

# PEDIATRIC EDUCATION ARTICLE ON

## PERFORMANCE ENHANCING SUBSTANCES

**Performance enhancing substances or ergogenic substances** are supplements or drugs used to enhance athletic performance. They are widely used because of the desire to be strong, look better, improve overall performance and because of peer pressure. They are commonly classified as metabolic stimulants (e.g. Ephedra) or anabolic agents (e.g. anabolic-androgenic steroids, prohormones, protein supplements and creatine).

Few if any medical research studies with these substances have been performed on children or adolescents. What little research is available was done almost exclusively in adult populations. Nutritional supplements are not regulated, controlled, or have any oversight by the FDA or other government agencies. Therefore, a supplement may or may not have the labeled substances in it and the amounts listed may or may not be accurate.

When counseling adolescents it helps to emphasize the current or near future effects. For example, for anabolic-androgenic steroids emphasize the decreased tendon strength (i.e. risk for rupture) and the irreversibility of gynecomastia and virilization rather than the malignant risk. Emphasis on what adolescents can do, such as proper strengthening and conditioning along with eating a well-balanced diet including extra calories, extra carbohydrates during workouts, and extra protein after workouts may be helpful.

### **Learning Point**

Some of the common performance enhancing substances are listed below.

#### **Creatine**

- Action: amino acid compound synthesized in skeletal muscle that facilitates regeneration of ATP needed for muscle contraction
- Proposed effects: delays workout fatigue, promotes weight gain, improves performance for sports needing short bursts of energy (e.g. weight lifting, sprinting, etc.)
- Medical research: increases workout capacity for certain short burst energy sports, increases weight mainly through water retention, improves physiologic response to resistance training, does not improve endurance
- Potential side effects: muscle and stomach cramps, nausea and diarrhea, dehydration, renal overload with rare case reports of renal failure
- Legal: Not banned by sports governing organizations, but the National Collegiate Athletic Association prohibits distribution at training facilities

#### **Protein supplements**

- Action: increases dietary protein intake
- Proposed effects: increase lean muscle mass, strength and power, promotes weight gain

- Medical research: does not build muscle strength or mass by itself, requires increased calorie and carbohydrate intake for strength and muscle mass increases, weight gain varies depending on the athlete's routine diet
- Potential side effects: antedoctal reports of renal problems
- Legal: not banned by sports governing organizations

### Prohormones

- Names: Androstenedione and DHEA
- Action: hormone precursors to testosterone
- Proposed effects: increases strength, improves performance and builds muscle
- Medical research: in moderate doses does not increase testosterone, in high doses may increase testosterone, not proven to increase strength, muscle mass or performance
- Potential side effects: same as anabolic-androgenic steroids, increased estrogen effect and therefore may increase hormone-sensitive malignancies
- Legal: Androstenedione is banned by sports governing organizations and is a controlled substance by the Federal Drug Administration (FDA). DHEA is available as a nutritional supplement and therefore is not regulated.

### Anabolic-androgenic steroids

- Action: increases protein synthesis, enhanced development of male secondary sex characteristics. All anabolic steroids are also androgenic.
- Proposed effects: increases strength, improves performance and builds muscle
- Medical research: increases muscle mass and strength at high doses, does not increase endurance, not proven to improve performance
- Potential side effects:
  - Cardiovascular: cardiomyopathy, hypertension, lipid profile changes (decreased HDL, increased LDL)
  - Endocrine/reproductive: gynecomastia in males (irreversible), precocious puberty, testicular atrophy, virilization in females (irreversible)
  - Gastrointestinal: liver enzyme elevation, jaundice, possible malignancy
  - Musculoskeletal: premature closure of growth plates, decreased tendon strength
  - Psychological/behavioral - **these problems can last up to one year after the steroids are stopped**: mood swings, aggressive behavior ("roid rage") depression and/or suicide, psychosis, addiction/dependence and strong correlation with other drug use
- Legal: banned by sports governing organizations, are controlled substances by the FDA

### Ephedra

- Herbal name: ma huang
- Action: sympathomimetic which acts on alpha and beta adrenergic receptors
- Proposed effects: burns fat, increases energy, decreases appetite, delays workout fatigue and improves performance and concentration

- Medical research: burns fat when combined with high-doses of caffeine. It may delay fatigue but this is not proven.
- Potential side effects (which can be potentiated with caffeine): include heart attack, hypertension, stroke, seizure, sudden death and heat stroke
- Legal: banned by sports governing associations, and banned by the FDA