

## Dietary supplements in sport – side effects

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### Abstract

Introduction: Dietary supplements (DS) were legalized for the first time in 1994 by the Dietary Supplements Health and Education Act. The statute defined DS as a source of one or more nutritional component such as minerals, herbs, vitamins, etc. Athletes are known as a distinctive group with the highest DS in sport intake (from 48-81%) The consumption of DS has been reported among recreational active individuals and non-athletes

Purpose: present possible side effects caused by DS usage in sport.

State of knowledge: Protein powders are common DS among athletes and bodybuilders, which consist of whey, casein, vegetable proteins in soy protein isolate (SPI). SPI contains weak estrogens such as isoflavones genistein and daidzein. The surveys with isolated cases showed hepatic injury among athletes users of creatine, but the doses of DS were inappropriate and excessive. L-carnitine is a substance which is used due to its „fat-burning” abilities and a consequence of its higher intake are atherosclerotic lesions.

Summary: DS in sport are used due to enhance muscle mass, duration, and efficiency of training. However, inappropriate usage of them may lead to many side effects. Athletes and professionals in sport should be consulted by the physician before and during the supplementation of DS in sport. Creatine is a substrate for a contraction of a muscle

Key words: dietary supplements, sport, adverse effects

## Introduction

Dietary supplements (DS) were legalized for the first time in 1994 by the Dietary Supplements Health and Education Act. The statute defined DS as a source of one or more nutritional component such as minerals, herbs, vitamins, etc. [1]. DS usage in sport is a manner to improve the efficiency of exercises and maintain specific health results [2]. Athletes are known as a distinctive group with the highest DS in sport intake (from 48-81%) [3-5]. The use of DS is different in each sport, but it increases with age and is higher among men than women [2]. DS are becoming more and more popular among the general population worldwide. The consumption of DS has been reported among recreational active individuals and non-athletes [6]. The main DS in sport are proteins, amino acids, multivitamins, glutamine, etc.

It is known, that law regulations among dietary supplements and drugs are different. As opposed to DS, it is essential to document effectiveness and safety before selling the drug. Moreover, clinical trials are not required before the DS can be distributed [7]. Therefore increasing usage of DS should be considered because of possible side effects and unknown interactions with drugs.

## Purpose of study:

Aim of the study is to present side effects caused by DS in sport.

## State of knowledge:

### Protein powders

Protein powders are common DS among athletes and bodybuilders, which consist of whey, casein, vegetable proteins in soy protein isolate (SPI). The main desired effect is an increase in muscle anabolism during resistance training [8]. SPI contains weak estrogens such as isoflavones genistein and daidzein. According to survey Akingbemi et al., perinatal diets made with soy resulted in increased Leydig cell proliferation, lower steroidogenesis, decreased testosterone secretion in rats [9]. However, a recent meta-analysis performed on adult man presented no significant effects of soy protein on male reproductive hormones [10].

### Creatine

It is found in milk, meat, fish and also in specific DS. Creatine is a substrate for a contraction of a muscle. Creatine supplementation leads to increasing resting phosphocreatine levels in muscles and creatine, with the goal of delay fatigue for sports-enhancing results [11]. The surveys with isolated cases showed hepatic injury among athletes users of creatine, but the doses of DS were inappropriate and excessive. In the case of therapeutic doses, that kind of adverse effects has not been observed. Moreover, creatine could cause water retention and decreased urinary volume because of its osmotic effect. This may result in temporary weight gain [12].

### Weightloss product

Weight loss supplements contain extracts of *Mua Huang* (ephedra), which consist of sympathomimetic alkaloids and leads to weight loss about 0,9kg/month better than placebo. Adverse effects are connected with hyperactivity of autonomic sympathetic nervous system such as increased perspiration, tremors, insomnia [13]. L-carnitine is another substance which is used due to its „fat-burning” abilities. It stimulates trimethylamine N-oxide (TMAO) production, which is an enzyme responsible for cholesterol uptake in the vascular wall and as a consequence leads to atherosclerotic lesions [14].

### Bodybuilding supplements

According to the data body, about 15% of building supplements consist of non-declared androgenic steroids due to increase in muscle mass. Adverse effects of these products include acne, hepatotoxicity, cardiomyopathy, altered serum, and hepatic cholestasis. The mechanism of how the anabolic steroids lead to hepatotoxicity is poorly understood, but it has been hypothesized to be connected with activation of the androgen receptor in hepatic cells, which lead to upregulation of the rate-limiting enzyme, CPT1, in mitochondrial fatty acid  $\beta$ -oxidation, increased oxidative stress, and mitochondrial degeneration and hepatotoxicity [15].

**Branched Chain Amino Acids (BCAA)**  
BCAA, which include leucine, isoleucine, and valine are used before and after exercise due to decreasing exercise-induced muscle damage and providing muscle-protein synthesis [16]. Moreover, they participate in glucose homeostasis, protein synthesis and different pathways as bioactive molecules [17]. Increased level of BCAA leads to increased gluconeogenesis in the liver, high glucose level in the blood and glucose intolerance [18]. Inappropriate consumption of dietary BCAAs may increase the risk of insulin resistance and metabolic abnormalities such as metabolic syndrome and diabetes [19].

**Omega-3 fatty acids**

According to data, fatty acids consumption is important in endurance training, because of lowering oxygen consumption and submaximal/peak heart rate during exercise. Moreover, it reduces resting heart rate and diastolic blood pressure. Besides 150 days of fatty acids usage has been reported to improve strength and also neuromuscular function following exercise training programs [20]. Regular consumption of fatty acids may lead to hypervitaminosis A and may promote bleeding among patients using warfarin [21].

## Summary

DS in sport are used due to enhance muscle mass, duration, and efficiency of training. However, inappropriate usage of them may lead to many side effects. Athletes and professionals in sport should be consulted by a physician before and during the supplementation of DS in sport. The consultation should consist of a selection of proper DS in sport in each case by taking into consideration chronic disorders and possible interactions with permanently used drugs.

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