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Testosterone Booster Recommendation Report



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Abstract

This article reviews approximately 25-40 (depending on how you count, some are the same thing just different names) purported testosterone/ anabolic supplements. A discussion, conclusion, and recommendation is given on each one. The information used to make conclusions and recommendations come from peer reviewed journals and other expert advice. It is important to note that not all articles are equal in validity. In other words, for every one of these supplements there is most likely some Russian/Chinese/Asian etc. study supporting its ergogenic effects. The material used in this article came from more authoritative and trustworthy sources.

Tribulus terrestris

Tribulus terrestris (also known as puncture weed/vine or caltrops) is a plant extract that has been suggested to stimulate leutinizing hormone (LH) which stimulates the natural production of testosterone. Consequently, Tribulus has been marketed as a supplement that can increase testosterone and promote greater gains in strength and muscle mass during training. Several recent studies have indicated that Tribulus supplementation appears to have no effects on body composition or strength during training.

Active Ingredient: Protodioscin

Protodioscin is steroidal saponin that is found in significant concentrations in tribulus terrestris.

Saponin

Saponins are a type of glycosides that comes from mainly plants but also some types of organisms. Saponins are further broken down into other categories, basically (strongly oversimplifying) it is a type of sugar attached to either a type of steroid or a type of triterpenoid—which is a large class of other organic chemicals made of isoprene units. As mentioned protodioscin is the former type of saponin.

Claims

Tribulus terrestris marketed at increasing libido and hormone levels, (testosterone, DHEA and estrogen). Tribulus supposedly is able to increase the amount of luteinizing hormone which is responsible for the production of testosterone. Thus the theory, if we increase A we can increase B. Some of these claims originate with a study conducted in Bulgaria in 1981. It was observed that when tribulus terrestris containing high concentrations of the saponin protodioscin was administered to men (“who were part of infertile couples”) with low testosterone and low luteinizing hormone, the extract elevated circulating testosterone and luteinizing hormone.

Effectiveness

However, the way these studies were designed fall short of scientific standards. The few well controlled studies report no benefit. Some of these studies found that tribulus did not increase testosterone in young men. Another study (22 athletes, five weeks, 450mg/day) failed to show any benefit. Again in another study in resistance training (dosage at 300mg±25/day) showed no anabolic benefit. In fact the only statistical difference found, was that the group taking tribulus improved less in endurance tests than did the placebo group.

Aphrodisiac Properties

In animals it can enhance sexual behavior by stimulating androgen receptors in the brain. It also has shown to produce proerectile effects in isolated tissues in several animals. This latter effect appears to be due to the release of nitric oxide from the nerve endings innervating the corpus cavernosum penis. However, evidence of its effectiveness in humans is poorly supported and is very controversial.

Safety

According to the few and not reputable studies, there appears to be no significant adverse effects. Tribulus is toxic to sheep, however. Also the plant that this ingredient comes from contains some toxic poisons (alkaloids, etc) I don't know if there is a possibility that if there purification process is not sufficient there could be trace amounts of toxins in the supplement.

Conclusion

The researchers of an extensive review article (the first paragraph) concluded—that same as I did—that Tribulus supplementation appears to have no effects on body composition or strength training.

Recommendation

I don't feel its inclusion is sufficiently justified; however, if it will increase sells and perhaps give an effective placebo effect, then I don't think there is sufficient negative side effects that would deter one from adding it in the mixture.

D-Aspartic Acid and N-Methyl D-aspartic acid

The first part is from a review which is well cited, interesting and very informative.

“The coming explosion of media coverage and undoubtedly dietary supplements is inspired by a study published in the journal *Reproductive Biology and Endocrinology*.⁴² In this study, performed by scientists and physicians in Italy, the role and mechanisms of DAA relating to testosterone and LH in humans and rats was evaluated and reported. To sum the study's finding in the briefest and most relevant manner: DAA was found to accumulate in the pituitary and testes (in rats); in humans, DAA increased circulating (blood) LH by 33 percent ($p < 0.0001$) and testosterone concentration by 42 percent ($p < 0.0082$) on average, in men aged 27-37 years, after taking slightly more than 3 grams a day, orally.

Consider that closely; taking a flat teaspoon full of an amino acid (DAA) daily increased testosterone about 40 percent on average in healthy men who were at their peak of natural testosterone production. This was not castrated rats, elderly men, post-menopausal women, or men suffering from low testosterone. This was not a vaguely-defined herbal extract, steroidal prohormone, or dietary ingredient that only works if there is a deficiency.

DAA did not elevate testosterone at the cost of pituitary suppression; in fact, it increased pituitary stimulation of the testes, while directly stimulating the testes, offering a two-pathway effect. The effect

was seen in the human subjects, as well as the rats, and has been reported in reptiles and birds, suggesting it is a highly-preserved pathway along the eons old time-trail of evolution/adaptation.⁴³⁻⁴⁵

It is also critical to note that no adverse effects were noted in the human or animal trials. These results followed just 12 days of DAA use; however, testosterone concentration began to return to baseline value just three days after DAA treatment stopped.⁴² *[The human study used a blended product combining DAA with specific B-vitamins, but the rat data was based upon DAA consumption only and was equally impressive.]*

...

As noted earlier, the existence of D- forms of amino acids has been known for many, many decades. As living organisms use only the L- form of amino acids to meet structural (e.g., muscle tissue) or functional (e.g., enzymes) needs, and the inclusion of D- forms of amino acids in the diet was learned to be detrimental to growth, D- form amino acids were little considered.³¹⁻³³ However, as analytic methods became more fine, it was discovered that D-amino acids were present in certain locations and tissue types. Some areas accumulated D-amino acids as a result of aging changes; others seem to generate free D-amino acids, suggesting certain D-amino acids may have a functional role— similar to neurotransmitters, hormones, or secondary messengers.

The potential for D-amino acids to act as neurotransmitters is not difficult to accept. Many neurotransmitters are derivatives of amino acids, such as dopamine and serotonin which arise from tyrosine and tryptophan respectively.⁴⁶ Another amino acid which is a neurotransmitter is glutamic acid; the flavor-enhancer MSG is glutamate (the salt form of glutamic acid), and sensitive individuals can suffer debilitating headaches if they consume MSG.

The practice of using MSG or glutamic acid-rich seaweed extract in Asian cooking caused MSG-induced headaches to be known as *Chinese Restaurant Syndrome* many years ago.⁴⁷ Interestingly, a synthetic (lab-created) amino acid called N-methyl-D-aspartate (NMDA), was found to activate only a specific subset of glutamate receptors in the brain. NMDA is so potent at stimulating the NMDA-sensitive nerves that it over-excites them and the nerve dies. A very valuable trait in the lab, but toxic in high concentration to living organisms— which is why NMDA is classified as an excitotoxin.

