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## The Role of Aerobic Fitness in High Intensity Efforts, Part III

*This continues the refutation of misconceptions and errors in the quote from Charles I. Staley. (See the first two parts in Spring 1999 and Summer 1999 issues.)*

### Why do you need aerobic fitness for “anaerobic” sports?

To get the skill you need to drill. No drill—no skill. The faster you recover between the drills the more you can drill. This is the reason for developing aerobic fitness, which determines how fast you can recover.

Zbigniew Czajkowski, a teacher of coaches and a world-class fencing coach himself, who trained medal winners at world championships and the Olympics in foil, épée, and sabre, says: “In sports in which short, speed-type, high-energy-cost efforts are characteristic, one ought to do a lot of exercises stimulating anaerobic metabolism. Of course, every excess may lead to nonsense—and in those sports it is necessary to do a certain minimum of aerobic exercises, because:

“1) a certain level of aerobic fitness (in some sports not very high) is a foundation of general fitness [and thus of health];

“2) some actions during a fight demand aerobic energy; and

“3) maintaining a certain level of aerobic fitness is necessary for timely recovery after effort” (Czajkowski 1997).

Passive rest after an intense anaerobic workout may not be the fastest way to recover. A light aerobic effort, below the anaerobic threshold (McArdle, Katch, and Katch 1991, Wawrzynczak-Witkowska 1991), preferably of different character and in different surroundings than your regular workout, speeds up recovery and refreshes you mentally.

You need to train first to be fit for training before you train for competition. Lev Matveev, the researcher who systematized the concept of periodization, points out that endurance requirements for competition are not exactly the same as for training. To progress, the athlete must perform greater efforts in training than during the competition. Volume of sport-specific loads may increase in the course of a few years tenfold and more, while in several sports the duration of the competitive event may remain the same—for example, the duration of a match, or the number of rounds. The volume of training loads must also increase to improve time for covering distance (Matveev 1981).

*(continued on page two)*

### Highlights

- *The Role of Aerobic Fitness in High Intensity Efforts, Part III*  
pages 1 and 2
- *Vitamin C and Athletes*  
page 2
- *Self-Defense Tip*  
page 2
- *Machines and Gizmos vs. Natural Exercises*  
page 3
- *Q&A on Stretching and Training*  
page 4

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### Thomas Kurz's column on training, stretching, and flexibility

*Taekwondo Times* magazine carries Thomas Kurz articles on training, stretching, and flexibility in a column titled “Stretch Yourself.” Australian readers will be reading the same column soon in *Blitz* magazine. Previous articles from the column are posted on the Stadion Publishing Company Web site at <http://www.stadion.com/column.html>.

Here is a list of articles already published by *Taekwondo Times* and posted on

Stadion's Web site:

1. Misconceptions on Stretching and Flexibility and the Method of Testing Your Potential to Do a Side Split
2. Difficulties with Doing a Side Split
3. The Method of Testing Your Potential to Do a Front Split
4. Kinds of Flexibility and the Right Role of Splits in Taekwondo, Karate, and Kickboxing

5. Right Stretches for High Kicks with No Warm-Up

6. High Kicks with No Warm-Up: The Right Body Alignment for Great Height and Power in the Side Kicks

Forthcoming article, in print and not posted yet:

High Kicks with No Warm-Up: The Right Body Alignment for Great Height and Power in the Roundhouse Kicks

## Aerobic Fitness

(continued from page 1)

Increasing aerobic endurance—the ability to supply tissues with oxygen during work—increases the intensity of efforts at which energy is produced anaerobically with resultant buildup of acids in body fluids. The higher aerobic endurance, the later fatigue occurs (or at the higher intensity of effort) and the longer techniques can be “sharp and crisp.” During a boxing round, periods of high activity, such as a series of punches, are followed by short periods of lowered activity. During these periods, when boxers prepare their next attacks, they relax and move differently than during the attack, they breathe heavily, oxidizing the buildup of lactate (an ester of lactic acid), product of the anaerobic metabolism, and this lets them recover partially. This aerobic recovery mechanism explains the relatively low concentration of lactate in boxers’ blood after matches (Dziasko et al 1982).

