Scientific Breakthrough: Spot Reduction

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A Plethora of Solutions

Bodybuilders know that trophies are won based on the details. When the judges are tallying up the score sheets deciding which of the contestants with 20” arms is walking away with the hardware, the difference usually lies in striations versus separation. Put two guys of equal size side-by-side, and the leaner one should always win.

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Often, there’s one little spot of fat that’s really bothersome. People are frequently made to feel as though they suffer from some latent psychosis if they comment on a tiny bit of fat around the belly button or just under the gluteal crease (butt cheek).1 Certainly, there are individuals who are overly fixated on minor or nonexistent deposits of fat and track down gym personnel to pinch the spot with calipers more often than Lady Macbeth washed her hands as she droned on, “Out damned spot! Out, I say!”2

A plethora of solutions promising spot reduction have been offered to consumers, ranging from potions and unguents to vibrating belts, to subdermal injections, to surgical liposculpture.3-5 Though the surgical techniques are highly effective (and expensive) and mesotherapy is gaining support as practitioners gain experience and expertise, the nonmedical approaches have generally been disappointing. Several sprays and creams have claimed success in limited clinical trials, but most of these products have been debunked by consumer advocates or in the court of public opinion.6

Studies on Subcutaneous Fat

A new study accepted for publication by the American Journal of Physiology— Endocrinology and Metabolism presents evidence that exercise may offer local benefit in fat loss.7 That’s right. Pumping up the biceps may shred the overlying fat as it’s stimulating the muscle to grow…kinda. Some studies and reports have suggested that weight training may cause quicker fat loss from the overlying area or at least create a leaner appearance, while others refute the claim, though the research is very limited and most of it is dated. For example, two studies performed in the 1960s had subjects exercise one arm for a period of time and measured the change in skinfold thickness, comparing the exercised arm to the control arm of each individual. One study demonstrated a significant decrease in subcutaneous fat (the kind you can pinch) over the exercised arm only, while the other study showed a significant decrease in subcutaneous fat over both arms.8,9

The findings of the second study reporting fat loss over both arms is more consistent with observations made in athletes who emphasize one-sided movements.9 A more recent study, published in 1971 (yes, that was sarcasm) measured skinfold thickness of the arms of tennis players and control subjects (nonathletes).10 Though tennis players tend to develop the muscles of their dominant arm and shoulder due to the (typically) one-handed grip on the racket, there was no difference in skinfold thickness between the dominant and non-dominant arms. Tennis players were significantly leaner than the control subjects, but that was to be expected.10

Another study including 10 women had the subjects exercise one leg only for five weeks. Though the exercised leg demonstrated a slight decrease in subcutaneous fat thickness and the control leg that did no exercise showed a slight gain in subcutaneous fat, the differences were not significant, possibly due to the small number of people in the study.11

A Leg Up

Given the contradictory findings and lack of recent investigations, the submission of a well-designed study by a group of Danish scientists from the University of Copenhagen, Denmark, is a welcome addition to the literature.

This group took a step back and designed an experiment to prove that during exercise, more fat is released from fat cells overlying the exercising muscles than other (sedentary) areas. They endeavored to prove that there’s an increase in the breakdown and release of stored fat and greater blood flow to disperse the newly freed fatty acids over the quadriceps of an exercised leg as compared to the opposite leg, which was not exercised. Needle-like catheters were inserted into both legs to measure the blood flow and breakdown of stored fat in the subcutaneous fat overlying the exercised or sedentary quadriceps muscles. Another catheter was inserted into an artery of the arm to measure epinephrine (adrenalin) and insulin, the two hormones most affecting fat storage and release, as well as comparing general (whole body) stored fat breakdown to the breakdown occurring over the muscles. Finally, a mask was placed over the mouth and nose that could measure the relative amount of effort (work) being performed.

The 10 subjects, all healthy young men, fasted overnight and avoided smoking or any beverages that might affect the results (alcohol, caffeine, nicotine) for 12 hours prior to exercise. At this point, the experiment began using an exercise protocol completely unlike the weight training used to build muscle, limiting the applicability of the findings for a strength athlete. The subjects performed three hours of leg extensions (with two breaks of 30 minutes each) at varying intensities,

to see what effect the exercise had on the overlying adipose tissue. One aspect of the study design that seemed a bit flawed was that one leg was exercised at two different intensities during the session for one hour total, while the other was exercised at only one intensity, but for two hours total. One would assume that the ongoing exercise in the opposite legs would keep the general (whole body) sympathetic tone (adrenalin levels) and lipolysis (fat breakdown) elevated, making it more difficult to detect local differences as the study progressed.

