Background

For decades, athletes—both male and female—have looked to obtain an edge in competition by increasing circulating anabolic steroid compounds. Testosterone is a naturally occurring anabolic and androgenic steroid hormone that is only legally available by prescription for male patients with hypogonadism (low production of hormones by the sex organs). Testosterone enters cell nuclei and “turns on” genes that promote growth, which in turn increase muscle mass and strength. The dietary supplement industry has long tried to increase circulating testosterone levels with the use of testosterone precursors such as androstenedione (Andro; an anabolic steroid, not a dietary supplement) or dehydroepiandrosterone (DHEA), testosterone “boosters” such as tribulus (puncturevine caltrop), and aromatase inhibitors (which reduce estrogen production) such as chrysin and androstene TRione. Many of these compounds have fallen into and out of favor over a period of months or years, depending on sales. The myriad products in this category stem from the complex process of steroidogenesis—the process whereby steroids are generated in the body from cholesterol—which involves numerous stages and chemical products. This monograph discusses only those products that can be purchased over the counter and does not include any drug that requires a prescription, such androstenedione or other such anabolic steroids.

Athletes used to take Andro and DHEA under the theory that, as with many chemical pathways, increasing the substrate will ultimately increase the product. This is not always the case. Although DHEA is still an over-the-counter product, it has been banned by the World Anti-Doping Agency.

Dose Range and Upper Limit

Food and Nutrition Board DRI:

RDA/AI: Not relevant for these substances.

Upper Limit: Not relevant for these substances.

Doses Used in Randomized Clinical Trials: DHEA doses have ranged from 25 mg up to 2.25 grams per day (in a study involving patients with HIV). However, doses of 200 mg/day or more of DHEA can often cause adverse effects (see Other Health Risks below). Aromatase inhibitors are abundant; at the date of publication one of the most popular, chrysin, was studied in doses of up to 625 mg daily without adverse effects in a small study of healthy young men. There are no data on NOAEL/LOAEL (no observed adverse effect level/lowest observed adverse effect level) for the majority of the “ergogenic” aromatase inhibitors.

Tribulus, a botanical and purported indirect testosterone “booster” that is a top-seller at the time of writing, has been dosed in three different studies from 250-750 mg per day. There is no known LOAEL.

Diindolylmethane (DIM), a plant component found in cruciferous vegetables (e.g., cabbage, broccoli, and cauliflower), is purported to enhance “healthy estrogen metabolism” and is found in a typical diet in amounts from two to 24 mg/day. Typical DIM products are marketed at doses from 100-400 mg/day, but no clinical studies are available for typical dosage. There is no reported NOAEL/LOAEL for humans.

Toxicology Data: No data found. However, there have been rare case reports of mania with as little as 50 mg/day of DHEA.
Evaluation of Potential Benefits

Although multiple studies have been done on testosterone precursors, “boosters,” and aromatase inhibitors, no studies definitively support claims that their use increases circulating testosterone levels in men or support their use as ergogenic (performance-enhancing) agents.5,12-16

Potential Deterimental Effects on...

Military Performance: Any supplement that increases testosterone levels could, in theory, increase risk for cardiovascular disease and liver disease and cause aggression, depression, and psychosis.5,17,18

Military Survivability: The concerns for increased risk of cardiovascular disease, liver disease, and steroid psychosis are of importance for all Warfighters, particularly those in a war zone.5,17,18

Other Health Risks

Possible effects include cardiomyopathy; increased LDL and decreased HDL, cholesterol; increased platelet aggregation; increased blood pressure; gynecomastia (male development of large mammary glands); acne; hair loss; hirsutism (excess body hair) in females; cholesterol (a liver disorder); liver cancer; fatty liver; testicular atrophy; erectile dysfunction; prostrate disease; breast atrophy (females); virilization in females; menstrual changes; aggression, anxiety, psychosis (“roid rage”), and depression.5,17,18

Interactions with Medications or Other Bioactive Substances

No conclusive data exist; however, supplements that could increase anabolic, androgenic steroid levels may affect other steroids and sex-hormone-binding globulin (SHBG). In women, estrogens (e.g., in hormonal contraceptives) increase SHBG levels, while androgens decrease SHBG levels.20 Women on hormonal therapies such as contraception should use other hormonal supplements with increased caution. Other potential interactions include:

DHEA: Insulin might lower the effectiveness of these supplements. Caution should be used when taking triazolam (Halcion), as DHEA can increase plasma triazolam concentrations. Soy also may decrease the effectiveness of DHEA.5

Chrysin could theoretically add to the effects of other aromatase inhibitors if taken together.

Tribulus: Taking with diabetes medications may cause blood sugar to get too low.21

Withdrawal Effects

There is some evidence that anabolic compounds will create a dependent state.1

Concern and Benefit Estimate (see Dietary Supplement Risk Matrix)

Benefit potential: Low

Risk (safety concern): Moderate (over-the-counter substances only)

Classification score: 11

There is no convincing evidence that testosterone precursors/boosters or anabolic compounds can enhance performance or increase testosterone levels. Possible adverse effects are numerous.

References