Of course, NMDA-sensitive nerves exist for a purpose, and certain mental health conditions appear to be associated with an under stimulation of these (NMDA-sensitive) nerves, such as the condition schizophrenia.⁴⁸ Even more interesting for those so inclined to gain a broad awareness, D-serine (another D-form amino acid) acts to enhance activity of the NMDA-subtype of the glutamate receptor.⁴⁹ This rambles a bit, but it shows that not only are amino acids either directly or indirectly used as neurotransmitters, but D-forms of certain amino acids have an endogenous role in central nervous system (brain) function.

DAA has been found to be present in, and accumulate in following peripheral injection or ingestion, both white and grey matter of the brain. White matter refers to cells that insulate and protect the nerve cells that actually produce thought or respond to the environment. Grey cells are nerve cells.

The same group that published the DAA testosterone paper also has another peer-reviewed paper accepted, showing that DAA supplementation improved learning and memory in rats; it also showed untreated rats who were better learners had higher concentrations of DAA in the hippocampus (a region of the brain).⁵⁰

More relevant to those interested in the testosterone-associated pathways, research published in 2007 showed DAA is present in nerve endings and is released when the nerve is stimulated, confirming its function as a neurotransmitter.⁴⁴ DAA stimulation increases cyclic AMP (cAMP) in the “receiving” nerves. In the neuroendocrine axis (the hypothalamus and pituitary), DAA enhances the release of GnRH (the hormone that tells the pituitary that testosterone concentration is falling), as well as the production of two other hormones, oxytocin and vasopressin.^{37,44}

At the pituitary, DAA stimulates the secretion of three hormones: LH (testosterone-related), prolactin (promotes milk production in nursing mothers, sexual gratification, and in excess can impair libido and erectile function), and GH (growth hormone).^{37,44} Unfortunately, the Italian study did not measure changes in prolactin or GH/IGF-1 concentrations in the human subjects. Bodybuilders, athletes and anti-aging advocates, particularly those prone to gynecomastia or suffering from erectile dysfunction, may wish to delay using a DAA-based product until data relating to potential increases in prolactin are available.

The function of DAA is not solely as a neurotransmitter, though its effectiveness and oral bioavailability alone makes this intriguing. It also appears to have function at the testes directly, acting as a paracrine-hormone (a chemical that communicates with nearby cells). In rat testes, DAA has been shown to increase testosterone release (more than doubling testosterone synthesis), by increasing the concentration of cAMP, a secondary messenger that stimulates cell response to hormones.⁴²

DAA holds the potential to be an effective testosterone booster, available as a dietary supplement. It appears to satisfy the criteria to be considered a DSHEA-eligible candidate, being an endogenous bio-molecule, and present in common food products.³³

DAA accumulates in tissues involved in sex steroid production (hypothalamus, pituitary, and testes); sites where enzymes involved in DAA production and clearance are present. Its activity has been demonstrated in numerous biological models, including human subjects, to increase circulating testosterone and LH concentration. It has been shown in tissue cultures to increase secondary messengers involved in testosterone synthesis or regulation. Its testosterone-boosting properties are not suppressive to the hypothalamic-pituitary axis, supporting rather than suppressing normal reproductive function. It may even aid in sperm maturation.

If no adverse effects are noted with DAA use, who could benefit? Seemingly, most adult men may benefit from DAA supplementation. In addition to the positive effects of increasing testosterone production, possibly enhancing physical and sexual performance, DAA supplementation may aid in learning and memory. Even anabolic steroid-using athletes could possibly benefit from DAA supplementation, as it may reduce the suppressive effect of anabolic steroids on natural testosterone production, and/or maintain testes sensitivity to LH/hCG, and/or maintain testes size/function on-cycle.

DAA could also be a potent adjunct to hCG as part of post-cycle recovery, though all these concepts would need to be studied before any claim could be made.

DAA. It sounds like a do-it-all wonder product, which is usually the first warning sign of market fraud. However, given the research supporting this amino acid as a neurotransmitter and neuroendocrine agent in man, rats, and reptiles, it holds more promise than most unproven products. When DAA products arrive on the market, and they inevitably will, consumers should look for a company that: 1) tests the raw material received from their supplier, as it would be simple to substitute L-aspartic acid; 2) performs clinical testing to show that the marketed product increases testosterone and LH (possibly GH/IGF-1 as well); 3) justifies the inevitable “kitchen sink” of added ingredients; 4) tests to assure that prolactin and estradiol concentrations are not elevated above physiologic normal range. Times are hard for everyone right now, but it is critical that consumers support only such companies, as the low road companies will be able to undercut more ethical companies by cutting corners to cut cost.

A number of questions remain to be considered. There is no documented evidence that DAA would increase testosterone in women. In fact, in the lizard study, testosterone decreased in female lizards, though estrogen was elevated.⁵¹ There appears to be benefits to mental function, and possibly protective effects against certain psychological states, but it is unknown what effect DAA will have long-term. The long-term safety of supplementing DAA has not been studied; neither has the therapeutic range. It should be noted that higher doses did not generate significantly higher testosterone response.⁴² Thus, it is critical (yes, I am using that word again) that consumers monitor changes in mood, concentration, and physical symptoms. At the first sign of gynecomastia or mood changes, DAA use should be discontinued. The effect of DAA on developing brains and sexually immature subjects has not been studied in humans. Therefore, DAA should not be given to children or adolescents. It would be a shame to see a potentially beneficial product removed from the market, due to irresponsible use.

Concerning the excitotoxicity of NMDA; Several in vitro studies found that neurons exposed to either glutamate or beta-amyloid (both highly toxic to neurons and involved in various neurological diseases) were protected when exposed to creatine.³ The researchers hypothesized that, More recent studies, in vitro and in vivo in animals, have found creatine to be highly neuroprotective against other neurotoxic agents such as N-methyl-D-aspartate (NMDA) and malonate. (so is Taurine)

There is an increase in the activity of cytochrome P-450, the enzyme that converts testosterone in 17 β -estradiol. Interpretation: D-aspartic acid is implicated in the regulation of the release and synthesis of LH and testosterone in human and in the activation of aromatase activity.

Safety

DAA increases the levels of prolactin (which can impair libido and erectile function), and GH (growth hormone).^{37,44} The increase of prolactin does not appear to be a real issue, and DAA has been shown to increase GH; therefore, theoretically no problem should arise from this either.

NMDA is so potent at stimulating the NMDA-sensitive nerves that it over-excites them and the nerve dies. N-Methyl-D-Aspartic acid is an excitotoxin. Excitotoxicity is the pathological process by which nerve

cells are damaged and killed by excessive stimulation by neurotransmitters such as glutamate and similar substances. This occurs when receptors for the excitatory neurotransmitter glutamate such as the NMDA receptor and AMPA receptor are overactivated.

