



STADION® news
Training Info for Serious Athletes

<http://www.stadion.com>

Volume 10, Number 3, Summer 2003

\$3.00

Immune System and Exercise

by Piotr Drabik

The immune system responds to physical activity—heavy exertion is associated with immune suppression for several subsequent hours, while moderate exercise activates some immune functions. (How to evaluate degrees of exertion or fatigue, from moderate to heavy, is described in [Science of Sports Training](#).)

Intensive but short exercise (or a short workout) increases functioning of the immune system—increases neutrophil count, recruitment of natural killer (NK) cells, and lymphocytes B and T. (Neutrophils are a type of white blood cells that destroy microorganisms. NK cells destroy viruses and prevent tumors from spreading. T cells defend against viral and fungal infections and destroy cancer cells. B cells, when activated by foreign bodies, produce antibodies that mark these foreign bodies for destruction by T cells and NK cells.)

Intensive exercise of long duration, however, suppresses functioning of the immune system (lymphocyte count declines while the neutrophil concentration in-

creases, and cell-killing ability of NK cells is suppressed). In the case of prolonged exercise, increases in catecholamines (adrenaline, noradrenaline, and dopamine) and growth hormone cause the immediate effects of exercise on neutrophils, whereas cortisol may be responsible for maintaining low lymphocyte count and increased concentration of neutrophils afterwards.

When one has a minor cold a light workout might help but a hard workout will very likely hurt.

Many aspects of immune function can be depressed temporarily by either a single bout of prolonged intensive exercise such as a marathon run or by a longer period of very hard training such as during preparation for an important competition. (Whether an effort or workout is heavy or light is determined in relation to one's capability and not just by how many miles, tons, or repetitions are achieved.) Although the disturbance is usually transient, it can be sufficient to allow an infection to

(continued on page two)

Highlights

- *Immune System and Exercise*
page 1
- *Have an Injury? Read This Book!*
page 1
- *Massage*
pages 2 and 3
- *Q&A on Stretching and Training*
page 4

STADION NEWS is published by Stadion Publishing Co., Inc., P.O. Box 447, Island Pond, VT 05846, U.S.A.
Contents copyright © 2003 by Stadion Publishing Co., Inc. All rights reserved.
Nothing can be reprinted in whole or in part without written permission from the publisher.
Printed in U.S.A.

Have an Injury? Read This Book!

Management of Common Musculoskeletal Disorders by D. Hertling and R. M. Kessler should be read by every coach and athlete. Reading this book can be the best injury prevention, making people aware of the significance of all the little symptoms felt days, weeks, or even months before a major injury occurs.

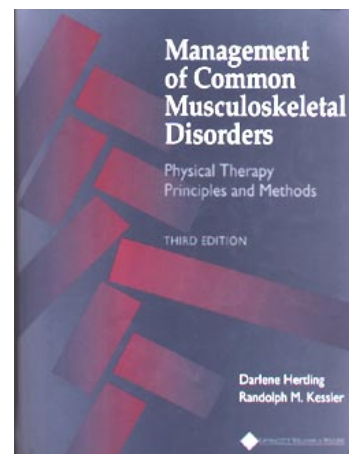
An injured athlete will find in this book the most effective exercises for self-mobilization and strengthening of injured muscles and joints.

This excellent book can help an injured

athlete evaluate the qualifications of physical therapists or even design his or her own program of rehabilitation.

Although not available from Stadion Publishing Company, it may be purchased on the Internet at the Athlete's Bookshelf (<http://www.stadion.com/bookshelf.html>).

Here is full bibliographical information for this book: *Management of Common Musculoskeletal Disorders: Physical Therapy Principles and Methods* by D. Hertling and R. M. Kessler, 1996 (Philadelphia: Lippincott Williams & Wilkins).



Immune System and Exercise

(continued from page 1)

occur. By altering circulating neuropeptide (substances secreted in the central nervous system, some with opiate-like effects) concentrations, it might also contribute to adverse mood changes that are associated with overtraining.

A competing athlete experiences strong emotions connected with so-called pre-competition states. Adverse pre-competition states may impair function of the immune system. Thus it is reasonable to use proper nutrition and supplementation before and during the competition period to minimize the risk of infection. It is also important to design restitution periods of adequate duration to give time for the immune system to regenerate.

