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Mental Toughness and Planning Ahead

by Thomas Kurz

The following story, whether completely accurate or not, is so revealing it is worth telling. I heard it from sports psychologist Artur Poczwardowski, who in turn heard it from another sports psychologist.

Here is the story: During the 2003 Judo World Championships in Osaka, prior to each contestant's entry into the fighting area a short video introduction including his or her recent important matches was shown to the spectators. The video could be watched by the waiting contestants, either on a TV monitor in the waiting area or directly on the main screen if it was visible from that area. The athletes and their coaches knew that the videos of their recent fights would be shown prior to each match.

A former world champion and Olympic gold winner watched the screen as he waited and, just prior to being called to the mat, he saw his defeat during a recent world-class contest. With these distressing images in mind he went on to fight—below his ability—and lost.

Artur Poczwardowski attributes his subpar performance to the mental effect that viewing his prior defeat had on his composure. Seeing a video of one's actions has a much deeper psychological effect than hearing or reading about it. This is why athletes visualize a successful performance during mental training and why they watch videos of their successful performances to boost their confidence.

Artur Poczwardowski's lessons from this story for athletes, coaches, and sports psychologists:

1. Do not let the athlete watch such videos, since you do not control their content. If the screen is in the waiting area or is visible from there, at least have the athlete turn his or her back on the screen. Better, have him or her go through a mobilizing mental exercise from the *Gold Mental Mental Workout.*

2. A more general lesson: Limit athletes' exposure to unforeseen situations. Scout the contest venue ahead of time and do it thoroughly to make a good plan of action to avoid distractions. A good coach prevents bad surprises.

Highlights

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Secrets of Stretching to Be Released on DVD!

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We are currently preparing all the recorded materials (edited video and English, French, and Spanish voice tracks) for final DVD production. Customers who have registered their e-mail addresses at http://www.stadion.com/registration.html will be notified as soon as the DVD is ready for sale.

Endurance Workout: Slow to Fast or Fast to Slow?

by Thomas Kurz

There are ways of arranging exercises in endurance workouts that increase the recovery time for the same amount of work if it were done in a better arrangement. I will use the example from a question I received recently. The question deals with a swimmer's endurance workout, but the answer applies to any type of endurance activity. Here is the question:

"I have a question about specific strategies for endurance training. It's common to do workout sets that move from longer yardage to shorter (e.g., 500 yards, followed by 400 yards, 300 yards, etc.), with shorter lap times as you move down in yardage. Is this the best way to go about this? I'm a novice [in swimming], but doing this kind of workout seems to have increased both my endurance and strength (I've gone from being able to swim only 50 yards at a time to 1,200 yards at a good pace), but I'm wondering if this is the best way to do this from a physiological standpoint. I generally alternate during the week between long swims and these kinds of shorter, faster sets."

Now, my answer: Doing speed work after endurance work raises lactate levels and increases recovery time more than doing speed before endurance. Prefatiguing slow-twitch (ST) muscle fibers with long-duration aerobic work impairs intramuscular coordination, so a greater mechanical stress is put on the structurally weaker fast-twitch (FT) fibers. This causes greater muscle soreness after a workout that begins with aerobic endurance, proceeds to increasingly anaerobic efforts, and ends with sprints. Mechanical stress, which damages muscle fibers, is the main factor in muscle soreness.

Damage from mechanical stress is compounded by chemical damage from muscle acidosis when a workout ends with exercises of intensity exceeding the anaerobic threshold. Muscle acidosis is caused by conversion of lactic acid to lactate and an accumulation of hydrogen ions—H+. If a high-intensity effort is followed by a long low-intensity effort (for example, 40 minutes at 35% of VO2max) or by an effort of decreasing intensity (for example, 7 minutes at 65% of VO2max plus 33 minutes at 35% of VO2max), there is much less accumulation of lactate than if the high-intensity effort was followed by rest (McArdle, Katch, and Katch 1996).

At low exercise intensities—when you do not exceed your anaerobic threshold and are not very fatigued—going from long and low-intensity efforts to shorter and more intense efforts will not hurt you. As the intensity in shorter yardages rises above your anaerobic threshold, you may feel overstressed after a few workouts with this arrangement of increasing the intensity of effort after fatiguing aerobic work (the longer distances). This is explained in *Science of Sports Training* and in the books on exercise physiology listed at The Athlete's Bookshelf.

If this arrangement works for you, either because you do not exceed the anaerobic threshold much or because you are in great shape and can recover quickly after such a workout, then keep doing it. You can also try reversing this "common" order of decreasing yardage and increasing intensity to see how you feel after a workout in which following a good warm-up you begin with short distances at high intensity and then move to lower intensities and longer distances.

I have encountered this topsy-turvy arrangement of exercises (from endurance to sprints) in workouts in other sports, such as ball games. For example, the main part of the volleyball player's workout would consist of drills and then running 400, 300, 200, 4 x 150 meters or 200, 180, 160, 140, 120, 100 with the goal of, I guess, improving endurance.