NMDA receptors are particularly important when they become overactive (which can happen from supplementing with N-methyl-D-aspartate) during withdrawal from alcohol as this causes symptoms such as agitation and, sometimes, epileptiform seizures. Those prone to gynecomastia or suffering from erectile dysfunction, may wish to delay using a DAA-based product until data relating to potential increases in prolactin are available.

Conclusions

Research has indeed shown DAA to be effective at increasing testosterone levels. This would result in increased lean muscle mass. Both DAA and NMDA work on the NMDA receptor, the receptor has a far greater affinity for NMDA than DAA. Nevertheless, many of the benefits from DAA are had not solely by NMDA, but also by DAA which also acts in other areas.

The side effects of these molecules appear to be more therapeutic than deleterious. For example, understimulation of these receptors is linked to psychotic problems, poor memory and apoptosis. However, because NMDA is a potent glutamate agonist at stimulating the NMDA receptor, it is also termed an excitotoxin. Low doses can potentially hyper-stimulate the receptor and kill the cells. Nevertheless it was also demonstrated that creatine exhibits a significant protective effect against neurotoxic agents such as NMDA; therefore, combining creatine (and maybe Taurine) with this booster may nullify any negative side effects of the receptors being over stimulated.

It is also demonstrated that NMDA can increase prolactin levels which may cause adverse side effects. However, it doesn't appear to be certain. Nonetheless it may be wise to look into adding a prolactin inhibitor to assure all the benefits from supplementation.

It also increases estradiol concentrations, increasing the risk of gynecomastia (man boobs). The reasons are twofold. One is simply due to Le Chatelier's principle of equilibrium, that is as testosterone goes up so too does estrogen. The other reason is that DAA increases the activity of the aromatase enzyme cytochrome P-450 which catalyzes the conversion of testosterone to 17 β -estradiol. Therefore having enough zinc and possibly some type of aromatase inhibitor is warranted.

DAA also increases vasopressin and oxytocin, these increased hormones can lead to hyponatremia; therefore, consuming the sodium D-aspartate may help to blunt this effect.

Some questions need to be further addressed to assure the safety of DAA. Such as:

- a. After xg of DAA, how much did neuronal calcium influx increase?
- b. Amount of apoptosis markers after xg of DAA

Magnesium and zinc are known to be modulators for the NMDA receptor ion channels. This may reduce the neuronal calcium influx.

It may also be advised to add S-Adenosyl methionine (SAME) to the mixture, as SAME has shown to have therapeutic value in itself and can assist in the conversion of DAA to MDAA. (Of course if MDAA is also taken this may ingredient may be superfluous.)

Along the same lines it may be wise to add trimethylglycine to the mixture as well, trimethylglycine is an effective methyl donor which is needed by SAME to convert DAA into NMDA, as well as decrease homocysteine levels.

It is also advised to add vitamins B6, B12, and folic acid to the mixture as well, especially if adding SAME and trimethylglycine.

Dosing

This area needs more investigation. The studies are conflicting with what is the optimal dose, and where do negative side effects take place. However, 3 grams does appear to be the upper limit, and some suggest the dose to be closer to 1g, in fact a lower dose can be more effective than a higher dose. Investigation on dosing with MNDAA needs to be done with caution and valid data before making conclusions as MNDAA is an excitotoxin.

Recommendations

- DAA and MDAA are shown to be effective and their use is justified.
- Take it with creatine
- Maybe include Taurine also for increased neuroprotective effects
- Use sodium D-aspartate
- Maybe include prolactin inhibitor
- Include an effective and safe aromatase inhibitor
- Zinc and Mg may be beneficial
- SAME may be beneficial
- Trimethylglycine is also good
- B6, B12, and folic acid are also good.
- Dosing should be no more than 3 grams.

5-Methyl-7-Methoxyflavone

Isoflavones are naturally occurring non-steroid phytoestrogens that have a similar chemical structure as ipriflavone (a synthetic flavonoid drug used in the treatment of osteoporosis) [156-158]. For this reason, soy protein (which is an excellent source of isoflavones) and isoflavone extracts have been investigated in the possible treatment of osteoporosis. Results of these studies have shown promise in preventing declines in bone mass in post-menopausal women as well as reducing risks to side effects associated

with estrogen replacement therapy. More recently, the isoflavone extracts 7-isopropoxyisoflavone (ipriflavone) and 5-methyl-7-methoxy-isoflavone (methoxyisoflavone) have been marketed as “powerful anabolic” substances. These claims have been based on research described in patents filed in Hungary in the early 1970s [159,160]. Aubertin- Leheudre M, et al. [161] investigated the effects that isoflavone supplementation would have on fat-free mass in obese, sarcopenic postmenopausal women. Eighteen sarcopenic- obese women ingested 70 mg of isoflavones per day (44 mg of daidzein, 16 mg glycitein and 10 mg genistein) or a placebo for six months. There was no exercise intervention in the investigation, only the isoflavone supplementation. At the end of the six month intervention, it was reported that there was no difference in total body fat free mass between the isoflavone and placebo groups, but there was a significant increase in the appendicular (arms and legs) fat free mass in the isoflavone supplemented group but not the placebo group. Findings from this study have some applications to sedentary, postmenopausal women. However, studies using healthy people failed to find any benefit.

Methoxyisoflavone is a member of the flavonoids (isoflavones) family that are primarily obtained in the diet from soybeans and soy foods [1]. The two most popular forms of methoxyisoflavones on the market are 5-methyl-7-methoxy-isoflavone (Methoxyiso-flavone) and 7-Isopropoxyisoflavone (Ipriflavone). Initial claims based on animal research suggested that methoxyisoflavone supplementation possesses a muscle-building and bone-building (anabolic) component without the side effects of traditional hormone replacement therapies that would give similar results [1]. Despite these claims, the only beneficial effect of methoxyisoflavone that has been reported in multiple research publications and U.S. patents is the benefits of reduced bone resorption and bone loss prevention [2-4].

Isoflavones are naturally occurring non-steroidal phytoestrogens found primarily in soy beans [1]. 5-methyl-7-methoxy-isoflavone is believed to play a role in increased protein synthesis and muscle accretion. They are also believed to reduce body fat, lower cholesterol levels, promote endurance, increase vitality, and the body's ability to use oxygen. The primary foundation of these beliefs have been data described in a U.S. patent in the early 1970's [16,17]. Feurer et al [16,17] reported lower cortisol levels, increased protein synthesis, and improved overall recovery from exercise as a result of isoflavone supplementation in animals. Preliminary results from a study only available in abstract form [18] evaluated the effects of 5-methyl-7-methoxyisoflavone supplementation (800 mg/day for 8-weeks) on training adaptations in 14 resistance-trained men. Inclendon et al [18] reported 5-methyl-7-methoxyisoflavone supplementation did not significantly affect changes in body weight, body mass index, bone mineral content, or isokinetic peak force between groups. However, DEXA determined FFM increased by 1.3 kg in the methoxyisoflavone group while being unchanged (0.1 kg) in the placebo group resulting in a significant reduction in body fat percent. Results of the present 8 week study do not support the purported ergogenic value of 5-methyl-7-methoxyisoflavone supplementation in resistance-trained males.