The effects of malnutrition upon the immune system have long been recognized, and there have also been suggestions that nutritional status may influence the effect of exercise on immune function.

Top-level athletes and habitual exercisers sometimes make bizarre dietary choices. Many of these dietary practices affect immune function.

Deficiencies of almost all vitamins can impair immune function. A lack of vitamin A or its precursor beta-carotene, vitamin B₁₂, pyridoxine, or folic acid can depress immune function substantially.

A two- to tenfold increased intake of vitamin E, which is an antioxidant, enhanced immune function in normal subjects, but megadoses (for example, 300 mg/day for 3 weeks) inhibited a number of key immune reactions, particularly activity of interleukin-2 (a protein belonging to a large family of proteins called cytokines that stimulate immune response).

Athletes may also have to take mineral supplements, particularly sodium, potassium, calcium, and iron. Some endurance athletes show a latent iron deficiency, in part because of the involvement of transferrin (a protein in the blood serum that combines with and transports iron) in antioxidant reactions, and in part because diets with a high protein-to-fat ratio, as well as diets that impair production of bile, can restrict iron absorption. (Production of bile is impaired by diets poor in protein or rich in refined carbohydrates. When there is not enough bile to digest fat well, the undi-

gested fat combines with iron and calcium and prevents their absorption.) The immune system seems particularly sensitive to a lack of serum iron. NK cell cytotoxicity is reduced and immune tissue atrophies, with an impaired *in vitro* response to factors that stimulate division of lymphocytes. However, excessive quantities of dietary iron (for example, a single dose of 1000–2000 mg) can saturate iron-binding proteins, releasing iron that can facilitate bacterial growth and thus a bacterial infection, and impair the phagocytic function of white blood cells (specifically, of polymorphonuclear granulocytes).

Other minerals that are important to immune function are zinc and selenium. Selenium regulates the biosynthesis of prostaglandins, which in turn can modulate NK cell activity. The selenium requirement is probably increased in people who exercise hard on a regular basis. Supplementing zinc in those performing exhausting exercise helps to block the excessive release of reactive oxygen compounds (free radicals and species easily converted to them) by polymorphonuclear granulocytes, but it suppresses T cell proliferation.

In exercisers, immune function (interleukin-1 production and phagocytic activity of macrophages) was optimal when consuming a diet that contained 20–40% protein. Poorer immune function was observed if the diet contained either too little or too much protein.

Some regular endurance exercisers consume large quantities of polyunsaturated fats, and this can have significant consequences for the immune system, whether the person is sedentary or physically active. Polyunsaturated fats are necessary for T cell function, and a deficiency of essential fatty acids impairs immune function. However, an excessive intake of polyunsaturated fatty acids can suppress both neutrophil and monocyte function, with a decreased mitogen response of lymphocytes and a reduced production of interleukin-1 and interleukin-2. The adverse effects may arise because the fatty acids alter cell membrane properties, modify eicosanoid synthesis, or change plasma hormone levels.

Even physiologically normal high lev-

els of polyunsaturated fatty acids can inhibit the proliferation of lymphocytes, and the rising level of these fatty acids in plasma, associated with depletion of glycogen reserves and the anxiety accompanying overtraining, could provide one more reason for an impairment of immune function in an athlete who is training hard.

There might also be a more direct competition between the metabolic needs of the immune cells and the demands of the exercising muscle, either for immediate metabolites or for amino acids to be used in tissue hypertrophy.

As glycogen reserves diminish during endurance exercise, the formation of glucose from amino acids in the liver (gluconeogenesis) is increased. These metabolic changes have implications for tryptophan balance, plasma glutamine levels, and plasma levels of free fatty acids.

Traditionally, it has been accepted that the cells of the immune system meet most of their energy needs by the metabolism of glucose. However, there is evidence that glutamine is an important metabolite for both macrophages and lymphocytes. Glutamine levels influence lymphocyte proliferation, macrophage phagocytosis, antibody synthesis, RNA synthesis, protein synthesis, and production of the key cytokines (interleukin-1 and interleukin-2).

