Performance-enhancing drugs: Dangerous, damaging and potentially deadly

Most young athletes can attest to the fact that the competitive drive to win — and win at all costs — is fierce. Besides the glory of bragging rights and the satisfaction of personal gain, often times young athletes compete in the pursuit of greater dreams — a medal for their country, a college scholarship or a place on a professional team.

For a growing number of athletes, winning at all costs includes taking performance-enhancing drugs. Some may appear to achieve physical gains from such drugs, but at what cost? The truth is, the long-term effects of these drugs haven't been rigorously studied. And short-term benefits are tempered by many drawbacks.

Take the time to learn about the benefits, risks and many unknowns regarding purported performance-enhancing drugs. You may decide that the benefits aren't worth the risks.

Exercise physiology: The basics

In most amateur and professional sports, the athletes who win are those with the greatest strength, speed or endurance. Each sport requires specific skills, such as the ability to kick a ball a certain way or hit a home run. Doing so with not just excellent but instead extraordinary strength, speed or endurance marks the difference between a good player and an elite player.

Sheer strength is determined by two factors: amount of muscle and the ability of nerves to stimulate muscle contraction. Some elite athletes perform special exercises specific to their sports to improve the neural stimulation of their muscles, and many do weight training to build more muscle. Some, especially professional athletes, also take hormones, supplements and man-made (synthetic) drugs to induce their body to build even more muscle.

The amount of muscle and the ability of your nerves to stimulate muscle contractions also play a big role in determining your speed. A larger muscle mass allows you to generate more power, which helps you perform short bursts of activity — a track sprint or short swim race — faster.

Can performance-enhancing drugs and supplements improve your performance? Here's what the research says.

Anabolic steroids

Some athletes take a form of steroids — known as anabolic steroids — to increase their muscle mass and strength. The main anabolic steroid hormone produced by your body is testosterone.

Testosterone has two main effects on your body:

Anabolic effects promote muscle building.
Androgenic effects are responsible for male traits, such as facial hair and a deeper voice.

The anabolic steroids that athletes use are synthetic modifications of testosterone. These drugs were developed in an attempt to maximize the anabolic effects and minimize the androgenic effects of testosterone. As it turns out, these two actions of testosterone can't be separated.

Given by pill, injection or topical treatment, these hormones have many medical uses. Some of these include replacement therapy for men deficient in testosterone, helping people with AIDS maintain muscle mass and reduce muscle wasting, and treating rare types of anemia.

Why are these drugs so appealing to athletes? Besides making muscles bigger, anabolic steroids may help athletes recover from a hard workout more quickly by reducing the amount of muscle damage that occurs during the session. In addition, some athletes may like the aggressive feelings they get when they take the drugs.

However, many athletes take anabolic steroids at doses that are much higher than those prescribed for medical reasons. The effects of taking anabolic steroids at very high doses haven't been well studied.

Anabolic steroids come with serious side effects.

Men may develop:

Prominent breasts
Baldness
Shrunken testicles
A higher voice
Infertility

Women may develop:

A deeper voice
An enlarged clitoris
Increased body hair
Baldness
Increased appetite

Both men and women might experience:

- Severe acne
- Liver abnormalities and tumors
- Increased low-density lipoprotein (LDL) cholesterol (the "bad" cholesterol)
- Decreased high-density lipoprotein (HDL) cholesterol (the "good" cholesterol)
- Aggressive behaviors, rage or violence
- Psychiatric disorders, such as depression
- Drug dependence

If an injected form is used, you'll face a higher risk of infections and diseases that are transmitted in blood, such as HIV and hepatitis. And in teens, steroids can halt their normal pattern of growth and development and put them at risk of future health problems.

Anabolic steroids aren't legal substances, unless your doctor has prescribed them for medical reasons. Taking anabolic steroids to enhance athletic performance, besides being prohibited by most sports organizations, is illegal.

One anabolic steroid receivng a lot of attention is tetrahydrogestrinone (THG). Until recently, THG was marketed as a dietary supplement for enhancing athletic performance. However, researchers have found that THG is actually a chemically altered version of an anabolic steroid that is banned by most sports organizations. THG is referred to as a "designer" steroid because it's undetectable by traditional steroid testing techniques. A new laboratory test, however, now makes its detection possible. The Food and Drug Administration (FDA) warns that athletes taking THG may be putting their health at risk — THG is an unapproved new drug and little is known about its safety.

Other common anabolic steroids include dehydrochlormethyltestosterone (Turinabol), metandienone (Dianabol), methyltestosterone (Android), nandrolone (Durabolin), oxandrolone (Oxandrin), oxymetholone (Anadrol) and stanozolol (Winstrol).

Androstenedione

Androstenedione (andro) is a hormone produced by the adrenal glands, ovaries and testes. It's a precursor hormone that's normally converted to testosterone and estradiol in both men and women.

Manufacturers of synthetic androstenedione, through vigorous marketing efforts, have claimed that their products increase your body's production of testosterone. According to proponents of andro supplements, an elevated level of testosterone allows athletes to train harder and recover more quickly.

Scientific studies that refute these claims are now emerging. In fact, these studies show that supplemental androstenedione doesn't increase testosterone and that your muscles don't get stronger with andro use.

On Oct. 22, 2004, the Anabolic Steroid Control Act of 2004 classified andro as a controlled substance, adding it to the list of banned anabolic steroids and making its use as a performance-enhancing drug illegal.