Safety

Analysis of post study questionnaires revealed that subjects tolerated the supplementation protocol well with no reports of medical problems or symptoms.

Conclusions

These isoflavones were not intended to boost Tst, but increase protein synthesis. It may help prevent osteoporosis, it may help a little with sedentary obese, sarcopenic postmenopausal women. Also it may help with reduced bone resorption and prevention of bone loss. However, all studies involving healthy active individuals do not support any ergogenic value of the difference isoflavones.

Recommendations

Studies show no ergogenic value.

Rhaponticum Carthamoides Extract (RCE)

See Adaptogenic compounds or ecdysteroids.

Dehydroepiandrosterone (DHEA) or Prasterone

Other names include: 3-beta-hydroxy-5-androsten-17-one, 3-beta-hydroxyandrost-5-en-17-one, 3beta-hydroxy-5-androsten-17-one, 3beta-hydroxy-androst-5-en-17-one, 3beta-hydroxy-D5-androsten-17-one, 3beta-hydroxyandrost-5-en-17-one, 3beta-hydroxyandrost-5-ene-17-one, 3-beta-hydroxy-etioallocholan-5-ene-17-one, 5-androsten-3beta-ol-17-one.

DHEA is a natural steroidal hormone secreted by the adrenal glands. It then undergoes further modifications to produce other sterol compounds like testosterone and estrogen. Supplementing with DHEA may or may not increase both of these hormone levels. And Because DHEA must first be converted to androstenedione and then to testosterone in men, it has two chances to aromatize into estrogen- estrone from androstenedione, and estradiol from testosterone. As such, it is possible that supplementation with DHEA could increase estrogen levels more than testosterone levels in men.

Besides the fact that DHEA is a prohibited substance under the World Anti-Doping Code of the World Anti-Doping Agency; a randomized placebo-controlled trial found that DHEA supplementation had no (statistically significant) effect on lean body mass, strength, or testosterone levels.

Safety

As a hormone precursor, there has been a smattering of reports of side effects possibly caused by the hormone metabolites of DHEA. Some of these include possibly serious cardiovascular effects such as heart palpitations

Conclusions

DHEA is not a good tst booster, doesn't work and is banned anyway.

Recommendation

Don't use it.

6-Keto-Diosgenin (25R, Spirostan-5a-Diol-6-One-3-One Undecanoate)

According to some manufactures, the 6-keto and 25R is the same as 25R, spirostan-5a-diol-6-one-3-one. This compound is reported to have anabolic effects from a study done in Russia back in 1976. This study gives no validity to the compound, as it does not have any credibility, it was tested on rats, and other studies haven't replicated any anabolic properties.

It is true that Diosgenin is used to synthesis a number of steroids (progesterone, corticosteroid, etc) it isn't anabolic and the steps required to convert this sapogenin into a steroid can't occur in the body because we lack the necessary enzymes. This compound is related to ecdysteroids (turkesterone)

Interestingly the very names given to this compound doesn't make any sense to me at all. Diosgenin has a double bond on the 5,6, carbon so you there is no way you could have a keto group on the 6th carbon. It's physically impossible!! Moreover, if the double bonds is gone that what is left at the 5 position a hydrogen? Alcohol? Is it R or S? This is not all, the other name given is also contradictory it says 5a diol...well in order to be a diol it has to designate another carbon for the hydroxyl group.

Conclusion

The names appear to be made up, and whatever type of sapogenin it is, doesn't appear to be ergogenic.

Recommendation

This product is not a good choice.

Fenugreek

Fenugreek (*Trigonella foenum graecum*) is a type of plant with a variety of different compounds, that account for it holistic usage. It is also a powerful prolactin stimulator because it is high in galactagogue which is a substance that increases lactation, and thus the herb has been successfully used for nursing mothers. It is also source of many other bioactive constituents. Some companies include fenugreek in their T-boosters because it is also a source of saponins such as diosgenin, yamogenin, gitogenin, tigogenin, and neotigogens. As such it is related to the previous reviewed compound, diosgenin, is used synthetically to make different types of steroids, but the body lacks the required enzymes to undergo that same conversion. Furthermore studies evaluating its effect on testosterone levels failed to find any effect. One study in particular concludes,

"...That in conjunction with structured resistance training, supplementation of fenugreek extract does not appear to affect hormonal status in resistance trained males and shows no anabolic potential as has been purported."

Nevertheless, because fenugreek has a number of other important nutrients (vitamin C, niacin, potassium), it may potentially benefit the athlete, at least not inhibit performance. A few studies show that supplementing with fenugreek coupled with resistance training elicits positive effects; furthermore, fenugreek is a good source of 4-hydroxyisoleucine which increases insulin sensitivity and thus exhibits anti-diabetic effects. However, the diosgenin in fenugreek apparently also exhibits estrogenic activity and is heavily marketed as a natural breast enhancer—even for males. Therefore taking fenugreek may potentially cause gynecomastia.

Conclusion

Fenugreek contains many compounds including diosgenin which is purported to increase testosterone and have anabolic effects. Studies have shown no effect. In fact its consumption may actually increase estrogen levels and potentially cause gynecomastia.

Recommendation

Studies show no anabolic effects and other potential side effects are disconcerting.

Divanil

Divanil, better known as 3,4-divanillyltetrahydrofuran, is a compound from the plant *Urtica Dioca* (also known as stinging nettle). This particular extract of the nettle is theorized to increase the amount of free testosterone by occupying the space of a transporting glycoprotein that normally binds testosterone and estradiol known as sex-hormone binding globulin. However, though studies have shown that 3,4-divanillyltetrahydrofuran binds to the glycoprotein—and with very high affinity—studies have not examined whether or not there really is an increase in free testosterone.

Theoretically it is a sound hypothesis and I can definitely see it working, as other antagonists can competitively inhibit other enzymes to increase the amount of certain molecules. There does exist some anecdotal evidence that free testosterone is increased, some people have blogged the increase and showed their blood chemistry before supplementation and again after which showed an increase.

However, the increase in sex hormones is not specific to just testosterone and the increase in estradiol (estrogen) would be commensurate with the increase in testosterone. Therefore, if this product is used it would be wise to maybe add an estrogen blocker along with an aromatase inhibitor. Another concern is that by increasing hormonal levels in this manner, it is possible that the increased T-levels can allosterically lower the body's endogenous production of testosterone via negative inhibition. This may lead to gonadal atrophy.

Note: It appears that there has been some kind of scam with this product, companies were marketing there divanil as being 95% pure; lab analysis showed less than 5% purity. Therefore it is requisite to assure the purity of this compound before selling it.

