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Experts' Opinions on Squats by Thomas Kurz

This article is about squats, but it applies to any exercise.

Experts argue whether deep squats are good or bad, should one squat flat-footed or heels-up, whether Hindu squats damage knees or not, and so on.

Some preach against Hindu squats because these are usually done heels-up. They say that since squatting flat-footed, whether weightlifting or just resting, is more comfortable and easier on one's knees than squatting heels-up, one should eliminate all heels-up squatting.

Many people pay attention to such experts, never asking the experts to show whether they know how to do these Hindu squats.

The experts are confused. They confuse static and slow squatting, such as with weights, with quick, rhythmic squatting in which up and down movement of the body is coordinated with swings of the arms and trunk. Those swings, when done correctly, unload the knees and facilitate standing up.

The cure for the confused experts is to actually do the exercise: Squat with a heavy

weight and you'll find that the flat-footed squat is better. Do a few workouts, each with at least a couple hundred Hindu squats (in one set) and you'll see that heels-up is easier. If your knees hurt afterwards, learn to move your arms correctly. Keep in mind that if you are hurting during the exercise, you will be hurting even more with every repeat session of exercising like that. (By the way, you can do Hindu squats flat-footed—if you want to get really tired.) Before doing an exercise, learn its correct form.

For weightlifting squats, watch weightlifters as they squat with multiples of their own body weight—without the correct form, the weight would break them.

For Hindu squats, watch someone who knocks a few hundred without breaking pace and whose knees are in great shape.

To sum it up: Much stupidity comes from not doing the thing one professes expertise in. People who don't do the thing correctly can speak a lot of nonsense about it.

Theories of Training: One-factor vs. Two-factor

by Thomas Kurz

There are two very general training theories, or ways of thinking about training: the one-factor or supercompensation theory and the two-factor or fitness-fatigue theory. Some coaches believe them to be contrary or conflicting, as if one were right and the other wrong, while both are useful.

In the theory of supercompensation, an athlete's readiness or ability to train or compete is assumed to depend on the athlete's resources (energy sources, structural proteins, electrolytes, etc.). As exercise uses up those resources, the athlete's readi-

ness diminishes, but during rest, given sufficient nutrition, those resources are rebuilt.

Because of the "inertia" or "overshooting" of the biological processes, the rebuilding does not end as soon as the athlete's work ability has returned to the initial level but continues. (Biological systems and processes respond to change by bouncing in the opposite direction, overshooting their normal balance first in one way, then in another, until through gradually smaller oscillations, they come close to the most balanced state.) This rebuilding above the

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initial level of capability is called supercompensation. With just the right amount of rest, the athlete's resources can be greater come the next exercise session, and so the possible amount and intensity of work during it can be greater too. If no work is done during the supercompensation phase, then the athlete's work capability will return to its initial level and may keep falling with continued inactivity.

The theory of fitness-fatigue assumes that the athlete's readiness depends on two-factors: on fitness, which changes slowly,

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On Elegance and Single Workout

by Thomas Kurz

Elegance is [achieved by] selectiveness or restraint in the use of means—a good selection gets to the point with just the right means.

In my opinion, the crucial element of a training program is a workout. Not an exercise and not a microcycle but a single workout.

Why not an exercise—the basic building block of training? Because exercises are like words of a language. Speaking or writing words is not enough to be understood well—just as doing exercises correctly is not enough to get the desired training effect. One has to put them together into sentences (workouts) that make sense.

Even marginally competent instructors know hundreds of exercises and the correct form and purpose of each. It would take gross incompetence to teach an exercise incorrectly or to order an athlete to do an inappropriate exercise. (Say, beyond the athlete's ability or that accentuates the athlete's liabilities, such as posture defects.)

So, proficiency in selecting and teaching exercises I consider a given.

Many believe the microcycle is the most important building block of a training program. But the microcycle is made of workouts (as a paragraph is made of sentences), and if those are composed poorly then the whole microcycle doesn't work.

In the U.S.A., in various courses, instructors and trainers are taught how to do exercises and how to screen athletes for exercises. Hardly ever are they taught how to compose a workout with those exercises for an optimal effect.

Composing and conducting a good workout is not difficult. One has to consider the athlete or athletes and the purpose of the workout, then select exercises that match both and make it all flow.

A good, purposeful, flowing workout leaves athletes happy, confident, and looking forward to the next workout. Athletes should feel so confident in the skills acquired or improved that they do not do on their own more than the instructor ordered

them. When athletes linger after a workout and do more, it means that —they have not done what they wanted; —they don't trust their skill; and —the workout has not given them confidence that they have made sufficient progress.

After a well-run workout, athletes feel that all they need to do is rest before the next great workout. If they don't feel that way and do more on their own, their readiness for the next workout suffers, and so the whole microcycle unravels.

So, that is why I believe the workout is the element that makes or breaks the training program.

Back to elegance....

A good workout is like a good speech—compact, getting to the point without needless digressions—in a word, elegant in its economy of means and thus effective and memorable. Like a good speech (or writing), all its elements flow and build upon each other, leading to the aimed-for outcome.

