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# Pills, Powders & Potions

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**M**any of your athletes (and other students) will be tempted to use a wide variety of supplements in an attempt to improve their appearance, muscle mass, strength and/or sports performance.

The most popular supplements are vitamins and minerals, protein powder/shakes, amino acids, and creatine. But a plethora of other pills, powders and potions are also available to them.

## THE RESEARCH SAYS

Supplements are the topic of major conversation in fitness centers, physique magazines, and web forums. And there's no shortage of gym "gurus," at-home chemists, and Internet "experts" who are all too eager to offer advice. Of course, anecdotal reports are one thing and scientific studies are another.

Let's take a look at what the research says about the perceived

benefits and safety of some popular supplements.

## BORON

Athletes have used boron in the belief that it would increase their muscular size and strength. A study cited by the supplement industry showed that boron increased the concentration of serum testosterone as much as 300%. What the promoters didn't mention was that the subjects were postmenopausal women whose testosterone levels were quite low. In fact, the women hadn't received adequate boron intake for the previous 119 days prior to the supplementation.

In a study that involved 19 male bodybuilders, the researchers concluded that boron supplementation had little effect on total testosterone, lean-body mass, and muscular strength.

In general, low doses of boron are safe. But high intakes may cause loss of appetite, nausea, vomiting, and diarrhea.

## CAFFEINE

Perhaps the most widely used drug in the world is caffeine. It's a stimulant of the central nervous system and a component of tea, coffee, chocolate, and soft drinks as well as pills to lose weight and combat drowsiness.

Numerous laboratory studies have shown that caffeine improves performance in cycling and running for durations of roughly 5 - 20 minutes. But studies done outside a laboratory have found mixed results. At this time, for example, it doesn't appear that caffeine improves sprint performance (inside or outside a laboratory).

When consumed in low doses, caffeine doesn't pose any serious risks; in high doses, it has the potential for many side effects such as anxiety, jitters, tremors, inability to focus, gastrointestinal distress, diarrhea, insomnia, irritability, and "withdrawal headaches."

Since caffeine is a potent diuretic – which increases the production of urine – it can increase the risk of

dehydration. This is a major concern during physical activity, especially in a hot, humid environment.

### **CHROMIUM**

An essential mineral, chromium plays a role in the metabolism of carbohydrates and fat and helps maintain blood-glucose levels. It's believed that chromium decreases body fat and increases muscle mass but there's little scientific evidence to support this.

In a study that involved 95 healthy subjects, for example, a group that received chromium didn't significantly reduce body fat more than a group that received a placebo.

One study did find that chromium increases muscle mass. In that study, however, muscle mass was estimated from anthropometric measurements, which can be unreliable. And it appears as if chromium doesn't increase muscular strength, either. In one study, a group that received a placebo actually increased their strength more than a group that received chromium.

Interestingly, the researchers also found that the subjects who received chromium had urinary chromium losses that were *nine times greater* than the subjects who were given the placebo.

### **CLENBUTEROL**

This veterinary drug is used illegally to increase muscle mass in show animals such as cattle, pigs, and sheep. Because of its proven effects in animals, clenbuterol has been marketed to those who are trying to achieve the same success. However, there's no evidence that the drug increases muscle mass in humans.

In 1990, 135 people were hospitalized in Spain for eating beef liver that contained residues of clenbuterol. Their symptoms included a rapid heart rate, muscle tremors, headaches, dizziness, nausea, fever, chills and insomnia.

In one study, researchers analyzed

telephone calls that were placed over a nine-year period to the anti-poison center in Marseilles, France. Of the 51 cases that had to do with the use of doping substances, 14 involved clenbuterol. Remember, these were calls to an anti-poison center.

Clenbuterol is a banned substance that isn't legally available in the United States. As recently as the 2004 Summer Olympics in Athens, two Eastern European athletes were sent packing after their drug tests showed traces of clenbuterol.

### **DEHYDROEPIANDROSTERONE**

Since it's a precursor to steroids, dehydroepiandrosterone (DHEA) is believed to increase the production of testosterone, but this hasn't been proven by research.

In one study, subjects who received a 50-milligram dose of DHEA didn't increase their levels of testosterone. In another study, subjects who received 150 milligrams of DHEA per day didn't improve their body composition or muscular strength.

Since DHEA is a precursor to steroids, it's no surprise that it has the potential for similar side effects. There are reports of hair loss, growth of facial hair and voice deepening in women, as well the appearance of female-like breasts in men (which isn't reversible).

DHEA may also increase the risk of off uterine and prostate cancer. Understand that this or any other steroid precursor could cause an athlete to fail a test for steroids.

DHEA is available over the counter; it's not subject to government regulation. It has, therefore, the potential for inaccurate dosage and impurities. Independent testing of 16 DHEA products found that only eight (50%) contained the exact amount of DHEA that was stated on the labels, and the actual levels varied *as much as 150%*. Amazingly, three (18.75%) of the 16 products didn't contain any DHEA whatsoever.

### **EPHEDRA**

An herbal form of the powerful stimulant ephedrine, ephedra (or ma huang) is marketed as a weight-loss aid. Ephedra is often used with caffeine and aspirin – sometimes referred to as an "ECA Stack" – to optimize its fat-burning and stimulant effects.

