

Practical Information about Training and Sports Nutrition

Running Research News

RUN FREE—OR TRY

Nike's paradigm-busting shoe, the Free, is designed to simulate barefoot running, and Frees are fun and light to wear during training. However, it is not clear that barefoot running should be one of the optimal goals of training, nor is it certain that Free running perfectly matches the forces and movements of unshod ambling. There is almost no published research concerning the Free, although one study suggests that Frees can upgrade toe-flexion strength.

For the past 25 years, running-shoe manufacturers have been trying to sell us on the idea that running shoes need to support, stabilize, cushion, and protect us from the harsh forces and stressful move-



The New Nike Free

ments associated with the gait cycle of running. Now, Nike Inc. is trying to sell us on the reverse proposition – that running shoes should do almost nothing at all. Scooting along while wearing a pair of Nike's new Free shoes, in fact, is supposed to be like running barefooted on grass. With Free, the feet and ankles are suddenly almost completely unrestricted kinematically, and that free-

dom – despite everything we have heard from Nike and other shoe-makers for 25 years – is supposed to be a great thing, from both the injury-prevention and performance standpoints.

Why did Nike introduce such a dramatic shift in shoe design? Why did it develop the Free? For one thing, a small but grow-

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A little-known type of training—VP effort—is great for improving marathon and 5-K performance capacities. VP workouts differ from traditional interval sessions because they allow no easy, jogging recoveries. Instead, marathon and 5-K paces are alternated over running segments which may last for up to 2400 meters or more.

VP TRAINING—JUST RIGHT FOR MARATHONS AND 5KS

At this time of the year, marathon runners are looking for the perfect “tune-up” workouts for their marathons – sessions which spike fitness and increase the likelihood that an upcoming marathon can be

completed at goal speed. 5-K runners, on the other hand, are searching for sessions which will produce one last 5-K PR before the season ends.

Strangely enough,

both groups of runners can employ the same kind of training – in the form of **VP** workouts. Performed properly, VP (variable-pace) sessions produce major upswings in aerobic capacity, $v\text{VO}_2\text{max}$, and lactate

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Running Research News
P O Box 27041
Lansing, MI 48909-7041 USA

Phone: 517-371-4897
Fax: 517-371-4447
Email: info@rrnews.com
Web: <http://www.runningresearchnews.com>
Owen Anderson, Ph. D., Editor
Teresa Blanchett, Publisher

ing trend had developed in the running community for runners to complete some of their training while barefooted. Nike spokesperson Ilana Finley indicates that former Stanford coach Vin Lananna alerted Nike that barefoot training seemed to be strengthening the feet and ankles of runners he coached – and also appeared to lower their risk of injury.

In addition, increasing numbers of runners and coaches have come to believe over the years that running shoes are “over-engineered” – with a variety of features which encase the feet in such a way that they are isolated from many of the forces and movements associated with natural (barefooted) running. While this shielding function *might* be good from an injury-prevention standpoint (since there would be less total stress on the feet), it is also possible that the utilization of modern running shoes almost automatically leads to a general weakening of run-

ners’ feet and ankles, a weakening which might actually *increase* the risk of injury over the long term.

The logic works like this: Human muscles and tendons need to receive mechanical stimuli in order to adapt and grow stronger. If these mechanical stimuli are large, adaptation can be extensive; if they are small (or non-existent), muscles and tendons may actually decrease their strength and functional capacities. Thus, if running shoes perform much of the actual work of running by cushioning impacts and controlling and stabilizing movements of the feet and ankles during gait, a runner’s functional strength should actually diminish over time, and the possibility of injury should rise.

The overall argument in favor of the use of Nike Frees would thus be as follows:

(1) Compared with shod running, barefoot running forces the feet to experience greater forces and thus work harder.

(2) As a result, barefoot running ultimately strengthens the feet to a greater extent, compared with shod running. This strength-

ening should lead to greater stability while running, thus improving running economy, and should allow the feet to exert more force on the ground with each step, leading to higher maximal running speeds.

That seems logical enough at first glance, and there’s more:

(3) A bare foot lands more evenly on the ground, compared to a foot wearing a running shoe. Landings which are more even distribute pressure over a greater area of the foot, reducing stress on the legs above.