Boxers during fights generate a great oxygen debt and, if they are in good shape, very effectively “pay it back” afterwards. Their readiness for a next round during a match, and for a next fight during a tournament (or for a next workout) depends on their speed of recovery, which depends to a great degree on their aerobic fitness.

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### Self-Defense Tip

I just read an article—“The Night I Met Bruce Lee” by Chuck Sullivan in *Blitz*, October 1999 (vol. 13, no. 10, p. 38)—reporting an argument between Chuck Sullivan (9th dan Kenpo) and Ed Parker (Grandmaster of American Kenpo Karate, 10th dan) about what a person would do when struck with a forearm across midsection. I found it hilari-

## Vitamin C and Athletes

*This whole article is based on an article by Jędrzej Antosiewicz, “Witamina C w żywieniu sportowców.” in Sport Wyczynowy no 1-2/397-398 1998, pp. 60-66.*

Vitamin C speeds up healing of wounds, strengthens scars, and reduces muscle damage resulting from strenuous exercises.

Exercisers who took 400 mg of vitamin C daily for 21 days prior to and for 7 days after an eccentric (i.e., “yielding”) strength effort—muscle soreness is greater after eccentric exercises than after concentric or isometric strength efforts with the same resistance—showed a smaller loss of maximal strength immediately after and two days after the effort than people who took a placebo.

Lack of vitamin C reduces production of collagen and thus weakens ligaments, tendons, and fascia, predisposing an athlete to sprains and strains.

Together with vitamin E, vitamin C removes free radicals produced by muscle fibers during intensive efforts. The free radicals reduce muscle’s contractibility.

The immune system of athletes also benefits from high doses of vitamin C. The frequency of flu and infections of the upper respiratory tract is greater among high performance athletes than among people who are not in training, but athletes taking 600 mg of vitamin C daily for three weeks prior to running an ultramarathon (90 km) reduced the frequency of infections within two weeks following the run to a level below that of nonathletes. The frequency of infections among athletes who took a placebo was nearly double that of athletes who took vitamin C.

When things are already gone wrong, you have to take more vitamin C than the preventive dosage. So instead of the 600 mg needed to prevent infection, you need nearly four times as much vitamin C—4 g daily—for the white blood cells to function

well and fight the infection. While you require 400 mg to strengthen connective tissue to better withstand eccentric exercises, you need 25 times as much—10 g of vitamin C per day—to speed up healing after surgery, for example, on a torn muscle.

Athletes with low blood iron should increase their intake of Vitamin C because it facilitates absorption of iron in the digestive tract.

There is a correlation between the concentration of vitamin C in plasma and results on an intelligence test. Children with a vitamin C concentration greater than 1.1 mg/100 ml of plasma scored 4.51 points higher than their peers who had a lower concentration. Supplementing vitamin C for children who had a lower concentration raised their plasma concentration of vitamin C and raised their IQ scores.

The best method of supplying vitamin C is eating foods rich in it. The richest sources of vitamin C are broccoli, black currants, italian cabbage, parsley, hot peppers, and sweet peppers. Foods with high content of vitamin C: 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.

One pound of red peppers and one pound of black currants supplies 2 g of vitamin C. In the amounts needed for recovery rather than prevention, it is not practical to get vitamin C only from foods. If you have to take vitamin C as pills, then several small doses with meals during the day are better than one large dose.

Let us know what you think about our newsletter. Have you learned something that improved your or your athletes’ performance or health? What would you like to learn more about? Write to us at our address: Stadion Publishing Company, Inc., P.O. Box 447-N, Island Pond, VT 05846, U.S.A. e-mail: [stadion@together.net](mailto:stadion@together.net)

ous that two people with sky-high ranks argue about something anyone can just check during sparring.