Doing long distances and then short may be good for mental toughness if done occasionally, but it is not very good for endurance in the long term and is bad for speed and agility because the short runs are done when you are fatigued and relatively slow. See the chapter "Speed" in the book *Science of Sports Training*.

It is better to start the main part of a workout (after the warm-up) with short sprints (maximal speed) and end it with longer distances. Volleyball, to continue with the previous example, requires not only endurance but also (if not mostly) speed because the distances to be covered on the court are short and need to be covered fast.

I know two typical explanations for doing sprints when tired by the preceding endurance work. One is that such an arrangement helps recruit fast-twitch glycolytic fibers (FTb or type IIb), which are recruited for high-intensity efforts such as the 100-meter track-and-field sprint or 50-meter swimming sprint (Wilmore and Costill 1999). The other is that sprinting when fatigued gives the ability for a strong finish, the final "kick."

Well, it is true that during long-duration efforts, as slow-twitch muscle fibers are fatigued, more fast-twitch fibers are recruited to maintain muscle tension. The more slow-twitch fibers are depleted of glycogen, the greater the recruitment of fast-twitch oxidative glycolytic fibers (FTa or type IIa) and then FTb. When there is very little glycogen left in the slow-twitch fibers, the greatest effort falls on the two types of fast-twitch fibers, and eventually there is a considerable involvement of FTb fibers. There is a snag though, as Wilmore and Costill (1999) write: "When glycogen stores in ST fibers are depleted, it appears that FT fibers either are unable to generate enough tension or cannot be sufficiently recruited to compensate for the loss of muscle tension. . . . The sensations of muscle fatigue and heaviness during long-term exercise may reflect some muscle fibers' inability to respond." Furthermore, when an athlete's nervous system is fatigued, the mobilization for maximal-intensity efforts is very difficult and coordination is off. It is much better to work on sprints and other high-intensity efforts that recruit the FTb fibers when fresh and sharp, after a good warm-up and not when fatigued.

As for the final "kick" at the end of a race (or a bout or a round, or whatever), it depends on good aerobic endurance for sparing glycogen in all muscle fibers throughout the distance and on strength and work capacity of fast-twitch fibers used for the final sprint. All these are best improved by rational speed or speed-endurance (a form of anaerobic endurance) workouts. For example, a good warm-up, then intervals followed by a longer run and a cool-down. Even though this arrangement does not mimic what happens during a middle- or long-distance race—when athletes first try to pace themselves and then at the finish go all out with what they have left—it works very well. The reasons

(continued on page three)

I Told You So. . . Supplements vs. Food

by Thomas Kurz

The best source of vitamins and other micronutrients is food—not pills and capsules. Readers of *Stadion News* know this from past articles (Fall of 1999 and Spring of 2001). Vitamins and other micronutrients work best (and safest!) when ingested as they occur in nature and not in artificially isolated forms. A recent article in *Medscape General Medicine* (Morris 2004) drives this point home.

The article is about diet and Alzheimer's disease but athletes should be interested as the vitamins and fatty acids discussed in it play a great role in exercise, and besides, we all age . . .

Alzheimer's disease is linked with oxidative and inflammatory damage to nerve cells, which occur also with intensive exercise. Eating foods rich in vitamins E and C and omega-3 polyunsaturated fatty acids is associated with lowering the risk of developing the disease because these antioxidant nutrients protect the brain from oxidative and inflammatory damage.

Vitamin E is a strong antioxidant and also has anti-inflammatory properties. Natural sources of vitamin E contain several of its forms—not just one (alpha-tocopherol) as is typical of vitamin E supplements. The combined effect of all naturally occurring forms of this vitamin is greater than of any one of them alone.

The foods richest in vitamin E are vegetable oils, almonds, and sunflower seeds. Moderate amounts of vitamin E are in whole grains, egg yolk, avocados, apples, melon, and in collard greens.

Vitamin C is a weaker antioxidant than Vitamin E but it restores the antioxidant capacity of vitamin E. The richest food sources of vitamin C are broccoli, black currants, Italian cabbage, parsley, hot peppers, sweet peppers, Brussels sprouts, cauliflower, and chives. Foods with moderate content of vitamin C: artichoke, asparagus, cantaloupe, Belgian endive, Chinese cabbage, dill, lemon, lime, orange, radish, spinach, zucchini, strawberries, tomatoes, and beet greens.

In none of the three prospective studies on diet and Alzheimer's disease was use of vitamin E and C supplements (pills, capsules) associated with lessening the risks of the disease. Only the foods rich in those vitamins lessened the risk. Of two studies examining the effect of vitamin E and C supplements, only one has found evidence of reduced risk of Alzheimer's disease.

Omega-3 polyunsaturated fatty acids are essential in early brain development and have anti-inflammatory and anticlotting properties. One of these fatty acids (docosahexaenoic acid—DHA) is the primary component of cell membranes in the brain. Several studies have found that a diet rich in omega-3 polyunsaturated fatty acids reduces oxidative damage to cells and improves nerve function—both effects of concern to athletes.

These fatty acids are best obtained from fatty fish like mackerel, lake trout, herring, sardines, albacore tuna, and salmon. Morris (2004) states, "Thus far, no human study has indicated that taking a fish oil capsule is associated with less risk of developing the disease."

