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Review Article

Supplements and Enhancement Drugs: Athletes Torment Themselves with Potential Risks- Mini Review

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Abstract: An individual's dietary and supplement strategies can influence markedly their physical performance. Issues related to knowledge of nutrition and dietary supplementation (DS) are understudied in professional athletes. Supplements nowadays are used with the aim of improve body composition, of which the origins are multiplex in structure. Many approaches to improve the response to resistance training are the use of pre-/post-/in between workout nutritional interventions; with beverages garnering significant interest. The health benefits and risks of dietary supplement use are controversial as there is no visible immediate benefits observed. Sports nutrition recommendations for endurance exercise however remains a complex issue with often opposing views and advice by various health care professionals. Many athletes, at all levels of competition, place great emphasis on the use of dietary supplements, but of all the factors that determine athletic performance, supplements can play only a very small role. Compared with factors such as talent, training, tactics, and motivation, nutrition has a small effect on performance, and supplements can be no more than a minor part of the athlete's nutrition strategy.

Keywords: dietary supplementation; Supplement abuse; anabolic steroid; protein beverages; creatine supplements; caffeine habituation; endurance training; Testosterone booster; Heavy metal toxicity

Fig-1: Enhancement Drugs [1].

Some athletes abuse performance-enhancing drugs (PEDs) like anabolic steroids and stimulants (including caffeine and ephedrine, and even methamphetamine) to help them perform better. Each comes with its own set of risks. But in general, these PEDs increase the risk for high BP, an enlarged heart, irregular heart rate, CHD, stroke, dangerously high body temperatures, and mood swing or paranoia.

INTRODUCTION

The use of dietary supplements is widespread in the general population, in athletes and recreational exercisers, and in military personnel. A wide array of supplements is available. DSs seldom prescribed to critically ill patients as well. In US, there are an estimated three million anabolic-androgenic users of whom 60% are non-competitive recreational bodybuilders or non-athletes, who use these drugs for cosmetic purposes [2]. Approximately 70% of these supplements were sport and protein beverages or powder. It

was recognized over a decade ago that some 20% of nutritional supplements sold in Europe and the USA contained anabolic steroids [3]. Anabolic steroid abuse could lead to reduced fertility and increased cardiovascular diseases [4]. The most likely cause of the patient's systemic and metabolic disturbances is hypercalcemia. As previously reported, constipation, anorexia, nausea and vomiting are often the prominent symptoms of hypercalcemia [5]. Indeed, one fourth of opiate users admitted to treatment centers acknowledged an earlier use of steroids [6]. An increased health awareness among athletes and the public will favor the global sports nutrition market which is predicted to have an annual growth rate of 9% from 2013 to 2019, to an estimated value of USD 37.7 billion in 2019 [7]. In addition to supplementation timing, the optimal dosage also needs to be considered [8]. It was observed that a dose higher than 300 mg/kg of sodium bicarbonate likely causes gastrointestinal discomfort [9]. Creatine supplementation is an established ergogenic aid in sports and is now claimed to have therapeutic applications in a variety of diseases [10]. A risk for acute and potentially chronic kidney injury among young men abusing anabolic steroids and using excessive amounts of nutritional supplements already reported [11]. Reported cases of herbals and DS-induced liver injury are increasing worldwide. Regulation of herbal products may vary between different countries. In the European Union, the concepts of traditional herbal medicines and traditional plant food supplements are defined under different legal frameworks [12]. Herbal and dietary supplements (HDS) induced liver injury found in Asian countries where there is a widespread consumption of HDS, 73% in Korea, 71% in Singapore, and 40% in China [13]. The 17-α-alkylation modification allows steroids to be taken orally, but the slower clearance in the liver makes them more hepatotoxic [14]. Data from the US suggest that 1-3 % of the inhabitants use anabolic steroids. The lifetime prevalence of anabolic androgenic steroids use in the US was estimated in a recent study with about 3-4 million [15]. Again, case reports revealed the connection between myocardial infarction, myocardial hypertrophy and hypertension with anabolic androgenic steroids abuse [16]. Major mood disorders, aggressive behavior, dependence syndrome, or cognitive effects also reported to a significant extent [17]. Caffeine is perhaps the most common pre-workout stimulant consumed by bodybuilders. Numerous studies support the use of caffeine to improve performance during endurance training [18,19]. Many mechanisms have been suggested in relation to caffeine toxicity, which primarily affects the cardiovascular system [20]. However, at present the evidence base exploring both caffeine habituation and withdrawal strategies in athletes is surprisingly small. Accordingly, despite the prevalence of caffeine use within athletic populations, formulating evidence-led guidelines is difficult [21]. Potential for diarrhea, nausea, abdominal cramps, and other gastrointestinal disturbances with vitamin C intakes of more than 2,000 mg/day in adults; increased risk of hemorrhagic effects with vitamin E intakes of more than 1,500 IU/day (natural form) or 1,100 IU/day (synthetic form) in adults; nausea, heartburn, and other side effects with coenzyme Q10 [22]. Some 30000 supplements are commercially-available in the USA [23]. Recent research also shows that athletes are willing to take supplements based on personal recommendation without gathering reliable information about the substances, often obtaining them directly from retailers and internet sites. Adolescents are more willing to take supplements obediently if they are informed by their parents/guardians, as opposed to by coaches or resulting from published research [24]. Excess intake of vitamin C can be harmful as well as in combination with iron, which may cause damage to the gastrointestinal tract and initiate or aggravate symptoms associated with chronic GI disorders [25,26]. Cobalt produces similar effects to hypoxia and results in enhanced erythropoiesis, thus in improved sport performance but such practice may be harmful [27]. Whilst the controversial natural stimulant, ephedrine, has a threshold (concentration in the urine exceeds 10 μg/ml) for consideration for doping, the serious harm, which may be caused by ephedrine is well documented [28,29]. Some supplements have even been implicated as the cause of death and disability when used improperly [30]. 75% athlete reported using calorie replacement products including drinks, bars, and powders [31]. Similarly, the use of vitamins and multivitamins ranges from 26 to 82% among athletes. The use of multivitamins and vitamin C is higher than 50% and 80%, respectively [32,22]. The reasons these athletes use vitamins are primarily to stay healthy and to prevent illnesses during the game season [34]. The sudden heart attack death of former baseball star Ken Caminiti, 41, highlights the potential link between substance abuse among pro athletes and its dangerous effects on health, according to experts [35]. Bodybuilding brothers Mike and Ray Mentzer of Redondo Beach, California, were both plagued with health problems in their late '40s after long careers. Ray officially died of kidney failure, and Mike's death was heart-related [36]. Elite bodybuilder Rich Piana has died, police later revealed they found bottles of testosterone and white powder in the house [37]. High testosterone dosages appeared to be protective of erectile function during use, de novo symptoms such as decreased libido and erectile function occurred more frequently after discontinuing testosterone, particularly among those using more frequently and for longer durations [38]. Testosterone booster products obtained from trusted sources and administered as per the recommendations of the manufacturer may still present some health risks [39]. Former anabolic androgenic steroids abusers exhibited significantly lower plasma testosterone levels and higher frequencies of symptoms suggestive of hypogonadism than healthy control participants years after anabolic androgenic steroids cessation [40]. Unfortunately, since most men begin anabolic androgenic steroids at a young age and are presumed to obtain the medication from illicit sources, they are not educated regarding the possible negative outcomes that come with their use [41]. In addition to damage to other organs, a diverse range of nephron-toxicities have been reported with dietary supplements. A case report reveals acute tubular necrosis with vacuolization, acute interstitial nephritis, and secondary membranous nephropathy, consistent with an NSAID-like nephropathy [42]. The endocrine effects of anabolic androgenic steroids abuse are well established and commonly include testicular atrophy, decreased fertility, and gynecomastia. Additional adverse effects associated with AASs include changes in blood lipid levels (increase in LDL and decrease in HDL) and neuropsychiatric disturbances [43]. Ephedra and ephedrine for weight loss and athletic performance enhancement is well-known. An association between short-term use of ephedrine, ephedrine plus caffeine, or dietary supplements that contain ephedra with or without herbs containing caffeine and a statistically significant increase in short-term weight loss is established. But that they are associated with increased rates of side-effects. These conclusions reflected the limited evidence available and are likely to be reliable [45]. Weight Loss regardless of its severity could improve anthropometric indicators, although body composition is more favorable following a slow weight loss [45]. However, several sport nutrition experts indicated that some