This argument shows the ridiculousness of patronizing other than knock-down systems of striking arts. In a knock-down system students know what happens to a hit person because they hit and are being hit.

It is not easy to find a knock-down (popularly called full-contact) martial art school. I visited Ed-

monton, Alberta, this summer, and in this city of 800,000 people there are only two full-contact schools, although every school asked over the phone claimed they do full-contact sparring.

To find knock-down schools visit Stadion Publishing Company’s links page: <http://www.stadion.com/links.html#CombatSportsandMartialArts>.

# Machines and Gizmos vs. Natural Exercises

by Thomas Kurz

## Resistance Machines

Most resistance machines offer either isolated exercises (knee extension, knee curl) or alter the natural path of movement in complex exercises (Smith machine).

The Smith machine forces you to move the bar on a straight line while your body is planted in one spot. This is not a natural movement pattern. In a natural squat the bar moves in an arc, the more pronounced when you squat on the whole surface of the soles of your feet. The straight up and down movement of the bar while your feet are planted in a Smith machine squat produces excessive strain on the lower back and knees (Bompa and Cornacchia 1998).

The isolated exercises, such as leg extensions or leg curls, produce greater shearing forces within the moving joint than the complex exercises such as squats, so leg extensions with less than 50° of knee flexion (meaning at any angle greater than 50°), for example can strain the anterior cruciate ligament of the knee. To produce similar shearing forces in a natural squat, you would need to flex your knees below 50°, practically sitting on your heels (Barrentine 1996).

Both squats and leg presses produce greater activity of the hamstring and gastrocnemius (calf muscle) throughout the majority of the movement than do knee extensions. Natural squats generate 20-50% more quadriceps activity, 65-140% more hamstring activity, and 15-35% more gastrocnemius activity than leg presses (Barrentine 1996).

The best means to increase bone density are weight-bearing exercises that involve many muscle groups and direct the force vectors through the spine, hips, and shoulder girdle, such as squats, deadlifts, cleans, shoulder presses, and bench presses (Baechle 1994).

Research by Chilibeck et al. (1996) showed that women who did 20 weeks of resistance training on a Universal-type machines increased their muscular strength but not their bone mineral density.

Women who did 27 weeks of gymnastic training increased their lean tissue mass more than the women in the previously quoted study (6.7% versus 3.7%) and sig-

nificantly increased their bone mineral mass (Nichols et al. 1994). Similar results were achieved with six months of high-impact exercises (Bassey and Ramsdale 1994). The natural whole body loading in the gymnastics and high-impact exercises improved lean tissue and bone density more than the Universal-type machine.

To build useful strength of muscles and bones, do exercises that closely resemble the natural forms of human movements, such as squats, lunges, deadlifts, push-ups, benchpresses, chin-ups, sit-ups, abdomen crunches, varieties of pull and jerk and snatch done with both arms and with one arm. In all those exercises your muscles work the way they do in your sport and in life.

## Abdominal training devices

Beim et al. (1997) compared the activation of abdominal muscles in various abdominal training gizmos, a bent-knee sit-up, and in a standard abdominal crunch. The abdominal crunch activated both the upper and the lower abdominal muscles more than the sit-up. Only one gizmo activated the upper part of the rectus abdominis more than the standard crunch—because this gizmo offered additional resistance during the movement while the crunch was performed without additional resistance. For fair comparison with that gizmo the abdominal crunch would have to be performed while holding a weight plate. It looks to me that an abdominal crunch with additional weight is as good as the best “abdominal training device.”

## Stretching machines

In my 25 years of living in Poland I have not seen even one stretching machine and I worked out in the best equipped training halls in Warsaw (at AWF—the University School of Physical Education), and in several other cities. I didn't see a stretching machine anywhere because athletes do not need stretching machines. In relaxed stretches for the hips and thighs, you can as easily relax into a stretch on your own on a smooth floor. In isometric stretches for hips and thighs, a machine will make it more difficult for you to tense your muscles because it prevents the weight of your body from pressing on your thighs and thus forcing them to tense more. The harder you

tense in isometric stretches, the greater is the following relaxation and the resulting stretch.