(see: <http://www.prweb.com/releases/2010/01/prweb3519384.htm>)

Conclusion

Divanil has theoretical potential and boosting testosterone levels. It prevents tst from binding to globulin and thus increases the amount of free testosterone. It probably works, but would also increase estrogen to some extent as well. It would be important to add maybe an estrogen blocker with an aromatase inhibitor. The purity of the compound must also be verified.

Recommendation

- Its inclusion is theoretically justified, but not scientifically proven.
- Needs estrogen blocker with an aromatase inhibitor.
- A good supplier and verified purity

Vitamins and Minerals

B6, zinc, magnesium aspartate and others.

5alpha reductase converts testosterone to DHT—bad.

“Some nutrients have been shown to inhibit the activity of 5 α -reductase and therefore the production of dihydrotestosterone (DHT) which may be of great benefit in the treatment of androgenetic alopecia. There have been studies in which zinc is shown to inhibit 5 α -reductase activity and it has therefore been concluded that zinc is beneficial in disease and disorders related to an excess in dihydrotestosterone (DHT). The greater the amount of zinc, the less amount of DHT, the more abundance of head hair. There have also been studies which have shown that vitamin B6, zinc and azelaic acid combined together even at very low concentrations produced a 90% inhibition of 5 α -reductase activity”. [26][27][28]

“Zinc is shown to inhibit 5 alpha reductase activity and it has therefore been concluded that Zinc is beneficial in disease and disorders related to an excess in dihydrotestosterone (DHT). There have also been studies which have shown that vitamin B6, Zinc and Azelaic Acid combined together even at very low concentrations produced a 90% inhibition of 5 alpha reductase activity.”

<http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2133.1988.tb03474.x/abstract>

In fact, an 8-week study showed that weight-training subjects using key ingredients in advanced ACETABOLAN III[R] (ZMA[R] [30 mg zinc monomethionine aspartate, 450 mg magnesium aspartate, and 10.5 mg vitamin [B.sub.6]]) increased free testosterone levels significantly more than subjects using a placebo (132.1 to 176.3 pg/mL vs. 141.0 to 126.6 pg/mL). It's important to note that this study measured free testosterone versus total testosterone

A single ejaculation can have as much as 15mg of zinc. The average person gets 2/3s of the RDA requirement. If you are active—especially sexually—than you would want even more zinc.

Recommendation

B6, zinc, magnesium aspartate etc.

Better Classified as Fat Burners

Tetradecyl Thioacetic Acid (250mg), Salvia Miltiorrhiza Extract (standardized for 40% Mixed Tanshinones) (250mg) Propionyl-L-Carnitine (300mg) Potassium Pyruvate (300mg), Raspberry Ketones (100mg)

These are principally fat burners and will be discussed later. However a brief note on the carnitine, though it is generally talked about as increasing fatty acid oxidation it may still be a useful additive in a T-booster. It has been shown to increase insulin-like growth factor-binding protein-3, and may work really well in the pre-work drink as it has ergogenic value at reducing muscle soreness, increasing recovery, effective antioxidant and inducing vasodilatation.

Icariin

Icariin is a type of flavonoid that is derived from Horny Goat Weed or Yin Yang Huo. It has aphrodisiac properties and enhances erectile function. It does so by inhibiting phosphodiesterase 5 (PDE5), increases production nitric oxide and mimics the effects of testosterone. You are probably already sufficiently familiar with this product as you currently sell it, so I will forgo a detailed discussion.

Recommendation

It definitely has merit; its principle effect is not increasing T levels, however.

Fadogia (Instead of Tribulus)

Fadogia is a type of herbal aphrodisiac and though it may have some potential specific benefit to a specific population, a study entitled "Evaluation of biochemical indices of male rat reproductive function and testicular histology in wistar rats following chronic administration of aqueous extract of *Fadogia agrestis*" Shows some significant side effects upon consumption. For example reduced sperm count and motility destruction of spermatid cells and seminiferous tubules and at higher doses irreversible derangement on male testicular histology was noted which would lead to infertility.

Recommendation

At this point is advised to steer away from this product.

25R

See 6-Keto-Diosgenin (25R, Spirostan-5a-Diol-6-One-3-One Undecanoate)

Mucuna Pruriens

Mucuna pruriens also known as velvet bean is high in the compound L-DOPA (L-3,4-dihydroxyphenylalanine) which is a precursor to the catecholamines, dopamine, epinephrine and norepinephrine. L-DOPA is used to treat Parkinsons disease, one of the effects is hypersexuality because of the increased libido due to the enhanced dopamine concentrations. M. Pruriens has been shown to increase both testosterone and growth hormone. This is because dopamine stimulate the hypothalamus and forebrain to secrete gonadotropinreleasing hormone (GnRH). This, in turn, upregulates the anterior pituitary gland to secrete follicle stimulating hormone (FSH) and luteinizing hormone (LH) causing increased synthesis of testosterone by Leydig cells of the testis. However, another study showed that L-DOPA administration did not increase testosterone or luteinizing hormone production. Most likely individuals respond differently to it, and the use of different doses it also a factor. (Note protein can interfere with absorption.)

L-DOPA is a psychoactive drug and can have a psychedelic effect. Indeed, when the drug L-DOPA was available without prescription many athletes took the drug in hopes to boost performance, it was reported that after only 2 days of taking the drug hallucinations were experienced. This led to L-DOPA being pulled of the market. Many supplement companies include Mucuna pruriens in their T-boosters or sex enhancers not only because of the favored responses previously mentioned, but also studies have shown that L-DOPA is an effective prolactin inhibitor. So some companies would add M. Pruriens to their DAA or Fenugreek to help control prolactin levels. However, it appears that in order to get the desired benefits there are a list of negative side effects. "Besides the CNS, L-DOPA is also converted into dopamine from within the peripheral nervous system. The resulting hyperdopaminergia causes many of the adverse side effects seen with sole L-DOPA administration. In order to bypass these effects, it is standard clinical practice to co-administer (with L-DOPA) a peripheral DOPA decarboxylase inhibitor (DDCI)" This inhibitor brings on other potential side effects perpetuating a down ward helical spiral.

The following is a list of side effects from the drug L-Dopa. How many of these would be present if taken as the herb and in a perhaps smaller dosage is unknown.

Hypotension, Arrhythmias, Nausea, Gastrointestinal bleeding, Disturbed respiration, Hair loss, Disorientation and confusion, Extreme emotional states, anxiety, excessive libido, Auditory and/or visual hallucinations, impairment of complex learning functions, Somnolence, narcolepsy (A condition similar to stimulant psychosis) Possible dopamine dysregulation and possible serotonin depletion: Recent studies have demonstrated that use of L-DOPA without simultaneously giving proper levels of serotonin precursors depletes serotonin.

