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Most Effective Abdomen Exercises

by Thomas Kurz

Strengthening the abdomen is advised for preventing lower back injuries and prescribed in the course of treating such injuries. Some abdominal exercises, however, may be risky for people with a weak lower back, mainly due to the considerable tensing required of the hip flexors, which attach at the front of the lower back and inside pelvis. Tension of the hip flexors, if not balanced by equally strong back erectors, increases lumbar lordosis and puts shearing stress on the lower back.

Axler and McGill (1997) tested 12 abdominal exercises to identify the exercises that optimally strengthen the abdominal muscles (rectus abdominis, external oblique, internal oblique) with minimal loading of the lower back. Those 12 exercises were:

- Straight-leg sit-up
- Bent-leg sit-up
- Crunch with feet anchored
- Crunch with feet free
- Quarter sit-up
- Lying straight-leg raise

Lying bent-leg raise
 Dynamic cross-knee (twist) crunch
 Static cross-knee crunch (similar to a cross-knee or twisting crunch but placing the opposite hand on a knee and pushing against the knee for three seconds at the top of the crunch)

Hanging straight-leg raise
 Hanging bent-leg raise (on a Roman chair, body's weight supported on the forearms)

Isometric side support
 The exercises with low activity of the abdominal muscles and the worst ratios of abdominal activity to lower back loading were lying straight-leg raise, lying bent-leg raise, hanging bent-leg raise, and static cross-knee crunch. If your goal is to strengthen your abdomen, then these exercises are not recommended.

Sit-ups placed high stress on the lower back but also had high activity of abdominal muscles, mainly of the rectus abdominis, and are recommended if they do

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I Told You So... Hydrogenated and Partially Hydrogenated Fats

by Thomas Kurz

A California attorney sued to ban Oreos because of their disease-promoting trans fat content. (Trans fat or trans fatty acids are a product of hydrogenation or partial hydrogenation of oils and so are contained in hydrogenated or partially hydrogenated fats.)

Later, after generating public awareness of the vile content of these and other Kraft Foods products, he withdrew his suit. Subsequently, Kraft Foods announced that it will change the recipes of some of its prod-

ucts "to put healthier snacks in kids' lunchboxes and fight obesity."

The harmful effects of hydrogenation or partial hydrogenation of oils and of trans fats have been known to scientists for more than 20 years. These effects are: promotion of chronic inflammation, clogging arteries, impairing endurance—all the results of blocking the absorption of essential fatty acids. Now, the question some attorney should ask is, "What did Kraft Foods know and when did they know it?" Cigarette

makers have been successfully sued on behalf of the morons and shameless leeches who pretended to be ignorant of the effects of smoking and of the fact that cigarettes contain addictive nicotine. While every normal person for nearly a half century knew that nicotine is addictive, that tobacco contains it, and that smoking is not healthy, not all people know the chemistry and physiological effects of foods—especially if they do not know how these foods were made.

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not cause lower back pain. In Axler's and McGill's study sit-ups were done differently than I describe them (and do them)—namely, in the study subjects lying on the back raised their stiff, straight trunks to a vertical position and then lowered them back down to a mat. I start the sit-up by curling up my trunk and pressing my lower back to the floor, so the first one-third or so of the movement is just like a crunch. The purpose of pressing the lower back to the floor during the first and the last one-third of the sit-up movement and then keeping the lower back flexed until the trunk is nearly vertical is to prevent problems arising from arching the lower back while hip flexors pull on it.

The crunches, whether with the feet free or anchored, had the best ratio of abdominal muscle activity to compressive forces acting on the lower back, but not the greatest absolute values for activation of all the abdominal muscles. So, to develop strength of all the abdominal muscles, other exercises besides the crunches have to be done.

For a gradual increase of difficulty and to postpone loading of the lower back, your abdomen strengthening program may progress through a variety of crunches before including more challenging exercises. Willett et al (2001) tested four types of abdomen crunches—normal crunch, reverse crunch, twist crunch, and combined crunch. All these types of crunches done on the floor have similar effects on the upper rectus abdominis; a reverse crunch (pelvis and lower limbs are lifted off the floor) activates the lower rectus abdominis more than the upper rectus abdominis; and a combined crunch—combining a crunch with a reverse crunch, in which both the shoulders and the pelvis and lower limbs are simultaneously lifted off the floor, is most effective for activation of external oblique muscles. Contrary to common belief, the combined crunch activates external oblique muscles more than the twist crunch. Actually, EMG data shows that even the reverse crunch activates the external obliques more than the twist crunch (Willett et al 2001).

Crunches on movable surfaces—for example, on a Swiss ball—make both the

upper rectus abdominis, lower rectus abdominis, and external and internal obliques tense more than crunches on the floor, mainly due to the need to stabilize the trunk (Clark, Holt, and Sinyard 2003; Vera-Garcia, Grenier, and McGill 2000).

