

Sports Shorts

GUIDELINES FOR PHYSICIANS

Performance Enhancing Substances

A performance enhancing substance (PES) is any substance taken in non-pharmacologic doses specifically for the purpose of improving sports performance. This includes substances taken in supratherapeutic doses or without therapeutic indication, those taken for weight gain or weight loss, those used to increase oxygen carrying capacity, and any agent used to mask detection of, or minimize, the side effects of another PES. Examples include anabolic androgenic steroids (AAS), steroid precursors or prohormones, human growth hormone (hGH), creatine, stimulants such as ephedrine and caffeine, erythropoietin (EPO), diuretics, laxatives and nutritional supplements. This article will focus on the more commonly used substances in the pediatric population.

Epidemiology

Boys are 2-3 times more likely to use PES than girls and those that use alcohol, tobacco and other illicit drugs are also more likely to use PES. PES use is more common in athletes than in non-athletes, especially those involved in sports that rely mostly on strength, power and speed. However an estimated 30-40% of adolescents that use PES do not participate in a school sport, but instead take them to improve their physical appearance and self-esteem. Usually these substances are acquired from a physician, health food stores, at the gym, or the Internet.

Prevalence rates vary somewhat from study to study but in general show:

Anabolic Adnrogenic Steroids	Creatine or other protein supplement
4-6% of adolescent boys	11-35% of adolescent boys
1-3% of adolescent girls	30-40% of college athlete
1.5% of junior high students	

Nutritional Supplements

Up to 58% of high school athletes; Up to 88% of college athletes

AAS and Steroid precursors

AAS are synthetic testosterone derivatives taken orally, transdermally, or by injection that have anabolic and anti-catabolic, as well as emotional effects, which promote muscle building. They are classified as schedule 3 controlled substances. AAS have been shown to increase strength and lean body mass through muscle hypertrophy as well as the formation of new muscle fibers. They also have numerous adverse effects which involve nearly every body system (see table at right). Steroid precursors or prohormones are testosterone precursors taken in an attempt to increase testosterone levels and achieve effects similar to AAS. Studies have shown that they do neither. They do, however, have many of the same side effects as AAS.

Stimulants

The stimulants most commonly used as PES are ephedrine and caffeine. Ephedrine is the active ingredient of the herb ephedra, which was banned by the FDA in 2004 after being linked to numerous deaths. Ephedrine, however, is still accessible in over-the-counter cold medicines. These substances work as PES by increasing heart rate, contractility and blood pressure, increasing central nervous system stimulation and decreasing the perception of exertion during activity. Caffeine, especially, has been shown to increase performance in endurance sports although its influence on shorter bursts of activity is less conclusive and it may even impair functioning at higher doses. Stimulants can produce numerous adverse effects including arrhythmias, diuresis, increased core body temperature, tremors, anxiety and seizures.

Nutritional Supplements

The term nutritional supplement generally refers to substances such as protein/amino acid preparations, trace elements, vitamins, minerals and herbal preparations. Creatine, a complex, non-essential amino acid, is the most popular supplement used as a PES. It is thought to increase muscle mass and strength, shorten recovery times during workouts and increase training load overall. It does appear to improve strength and performance in short-duration, anaerobic events but has little effect on endurance activities. Also, up to 30% of people seem to be "non-responders" to creatine, likely because they have already maximized creatine stores in the body through dietary

Side effects of Anabolic Androgenic Steroids (AAS)

Cardiovascular

- Increased LDL
- Decreased HDL
- Thrombus formation
- Coronary vasospasm
- Hypertension

Hepatic

- Elevated LFTs
- Cholestasis
- Hepatocellular adenomas

Reproductive/Endocrine

Males

- Testicular atrophy
- Decrease spermatogenesis
- Gynecomastia
- High pitched voice

Females

- Amenorrhea
- Breast tissue atrophy
- Deepened voice
- Clitoromegaly
- Hirsutism

Infectious

- Soft tissue & muscular abscesses
- HIV/Hepatitis risk

Musculoskeletal

- Increased likelihood of tendon rupture
- Physical arrest

Dermatologic

- Severe acne
- Striae
- Premature balding

Psychiatric

- Mood swings
- Hypomania
- Mania
- Depression
- Decreased libido
- Aggression
- Addiction
- Withdrawal

intake. Commonly reported side effects include weight gain through water retention, muscle cramps, diarrhea and rarely impaired renal function. The larger problem with nutritional supplements is that they are not regulated by the FDA. This means that manufacturers do not have to prove the safety or efficacy of their products. Multiple studies have shown that stated ingredients are often missing or present at levels much higher than what has been reported on the label. Also, steroids and stimulants have been shown to be present in up to 25% of nutritional supplements.

Prevention

Drug testing is widely used as a deterrent at the collegiate, professional and amateur elite levels of sports but is more problematic in the school-aged population because of time constraints, high cost, and a relatively low yield of positive tests which occurs for a variety of reasons. On the other hand, education, in the form of interactive classroom and training activities led by coaches and peer leaders that teach kids about the side effects of PES and ways to reject offers to use them, have been shown to decrease the reported use of these substances.

Other tips for physicians in dealing with the use of PES

- Encourage discussion of PES during yearly pre-participation exams.
- Be honest – Acknowledge that some PES do work, but emphasize that many of these gains are incremental improvements that may help elite athletes much more than the typical school-aged athlete.
- Discuss the side effects that are most likely to have an immediate impact on the adolescent's appearance or performance.
- Screen for use of other substances (alcohol, tobacco, illicit drugs).
- Describe alternative ways to improve performance - nutrition or utilizing a certified strength and conditioning coach.