If you want to stretch the muscles of your shoulders and arms, then a rope with knots held behind your back and worked with your hands like a rosary or prayer beads is all you need.

Stretching machines “may be particularly helpful for special populations, such as the elderly and those with physical problems that prevent them from executing certain stretches by themselves” (“Stretching Machines,” 1999.). Unless you have been severely injured or have a crippling disease, you do not need a machine to increase your flexibility. Manufacturers of stretching machines know it too. The editors of *Georgia Tech Sports Medicine & Performance Newsletter* report a study of stretching machines conducted at the University of Oregon and funded by a company that manufactures stretching machines. The study showed flexibility gains among people who stretched on the machines *but their gains were not compared to the people who stretched without machines* (“Stretching Machines,” 1999.).

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# Q and A on STRETCHING and TRAINING

(continued from previous issue)

■ *I used to do deadlifts some years back, and I hope to add it soon. Unfortunately, my grip used to give out before my back; any suggestions on improving that? Should I think about getting hooks?*

Nothing wrong with hooks but I would give consideration first to limiting the weight so your grip holds well until the end of a set (in the case of deadlifts I would not do more than 12 reps).

■ *I'm a basketball player and I've tried to work on my jump before, but the exercises I've done have given little result. Is there a way to increase my vertical jump dramatically? And what results are typical for a good program that trains for jumping?*

Here are typical exercises for developing jumping ability (Starzynski and Sozanski 1999): fast squats and half-squats, jumps in a spot, jumps with a pre-run, multijumps over obstacles with double leg takeoff and single leg takeoff with and without a prerun, and depth jumps. Selection of exercises and the explanation of training methods for improving jumping ability is covered in detail in *Explosive Power and Jumping Ability for All Sports: Atlas of Exercises* by Starzynski and Sozanski.

■ *I am a college football player (running back) and I have some questions to ask pertaining to football training. The first question is how I can find out the benefits of power exercises such as cleans, snatches, and plyometrics. I also would like to know some new exercises I could do for power and speed. I am fine in strength although I need to improve my burst. I also would like to know how I should periodize my training for football.*

If cleans and snatches resemble movements you do during a game, then you should do these lifts in your sport-specific strength training. If not, then you still can do them as a part of your general strength training.

Regarding power and speed exercises I suggest those for rugby and for track and

field sprints that are shown in *Explosive Power and Jumping Ability for All Sports: Atlas of Exercises*. Another book that contains information on this subject is *The Gambetta Method* by Vern Gambetta (go to <http://www.gambetta.com> and click the "catalog" link).

Periodization is covered in books by Tudor Bompa listed on "The Athlete's Bookshelf" (The Web page address is <http://www.stadion.com/bookshelf.html>).

■ *Is it recommendable to do relaxed (static passive) stretches during a bodybuilding workout, e.g., stretching the pectoralis muscles between two sets of bench presses?*

It depends on the amount of resistance in your lifts and on how strenuously you stretch. The greater the resistance the more dangerous it is to do strenuous static stretches between sets. Maximal force production is impaired for several minutes after strenuous static stretching. Your own lifting experience should tell you that. Research confirms it too (Kokkonen, J., A. G. Nelson and A. Cornwell. 1998. "Acute muscle stretching inhibits maximal strength performance." *Research Quarterly for Exercise and Sport* vol 69, no 4, pp. 411-415).

Maximal force production in bench press, one of the events of powerlifting, is positively related to the stiffness of prime movers (Wilson 1994, quoted by Kokkonen et al.) so flexibility training could affect it adversely.

■ *I practice hamstring stretches lying on my back, but I am a bit confused as to whether it is a good idea to flatten the back or to maintain the curve in the lower back. Can you shed some light on this?*

In such a stretch keeping your back straight or maintaining normal lumbar lordosis stretches hamstrings. Arching your back (the opposite of lumbar lordosis) will stretch the back muscles.

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