(4) Thus, barefoot running is highly desirable, but there’s one major problem: On typical running surfaces, glass, rocks, and debris pose safety hazards, making barefoot running rather impractical. In addition, most Western runners, having pursued shod lifestyles, have rather fragile skin on the bottoms of their feet. A runner from Milwaukee simply does not have the kind of stratum corneum on the plantar surfaces of his feet that one might see among Masai tribespeople in western Kenya, for example.

Enter the Nike Frees, which allegedly provide the bene-

fits of being barefooted while protecting the bottoms of runners' feet. According to Nike publicity, the deep, segmented grooves in the Free's outsole augment flexibility and allow a runner's feet to experience their full range of movement (Frees for females have an extra groove to take into account women's "more-flexible feet). The pressure distribution on the bottom of feet clad in Frees is also supposed to mimic the pressure alignments of barefoot running. Thus, the foot becomes "more involved" when running is performed with Frees (similar to what happens in the barefoot condition), and there is a foot-strengthening effect which improves performance and decreases the likelihood of injury.

Is all of this thinking solid? What does scientific research have to say about barefoot running, the capacity of Nike Frees to simulate barefoot running, and the overall value of the Frees?

Let's take a step-by-step approach. First, is there any solid evidence that barefoot running is really good for runners' feet? To answer that question, we'll examine the kinematics of barefoot running, compared with shod ambling (that is, the actual movements of the feet, ankles, and legs in the two situations) and also the kinetics of the shod-unshod scenarios (how the forces placed on the legs, feet, and ankles vary, depending on whether the feet are encased in shoes or not).

One long-standing hypothesis is that barefoot running is "more natural" than shod hurrying – that it allows the joints in the feet and legs to move in a spontaneous, healthy, and optimal manner. While this contention has a certain pleasing and logical appeal, it has not always been supported by scientific research. In fact, although barefoot running kinematics are assumed to vary significantly from those associated with shod running, one important study, in which subjects ran while barefooted, while wearing normal running

shoes, while wearing three different types of shoe soles, and while utilizing two orthotics modifications as well, revealed that differences in movements of the heel and tibia *were very small and unsystematic* (between barefoot and shod running). In this inquiry the changes in movement at the joints (in the shod vs. unshod conditions) were less than 2 degrees, much smaller than the differences *between subjects* (which amounted to almost 10 degrees). The researchers involved in this study suggested that the belief that the kinematics of barefoot running varied extensively from the movements of shod running may have been based on faulty methodology in previous research (which typically employed externally mounted movement markers on runners' legs instead of intracortical bone pins) (1).

How about the **kinetics** of barefoot and shod running? Here, the research does suggest that there are some key differences between shod and dis-calcated conditions. Without boring you with the details of a morass of different investigations, we can mention that scientific inquiries indicate that the "loading rate" (the rate at which force is experienced by the various structures of the foot) is generally higher during barefoot running, versus shod running (2). This should make sense, since the unshod foot has less protection from the impact forces which occur when the foot hits the ground (such forces do not have to travel through a cushiony midsole before reaching the foot).

As you might expect, then, the *timing* of force production by the foot and ankle muscles is different during barefoot running, compared with shoed hustling. For example, the tibialis-anterior muscle, which helps to stabilize the foot during stance, becomes active during a later phase of stance during shod running, compared with the barefoot condition (3). This is not especially surprising, if one believes that traditional running shoes tend to "take over" during stance, making actions by key

joint-controlling muscles less urgent.

Thus, we can tentatively accept the idea that barefoot running makes the foot “work harder” (since the loading rate is increased, requiring greater responsiveness by the naked foot). *For now, however, we can reject the notions that barefoot running improves running-specific foot strength in a significant way and that barefoot running upgrades performances; not a single study has ever documented either of these effects!*

Interestingly enough, the argument that barefoot running improves race performances violates our treasured specificity of training principle. The violation occurs in this way: It has been established that the kinetics of barefoot running are different from the kinetics of shod dashing; the magnitudes and timing of the forces are different in the two situations. Unfortunately, that means that the runner who trains barefooted and then races in shoes has trained himself/herself for the kinetics of naked-foot running but is attempting to excel with the kinetics of shod hustling! He/she would be functionally strong while barefooted – but much less strong in brogans. In theory, for barefoot running to be a race-improver one would have to race in bare feet, too (by the way, that is what outstanding Kenyan runners usually do until they are “fortunate” enough to secure shoes).