Doing crunches alone won't do if your sport requires sit-up-like movements. You will have to include sit-ups in your abdomen strengthening program. This specificity of training was revealed by the research of Baxter et al (2003), which compared the results of a maximal 2-minute sit-up test before and after a 6-week training program. One group of subjects did sit-ups, the second did crunches, and the third, control group, did no abdomen exercises. The sit-up group increased the number of sit-ups performed in 2 minutes and the crunch group did not. There was no significant difference in sit-up performance between the crunch group and the nontraining control group.

To do sit-ups safely in the long run, one has to have a strong lower back. This is because sit-ups activate the hip flexors, which either directly pull on the front of the lower back (psoas) or tilt the pelvis (iliacus) forward, indirectly increasing lumbar lordosis. Lower back problems are likely if these actions of the hip flexors are not counteracted by strong and fatigue-resistant lower back extensors.

All forms of sit-ups activate hip flexors more than the crunches. Specifically, in sit-ups the psoas tensed from 15% to 35% of its Maximal Voluntary Contraction (MVC), and in crunches the psoas tensed up to 10% of MVC (Juker et al 1998).

In sit-ups the hip flexors can be compensating for fatigued abdominal muscles, even though the sit-ups still look correct (Szasz et al 2002). When hip flexors do most of the sit-up work, they can get strained. Do not do so many sit-ups as to feel effort in front of your thighs, in front of your pelvis, and in your lower back.

The sit-up activates external obliques more than the crunch—regular crunch 28.71% of MVC, oblique (twist) crunch 36.2% of MVC, sit-up 56.51% of MVC. Of course, the most activity of external oblique muscles was in exercises specifically targeting them, for example, in side

bending (lying on one side, legs fixed, lift trunk) these muscles were nearly maximally activated—97.77% of MVC. In the lateral hip lift (body side-facing, supported on elbow and side of feet) 80.78% of MVC was reached (Konrad, Schmitz, and Denner 2001).

Double straight-leg lowering (with the posterior pelvic tilt) also activates abdominal muscles more than the crunch. In this exercise people display one of two patterns of muscle activity (Shields and Heiss 1997):

1. High activity of rectus abdominis and external oblique muscles and low activity of internal oblique muscles
2. Low activity of rectus abdominis and high activity of external oblique and of internal oblique muscles

The double straight-leg lowering is a good exercise if your lower back erectors and your hip flexors are both strong.

How about gizmos such as abdominal training devices? The range of motion for abdomen crunches done in gizmos such as the ABS Health Rider, AB Shaper, ABS T45, or AB Trainer is smaller than that for the normal crunches (Sands and McNeal 2002). The greater the range of flexion (flexion angle) in a crunch, the greater the activation of abdominal muscles (Andersson et al 1997).

Sternlicht and Rugg (2003) tested other devices (Ab Roller Plus, Torso Track 2, AB-Doer Pro, and Perfect Abs). Muscle activity as measured by EMG was either not significantly different than in a normal crunch (Ab Roller Plus and Torso Track 2 at high resistance) or even lower (AB-DOer Pro, Torso Track 2 at low resistance, and Perfect Abs at low resistance). Only Perfect Abs with medium and high resistance caused more activity in abdominal muscles than the normal crunch. Conclusion: Instead of buying and using strange gizmos it is better and more convenient to do normal crunches and when that is not challenging enough then hold a weight in one's hands and for even more muscle tension combine normal crunches with reverse crunches and put ankle weights on.

Besides dynamic exercises such as crunches, sit-ups, and leg raises, the abdomen may be strengthened with static, iso-

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metric exercises. Juker et al (1998) evaluated several isometric abdominal exercises for maximizing abdominal muscle activation while minimizing activity of the hip flexors. The best turned out to be a sideways balance position with support on the elbow and side of foot, with the body kept board straight (isometric side support). This exercise stresses mainly the external obliques.

The common-sense ways of finding which muscles work during an exercise are to a) touch and feel which are tensed during the movement; b) feel which are tired during or after the exercise; or c) feel which ones are sore after the exercise. To tell which form of an exercise (such as on the floor or on a Swiss ball) activates these muscles more, see which is harder to do—the more fatiguing the movement, the more tensed or activated are the muscles. Actions of muscles that are hard to palpate (the psoas, for example) can be detected by the tension of their easily accessible synergists, such as the rectus femoris, as was shown by McGill et al (1996). Those researchers found that activity of the rectus femoris in common hip flexion tasks can be used to estimate the activity of the psoas

muscle with an error of about 12%. In the case of the psoas, the tension of back erectors (its antagonists) can also indicate its activation.

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Tactics Outside Games and Contact Sports

by Thomas Kurz

What could be tactics in such sports as weightlifting or track-and-field jumps and throws? People who do not know those sports, believe that there are no tactics in them. But tactics are there and the right tactics may boost the athlete's confidence while at the same time mentally unbalancing his or her competitor, even mess them up physically. For example, during a weightlifting match a tactical decision by one weightlifter to skip attempts at a certain weight forces the other to rush his or her warm-up or cut short the preparation between attempts. These disruptions of an expected schedule affect the competitors both physically and mentally. Knowing oneself and knowing the competitors let the weightlifter decide which attempts to skip for the strongest effect.