Regardless, the researchers detected some notable differences between the exercised leg and the sedentary leg. A greater blood flow was noted in the fat tissue overlying the exercised leg at the lower two intensities. Surprisingly, the highest intensity (85 percent Wmax [maximum work capacity]) failed to show any difference, possibly due to the interfering factors present in the opposite leg, which had recently completed 120 minutes of knee extensions at 55 percent Wmax. A more ideal study design would have used three different groups and compared the different intensities over the same amount of time. One of the factors determining local blood flow is heat generation, as the body adapts to overheating by allowing more blood to flow through the skin and underlying fat tissue. It’s possible that while 30 minutes may have been sufficient recovery time after a 30-minute, 25 percent Wmax session, it doesn’t appear to have been enough after the 120-minute, 55 percent Wmax session.

Shredded Glutes & Striated Quads

With all three exercise sessions, whole-body stored fat release increased, but only during the higher two intensity sessions did the amount of fat released from the fat cells overlying the working muscle exceed the rate of whole-body fat release. The amount of fat released from the fat cells overlying the exercised quadriceps was higher for the 25 percent and 85 percent Wmax sessions, which were both 30 minutes long and were performed by the same leg. Interestingly, the 55 percent Wmax session showed no difference between the exercising or resting leg. Again, this may be due to a flaw in the exercise protocol or it may be due to the longer duration of exercise (120 minutes).

Blood (plasma) insulin levels dropped during the two higher intensity sessions, likely due to the utilization of blood sugar (glucose) for energy, whereas the lower intensity session didn’t affect blood sugar levels, possibly due to the light load and short duration. Plasma epinephrine (adrenalin) only increased during the final, high-intensity session. This may be a reflection of low blood sugar (due to prolonged fasting and exercise) and the need to recruit more muscle fibers to generate the force demanded by the researchers.12

This study was interesting because it looked at an issue that had been ignored for several decades. If a “spot reducing” effect of exercise is present, it would offer bodybuilders the hope that they might train their way to shredded glutes and striated quads. Indeed, the study demonstrated that the two identified components relating to local fat loss— increased blood flow and increased release of stored fat— are present over the exercising quadriceps, but not consistently.

The researchers discussed the various ways that the body might induce greater fat loss and blood flow in the fat tissue

overlying exercising muscle. The need to increase heat loss is one factor possibly accounting for the increase in blood flow, as was the increase in sympathetic tone (adrenalin) needed to release stored energy and recruit muscle fibers at the highest intensity. Another component recently covered in MD, was the release of the lipolytic cytokine interleukin-6 (IL-6) from the contracting muscle.13 IL-6 is a signaling chemical that participates in inflammation and the immune system’s response to viruses and bacteria, but also plays a role in reducing body fat.14

It’s unclear whether increasing stored fat release from the fat cells immediately overlying exercising muscle has any performance advantage, as the fat released doesn’t travel to the muscle directly; rather it empties into the general circulation. It appears that this phenomenon is more an example of metabolic spillover rather than any designed function of the body. It’s the metabolic equivalent of neighboring diners singing “Happy Birthday” to you at the restaurant, even though they don’t know your name nor will they bring you any presents.

The most important point made in this study was voiced at the beginning of the discussion, in which the researchers attempt to place their findings in perspective. Even though this study demonstrated “spot lipolysis,” it’s unlikely that these findings would lead to “spot reduction” of any measurable degree.7 First, it’s likely that any net fat lost from spot lipolysis would be fully replenished unless the athlete is on a hypocaloric diet. Secondly, the amount of extra fat lost from the exercised leg as compared to the resting leg was approximately 1-2 milligrams for every 100 grams of fat. In other words, it made 0.001 percent difference.7 If you can see that difference, you’re looking very, very, very closely and probably making everyone in the locker room nervous. Lastly, the exercise program used to induce this extremely minor difference wasn’t suitable for athletes who were seeking to increase strength or muscle mass.

Summing Up

The Danish researchers, using an elaborate and sophisticated study design, demonstrated fairly conclusively that while a measurable amount of spot lipolysis may occur during prolonged exercise, it’s unlikely to result in any appreciable difference over the course of time. So, unless you feel that your symmetry is suffering because your right quad is only 99.999 percent as ripped as your left quad, there’s little value in using weight training to attempt spot reduction.

For those of you who are trying to lose fat in general, exercise remains one of the keystones to success and may be of greatest benefit in reducing visceral fat (inside the abdomen), which is closely related to cardiovascular disease and Metabolic Syndrome.15 Exercise doesn’t offer the silver bullet of spot reduction, but it offers more recreational, social and health benefits than any other activity. For now, liposculpture appears to be the only practical solution for spot reduction of bothersome spots of fat.

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