LSDs teach your central governor [brain] that it is OK and safe to run much longer than 26.2 miles.

General rules:

- LSD runs should be appropriate for your intended race distances. For example, don't waste time running 20 milers if you are training for 10Ks and similarly don't waste your time running a bunch of 12 to 20 milers if training for a marathon. Instead, spend your time with the other types of workouts and 10K races, etc. Most marathon runners run entirely too many middle distance LSDs; there no scientific studies that show they are beneficial for experienced marathoners. [Note, in keeping with the primary purpose for LSDs, **Mental adaptation**, I suggest the traditional progressive milage program may be beneficial for first timers and those who haven't run a marathon for many years.]
- About every 5 miles, run a ½ mile fast.
- At about the last 90% [e.g., mile 10 for a 12miler and miles 28 and 29 for a 30 miler] run fast. This will materially improve your fatigue resistance adaptation.
- Finish all LSDs at a very slow jog. This is the start of your recovery period.

Footnotes:

Kinesiology addresses human movement, performance, and function by applying the sciences of biomechanics, anatomy, physiology, and motor learning.

Plyometrics is a type of exercise training designed to produce fast, powerful movements, and improve the functions of the nervous system, generally for the purpose of improving performance in sports.

Lactate [lactic acid] See [Lactic Acid and Running](#)

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