How about the idea that a bare foot lands more evenly than a shod foot during running, distributing impact forces more uniformly around the foot? This is undoubtedly true. For example, research indicates that during barefoot running less force is experienced by the heel, compared with shod running, with the heel forces associated with shod ambling “spreading out” to other regions of the foot (2). One reason for this is that runners tend to automatically land in a more flat-footed manner when they are running barefooted, compared with the shod condition (the latter tends to

be associated to a greater extent with heel-striking). To put it another way, barefooted runners try to avoid letting their heels absorb most of the impact forces when their feet hit the ground; when the same runners have shoes on, many let their heels soak up much more force.

Nike says that the more-even landing (associated with barefoot running and presumably with Frees) distributes pressure over a greater area of the foot, *reducing stress on the legs above*. This reduction in stress on the legs is pitched as being a good thing.

Note that Nike has suddenly veered “off-message” with its pro-Free arguments. First, we are told that Frees **increase** mechanical stress on our **feet**, and that this is a good thing. Then, we are told that Frees **reduce** mechanical stress on the **legs**, *and that this is also a good thing*. Which view is correct? Is mechanical stress good or bad? If the feet benefit from working harder, wouldn’t the legs also benefit from more-challenging effort? If one swallows Nike’s logic about the mechanism underlying the Free’s value and accepts the contention that Frees give the legs a bit of a furlough, one would be forced to conclude that systematic utilization of Frees would ultimately make the leg muscles less strong during running, since the legs are so well-protected by Free-adorned feet.

Truthfully, though, the idea that barefoot running reduces the stress above the feet has very little support in that vexing world of carefully controlled scientific research. In one study, for example, barefoot running actually *increased* the rate of shock transmission through the legs to the spine (4).

That’s certainly enough information for you to digest about barefoot running: What does research

specifically say about the Nike Free shoes? Are the claims made about Frees accurate? Are there any benefits associated with wearing them during training and/or racing? Is running in the Frees “just like” running barefooted on grass?

Well, the research carried out by Nike with the Frees is now contained in an “internal report” which may never be exposed to the harsh light of the peer-review process. We are thus left with the published information about Free, and this (at present) amounts to one, non-peer-reviewed abstract (5) associated with a presentation made at the 20th Congress of the International Society of Biomechanics by Gert-Peter Bruggemann, a researcher at the Institute for Biomechanics and Orthopaedics at the German Sports University of Cologne.



German research suggests that use of the Nike Frees during warm-up activities can improve toe-flexor strength.

Although the full paper has not yet been published, the abstract is worth examining, in part because Gert-Peter has a nice track record, with good research carried out over the years. In his study, which was conducted with co-researchers Wolfgang Potthast, Bjorn Braunstein, and Anja Niehoff, 50 athletes (male and female) were divided into two equal groups. Over a

five-month period, the experimental group wore Nike Free shoes during their warm-ups, while the control group employed their usual training shoes, while carrying out exactly the same warm-ups. The Nike Frees were *not* worn during the actual workouts – only during the warm-up activities (Bruggemann did not respond to our request for information about the specifics of the warm-ups). Before and after the five-month period, the strengths and cross-sectional areas of a variety of foot and leg muscles were assessed (Bruggemann also did not respond to our request for information about how strength was actually determined, e. g., whether it was measured during a running-related movement or during a passive, isolated action, for example).

Gert-Peter found that use of the Free shoes during warm-up produced a significant increase in the strength of the flexor muscles of the metatarsophalangeal joints (e. g., the joints which connect the metatarsal bones of the forefoot with the toes). Of particular interest to Gert-Peter were the flexor digitorum longus muscle, which connects the back surface of the tibia with the distal bones of toes II-V (by letting its tendons run along the plantar surface of the foot), and the flexor hallucis longus, which ties together the back of the fibula with the distal bone of the big toe. The cross-sectional areas of these muscles increased by about 4 percent over the five-month period when Nike Frees were employed during warm-up activities, and their “strength” was upgraded by around 20 percent (we’ve placed quotes around strength because we don’t know how it was measured).

