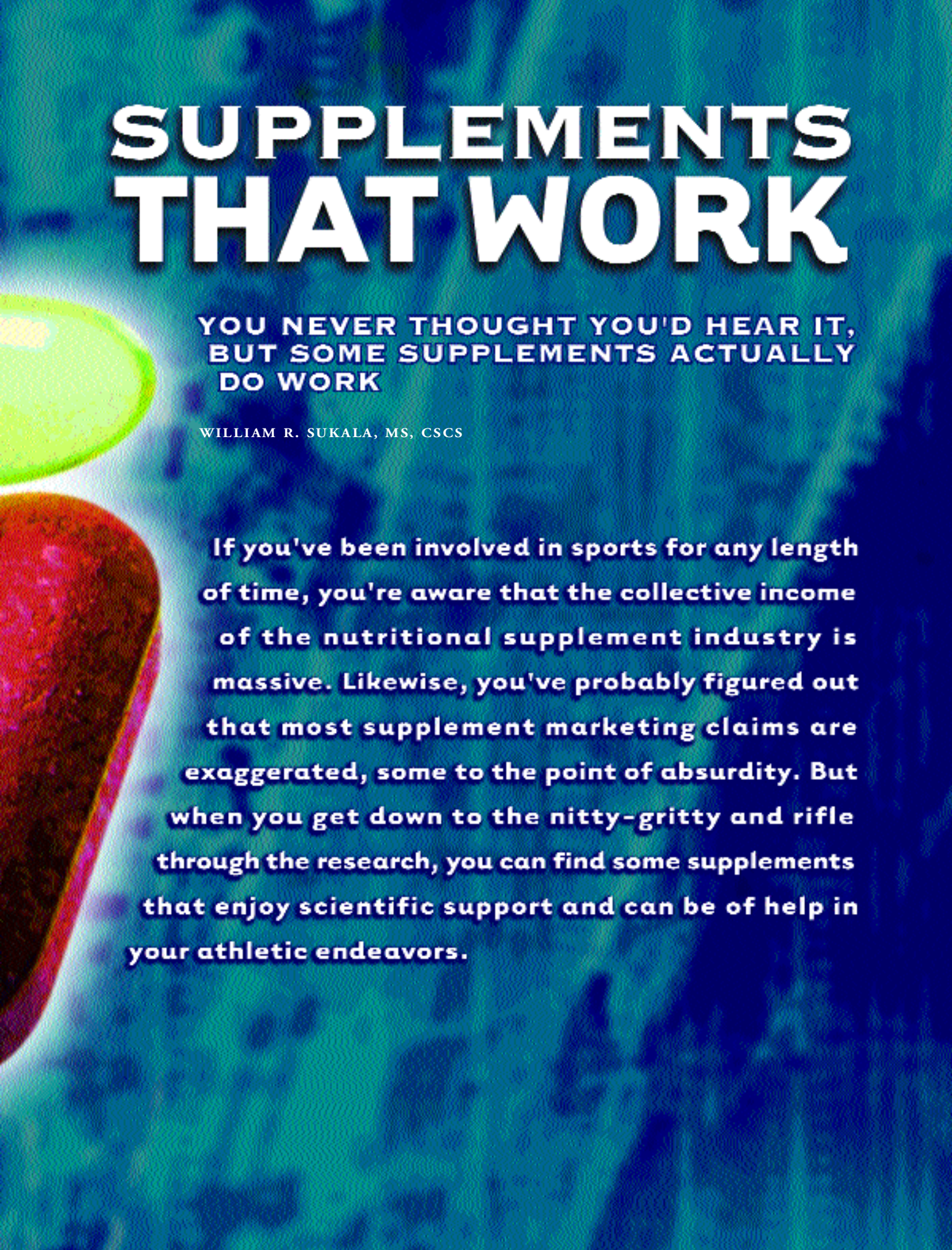

SUPPLEMENTS THAT WORK

YOU NEVER THOUGHT YOU'D HEAR IT, BUT SOME SUPPLEMENTS ACTUALLY DO WORK

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If you've been involved in sports for any length of time, you're aware that the collective income of the nutritional supplement industry is massive. Likewise, you've probably figured out that most supplement marketing claims are exaggerated, some to the point of absurdity. But when you get down to the nitty-gritty and rifle through the research, you can find some supplements that enjoy scientific support and can be of help in your athletic endeavors.