Short sprints increase plasma glutamine levels, but immediately following a marathon run, there is a 16% decrease of plasma glutamine, along with decreased levels of alanine and branched-chain amino acids. The abnormalities are corrected within a few hours after the exercise.

Overtraining is associated with some decrease of resting glutamine levels, apparently because of a slowing of glutamine release from muscle.

In situations of chronic nutritional deficiency caused by prolonged and excessive training, a systematic depletion of protein reserves can occur, with decreases in plasma levels of glutamine and increases of brain tryptophan and plasma fatty acids. A persistent decrease in glutamine levels can have adverse consequences for immune function by lowering lymphocyte proliferation, with a resulting increase in susceptibility to infections.

Massage

by Thomas Kurz

Few athletes integrate massage in their whole training program. That is a pity because a good massage therapist can improve performance, speed up recovery, and save an athlete a lot of grief and money by preventing injuries and helping healing.

A massage therapist can detect such early signs of muscle dysfunction as tenderness, stiffness, or uneven muscle tonus before even the athlete is aware of them. In a well-run training program, the massage therapist passes that information to the coach and the team's physician. Then, the exercises and training loads can be changed to prevent minor dysfunctions from becoming injuries.

When an athlete trains alone, acting as his or her own coach, the massage therapist's feedback is all the more valuable.

A good sports massage or therapeutic massage tends to be deep. It takes deep massage to penetrate the whole bulk of muscles, to feel out spots of abnormal muscle tissue that are stringy, hard, and painful, and to make that tissue relaxed, soft, and pain-free again.

A few sessions of deep massage can bring considerable relief from arthritis, frozen shoulder (adhesive capsulitis), tension headaches, and more (Hertling and Kessler 1996).

Hertling and Kessler (1996) quote a study of the effects of massage on a seriously injured muscle. Two groups of animals had a muscle crushed, and then one group had this muscle massaged and the other group was left to heal on its own. Muscles that were massaged healed better, looked normal, were soft (not stringy), had no abnormal thickening of connective tissue, and showed no signs of internal bleeding. Muscles of the untreated animals had all the negative effects of injury.

Russian sports massage utilizes the following techniques in this order (Pogosyan and Biryukov 2003; Vasichkin 2001): stroking, squeezing, kneading, shaking, rubbing, active movements (by the athlete), passive movements (by therapist's force), movements against the therapist's resistance, hitting, and shaking up. Rubbing and movements are used mainly to treat joints, ligaments, and tendons. Stroking is done between all intense techniques.

Russian therapeutic or medical massage uses four principal techniques: stroking,

rubbing, kneading, and vibrating, in that order. So, stroking prepares tissues for rubbing, rubbing for kneading, and vibrating ends the session.

Techniques of both kinds of massage are performed in the same way, only the selection and order differ. Application of therapeutic massage depends on the illness or injury, while application of sports massage depends on the athlete's training load, duration of rest, peculiarity of the athlete's sport, and mental state of the athlete (prestart state).

All principal massage techniques are selected according to their influence on the nervous system and on the body's structures (Pogosyan and Biryukov 2003; Vasichkin 2001). Squeezing and hitting stimulate the nervous system while stroking, shaking, and vibrating calm it down. Kneading and rubbing can stimulate or calm down depending on the pace, force, and duration of application. Fast, deep, and brief kneading activates neuromuscular apparatus and stimulates the nervous system. Slow, superficial, and prolonged kneading calms down the nervous system and so muscles relax. So, such a technique can be used for a different purpose at different times—to stimulate prior to a workout or a start, or to calm down as a means of aiding recovery.

The selection of techniques considers their influence on the body's structures (Pogosyan and Biryukov 2003):

- For the skin and fat tissue under the skin (subcutaneous adipose tissue)—stroking, squeezing, rubbing, and hitting.
- For the muscles—squeezing, kneading, hitting, shaking, and movements. Kneading of major muscles is combined with shaking and, for muscles of the arm or thigh, with rolling. Hitting is done after muscles are well prepared by other techniques. Otherwise techniques of hitting can cause pain, microtrauma to muscle fibers, microbleeding, and spasms of small blood vessels.
- When massaging a joint, first stroking and rubbing is done, then kneading of the muscles above and below the joint, then rubbing the joint capsule and ligaments, and then movements.
- To influence the peripheral nervous system, stroking and vibration may be used. Nerves

and painful spots are massaged toward the end of the session, using vibration.