That sounds rather impressive, but please note that one of the key functions of the flexor digitorum longus and flexor hallucis longus muscles is to flex the toes. It is natural and not unexpected that their strength improved among the Free users, since the Free shoes undoubtedly permitted more

extension of the toes during toe-off (because of the minimal midsole which is present in the anterior sections of Nike Frees) and thus placed more demands on the toe flexors to control extension. It is not clear, however, that improved *toe-flexion strength* leads to better running. In Bruggemann's study, running economy, maximal running speed, stride length, and running performance were not assessed. Thus, we can conclude that the utilization of Nike Frees during warm-ups has an uncertain effect on performance but can definitely improve your toe-flexion strength. This is certainly a useful attribute if you ever end up in a toe-wrestling match with a friend.

Incidentally, we don't know for certain that Nike Frees actually simulate the kinetics and kinematics of barefooted running (no data have been published on this – all the numbers are wrapped up within Nike's internal report). The mere strapping on of a pair of "minimalist" shoes like the Frees, with few of the features associated with modern running brogans, does not guarantee that the forces placed on the feet will be identical to the ones observed during barefooted running. The Nike Free, in fact, possesses a few somewhat-odd characteristics which suggests that it may not dependably simulate barefoot running. One is the *width* of the rear-foot area of the shoe, which is unexpectedly broad. Nike biomechanist Jeff Pisciotta indicates that the very wide rear-foot was incorporated into the shoe because Nike's tests indicated that such broadening made the pressures and forces associated with running in the shoe more similar to the ones corresponding with barefoot running.

The human, unshod foot is actually fairly narrow at the heel (in comparison with the rest of the foot), and thus the notion that the very wide rear-foot component of the Free helps it to simulate barefoot running appears to be paradoxical. However, bear in mind that one of the classic "knocks" against conventional running shoes has been that they are very unstable from side to side – they rock back and forth in

medial and lateral directions quite easily. One reason for this, of course, is that the ample midsoles of conventional running shoes in effect place the feet on platforms which can "tip over" readily to one side or the other if the feet put lateral- or medial-directed forces on the shoes' interiors. This is one reason why we don't wear running shoes to play tennis; we would sprain our ankles far too often if we did.

One of the classic "fixes" for this problem has been the creation of shoe midsoles which are flared outward dramatically at the bases of their heel areas; this flaring can probably provide stability and make it difficult for running shoes to roll over during gait (another classic fix has been to simply ignore the problem). At any rate, the broad heels probably make the Nike Frees more stable in a frontal plane during running, compared with narrow heels. The naked human foot (when structurally normal and healthy) is remarkably stable in the frontal plane during gait, and thus it is not surprising that the Free's broadened heels helped it to replicate the barefoot condition in Nike's tests.

Although the Free is supposed to simulate barefooted jaunted, it is a shoe, after all, and does bear some resemblance to conventional running footwear. For example, one of the big surprises (to your editor) was the relative thickness of the midsole in the rear portion of the shoe (the very thin midsole in front was entirely expected). In addition, the pricing of the shoes helps one remember that the word "Free" applies solely to the shoe's biomechanical properties and not to its economics. If experience is a valid guide, it is doubtful that the light-weight Frees cost more than \$5 to make, yet a typical retail price is around \$85.

Nike includes printed training recommendations (in seven languages) within each box of Frees; these recommendations include both drills and run-

ning workouts to be conducted with the shoes. These pointers add a comic element to the entire Free phenomenon. For example, after eight weeks one is advised to “add longer runs” if one is utilizing a “lightweight training shoe” (your editor assumed that the “lightweight training shoe” would be the Free, although this was not actually specified). However, if you have decided to train in a “stability and motion control shoe”, you should – after eight weeks - “avoid longer runs, unless you feel confident”. (!) No assessment tool for measuring confidence is provided, and it is not clear whether the confident state would be related to one’s fitness level or to the ability of a pair of modern running shoes to promote stability and control motion.