Structure of a Workout (from *Science of Sports Training*)

The basic unit of training is an exercise and its corresponding rest period. A physiologically justified sequence of exercises forms a workout. Exercises are assembled into workouts according to an athlete's needs and degree of recovery. Whether recovery is sufficient depends on what exercises were done in the previous workout and what the task is of the current workout.

A properly designed workout plan includes the following parts:

1. The introduction, where the coach briefly explains the task
2. The general warm-up
3. The specific warm-up, where movements more closely resemble the actual subject of the workout
4. The main part of the workout, when the main task is realized
5. The cool-down
6. The closing, summing up fulfillment of the tasks and dismissal of the group

The duration of the whole introduction indicates the degree of professionalism of the coach and the motivation of the athletes: the briefer, the better. In a well-run

training program, each task is based on the previous one. This makes lengthy demonstrations and explanations unnecessary.

The warm-up should start with exercises of low intensity and then progress to the intensity of the exercises that are the main subject of the workout. It is an error to start a warm-up with high-intensity exercises. Such an intensive start reduces the athlete's work capacity needed for effectively carrying out tasks of the main part of the workout. Intensive exercises quickly use up stores of muscle glycogen and increase the level of lactate in the blood. The higher the blood level of lactate, the lower is the use of free fatty acids for energy (Romanowski 1973). Conversely, the greater the use of free fatty acids for energy, the more work an athlete can perform before fatiguing.

Generally after the warm-up all the exercises are arranged in order of the descending difficulty. The exercises should not be grouped primarily by the body part or the form of movement, but by their difficulty and dynamics. The more difficult or more dynamic exercises are to be done

first. New skills should be learned before drilling in known skills or doing conditioning exercises. Speed exercises are to be done before dynamic strength exercises, dynamic strength exercises should be done before static strength exercises, and long-duration endurance exercises should be done at the end of the main part of a workout.

When the main part of the workout is over, it is then time for the cool-down—gradual lowering of the intensity of exercises until athletes stop sweating and their breathing feels normal. The cool-down proper should include exercises that slow down the physiological functions of the athletes' bodies and enhance recovery after the workout. It may start with a slowed-down version of the last exercise of the main part or a low-intensity ball game.

The cool-down may be used for performing exercises that correct posture defects resulting from sports training or of other origin. When the athletes breathe normally, they can do some static stretching.

Training tips for running technique

by Thomas Kurz

Running is the most commonly used form of movement for developing general aerobic endurance. It is a simple, natural movement, yet people can do it wrong.

Here is a description of the correct running technique:

- Keep the trunk straight, leaning slightly forward.
- Arms, bent at elbows, move forward and backward. Moving the arms across the front of the trunk causes swaying of the trunk, which stresses the knees and can injure them.
- Hands, arms, the upper part of the trunk, and facial muscles are fully relaxed.
- At low speeds the foot contacts the ground with the outer side of the foot close to the heel and rolls toward the front; or, at higher speeds or when running uphill, with the outer side of the front of the foot.
- The toes point slightly inward. To find out how much, tell the athlete to suspend his or her foot above the ground and relax it. The toes will turn slightly inward. This will be the correct position.
- Steps, at the beginning of the running program, should be short—one or two foot lengths.
- Direct the push-off forward, not up as in jogging. If the athlete runs too slow to push off forward—that is, jogs—the push-off is directed up, which causes injuries to the muscles and joints of the legs and the joints of one's back.
- In the first month of running workouts, one should breathe through the nose only. When a person breathes through the nose it means that the effort is adequate to his or her fitness. There is an exception to this rule—some people have trouble breathing only through the nose, even at a slow running pace. They should not force themselves to breathe only through the nose.

Running Pointers: From Head to Toe

- Head is up, at a constant distance from the shoulders.
- Trunk leans slightly forward.
- Arms move parallel to the direction of the run.
- Elbows are bent at about 90 degrees.
- Knee is slightly bent when the foot strikes the ground.
- Knee is completely straight when the foot pushes off.
- Foot lands on the ground with its middle or front part, depending on the speed of running.
- The whole body moves only very slightly up and down—the more vertical motion, the worse is the stress on the joints of the legs and the back.

Running Shoes

Australian researchers discovered that fashionable sneakers, with air or gel cushions, cause sports injuries. Basketball players who play in such shoes injure their ankle joints four times as often as those who wear shoes without such cushions. The air cushions and gel cushions increase the risk of injury during jumping and running.

One possible cause: The stronger the amortizers in the shoe, the less load falls on the tendons, such as the Achilles' tendon, so they grow weaker and eventually fail.

An experiment conducted by physicians at the Sporthochschule (Higher School of Sports) in Köln, Germany, supports this explanation. The physicians had athletes train one leg with relatively light loads and the other with heavy loads. After two weeks of such training, the physicians observed identical increase of muscle size in both legs. Increase of the size of tendons, however, could be noticed only in the leg trained with heavy loads.

So, the better the shoe protects the joints from shock/impact loads, the less the tendons have to adapt to such loads.