DETECTIVE WORK

I had no idea what I was getting myself into when I accepted this writing assignment. The topic seemed simple enough: supplements that work, with ìworkî being defined as supplements with scientific merit. I figured that with the hundreds of products on the market, this should be easy. But I was overlooking the many issues involved: there are few studies on strength and power athletes, more research is needed, experimental conditions donít apply to athletic situations, or, worse yet, the supplement is banned by the International Olympic Committee (IOC).

Many of you may buy products thinking, "Well, I'll just do my own research and see if it works for me." But this isn't science: it's guesswork and it doesn't prove a thing. At the end of the day, there's a chance that anything and everything could be ergogenic. A lot of substances out there show promise, and many of them actually have supportive research behind them. So now you're wondering why a product like pyruvate isn't on my list if, in fact, it has scientific support. But in order to be included in this article, not only must a product have scientific support, but those studies should be applicable to you — the athlete. For example, pyruvate's positive effect on body composition and endurance was demonstrated on morbidly obese women and untrained college students, respectively. But you need to know if the research has at least a shred of applicability to you, the highly trained athlete. So my list of supplements that work has been compiled with a fit and athletic person in mind, based on research that applies to you and that extends beyond some biochemical markers in a test tube. I'm talking about real-life situations.

UP TO SNUFF

Creatine

Creatine is a compound synthesized from amino acids in the liver and kidneys and stored as creatine phosphate in the muscles.[8] During high-intensity, short-duration exercise (<10 seconds) like lifting and sprinting, adenosine triphosphate (ATP) is rapidly broken down to adenosine diphosphate

(ADP). In order to sustain muscle contraction, ATP stores must remain elevated. Creatine serves this purpose by quickly donating its phosphate to ADP, which regenerates ATP and provides for muscle contraction to continue.

There's a mountain of creatine research out there, but it wasn't until the last decade or so that athletes started paying attention to this supplement's scientific merit. Variability in the success or failure of creatine in augmenting exercise capacity may be due to differences in methods, training level of subjects, amount of creatine used, exercise mode, or the statistical measures employed. But for the most part, literature reviews have shown that 20 to 30 grams per day taken over five days adequately increases muscle creatine stores. Improvements have generally been observed in repeated bouts of high-intensity exercise, particularly those with short rest intervals between bouts.[2, 9]

New research underscores these findings. A study out of McMaster University in Hamilton, Ontario,

Canada, tested the effects of 20 grams of creatine over four days on men and women.[15] The researchers measured peak power during two 30-second sprint cycling bouts and maximal voluntary torque (force generated around a joint) during dorsiflexion (pointing your toes up). Both women and men augmented their peak power and maximum voluntary torque with no observable differences between sexes.

Romer and colleagues at the University of Birmingham in England had competitive squash players take 20 to 23 grams of creatine per day for five days and then perform 10 sets of high intensity "ghosting" drills to simulate game play.[14] They were given 30-second rest intervals between bouts. Then, after a four-week washout period, the players performed the same protocol without creatine. The creatine-treated subjects were able to perform the drills 3 percent faster than under placebo conditions. The most significant differences were noted in sets 2 through 10, which suggests that creatine provided more stamina during the later bouts.

In another study, elite female soccer players took 20 grams of creatine per day for six days, followed by five 11-minute testing blocks.[4] Each block consisted of a series of all-out sprints, agility runs, and a precision ball-kicking drill, separated by 20-minute active recovery intervals. Subjects on creatine gained approximately two pounds more weight than those on a placebo. Even so, treatment subjects scored faster times in both repeated sprint and agility tasks, though they showed no observable difference in shooting accuracy.

Findings by Yquel and colleagues at UniversitÈ Victor Segalen in Bordeaux, France, shed light on the mechanisms by which creatine improves performance.[20] Nine healthy men took 20 grams of creatine per day for six days. The researchers measured maximal plantar flexor (pointing your toes away from you) muscle power output and blood chemistry indices of creatine metabolism. Subjects performed a series of plantar flexion exercise bouts with 30-second rest intervals for the first five bouts, and then one- and two-minute rests for the last two bouts, respectively. Muscle power output increased by 5 percent after creatine supplementation compared to when the subjects were taking a placebo. The researchers also found higher blood phosphocreatine concentration, lower inorganic phosphate accumulation, and a higher pH. In simple English, this means creatine efficiently took up the extra phosphate in the blood, allowing it to "recharge" itself for later exercise bouts. Furthermore, a higher pH means a lower blood acid level. Acidic blood can interfere with muscle contraction and cause early fatigue.