Training recommendations provided with the shoes are remarkable conservative.

Somewhat shockingly (given the hype about the Free’s roles in strengthening the feet and taking stress off the legs), the training recommendations are extraordinarily cautious. For example, the guide suggests wearing Frees “around the house” for a couple of weeks, before they are utilized during actual training (no mention is made of whether optimal adaptation to the Frees occurs during dishwashing, while watching TV, or during some other household activity). After that, during weeks three to four of the “program”, easy runs of three to five miles can be completed in the Frees, and within weeks five to six one can “gradually add more distance” (no further details or specific workouts are provided). As Nike has advised on its web site, “You can’t just put these on and run” (!!!).

Hello! We have been told that Frees strengthen our feet and take the stress off our legs, and now we are suddenly confronted with the idea that use of these brogans might be risky. Are we being given the conflicting message (advising very moderate use of the Frees) because Nike wants us to continue to buy their traditional, “foot-weakening” shoes, too? Are we supposed to achieve some kind of balance in our training – with strengthening of the feet on one day, followed by weakening on the next? Or, does Nike simply not believe its own message that the Frees will strengthen the feet and reduce stress on the legs? Nike may fear a backlash if hordes of “Free” runners suddenly begin reporting injuries.

Note that future marketing of its full shoe line would appear to present a major problem for Nike. Once the company realizes that it is actually promulgating the message that regular running shoes, *including its own models*, actually weaken the feet (and by extension hurt performance), will it continue to sell its old-reliable, money-making models? Won’t the company, to preserve its integrity, have to abandon its traditional trotters, including the Air and Shox models, and focus solely on the vastly superior Frees? It just won’t work for Nike to argue that use of the Frees increases foot-muscle strength, which then carries over to racing situations in traditional shoes. After all, Nike has already told us that conventional shoes produce completely different recruitment patterns for the muscles of the feet and legs, and thus training in the Frees would be entirely non-specific.

Another shoe company called Swiss Masai also espouses barefoot locomotion, and its new shoes are called MBTs, for “Masai Barefoot Technology”. Instead of creating a minimalist shoe, however, Swiss Masai has actually created training shoes with thick, layered midsoles which force one, in effect, to walk and run with modified rocker boards attached to the bottoms of the shoes; the midsoles introduce a great

amount of anterior-posterior instability. Blurbs for the MBTs (<http://www.mbt-uk.co>) suggest that their utilization can reduce the risk of back and joint problems, increase circulation, improve posture, spike calorie-burning, and upgrade athletic performances. We'll report on MBTs in an upcoming edition of this newsletter.

The media have not known quite what to do with Nike Free (and MBT). A recent article in *The Wall Street Journal*, for example, concluded that "If you decide to try Frees or MBTs, learn from a knowledgeable salesperson how to use the shoes properly" (6). However, the *WSJ* provided no information about how to determine if a salesperson is truly "knowledgeable." Anecdotal evidence suggests that a small minority of salespeople may not be outstanding coaches and might not possess in-depth understandings of the kinetics and kinematics of running in the Frees, so the consumer must be careful.

Is the Nike Free a "training tool", as Nike publicity suggests? Yes, of course it is, but we don't know yet whether it is an *effective* training implement. Here are the bottom lines about Frees:

(1) There is no solid evidence that barefoot running is good for you. No study has linked barefoot training with improved running performances. Indeed, since the kinetics of barefoot running are quite different from those associated with shod hustling, it may be quite difficult for strength gained while running barefooted to "cross over" to shod strength. If you decide to include barefoot running in your training program, you should also race barefooted.

(2) There is no published evidence which shows that running in Nike Frees simulates barefoot running in a meaningful way (we have only the Nike

internal report, which has not been published).

(3) Only one study has been published concerning the effects of Nike Frees on foot strength, and this study has been published only in abstract form; it has not yet completed the typical peer-review process. This investigation reveals that use of the Nike Frees during warm-up activities can improve toe-flexor strength.