Theories of Training

(continued from page 1)

and on fatigue, which changes quickly. (In a well-run training program the slow-changing fitness grows—thanks to supercompensation—TK.)

According to this two-factor theory, exercises increase both fitness and fatigue. The increase in fitness lasts longer than the increase in fatigue (if all is well). Fatigue recedes quickly but fitness slowly, so if the next workout falls when fatigue is gone, the increased fitness is still there. The two-factor theory can be simply put thus: Skills and conditioning are paid for with fatigue. The less fatigue you spend on your skills and conditioning the better—the more economical your training is and the more consistent your skills are.

Zatsiorsky (1995) makes two arguments against the supercompensation or one-factor theory:

1. That “the very existence of the supercompensation phase for a majority of metabolic substances has never been experimentally proven [except for glycogen].”

2. That “the restoration of initial levels of different metabolic substances requires unequal amounts of time” and so it is unclear which substance's restoration should guide the selection of time intervals between workouts.

Actually it does not matter: The physiological and functional signs tell the coach when the athlete is ready for the next workout and if the athlete's capabilities have increased. For example, when grip dynamometry improves (as compared to what it was before the previous strength workout), then probably the athlete's strength is greater than previously.

The easiest argument against exclusive correctness of the two-factor theory is hypertrophy (increase of muscle mass, of bone density, of tendon thickness). Hypertrophy that occurs as a result of exercising proves supercompensation (the one-factor theory).

It is good to keep both concepts in mind. In a short term (that is, during a workout or a day of workouts), the two-factor theory is the more useful concept. It is especially useful for exercises involving skill rather than conditioning abilities (strength, strength-endurance, endurance).

In a longer term (microcycles and longer training cycles), the one-factor theory must be taken into consideration.



Q and A on Stretching and Training

Study these questions on training carefully. You may find information that relates to questions of yours. Questions are in *italics*.

■ *If I was to focus primarily on leg raises, would my dynamic flexibility increase only up to my current maximum ROM, or would it also increase my ROM? Is it necessary to perform static stretches (isometric or relaxed) to increase ROM? My focus is flexibility for kicks, not the ability to perform splits.*

Dynamic stretches such as leg raises increase dynamic ROM only within the limit of the maximal static passive ROM. To increase maximal static passive ROM you'd have to perform static passive or isometric stretches, or do resistance exercises for your legs and hips at full ROM.

Theoretically, it should be possible to increase maximal static passive ROM with leg raises—but done ballistically. Practically it is not advisable as such ballistic stretches are risky (high forces and poor control) and not as effective at increasing maximal static ROM as static passive (relaxed) or isometric stretches. The reasons have to do with mechanical properties of muscles and tendons, and you can learn about them from sources quoted in *Stretching Scientifically*. Here is my brief explanation: Both the contractile and connective tissues of muscles are more permanently elongated when held in extension for about 15 seconds.

There is another way of increasing your static passive ROM: doing such weightlifting exercises as deep squats and stiff-legged deadlifts. At the bottom position in those lifts, muscles tense hard when maximally stretched.

Rationally trained athletes of combat sports and m.a. do a variety of deep squats and deadlifts. Doing various forms of those two fundamental lifts gives more than enough ROM for all high kicks, so practically such athletes don't need static stretches to increase ROM in their hips. All they need is dynamic stretching—to learn using their full ROM at full speed, eventually even without a warm-up.

■ *I have started to incorporate static active stretching into my regime because I prefer it to static passive stretching. I understand that the*

height of leg raises in dynamic stretching is limited by passive ROM. If I was to focus only on dynamic stretching and static active stretching—would the static active stretching increase my static passive ROM, therefore allowing me greater potential in dynamic flexibility?

It would not. See my previous answer.

■ *Is it possible for a person's dynamic flexibility to be lower than that person's static flexibility (such as in splits)?*

Yes, it is. One's maximal static passive flexibility (static passive ROM) usually exceeds one's dynamic flexibility (dynamic ROM). Dynamic flexibility is also limited by passive resistance to movement. Dynamic stretching or resistance exercises done throughout one's full ROM decrease this passive resistance.

■ *After taking a 4-year break from my taekwondo training, I decided to make a comeback 6 months ago. I've added weight training to my workouts in order to strengthen my legs so that I can prevent injuries (once a week deadlifts, squats, leg extensions and curls, adductor flies, back extensions, 3 sets of 20 each). Although my legs feel strong, I've recently been experiencing slight pain and tightness in my right knee. I think it may have been caused by doing deep squats. Is this possible? Should I continue training in the same way until the pain subsides or take some time off from training completely? Would squats without bending the knees as much prevent this?*

I suggest you stop doing leg extensions and leg curls (it is easy to overdo these exercises and put too much shearing stress on your knees) and temporarily but drastically reduce weight in squats.

Whether to squat deep or not is best decided on the basis of how it feels. Any exercise can be harmful if done too much or too often. Make sure you do not do more than your body can tolerate. Pain, feeling of joint instability, or other abnormal sensations during or after exercise are signs that either you do it wrong or you do too much.

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