

2.2 Sports Foods for Chronic Use

Next we will discuss sports foods for chronic use. The substances we are about to analyze may not be classified as sports foods in scientific literature. Nevertheless, since they are not ergogenic aids (which we shall analyze in module 3 and the last module of this course) we shall present them here.

2.2.1. Micronutrients (Iron, Calcium and Others)

Micronutrients

In the previous module, we introduced micronutrients. Therefore, we will not be doing so in this module, beyond underlining the fact that they do not provide energy themselves, but exert key functions for the functioning of the entire body.

Composition

A large part of the supplements available on the market that provide micronutrients, known as multivitamin or multimineral supplements, contain excessive doses of these, which is known as a megadose. The intake of these amounts is clearly not supported by current knowledge, as recommendations when using these supplements are to provide up to 100% of the dietary reference intake (DRI). This is particularly important in the case of vitamins C and E, which tend to be ingested in megadose (for instance, in tablets containing 1 or 2 g of vitamin C), which is not only not beneficial, but may also be detrimental to sports performance.

Applications

The daily needs for certain vitamins and minerals have been increased for populations that are submitted to intensive exercise programs (Gleeson, 2013). The potential reasons for this increase are losses through sweat, urine, and sometimes feces, and through the increasing production of free radicals.

The key factors that ensure an appropriate consumption of vitamins and minerals are a moderate to high energy consumption and a varied diet based on nutritious foods (Williams. 2005). Dietary studies show that most athletes report dietary practices that easily provide vitamins and minerals in amounts larger than their recommended daily allowance (RDA). However, not all athletes eat varied diets that provide the

necessary energy, and some may need help to improve the quality, as well as the quantity, of their food choices.

FCB states that the generalized provision of vitamins and minerals to all athletes is not justified. Furthermore, studies do not support an increase in performance resulting from said supplements, except in the cases where a previously existing deficiency is being treated (Clarkson, 1991). The best management for an athlete at high risk of not consuming the necessary micronutrients is to provide him with the necessary nutritional training to improve the variety and quantity of food intake. However, there are concrete situations where it is recommended to consume a multivitamin or multimineral supplement. It is recommended, for instance, in hypocaloric diets where a potential deficiency of these nutrients is expected; also in situations where it is known that, due to his nutrition, the athlete may experience a deficiency (traveling athletes or athletes competing internationally or with competition stages taking place abroad), or to prevent a certain deficiency in situations of significant increase in volume or intensity of training.

Australian Institute of Sport Protocol

Supplementing an inadequate intake of vitamins and minerals through food is justified when there is an inevitable reduction in the energy intake of the nutrient density of the foods consumed.

- A prolonged period of travel, particularly to countries with an inadequate or limited supply of foods.
- A prolonged period of energy restriction or weight loss, or weight maintenance.
- Restricted dietary intake in fussy athletes or athletes with significant food intolerances who cannot or do not manage to increase the variety of foods they consume.
- Overloaded competition schedules that produce an altering of normal food patterns and depend on a broad range of foods and sports foods.
- Normally these are used to provide a placebo for athletes who insist on needing a dietary supplement.

Iron

An inadequate level of iron may reduce performance in exercise through suboptimal hemoglobin levels, as well as potentially suboptimal levels of muscle enzymes associated with iron.

A low level of iron in athletes is over-diagnosed based on low measures of hemoglobin and ferritin (Taniguchi et al., 1991). One main issue is the

failure to recognize the increase in blood volumes that accompanies training, causing a dilution of all blood contents. This hemodilution, often known as sports anemia, is not detrimental to exercise (Balaban 1992; Sacirovic et al., 2013).

The existing evidence does not agree with the notion that a low level of iron without anemia may reduce sports performance. However, many athletes with low iron reserves, or those who experience a sudden drop in their iron levels, complain of tiredness or the inability to recover after an intensive training session. Many respond to strategies that improve iron levels or prevent a new drop in iron reserves (DellaValle & Haas 2014).

At FCB, the evaluation and control of the state of iron is treated depending on the person, by sports healthcare experts. The prevention and treatment of iron deficiency include iron supplements, with a recommended dose of 100 mg / day of elemental iron for 2-3 months. However, a control plan must include dietary assessment to increase the intake of bioavailable iron, as well as suitable strategies to reduce unjustified iron losses. Many athletes self-prescribe iron supplements. However, this practice does not provide the athlete with the opportunity to properly evaluate iron losses and to receive dietary advice from sports diet experts.

Calcium

Resistance exercise is considered one of the best protections for bone health. In spite of this, it is disconcerting to find reports of low bone density in certain female athletes. However, a serious consequence of menstrual disorders in female athletes is a high risk of both a direct loss of bone density and a failure to improve the attainment of maximum bone density during early adulthood. Be it individually or as a group, the problems that appear in the female athlete's triad (eating disorders, menstrual dysfunction and lower bone density) can have direct consequences over athletic performance, generating an increased long term risk of suffering osteoporosis in adulthood.

An appropriate intake of calcium is important for bone health. Up to 1200-1500 mg/day may be needed in athletes with alterations in menstrual function. Again, athletes must integrate these strategies to satisfy calcium needs into their nutritional goals. When an adequate calcium intake is not possible through dietary means, normally through the consumption of low fat lactic products or soy alternatives enriched with calcium, a calcium supplement must be considered.