Side effects of andro differ for men and women. In men it can actually decrease the production of testosterone while increasing the production of estrogen. Side effects in men include acne, diminished sperm production, shrinking of the testicles and enlargement of the breasts. In women, side effects include acne and masculinization, such as deepening of the voice and male-pattern baldness. Andro might also stunt your child's growth.

In men and women, supplemental androstenedione can decrease high-density lipoprotein (HDL) cholesterol (the "good" cholesterol). Lower HDL levels put you at greater risk of heart attack and stroke.

Creatine

Creatine monohydrate is a compound produced by your body that helps release energy in your muscles. Creatine is a naturally occurring compound — you can ingest creatine from protein-rich foods such as meat or fish, or you can take a nutritional supplement. Supplements are available over the counter.

Unlike androstenedione, scientific research indicates that creatine may have some benefit — it can produce small gains in short-term bursts of power.

"Most of the research points to small improvements in short-term power activities like improving maximum-weight bench press or increasing speed during cycling sprints of very short duration," says Edward Laskowski, M.D., a physical medicine and rehabilitation specialist at Mayo Clinic, Rochester, Minn., and co-director of Mayo Clinic's Sports Medicine Center. "Some studies have shown an increase in lean muscle mass with creatine. As a result, we've got a lot of press on creatine producing steroid-like results without the side effects."

Creatine helps muscles make and circulate more adenosine triphosphate (ATP). ATP is used for quick, explosive bursts of activity, as in weightlifting or sprinting. Creatine also reduces energy waste products — such as lactic acid — that can cause muscle fatigue. As a result, creatine is purported to enhance performance and decrease fatigue. But there's no evidence that creatine enhances performance in aerobic or endurance sports.

Your liver produces about 2 grams of creatine each day. You can also get creatine from the meat in your diet. Creatine is stored in your muscles, and levels are relatively easily maintained. Because your kidneys remove excess creatine, the value of supplements to someone who already has a high muscle creatine content is questionable.

Possible side effects of creatine that can decrease athletic performance include:

Stomach cramps
Muscle cramps
Nausea
Vomiting
Diarrhea

Weight gain is a known side effect of creatine — one that is sought after by athletes who need to increase their size. But with prolonged creatine use, weight gain is more likely the result of water retention than an increase in muscle tissue. Water is drawn into your muscle tissue, away from other parts of your body. This puts you at risk of dehydration.

High-dose creatine use may potentially damage your:

Kidneys
Liver
Heart

It's unknown what kind of effect taking creatine has over the long term, especially on teens or younger children. Dosage levels vary widely, depending on which product you use and how much creatine you take.

Since creatine isn't regulated by the Food and Drug Administration (FDA), you can't be sure of the purity of creatine supplements you buy on the market. Studies have found varying mixtures of creatine in different creatine products. And some of the inactive ingredients mixed in with the creatine may cause significant side effects, such as allergic reactions.

The bottom line is that the safety of taking creatine is questionable. Most studies involving creatine use examine the performance-enhancing aspects, and side effects are generally reported only anecdotally.

Stimulants

Stimulants are drugs that can reduce fatigue, suppress appetite, and increase alertness and aggressiveness. They stimulate the central nervous system, increasing your heart rate, blood pressure, body temperature and metabolism.

The most common stimulants include caffeine and amphetamines (Dexedrine, Benzedrine). Cold remedies often contain the stimulants ephedrine, pseudoephedrine hydrochloride (Sudafed) and phenylpropanolamine (Acutrim). Street drugs such as cocaine and methamphetamine also belong to this group.

Although stimulants can boost physical performance and promote aggressiveness on the field, they have side effects that can impair athletic performance. Nervousness and irritability make it hard to concentrate on the game, and insomnia can prevent an athlete

from getting needed sleep. Athletes may become psychologically addicted or develop a tolerance so that they need greater amounts to achieve the desired effect.

Other side effects include:

- Heart palpitations
- Heart rhythm abnormalities
- Weight loss
- Mild hypertension
- Hallucinations
- Convulsions
- Brain hemorrhage
- Heart attack and other circulatory problems

Diuretics

Diuretics are drugs that function to change your body's natural balance of fluids and salts (electrolytes) and can lead to dehydration. This loss of water may allow an athlete to compete in a lighter weight class, which many athletes prefer. Diuretics also help athletes pass drug tests by diluting their urine.

Diuretics are commonly used to treat high blood pressure and conditions that cause fluid retention (edema), such as congestive heart failure. When taken in small amounts, they have relatively few side effects, although electrolyte disturbances can occur.

When taken at the higher doses preferred by some athletes, however, the adverse effects may be significant.

Using diuretics to achieve weight loss may cause:

- Muscle cramps
- Exhaustion
- Decreased ability to regulate body temperature
- Potassium deficiency
- Heart arrhythmias

Some of the most common diuretics include acetazolamide (Diamox, Storzolamide), benzthiazide (Marazide, Aquastat), spironolactone (Aldactone), dichlorphenamide (Daranide) and furosemide (Lasix, Fumide).

Gaining the competitive edge

Athletic performance has more to do with skill and hard work than popping a pill or downing a super-drink, according to Dr. Laskowski. Concern is growing that young athletes will emulate sports figures who use substances of questionable value in a bid to gain a competitive edge.

"There's a danger that kids or young adults will think: 'If I want to be like that, I'll need to take something,'" says Dr. Laskowski. "There's a tendency to look for an external agent as a magic bullet, a magic pill that's going to help us perform. The truth is there isn't any."

By Mayo Clinic Staff

December 22, 2004