The session ends with stroking and in the case of limbs with shaking up. Not all techniques have to be applied in a single session.

There are following kinds of sports massage: workout massage, preparatory massage, and restorative massage.

Workout massage, whole body or local, speeds up the process of recovery after a workout. It is done 1.5–2 hours after the end of the workout. If a workout ends late in the evening, it may be followed by a short session of local massage or a restorative massage lasting no more than 20 minutes, saving the whole body massage for the next morning (Geselevich 1976).

Preparatory massage is done immediately before an effort. It is used to relax the body, to warm up and prevent cooling down of the body, and to regulate the prestart emotions. A massage to regulate emotions calms down the athlete in the case of prestart anxiety or energizes him or her in the case of prestart apathy.

Restorative massage is done during breaks between heats (running or swimming), bouts or matches (wrestling, boxing), before a change of apparatus in gymnastics, and after competitions or workouts to speed up recovery. (Seems the same as a workout massage but it differs in specifics.)

All these kinds of sports massage are described in the book *Science of Sports Training: How to Plan and Control Training for Peak Performance*.

The American Massage Therapy Association has information on sports massage and on finding a certified therapist at www.amtamassage.org/publications/sports_message_brochure.html.

References

- Geselevich, V. A. 1976. *Meditinskiy spravochnik trenera*. Moscow: Fizkultura i Sport.
- Hertling, D., and R. M. Kessler. 1996. *Management of Common Musculoskeletal Disorders: Physical Therapy Principles and Methods*. Philadelphia: Lippincott Williams & Wilkins.
- Kurz, T. 2001. *Science of Sports Training: How to Plan and Control Training for Peak Performance*. Island Pond, VT: Stadion Publishing Co., Inc.
- Pogosyan, M. M., and A. A. Biryukov. 2003. Klassifikatsiya priemov klassicheskogo massazha. Teoriya i Praktika Fizicheskoy Kultury no. 9, pp. 35–36.
- Vasichkin, V. I. 2001. *Bolshoy Spravochnik po Massazhu*. Moscow: EKSMO-PRESS.

Q and A on STRETCHING and TRAINING (continued from previous issue)

Study these typical questions on stretching and training carefully. You may find information that relates to questions of yours. Questions are in *italic boldface*.

■ *I am a 30-year-old woman who has been taking ballet and jazz dance classes on and off throughout my life for enjoyment and in the past 2 years consistently as an aspiring professional. I have never been able to do a front split or a side split even as a child.*

My typical dance class consists of 45–60 minutes of static stretching, resistance and technique-enhancing exercises, and another 45–60 minutes of choreographed dance routines. An optimum training week would consist of five classes a week of combined ballet and jazz. My flexibility has improved somewhat, but not enough to achieve a level consistent with what is expected of a professional dancer.

With exercises in your class arranged so backward, only the very talented may show progress—and not because of such training but despite it.

If your dance class was arranged correctly (rational warm-up including dynamic stretches, some technique practice, then dance routines, and then the bulk of technical exercises, resistance, and finally the static stretching) the class would be shorter and more effective.

It would be shorter because dance routines would go better when dancers are warmed up properly rather than after an hour of resistance exercises and static stretching; it would also take less time to reach maximal static flexibility at the end of the class. With faster progress in flexibility, dancers could dedicate less time to it in subsequent classes—both in a warm-up and in final stretches.

Shorter workouts are better for immune function too—see the article on page 1.

There is a possibility that the structure of your hips keeps you from achieving splits, and no matter how well and how much you exercise you will not do a full split. In-depth information on this issue and on how to tell if this is the case is in *Stretching Scientifically*. But as long as you feel that it is your muscles' tension and

not bone-on-bone contact that limits your range of motion, it means that you can improve.

Even if you are one of the few people whose hip structure prevents achieving splits, with rational training you would reach your full potential sooner and with less effort.