Warning – anecdotal information is coming now: Nike kindly provided the author of this article with a pair of Nike Frees to utilize during his training. He had fun with them – and found that they were indeed "minimalist shoes", which he tends to like. He remarked that his workouts in Nike Frees felt much like running in his bedroom slippers. The latter, however, cost only \$7.

And finally, the bottom, bottom line: To as great an extent as possible and practical, train in the shoes in which you are going to compete, because such shoes will mimic the kinetics and kinematics of race day and thus foster the best improvement in performance-specific strength. If you decide to give the Nike Frees a try, you will probably find that they are fun, stylish shoes. Bear in mind, though, that if you are going to train in them you will also want to race in them. The evidence that Nike Frees can sprinkle "magic performance dust" on your other running shoes is quite slim. ©

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VP Workouts continued:

threshold, all of which are important for 5-K and marathon success. VP training also enhances running economy at *both* 5-K and marathon speeds, making goal pace for either race more sustainable.

VP running is very similar to traditional interval training, but it differs from classic interval work in a fundamental way: When you conduct intervals, you ordinarily alternate between a high-quality velocity (your work-interval speed) and a rather-low-quality pace (your recovery, jogging speed). In VP training, you interchange two very important, high-quality running speeds during the course of your workout.

How is a VP workout actually constructed?

Here’s a perfect example of this unique form of training:

Carry out a thorough warm-up which fires up your cardiovascular *and* neuromuscular systems. Then, run 400 meters at your current (or reasonable-goal) 5-K pace and – *without stopping for recovery* – run 400 meters at your current, goal, or estimated marathon pace. Once you have completed the marathon-pace 400, return – without a break – to 5-K pace for another 400 meters. Finally, scamper through a fourth 400 – back at marathon tempo again. To summarize, you will have run four 400s in succession (1600 meters total) with no recovery at all; the first and third 400s will have been at 5-K speed and the second and fourth at marathon pace. Jog lightly for three to four minutes to recover.

After your short furlough, run 1600 meters while utilizing the same pattern (400 meters at 5-K pace, 400 meters at marathon tempo, etc.). Jog easily again for three to four minutes, and then complete one more 400-400-400-400 ensemble before cooling down. You will have completed 3 X 1600, with 2400 meters total at 5-K pace and 2400 meters at marathon speed. For subsequent VP training, you may add an additional (fourth) 1600 (provided all went well with 3 X 1600). If you are an advanced runner, you may work up to 5-6 X 1600 in a reasonable fashion.

Note that your *average* pace for the 1600s will be in-between 10-K and half-marathon speed. Let’s say, for the sake of argument, that you run your 5Ks at a tempo of 6:12 per mile. Remember that your pace slows down by roughly four seconds per 400 meters every time you double your race distance (from Horwill’s Law of Running). Thus, your 10-K tempo would be 6:28, your half-marathon pace would be 6:44, and your marathon alacrity would be about 7:00. Within your VP 1600s, 800 meters would be completed at 6:12 tempo and 800 would be knocked

off at 7:00. Thus, your average pace would be 6:36 – halfway between 10-K (6:28) and half-marathon (6:44) speeds.

Even though the average speed of VP training is below 5-K pace, VP workouts are incredibly good for improving 5-K performance capacity.

Of course, if you are a 5-K runner you might be saying: Wait a minute – how can such tepid, below-10-K-velocity running boost my 5-K chances? That’s a logical question, but you should not be worried. Bear in mind that each 1600 within a VP session features 800 meters right at current or goal 5-K speed. Thus, half of all the running you conduct within a VP is right on target, undertaken at a very high intensity (5-K speed generally corresponds with ~ 95 percent of $VO_2\text{max}$). Note, too, that 400s at 5-K pace take on a different quality when they are conducted immediately after 400s at marathon tempo, instead of being undertaken after inchmeal, jog-recovery intervals. The intensity of marathon 400s is high enough so that 5-K-paced 400s will be completed at higher fractions of $VO_2\text{max}$, at higher percentages of maximum heart rate, and with higher levels of blood lactate, compared with a situation in which easier recoveries are utilized.