Conclusion

Mucuna Pruriens is an herb that is high in L-DOPA which is a dopamine precursor. The increased dopamine leads to an increase in testosterone, libido and can inhibit prolactin levels. However it also

leads to a series of potential adverse side effects including hallucinogenic and psychedelic effects. For these and other reasons I currently don't feel that it would be a safe and effective ingredient for a testosterone booster.

Recommendations

Mucuna Pruriens is not an advisable additive

Sodium D- aspartic acid instead of D-aspartic acid

This form would be the preferred choice as it would increase its solubility and thus overall bioavailability. For more info see: D-Aspartic Acid and N-Methyl D-aspartic acid.

Yohimbine

This is not a testosterone booster, but a potential effective fat loss supplement; it can block the alpha-adrenergic receptors of adipocytes and thus stimulate lipolysis. It also has potential aphrodisiac properties. One study evaluated the effects of yohimbine supplementation did not increase, body mass, muscle mass, or any of the indicators for enhanced athletic performance. It did however increase fat loss. Due to the nature of these findings, this specific supplement will be better treated in the fat burner article.

Conclusion/Recommendation

Yohimbine does not have ergogenic or anabolic potential, but is a prospect for a fat loss supplement.

Tongkat Ali at 100:1

Tongkat Ali (*Eurycoma longifolia*) is a flowering plant that has some aphrodisiac and testosterone boosting properties. "Some scientific studies found that it enhances sexual characteristics and performance in rodents. Other laboratory animal tests have produced positive indications, with one extract having been observed to increase sexual activity in mature rats, including arousal, sniffing, and mounting behavior.

In an experiment conducted on male rats, it was found that *eurycoma longifolia* increases sperm count. The authors also reported that the plasma testosterone level of *Eurycoma longifolia* extract treated rats "was significantly increased when compared with that of the control and infertile animals."

Another group of scientists confirmed that *Eurycoma longifolia* has the capacity to "reverse the inhibitory effects of estrogen on testosterone production and spermatogenesis."

An Italian study on *Eurycoma longifolia* noted improved sexual performance in lab animals and concluded that the "effect could be mainly ascribed to increased testosterone levels."

After scientists investigating *Eurycoma longifolia*'s effect on sexual parameters had established that sexualizing effects went hand-in-hand with increased testosterone tone, researchers in the field of sports medicine started to look into the anabolic potential of the plant.

In a placebo-controlled human study with healthy young men in a weight-training program, it was found that "the lean body mass of the treatment group showed a significant increment, from 52.26 (7.18) kg to 54.39 (7.43) kg ($p = 0.012$).\" Furthermore, "the increase in strength in the treatment group was larger than in the placebo group (6.78% and 2.77% respectively)... The mean arm circumference of the treatment group increased significantly by 1.8 cm after the supplementation... but there was no significant increase in the placebo group.\" The results of the study were published in the peer-reviewed British Journal of Sports Medicine.

The anabolic impact of *Eurycoma longifolia* has been confirmed in the animal model, when the size and weight of just one muscle was measured in treated and untreated rats of equal size. "Results showed that 800 mg/kg of butanol, methanol, water and chloroform fractions of *E. longifolia* Jack significantly increased ($p < 0.05$) the levator ani muscle..."

In the US, the FDA has banned numerous products such as Libidus, claiming to use *Eurycoma longifolia* as principal ingredient, but which instead are concoctions designed around illegal prescription drugs, or even worse, analogues of prescription drugs that have not even been tested for safety in humans, such as acetildenafil. In February 2009, the FDA warned against almost 30 illegal sexual enhancement supplements, but the names of these products change quicker than the FDA can investigate them. Libidus, for example, is now sold as Maxidus, still claiming *Eurycoma longifolia* (tongkat ali) as principal ingredient.

The government of Malaysia has banned numerous fake products which use drugs like sildenafil citrate instead of tongkat ali in their capsules. To avoid being hurt by bad publicity on one product name, those who sell fake tongkat ali from Malaysia have resorted to using many different names for their wares.

The governments of Canada and Singapore have issued warnings against the product *XP Tongkat Ali Supreme* for containing the prescription drug tadalafil which can be life-threatening in some individuals.

A large number of Malaysian *Eurycoma longifolia* products (36 out of 100) have been shown to be contaminated with mercury beyond legally permitted limits.

Conclusion

Tongkat ali has shown to increase libido, improve erectile function much of which is due to the increased testosterone production. It has been shown to be anabolic when consumed concomitantly with resistance training. However, it is of extreme importance to verify the purity of the product assuring that a good concentration of tongkat ali is found, as well as, not contaminated with mercury.

Recommendation

Studies are limited and safety has not been verified. However, no major issue with it was found with the extract in itself. Because it appears to have ergogenic and anabolic potential its addition is sufficiently justified. Tongkat ali must come from a reputable company and verification of its purity. (Good concentration of extract and no mercury)

L-Taurine

I would not consider Taurine to be anabolic as it does not directly increase testosterone or protein synthesis. It does exhibit protection against glutamate excitotoxicity and thus may be of value if using DAA or MDAA for the test booster. It also has potential as an ergogenic aid to increase total work capacity and increase fat loss. Due to the nature of these findings, this specific supplement will be better treated in the fat burner article.

Conclusion/Recommendation

Taurine does not directly increase testosterone or anabolism. However it has ergogenic potential, and is a prospect for a fat loss supplement. It may be advised to add Taurine to the T-booster if using DAA or MDAA.

L-Lysine

Lysine is a branched chain amino acid and therefore is needed for protein synthesis and muscle recovery, but doesn't have any significant impact on testosterone levels. Indeed one study showed that oral arginine lysine administration to elderly did not increase IGF-I or growth hormone levels.

Conclusion/Recommendation

Lysine does not have direct testosterone stimulatory effects, but like any other amino acid is needed. Therefore its inclusion is not needed.

1-Androstene-3 β -ol, 17-one

1-Androstene-3 β -ol, 17-one is a pro-hormone that only requires a two step conversion to be anabolically active. Apparently it is quite effective, though little research has been undertaken. Because of the mechanism of action an aromatase inhibitor is not desired in this product. One journal article said the following about 1-Androstene-3 β -ol, 17-one "According to the wording of the WADA list of prohibited substances, "...and other substances with a similar chemical structure or similar biological effect(s)..." Its use by athletes is prohibited." Some of the side effects include lethargy, hair loss, enlarged prostate, etc.

Conclusion/Recommendation

I personally wouldn't take this product, but it does seem to be effective. If used it would probably be best as a standalone product with supporting additives. An aromatase inhibitor is not desired.