A great example of a purely mental effect of tactics in track-and-field throws was

recounted to me by Matt Mizerski, national coach and technical director of the Canadian Amateur Boxing Association. Matt Mizerski knew both the involved athlete and his coach. Here is the story: Before the 1972 Olympics, the best Polish shot-putter, Wladyslaw Komar, was outclassed by the best foreign shot-putters. He could not grow any taller, or more massive or faster than he already was. Nevertheless, his coach, Janusz Koszycki, decided that with the right tactics there was a chance of winning the Olympic gold. His plan was to use against the competitors their knowledge of Komar's potential and patterns of performance. They expected him to start with some mid-range puts, to "warm up" during the contest, and then do his best—which they could likely beat. Koszycki's plan was to surprise them with outstanding performance in Komar's first try. Koszycki ex-

pected the others to get worried whether their first attempts can beat Komar's best shot, then tense up from worry and perform below their potential.

This plan required that Wladyslaw Komar's first put during Olympics was his truly very best—a personal record—so Koszycki had Komar practice for just one put. Wladyslaw Komar would come to the stadium, warm up very well, then enter the circle and do one shot put. Just one. No repeats, no "one-more" tries. Then he would cool down and go home. This is how his shot put workouts were.

The plan worked just like coach Koszycki expected. Wladyslaw Komar took gold with a 21.18 m put. His first put was his life-time best. It won the Olympics even though George Woods, the runner-up, could put 22.15 m during a workout.

Q and A on STRETCHING and TRAINING

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

■ ***You say to perform crunches with your lower back in contact with the floor. Others have said that the stomach must be flattened in order to activate the transverse abdominals (TVA). Now, I am able to do both. What is the rationale for either? If I try to do both, I tire very quickly and find that I need to re-flatten my back and activate TVA after each rep—does this matter?***

Nothing wrong with combining these two actions. You are not supposed to keep pressing your lower back to the floor all the time—only at the right time. You need to relax between reps. The rationale for pressing the lower back to the floor in crunches is a) that it is very difficult to do it otherwise, and b) to ensure that the move is done mainly by your abdominal muscles and with minimal involvement of your hip flexors. The rationale for flattening your abdomen is that this tenses up the transversus abdominis muscle.

■ ***Others have said that a normal crunch done on the floor is very ineffective as the range of motion is too small and so they advocate doing them on a Swiss ball with a “prestretch” of the abs over the ball in order to maximize the range of motion. What is your opinion on this?***

All in good time. Rush too far too soon and you will be sorry. Start with normal crunches. By the way, in crunches on the Swiss ball the tension of abdominal muscles is greater than in crunches on the floor due mainly to the need to stabilize the trunk and less to the prestretch.

■ ***Still others say that if you are going to perform crunches at all, perform them as “Janda” crunches, where a training partner pulls back on the ankles, allowing the performer to contract the hamstring/glute area and so by the Law of Reciprocal Inhibition, relax the hip flexors thereby reducing the stress on the lower back and more effectively isolating the abdominals. What are your thoughts on this?***

Interesting but has anyone checked this with an electromyograph (EMG) or something like it? (And why do it in crunches, which activate the hip flexors the least among the dynamic exercises for abdomen muscles?) Whatever the result, I wouldn't do it because holding the legs is a waste of my or my partner's time.

■ ***Having had surgery to repair an epigastric hernia 7 years ago, I have not been able to do any abdominal work since. I can get away with up to 70 sit-ups on alternate days for 3 weeks, but then my abdominals seize up for up to 3 months of pain: the hernia repair patch and internal scar tissue seems to cause the problem. Prior to surgery, I'd done 200 sit-ups every night. Can you recommend any exercise that I can use to indirectly yet effectively work and regain lost flexibility in my flabby and weak midsection? Is it worth considering buying one of those electric ab training devices which promise a six pack?***

A skilled massage therapist can break adhesions between scarred muscles and make internal scars more pliable so they do not re-tear the muscle fibers around them.

Do not bother with EMS (electrical muscle stimulation) devices. For the EMS to cause a training effect, it has to zap the muscles real hard—so they tense at least as hard as when they move. Electric ab belts do not generate such shocks—the general public is not ready for the sensation of strong cramps seizing their abs and making them do a hip-hop or a St. Vitus dance. In these belts the shocks make the muscles twitch lightly, well below the force needed for strengthening, but enough to deceive the gullible.

You can strengthen your abs with isometrics—holding positions that force your abs to tense hard without making you move. Examples: assume a push-up position, keep your body straight; assume a sideways balance position with support on your elbow and side of your foot, keep your body straight; lie on your back, hold your shoulders off the floor; sit or lie on your back and hold your legs above the floor.

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