This combination is found in many "energy" drinks and weight-loss products. Some athletes consume these concoctions prior to a workout to get "instant energy." But this practice can have dire consequences since ephedra increases the heart rate and blood pressure.

Needless to say, it isn't a good idea to artificially elevate the heart rate and blood pressure and then do some type of physical training which elevates them even more.

Other side effects include insomnia, anxiety, palpitations, jitteriness, and irritability. More importantly, at least 100 deaths are associated with the use of ephedra-containing products. Dietary supplements that contain ephedra have been banned in the United States since April 2004.

### **GAMMA HYDROXYBUTYRIC ACID**

Yet another illegal substance is gamma hydroxybutyric acid (GHB). Promoters claim that GHB stimulates the production of human growth hormone and, thus, produces an increase in muscle mass and a loss of weight. GHB is also known as "liquid ecstasy" and, because of its sedative powers, is used as a "date-rape" drug.

When consumed in low doses, GHB can cause drowsiness, dizziness, nausea, and visual disturbances; in high doses, it can cause unconsciousness, seizures, slowed rate and depth of breathing, and comas. In 2000, nearly 2,500 were hospitalized due to overdoses of GHB. And since 1995, more than 70 people have died after taking GHB.

## HUMAN GROWTH HORMONE

It's thought that human growth hormone (HGH) stimulates protein synthesis. As a result, HGH has attracted some attention from the athletic community.

It is a prescription drug. Over-the-counter products are available, but they're precursors of HGH and there's no evidence that these precursors are effective at improving muscle mass.

One study that's often cited by the supplement industry uses prescription HGH. The study found that HMB increases lean-body mass and decreases body fat . . . in men who were more than 60 years old. There have been very few studies of HGH on younger individuals.

Since no legitimate studies have been published on over-the-counter HGH, its safety and efficacy are unknown. Prescription HGH has the potential for several side effects including glucose intolerance and insulin resistance as well as cardiovascular conditions.

## HYDROXYL METHYLBUTYRATE

A relative newcomer to the supplement ranks is hydroxyl methylbutyrate (HMB). It's a metabolite of leucine (a branched-chain amino acid).

HMB has been promoted as a supplement that increases strength and lean-body mass, supposedly by preventing the breakdown of muscle tissue. This, however, has no scientific proof.

One study did support the theory that HMB may prevent muscle damage. But the study didn't examine whether or not HMB increased strength and lean-body mass.

In a study that did look at this aspect, subjects who received HMB increased their upper-body strength more than subjects who received a placebo, but the same wasn't true for their lower-body strength. Also of note is that a supplement company sponsored the study.

Research on HMB has found minimal performance enhancement in untrained individuals and almost none in trained individuals. In a study that involved 26 collegiate football players, HMB didn't produce any performance benefits. It appears as if HMB is safe when taken for eight weeks or less.

## NITRIC OXIDE

Another relative newcomer is nitric oxide, which has been promoted by the supplement industry as a performance-enhancing substance. Previously, nitric oxide was best known as an air pollutant (formed when nitrogen burns such as in automobile emissions). Nitric oxide is actually a gas, though not to be confused with nitrous oxide or "laughing gas."

In the body, nitric oxide has numerous functions. For one thing, it signals the body to dilate blood vessels, thereby increasing blood flow. In addition, nitric oxide is an important neurotransmitter that relays messages between nerve cells.

Be that as it may, this doesn't mean that there's any benefit to taking nitric oxide as a supplement. At the present time, no scientific research has shown that nitric oxide improves physical performance.

## RIBOSE

The breakdown of Adenosine Triphosphate (ATP) is the primary – and immediate – source of energy that's used to perform muscular work. Since a limited amount of ATP can be stored, it must be resynthesized (or rebuilt) over and over again. In the body, ribose is a sugar that helps to resynthesize ATP. In theory, then, ribose supplements could increase the levels of ATP and improve performance.

One study showed that there was no significant difference between ribose and a placebo in peak power, average power, and percent decrease in power during 30 seconds of all-out

sprinting on a stationary bicycle.

The fact of the matter is that the vast majority of research hasn't found any significant enhancement of performance from ribose.

## SODIUM BICARBONATE

Also known as "baking soda," sodium bicarbonate has a wide range of applications such as treating acid indigestion, whitening teeth, and absorbing odors in refrigerators. But it's also been touted as an agent that delays the onset of fatigue.

A great deal of research has shown that sodium bicarbonate improves performance. In one eight-week study, a group that consumed sodium bicarbonate before each session of interval training had significantly greater improvements in lactate threshold and endurance than a group that consumed a placebo.

Now for the bad news: Likely side effects from sodium bicarbonate include gastrointestinal disturbances such as nausea, vomiting, diarrhea, and flatulence. Sodium citrate is thought to have the same benefits as sodium bicarbonate without the side effects. But in one study, eight of nine subjects (elite athletes) who received sodium citrate experienced gastrointestinal distress.

## THE LAST REP

Coaches must be aware of the many supplements that might be used by their athletes. This is no small task since new supplements come and go like the soup of the day.

As you can see, most supplements offer more hype than hope.

Remember, your athletes are prime targets for modern-day snake oil salesmen who peddle pills, powders and potions. ■

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