Adaptogenic compounds or ecdysteroids

Ecdysterones, Ectysterone, 20 Beta-Hydroxyecdysterone, turkesterone, ponasterone, ecdysone, or ecdystene ecdisten, isoinokosterone, 20-hydroxyecdysone, β -ecdysterone

Ecdysterones (also known as ectysterone, 20 Beta-Hydroxyecdysterone, turkesterone, ponasterone, ecdysone, or ecdystene) are naturally derived phytoecdysteroids (i.e., insect hormones). They are typically extracted from the herbs *Leuza rhapsodicum* sp., *Rhaponticum carthamoides*, or *Cyanotis vaga*. They can also be found in high concentrations in the herb *Suma* (also known as Brazilian Ginseng or *Paffia*). Research from Russia and Czechoslovakia conducted over the last 30 years indicates that ecdysterones may possess some potentially beneficial physiological effects in insects and animals [135-140]. However, since most of the data on ecdysterones have been published in obscure journals, results are difficult to interpret. Wilborn and coworkers [141] gave resistance trained males 200 mg of 20-hydroxyecdysone per day during 8-weeks of resistance training. It was reported that the 20-hydroxyecdysone supplementation had no effect on fat free mass or anabolic/catabolic hormone status [141]. Due to the findings of this well controlled study in humans, ecdysterone supplementation at a dosage of 200 mg per day appears to be ineffective in terms of improving lean muscle mass. While future studies may find some ergogenic value of ecdysterones, it is our view that it is too early to tell whether phytoecdysteroids serve as a safe and effective nutritional supplement for athletes

Ecdysterone (20-Beta-Hydroxyecdysterone) is a plant sterol that has also been linked to some bold claims including promotion of protein synthesis, maintenance of anabolic state, and enhancement of lean muscle mass, while subsequently decreasing adipose tissue. Some common names for ecdysterone include ecdisten, ecdysone, isoinokosterone, 20-hydroxyecdysone and β -ecdysterone. Currently the only research supporting these claims has been conducted in animals where reports suggest ecdysterone's lead to anabolic activity on skeletal muscles [5], cell proliferation and growth leading to increased mass from vitamin-like effects [6], improved liver secretory function [7] as they play a structural role in the mitochondrial membranes in cells [8], as well as immunomodulating effects [9]. Despite these potential benefits, no research has supported these claims in human models.

Ecdysterones have also been recently purported to enhance training adaptations during resistance training. In support of this contention, research in animal models has suggested that ecdysterone supplementation can promote anabolic activity in skeletal muscle [5], as well as increase cell proliferation and growth, which can lead to an increase in muscle mass [6]. Russian scientists' have been evaluating the effects of ecdysterones for years. Oral administration of *Leuza* (herbal ecdysterone) in male albino mice caused a statistically significant increase in the time of running [19]. After 20 days of supplementation, there was a significant increase in work capacity. The same researchers evaluated the effects of 20-day administration of ecdisten-containing tincture of *leuzea* and *leveton* on humoral immunity of track and field runners for distances of 5,000 and 10,000 m. Intensive cyclic physical activity induced significant decrease of IgG and IgA in blood serum of the athletes. These researchers concluded that both supplements contributed to restoration of the lowered IgG and IgA, while the working capacity of the athletes grew by 10 to 15% [20]. Furthermore, Chermnykh et al [5] compared beta-

ecdysterone with dianabol which is an extremely powerful anabolic steroid, suggesting both beta-ecdysterone and dianabol increased the size and strength of the muscles. These researchers concluded that ecdysterone had a greater anabolic action on the contractile proteins of the skeletal muscles than dianabol. The most often cited scientific study on ecdysterone was published in *Scientific Sports Bulletin* by Simakin [21]. This study sought to determine the effect of ecdysterone on muscle tissue mass and fat mass, while testing for hormonal changes in the subjects. Seventy-eight highly trained male and female athletes served as subjects in one of three experimental groups: protein, protein and ecdysterone, and placebo. Those consuming just protein, showed only a slight increase in muscle mass for the 10 day period of time, while the placebo group experienced a slight reduction in lean muscle. The addition of ecdysterone in conjunction with protein intake resulted in a 6–7% increase in lean muscle tissue with nearly a 10% reduction in fat. Finally, Gadzhieva and colleagues [22] reported that 3-weeks of Ekdisten, leveton, and Prime Plus (combination of Ekdisten and pure protein) supplementation during training increased skinfold determined muscle mass, decreased fat mass, and increased total work during training. Additionally, Ekdisten and Prime Plus supplementation appeared to promote the greatest gains during training. These studies found that ecdysterone might increase work capacity, decrease fat mass, and increase lean muscle mass. Results of the present study contrast these reports. In this regard, ecdysterone supplementation had no significant effects on body mass, body composition, strength, or markers of anabolic and catabolic status. Since most of the previous studies reporting positive effects of ecdysterones have been reported in obscure journals with limited details available to evaluate the experimental design and quality of the research, it is difficult to compare results. Nevertheless, present findings do not support the purported ergogenic benefit of ecdysterone supplementation in resistance-trained males.

Safety

Probably safe, I didn't find any studies that say it was a problem. And theoretically it would be fine.

Conclusion

Ecdysterone is not a testosterone booster, but has potential as an ergogenic aid. There are a number of studies showing significant anabolic effects and impressive ergogenic value. However all of those studies that report positive benefits have been published in obscure journals with limited details available to evaluate the experimental design. There has been some recent well designed studies conducted, one in particular, which contrasts the reported benefits and found no significant effects on body mass, body composition, strength, or markers of anabolic and catabolic status. The most recent recommendation from ISSN is the following. "...it is our view that it is too early to tell whether phytoecdysteroids serve as a safe and effective nutritional supplement for athletes..."

Nevertheless there is some inference the ingredients did not come from high quality extracts than it won't be effective. In other words it may work if 20-EC and turkesterone are used and are harvested from Russian *Rhaponticum carthamoides*, as opposed to Chinese versions. In short, due the abundant volume of literature on this area that show potential benefits and ergogenic value, as well as, and the lack of negative side effects reported, I believe there is sufficient justification to carry this product.

Recommendation

Too early to tell for sure; however, it has a good potential to be of ergogenic value. Carrying this product is justified.

Sulfo-polysaccharide (CSP3)

Sulfo-polysaccharide is a nutrient that is advertised to bind to myostatin and inhibit its activity in muscle. Sulfo-polysaccharide's active ingredient is a brown sea algae known as *cystoseira canariensis*. Myostatin is a cytokine that works by inhibiting the proliferation of satellite cells and the differentiation of myoblasts [10], while also decreasing adipogenesis via reductions in the secretion of leptin [11]. Thus, the rationale for binding myostatin with sulfo-polysaccharides would theoretically result in increased muscle mass and improved body composition. The interest in myostatin was generated by recent studies where antibodies for myostatin were created and administered to adult rodents, which resulted in an increase in body mass, muscle mass, muscle size, and strength [11,12]. Despite the success in rodents, human models have not been as successful in increasing body mass and muscle mass [13], but sulfo-polysaccharides have been reported to have a binding specificity for the myostatin inhibitor follistatin [14]. Further research is needed to see if sulfo-polysaccharides or *cystoseira canariensis* have any beneficial effect in humans in response to resistance training.