These are but a few studies showing that creatine can be ergogenic. However, consumer caution is still warranted. In a review of a large number of studies, about 33 percent of subjects showed no benefits from creatine. These subjects are typically referred to as nonresponders, and you should be aware that you could fall into that category. Also, there are many different forms of creatine available, such as powders, liquids, tablets. No research to date has found any difference among them in terms of benefits.

Sodium Bicarbonate

Sodium bicarbonate is nothing more than basic baking soda. High-intensity exercise causes the accumulation of lactic acid, which can impair muscle contraction and lead to early fatigue. Taking sodium bicarbonate makes the blood more alkaline, which, in turn, buffers the lactic acid and helps maintain a favorable metabolic environment. The usual dosages in most research have been around 300 milligrams per kilogram of body weight (about 25 grams for a 185-pound person) diluted in a liter of water.[19]

A few studies out of the University of Bath in England demonstrated positive results from bicarbonate supplementation. In one random, double-blind investigation, 10 well-trained cyclists performed three 1-hour bouts of high-intensity cycling under each of three conditions: no intervention (control), placebo, and with 20 grams of bicarbonate per day.[11] The researchers observed higher blood bicarbonate levels in experimental group, which were consistent with lower blood lactic acid levels (higher blood pH). The subjects taking bicarbonate also performed more overall

work than their control and placebo counterparts.

Another study evaluated the effects of chronic bicarbonate supplementation on 60 seconds of high-intensity cycling.[10] Seven subjects performed an initial exercise bout without supplementation and then ingested 35 grams of bicarbonate per day over five days, followed by a second bout for comparison. After bicarbonate loading, the athletes had higher peak power values along with higher blood bicarbonate and pH levels (less blood acid).

In 2001, the same researchers compared the effects of acute versus chronic bicarbonate supplementation on anaerobic work and power output.[12] Eight men performed three all-out 90-second exercise bouts on a cycle ergometer under each of three conditions: no intervention (control), 40 grams of bicarbonate taken one time, and 40 grams per day over six days. Consistent with previous findings, subjects were able to do more work with bicarbonate loading than without. Furthermore, the authors concluded that chronic supplementation was superior to a single dose.

While bicarbonate loading appears to be an effective sports ergogenic, there are some words of warning to heed. Mel Williams, PhD, professor in the Department of Exercise Science, Physical Education, and Recreation at Old Dominion University in Virginia, cautions, "Sodium bicarbonate may cause gastrointestinal distress in some individuals [i.e., explosive diarrhea] which might not be conducive to optimal performance."

Caffeine

Caffeine is generally accepted by the scientific community to be an effective ergogenic aid. But the exact mechanisms responsible for the improvements are not clearly understood. A few theories have been posited.[19] Caffeine is a central nervous system (CNS) stimulant. It promotes epinephrine secretion, which, along with CNS

stimulation, may improve cardiovascular function. Itís also been suggested that an increase in fat utilization spares valuable muscle glycogen, but this theory remains in question. Caffeine also promotes the release of calcium from storage sites, signaling more effective and efficient muscle contraction. But you want to know the bottom line: is caffeine going to help you move more weight?

Many studies have shown caffeine to exert a positive effect on endurance exercise. However, scant and conflicting data exist on its impact on strength and power. In one study, 250 milligrams of caffeine increased subjectsí maximal anaerobic power over the placebo group during short bursts of high-intensity cycling.[1] Other high-intensity cycling studies have shown no improvement in peak power or total work completed.[3, 18] Similarly, a recent study found no significant influence of caffeine on repeated 20-meter sprints.[13]