athletes may be at risk for a vitamin deficiency, such as those in weight-control sports and those who for one reason or another do not eat a well-balanced diet. Vitamin supplementation, particularly when limited to 100% of the recommended dietary allowance (RDA) for each vitamin, is generally regarded as safe [46]. The worldwide use of DS by athletes warrants attention and more research as there is a number of commonly used supplements that have not been thoroughly investigated. Furthermore, the intake of more than one supplement (polypharmacy) in high doses and for long periods of time poses serious concerns regarding their safety [47]. Although adulteration with drugs is by definition fraudulent, the inclusion of heavy metals could be either intentional for alleged medicinal purposes or accidental. Because they are not regulated as medicines and are freely available to everyone, serious safety concerns might be associated with these herbal medicines [48]. Contamination of soil, water, and air directly leads to contamination of plants and herbal preparations, and high levels of heavy metals such as lead, mercury, and arsenic, which have been observed in some traditional Chinese medicines and Indian herbal medicine preparations. Lead intake from TCM in this study was 3-4000 times higher than the recommended amount [49]. The National Collegiate Athletic Association (NCAA) prohibits the use of anabolic steroids by athletes and lists this class of drugs as banned substances. First anabolic steroids to be used as a doping agent by professional athletes in the 1960s. It was banned from the Olympics by the International Olympic Committee (IOC) in 1974 [50]. Diet can significantly influence athletic performance, but recent research developments have substantially changed our understanding of sport and exercise nutrition. Athletes adopt various nutritional strategies in training and competition in the pursuit of success [51]. Over the past two decades, the use of performance enhancing drugs (PEDs) has increased significantly. Once largely confined to professional athletes, PED use has transcended the elite sporting arena and is now predominantly found among non-elite, recreational gym users. The need for more research and understanding of the reasons and educational sources of these athletes in order to form the basis for educational programs on dietary supplementation and to reduce the chances of positive doping and disqualification from competition.

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Abbreviations

performance enhancing drugs (PEDs); National Collegiate Athletic Association (NCAA); Herbal and dietary supplements (HDS); Non-Steroidal Anti-Inflammatory Drug (NSAID); Anabolic Steroid Abuse (AAS); Recommended Dietary Allowance (RDA); International Olympic Committee (IOC)

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