Sulfo-polysaccharide, which is advertised to bind to myostatin and inhibit its activity in skeletal muscle. Of the three supplements examined in our study, sulfo-polysaccharide supplementation has the best theoretical rationale as a potential ergogenic aid. Myostatin is a cytokine that works by inhibiting the proliferation of satellite cells and the differentiation of myoblasts [10]. Research in mice has shown that binding or blocking myostatin results in dramatic increases in body mass, muscle mass, muscle size, and strength following administration of antibodies that are specific for the cytokine myostatin [11,12]. To date, only one human study has administered sulfo-polysaccharides in conjunction with a resistance training protocol [13]. This study examined 12-weeks of resistance training and *cystoseira canariensis* supplementation on serum levels of myostatin and muscle strength and body composition in twenty-two untrained males. Training consisted of three days per week using 3 sets of 6 to 8 repetitions at 85–90% 1 RM. The researchers concluded that 12-weeks of heavy resistance training and 1200 mg/d of *cystoseira canariensis* supplementation appeared to be ineffective at inhibiting serum myostatin and increasing muscle strength and mass or decreasing fat mass. The explanation for the dramatic effects in animals while no observed effects in humans probably lies in the fact that myostatin specific antibodies were used in the animal model, while human models use sulfo-polysaccharides that are only advertised to bind to myostatin. Results of this study support this prior report in that CSP3 supplementation had no significant effects on body composition, training adaptations, or markers of anabolic/catabolic status in resistance-trained men.

Sulfo-Polysaccharides (Myostatin Inhibitors) Myostatin or growth differentiation factor 8 (GDF-8) is a transforming growth factor that has been shown to serve as a genetic determinant of the upper limit of muscle size and growth [162]. Recent research has indicated that eliminating and/or inhibiting myostatin gene expression in mice [163] and cattle [164-166] promotes marked increases in muscle mass during early growth and development. The result is that these animals experience what has been termed as a “double-muscle” phenomenon apparently by allowing muscle to grow beyond its normal genetic limit. In agriculture research, eliminating and/or inhibiting myostatin may serve as an effective way to optimize animal growth leading to larger, leaner, and a more profitable livestock yield. In humans, inhibiting myostatin gene expression has been theorized as a way to prevent or slow down muscle

wasting in various diseases, speed up recovery of injured muscles, and/or promote increases in muscle mass and strength in athletes [167]. While these theoretical possibilities may have great promise, research on the role of myostatin inhibition on muscle growth and repair is in the very early stages - particularly in humans. There is some evidence that myostatin levels are higher in the blood of HIV positive patients who experience muscle wasting and that myostatin levels negatively correlate with muscle mass [162]. There is also evidence that myostatin gene expression may be fiber specific and that myostatin levels may be influenced by immobilization in animals [168]. Additionally, a study by Ivey and colleagues [167] reported that female athletes with a less common myostatin allele (a genetic subtype that may be more resistant to myostatin) experienced greater gains in muscle mass during training and less loss of muscle mass during detraining. No such pattern was observed in men with varying amounts of training histories and muscle mass. These early studies suggest that myostatin may play a role in regulating muscle growth to some degree. Some nutrition supplement companies have marketed sulfopolysaccharides (derived from a sea algae called *Cytoseira canariensis*) as a way to partially bind the myostatin protein in serum. When untrained males supplemented with 1200 mg/day of *Cytoseira canariensis* in conjunction with a twelve week resistance training regimen, it was reported that there were no differences between the supplemented group and the placebo group in relation to fat-free mass, muscle strength, thigh volume/mass, and serum myostatin [169]. Interestingly, a recent paper by Seremi and colleagues [170] reported that resistance training reduced serum myostatin levels and that creatine supplementation in conjunction with resistance training promoted further reductions. Nevertheless, though the research is limited, there is currently no published data supporting the use of sulfo-polysaccharides as a muscle building supplement.

Safety

It appears safe, but data is limited.

Conclusion

CSP3 is not a test booster, but is marketed as myostatin inhibitor, (a protein that prevents muscle growth) and has great theoretical ergogenicity. When specific antibodies were used in animals to inhibit myostatin drastic increases in muscle mass and strength were observed. However, CSP3 failed in the only two reputable published studies to show any significant effects on body composition, training adaptations, or markers of anabolic/catabolic status in resistance-trained men. Data is limited and thus caution is advised at making any decisive decisions.

Recommendation

Probably not.

Gamma Oryzanol (Ferulic Acid)

Gamma Oryzanol (Ferulic Acid) Gamma oryzanol is a plant sterol theorized to increase anabolic hormonal responses during training [195]. Although data are limited, one study reported no effect of 0.5 g/d of gamma oryzanol supplementation on strength, muscle mass, or anabolic hormonal profiles during 9-weeks of training[196].

Safety

Data is limited.

Conclusion

Supplementation with Gamma oryzanol has not been shown to be effective, but data is limited so it is too early to tell.

Recommendation

At this point probably not.

Aromatase inhibitors

androst-4-ene-3,6,17-trione; hydroxyandrost-4-ene-6,17-dioxo-3-THP ether; 3,17-diketo-androst-1,4,6-triene

Two studies have investigated the effects of aromatase inhibitors (androst-4-ene-3,6,17-trione) [240] and (hydroxyandrost-4-ene-6,17-dioxo-3-THP ether and 3,17-diketo-androst-1,4,6-triene) [241]. In both of these investigations, it was reported that free testosterone and dihydrotestosterone levels were significantly increased. Muscle mass/fat free mass was not measured in one investigation [240] and no changes were observed in fat free mass in the other investigation [241]

Safety

It is important to note that suppressing estrogen through aromatase inhibition can be detrimental to both health and performance.

Conclusion

A.I can work not sure how good or bad there addition would be.

Recommendation

Its inclusion would depend on what was the principle anabolic stimulator

Boron

A number of dietary supplements have been suggested to boost testosterone for weightlifters. Opinions vary regarding these products, ranging from useless to dubiously promising. Some may remember the promotion of the mineral boron as a testosterone booster over 20 years ago. Initial sales demonstrated the demand in the market for testosterone enhancement among athletes, but ultimately the products failed to deliver. Close scrutiny revealed the initial claims were based upon a study performed on post-menopausal women, hardly the appropriate subjects for verifying testosterone enhancement for healthy young men.

A follow-up study found no effect of boron on testosterone concentration in men and women over the age of 45. Subsequent research has confirmed a role for boron in steroidogenesis, but any benefit seems inconsequential in people eating a complete diet. In fact, at least one study suggests boron supplementation may increase circulating estrogen in males.

Conclusion/recommendation

Boron simply doesn't work; therefore its addition is not justified.

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