■ *I recently purchased your Stretching Scientifically to learn how my 12-year-old daughter could improve her flexibility for dance. She is 90 lb. and 5 feet 3 inches tall, so very slender for her height. She is unable to do a standing forward bend at a 90-degree angle with a flat back (her spine bows) and has trouble sitting with legs outstretched to do seated forward bends. However, she can easily do the flexibility tests for front and side-split potential. Do you have any suggestions in addition to a program of dynamic stretching with leg kicks to assist her?*

Seems like your daughter's lower back muscles and hamstrings and possibly calf muscles are abnormally short. Any orthopaedic surgeon, chiropractor, or applied kinesiology specialist can tell you which muscles exactly are short or overly tensed. I prefer to check such problems with AK specialists because their tests are most precise and best for revealing the root cause of a muscular problem.

If the physician sees no contraindication, you may consider exercises that strengthen and stretch the involved muscles at the same time, for example, the good morning lifts initially without extra resistance and then with resistance added gradually as your daughter's strength and flexibility increase.

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: news@stadion.com

ORDER FORM



Stadion Publishing Co., Inc.
P.O. Box 447-N
Island Pond, VT 05846
(800) 873-7117, (802) 723-6175
<http://www.stadion.com>

- ___ *Basic Instincts of Self-Defense*
(video 104 min.) @ \$39.95
 - ___ *Children and Sports Training*
(softcover 250 pages) @ \$29.95
 - ___ *Explosive Power and Jumping Ability for All Sports*
(softcover 144 pages) @ \$23.95
 - ___ *Gold Medal Mental Workout for Combat Sports*
(book, 6 audio cassettes) @ \$59.95
 - ___ *Power High Kicks with No Warm-Up!*
(video 80 minutes) @ \$49.95
 - ___ *Science of Sports Training*
(softcover 424 pages) @ \$39.95
 - ___ *Stretching Scientifically*
(softcover 214 pages) @ \$25.99
 - ___ *Tom Kurz's Secrets of Stretching*
(video 98 min.) @ \$49.95
- Please circle the video system: NTSC (North and Central America) or PAL (Europe, Asia, Australia).
SHIPPING: Air Mail for U.S.A. \$4.00 per book or video.
Foreign orders: \$8.00 per book or video. Foreign orders, please pay by International Money Order in U.S. dollars only. **You may return the videos or books with original invoice and in good condition at any time for a refund of the price of merchandise (less shipping and handling).**
- The following *Special Reports* are available in electronic form only (as PDF files) and will be e-mailed to your e-mail address.
- ___ #1 *How You Can Use Anatomical Tricks to Increase Stretches (15 p.)* @ \$10.95
 - ___ #2 *How Your Age Affects Your Stretching (8 p.)* @ \$5.95
 - ___ #3 *How You Can Stretch Fast for High Kicks with No Warm-Up (13 p.)* @ \$7.95
 - ___ #4 *How You Can Stretch Fast for Splits with No Warm-Up (11 p.)* @ \$7.95
 - ___ #5 *How and When You Can Do Stretches for Best Results (15 p.)* @ \$10.95
 - ___ #6 *How You Can Do Splits on Chairs (5 p.)* @ \$5.95
 - ___ #7 *How You Can Solve Typical Martial Arts Flexibility Problems (14 p.)* @ \$10.95
 - ___ #8 *How You Can Combine Stretching with Sports, Martial Arts, or Other Activities for Best Results (12 p.)* @ \$7.95
 - ___ #9 *How to Improve Your Flexibility and Prevent Injuries with Strength Training (22 p.)* @ \$12.95
 - ___ #10 *How You Can Speedup Recovery after You Were Injured (14 p.)* @ \$9.95

Name _____
Address _____
City _____
State/Zip _____
Phone _____
AmEx/Master/Visa _____
Expiration date _____
Signature _____

Checks held 14 days for clearing. No C.O.D. orders.
Make checks or money orders payable to **Stadion** and mail with this order form to **Stadion Publishing, P.O. Box 447-N, Island Pond, VT 05846, U.S.A.** or call toll free: **800-873-7117**, 24 hours, 7 days a week. Fax orders: **802-723-6171**, 24 hours, 7 days a week.