And that leads to another great progression possibility with VP. If you are a 5-K runner and your initial VP session goes well, you can throw away the 1600s and utilize 2000-meter segments. Within each 2000 meters of running, the first, third, and fifth 400s

would be at 5-K pace, the second and fourth at marathon tempo. This would provide you with two opportunities (within each segment of the VP) to challenge yourself with 5-K running without significant recovery, instead of the usual one (that is, the third *and fifth* 400s of a 2000-meter segment would be uniquely challenging, in contrast with just the third 400 of a 1600-meter jaunt). When you change over from 1600- to 2000-meter segments, it is reasonable to begin with 2 X 2000 and then “graduate” to 3 X 2000 at a later date (advanced runners may earn their VP Ph. D. by moving up to 4-5 X 2000).

Runners who are primarily interested in the marathon will find VP training to be particularly tasty, since it constantly forces them to find and sustain marathon pace in the face of fatigue induced by 5-K-tempo running. In addition, the spike of intensity added to training by the inclusion of the 5-K-paced 400s will boost fitness to a greater extent, compared with similar amounts of running at marathon tempo only. One very cool progression for the marathon runner is to move to 2400-meter segments: With 2400s, a marathoner must dial up marathon speed three times per segment, each time after a relatively scalding 5-K burst (of course, with 1600- or 2000-meter segments, this must be done just twice). The marathoner may start with 2 X 2400 and move up to 3 X 2400 (advanced individuals will progress to 4 X 2400).

Note that VP work represents terrific pace-judgment training; after a few VPs, 5-K and marathon runners develop a great “feel” for their paces in the respective races. VP effort also enhances running economy at both 5-K and marathon velocities, and a VP session is exactly the kind of workout a marathoner can conduct about a week in advance of a marathon, when he/she is searching for a workout which will both advance fitness and develop additional ease and confidence at marathon tempo. For many marathoners, a VP session of 3-4 X 1600

would be just right when conducted about seven days in advance of the big day (to obtain more information about how to train during the last month before a marathon, please go to <http://www.runningresearchnews.com/backissueDetails.php?x=xYE6k2j054jfdX1m6DQxschwGgXrMDhiHgKoHWq66ko%3D>)

Figuring your 5-K and marathon paces for your VP workout is fairly easy. For the shorter-distance tempo, take a recent, typical 5-K time, convert it into seconds, and divide by 12.5. The result will be the time (in seconds) you should take to complete each 5-K-based 400 within your VP. For example, if you run the 5K in 19 minutes, $19 \times 60 = 1140$ seconds, and 1140 divided by $12.5 = 91$ seconds per 400. You can also utilize a goal 5-K time or pace, which will ordinarily be two to four seconds per 400 faster than your current 5-K capability.

For the marathon, take your expected time in the race, convert it into seconds, and divide this rather-large number by 105.5 to obtain the time you should take to run each marathon-paced 400 within your VP. Of course, your expected pace for the marathon should be reasonable, based on previous marathons or on Horwill's-Law conversions from your recent performances in shorter races.

We can't forget about 10-K runners, who can also profit greatly from VP training. Running the 5-K-paced intervals of the VP without significant recovery will make 10-K speed feel easier, and it will allow 10-K runners to include faster segments within their 10-K competitions.

We can not close this article without including the "Finnish formula" for VP training. VP work is popular in Finland (1), and many serious Finns like to

conduct a VP workout with just one set of gradually expanding length. In other words, they will – over time – gradually increase the number of 400s in the first set to six, eight, 10, 12, 14, etc., until the workout eventually consists of continuous running with no three- to four-minute breaks (there is no second set). The VP workout simply ends when fatigue makes it impossible to maintain the desired pace(s). Some experienced harriers have gradually worked their way up to 24 400s without stopping (12 at each important pace), and this is almost like running at 15-K race pace for six miles.

VP training is very specific to the 5K and marathon, and it can do wonders for your aerobic capacity, lactate threshold, running economy, pace judgment, stamina, and confidence. Carrying out VP training is challenging and fun, and VP provides a welcome break from conventional interval training. Best of all, when it is part of a carefully constructed program, VP training will help you achieve significant improvements in performance. ©

Reference

- (1) Jussi Voima, personal communication