So what does all this mean to you? Instead of looking at each individual "tree," we need to step back to get a full, panoramic view of the entire research "forest." Comprehensive reviews of the scientific literature put the whole mess into perspective.[6, 7] Caffeine may help an athlete train for longer and at higher intensities. This has been observed in exercise lasting as little as 60 seconds and as long as two hours. There's little information on caffeine's influence on strength training. Drinking coffee doesn't appear to elicit the same effects as isolated caffeine tablets.[6] Most importantly, positive results from laboratory studies may not fully translate into improved training and competition performances. So more field research is needed to corroborate such findings.[7]

The take-home message is this: caffeine is an ergogenic aid and there's scientific support to prove it, but most of it applies to endurance athletes. This doesnít eliminate it from the running, per se, but it does mean more research needs to be done on caffeine and the strength and power athlete. According to caffeine researcher Terry Graham, PhD, at the University of Guelph, Ontario, Canada, "The research leads me to believe that

caffeine doesn't increase maximum strength, but does increase the ability to withstand fatigue. That is, one could do more lifts at a given submaximal effort." And it's legal; the IOC allows for up to 12 micrograms of caffeine per milliliter of urine. To give you an idea of the caffeine content of common beverages, a six-ounce cup of coffee typically contains 100 to 150 milligrams, while a can of cola has about 40. Drinking more than 8 cups of coffee or 16 cans of cola could send you over the legal limit. This can vary, however, depending on your body weight, gender, body water levels, and how soon before a competition you ingest caffeine.[19]

Carbohydrate

Open up any basic exercise physiology textbook and it won't take you long to learn that carbohydrate is the powerhouse nutrient needed for intermittent, high-intensity, anaerobic exercise. And pumping iron fits that description to a T. Train for a few hours on an empty stomach and youíll get first-hand proof. Carbs are the preferred fuel source for the central nervous system. "Hitting the wall" impairs your overall coordination and causes premature fatigue at exercise intensities you can normally handle. So how does carbohydrate improve performance?

An extensive review of carbohydrate and its impact on short-duration, intense exercise highlighted some key observations.[16] Literature on the beneficial effects of carbohydrate in resistance training is speculative. At the present time, it appears that more research is needed on carbohydrate consumption during weight training and its effects on performance. End of story? Not quite. Carbs may or may not help you in the weight room, but supportive evidence is emerging with regard to high-intensity, intermittent exerciseói.e., football, basketball, soccer, ice hockey, tennis. Carbohydrate drinks consumed during repeated one-minute cycling bouts to failure resulted in longer times to fatigue as well as lower

overall perceptions of fatigue.[5]

Welsh and colleagues at the University of South Carolina conducted a more real-life study. They evaluated the effects of a carbohydrate-electrolyte drink on intermittent, high-intensity exercise similar to those situations found in competitive sports (i.e., basketball or soccer).[17] Physically active subjects completed four 15-minute "quarters," including a 20-minute half-time rest phase. Each quarter was composed of a combination of shuttle runs to fatigue, 20-meter maximal sprints, 10-rep max vertical jumps, motor skills tests, and a profile of mood states. Athletes consumed a carbohydrate-electrolyte solution before testing, at half-time, and after each quarter. Supplemented participants had 37 percent longer run times to fatigue, faster 20-meter sprint times during the last quarter, improved motor skills, and decreased perceptions of fatigue compared to when they took a placebo.

The bottom line is that you should first meet your overall dietary calorie needs, with 55 percent or more of those calories coming from carbohydrate. High-intensity, exhaustive exercise has been shown to deplete muscle glycogen (stored carbohydrate) stores, which can lead to early fatigue and compromised coordination. Thus, carbohydrate supplementation helps maintain blood glucose, which spares valuable muscle glycogen, allowing you to maintain your energy late in the game.

THE REAL DEAL

The supplements mentioned in this article aren't sexy. Science isn't sexy and it certainly doesn't sell well. But when you view the thousands of commercially available supplements through the critical lens of science, only a small handful will make the cut as true performance enhancers. In all fairness, other compounds with scientific merit will come along. Some of them may be on shelves now, but thereís not enough evidence to justify sweeping claims about their efficacy.

With regard to creatine, caffeine, and bicarbonate, Williams warns, "They should only be taken in recommended dosages, as they can all cause health problems if taken in excess." And even if every single supplement on the market worked, the operative word is "supplement," not "substitute" for hard training and healthy eating habits.

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