Here is how Morris sums up her article: "The best evidence for nutritional prevention of Alzheimer's disease is through foods rather than vitamin supplements."

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Morris, M. C. 2004. Diet and Alzheimer's Disease: What the Evidence Shows. *Medscape General Medicine* vol. 6, no. 1 (http://www.medscape.com/viewarticle/466037).

More on Hydrogenated and Partially Hydrogenated Fat

by Thomas Kurz

In the previous issue of *Stadion News* (Fall 2003) you learned about some effects of hydrogenated and partially hydrogenated fat. Here is more. "High intake of saturated fat doubled the risk of Alzheimer's disease, and even moderate intake of trans fat [hydrogenated and partially hydrogenated fat] increased the risk by 2 to 3 times." (Morris 2004).

The FDA is still contemplating requiring a warning label about hydrogenated oils and trans fats. Meanwhile, you owe it to your body to get smart about what foods contain them so you can avoid them. It is not an easy task. As a report from the National Academies indicates, "Because trans fatty acids occur in so many foods, an all-out ban is impractical and would make it extremely difficult to get a nutritionally balanced diet" (http://www4.nationalacademies.org/news.nsf/isbn/0309085373?OpenDocument). This statement assumes that people *have* to eat foods made with hydrogenated or partially hydrogenated fat or made in a way that hydrogenates fat present in the food. No free person in America *has* to eat fried foods, cookies, and this vile stuff that passes here for bread.

References

Morris, M. C. 2004. Diet and Alzheimer's Disease: What the Evidence Shows. *Medscape General Medicine* vol. 6, no. 1 (http://www.medscape.com/viewarticle/466037).

Endurance Workout: Slow to Fast or Fast to Slow? (continued from page 2)

are given in books on exercise physiology, in chapters about basic energy systems (ATP–PCr, glycolytic, oxidative) and about glycogen depletion.

The ways of arranging exercises in a workout for best effect and the rationale for these ways are covered in the chapters "Basic Concepts of Sports Training," "Structure of a Workout," and "Endurance Exercises in a Workout" in the book *Science of Sports Training*. Athletes can make progress with bad training but not as much as with good training. Why bad training practices take hold and what their consequences are is well explained by coach Charles Richardson on page four in this newsletter.

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Wilmore, J. H., and D. L. Costill. 1999. *Physiology of Sport and Exercise.* Champaign, IL: Human Kinetics.

Bad Training

by Charles Richardson

Instead of the Questions and Answers on Stretching and Training *that are usually on this page, in this issue you can read here an article by coach Charles A. Richardson. His article comments on my answer to a question on the arrangement of efforts in a workout (see page 2 in this issue). He concisely and insightfully explains how bad training practices get established and what the consequences are of less than optimal training in the long term.*

—Thomas Kurz

Your answer about the order of intensity in a workout was very interesting. While these workouts [which begin with aerobic endurance, proceed to increasingly anaerobic efforts, and end with sprints—see article on page 2] have increased my strength and endurance, I am, as you suggest, starting to take more time to recover, and I am experiencing some muscle soreness.

Had I not been attempting to apply your training principles, I would have ignored this and put it in the "no pain, no gain" category, but I no longer subscribe to that theory. I have learned, from you, that continued muscle soreness is not a good measure of effort (or a measure of good effort), but rather a good indication of bad training. But because the training plan I described was increasing my strength, I was seduced by that into thinking it was a good long-term training regimen.

[When we take up a new activity, we make considerable progress with relatively little effort. It even matters little what the quality of training is—we get better just because we learn the new way of moving. As we advance in this new activity, the tolerance for nonsense diminishes. In technical sports we eventually arrive at techniques that cannot be learned well by just any method—only by the right method. In sports that stress conditioning we reach beginner's performance levels just because we show up for a workout, but to move beyond that we have to work harder or smarter. Eventually, working any harder becomes counterproductive and to reach our full potential we have to work smarter. But, as Charles Richardson notes/points out, it is better to work smart from the beginning.—T. K.]

As we both know, this is what causes so many bad training principles to get established. The positive effects are overemphasized, and the negative effects are ignored. It's not that bad training produces no results, usually, but it produces less positive results than are possible with more intelligent training. And athletes' negative responses to the pain caused by the damage are often dismissed as an indication of lack of desire or dedication.

I've also been of the opinion for a long time that bad training practices simply weed out those athletes whose pain threshold or joint strength can't handle the effects of bad training but who might, with the proper training methods, excel.

Given how widespread ignorance of good training principles is, it's clear to me that very often the ones who rise to the top are uniquely able to handle the stresses of bad training and possess joints, muscles, and energy production systems that are more impervious to that ignorance. I was unlucky enough to have both bad training as a young athlete and a body that couldn't handle that kind of stress very well, so I've made it into my 50s having never reached what I thought of as my potential as an athlete, and with a fair amount of damage that limits what I can do. But I am inspired by what the application of good training, good nutrition, and a much more patient and positive attitude can do to repair the damage and expand my range of athletic possibilities along with my range of movement. For much of that, I have your writings to thank.

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