The list of medical supplements for nutritional deficiencies may be seen in table 5.

Table 5: Dietary Supplements for Nutritional Deficiencies

The following dietary supplements must be used in specific situations in sports, under an evidence based protocol. They must be used by athletes to contribute directly to improving their performance. Supplements must be used on individual protocols, under the supervision and control of nutritionists/doctors/sports science experts.

Medical Supplements for Nutritional Deficiencies	Supplement
Medical supplements are used to treat clinical issues, including diagnosed nutritional deficiencies. They require individual dispensation and the supervision of sports science experts or doctors specialized in sports.	Iron
	Calcium
	Mutivitamins/minerals
	Vitamin D

Source: Taken from the FCB Sports Nutrition GSSI translated guide.

2.2.2. Antioxidants and Anti-Inflammatory Supplements (Flavonoids, Vitamin C and E and Others)

Antioxidants

Exercise has been linked to an ever increasing production of oxygen free radical species, capable of causing cell damage (Powers et al., 2010).

Administering antioxidant vitamin supplements such as vitamin C or E generally increase the antioxidative state and offer protection against this kind of damage (Taghiyar et al., 2013).

However, studies on the effects of supplementing with antioxidants in the antioxidative state, damage and cell functioning are complex and confusing.

Whether the ongoing administration of supplements is needed, or whether it is even desirable for training adaptations and optimal athlete performance in competition, is unknown. Recently, it has been suggested that the increase in production of free radicals during a non-excessive period of exercise may act as a signal for adaptation, and therefore, the intake of antioxidant vitamins may in fact interfere with the desired adaptation (McArdle & Jackson, 2000).

Having mentioned antioxidant vitamins C and E in the previous section, we will focus on other substances that have an antioxidant effect but are not vitamins.

Nowadays, interesting information with regards to antioxidants and other nutritional components that may indirectly influence the recovery process is becoming available. Eccentric exercise has been demonstrated to increase muscle damage, inflammation, delayed onset muscle soreness and muscle function (Bowtell et al., 2011). This response is probably caused by inflammatory cytokines (Davis et al., 2007). Although this is a healthy process to a certain degree, this point may be exceeded and limit recovery. In these cases, food components that modify the inflammatory process may be helpful in the recovery process (Nedelec et al., 2013). Studies show some of the beneficial effects of omega-3 fatty acids (Tartibian et al., 2009), curcumin (Davis et al., 2007), tart cherry juice (Connolly et al., 2006; Howatson et al., 2010) and N-acetylcysteine (Michailidis et al., 2013) in the process of recovery due to their anti-inflammatory and/or antioxidant effects.

Although this data shows promising results, it must be taken into account that not all of these have been obtained from trials on humans. Effects of functional results are not always clear, and have not been evaluated for the long term. In any case, the administration of anti-inflammatory and antioxidant substances must be carefully dosed, as reactions to inflammatory processes and redox reactions trigger exercise adaptation. Therefore, chronic high doses, or nonperiodized doses of antioxidants may be detrimental to training in the long term (Baar, 2014).

Another large group of these molecules is obtained from plants, such as tea catechins or the naringenin of citrus fruits, amongst other flavonoids. The latter are composed of flavonols, flavones, flavanones, anthocyanidins and isoflavonoids, which are widely distributed in plants and function as pigments, signaling molecules, and defense against infection and illness. A high consumption of fruits and vegetables has been linked to decreases in cardiovascular disease and different types of cancer. This effect may be linked to the high levels of flavonoids in these foods (Nieman et al., 2010).

Composition

Next, we highlight certain natural foods that are rich in flavonoids: onions, apples, parsley, red fruits, grapes, celery, artichoke, red fruits, soy, pepper, leafy vegetables. In terms of supplements, it is important that these contain a combination of antioxidants in moderate doses rather than a high dose of only one.

Applications

This type of antioxidants applies both to health and performance. We should highlight that the most appropriate option is to seek their contribution through natural foods. If supplementation is chosen, follow the recommendations in the previous section and use these based on what the specialized professional recommends.

2.2.3 Vitamin D

Vitamin D

Vitamin D is a water soluble vitamin that acts as a steroidal precursor for different metabolic and biological processes. Once it is converted into its biologically active form, 1,25-dihydroxyvitamin D, it regulates the expression of over 900 gene variants (Dahlquist, Dieter & Koehle, 2015). Notably, it appears that around 90% of the world population shows inadequate vitamin D levels. Inadequate reserves are associated with an increased risk of bone diseases and fractures, and show catabolic effects over muscle tissue, which can cause muscle weakness and a reduction in sports performance.

The discovery of a vitamin D receptor in the skeletal muscle of human beings has given rise to research on the potential role of vitamin D in muscle protein synthesis (MPS) and muscle function, which has obvious implications for training adaptation (Morton, 2014). The study of vitamin D is especially relevant taking into account that many athletes, amongst them professional soccer players, present a vitamin D deficiency during the winter months (Morton et al., 2012; Cerrar et al, 2013).

During this time of the year, there is no UV radiation with the appropriate wavelength to stimulate the skin's production of pre-vitamin D₃ (Webb & Holick 1988; Webb et al, 1988). Taking into account that ultraviolet-B radiation varies during winter, supplementing with vitamin D₃ (cholecalciferol) has become common practice to promote the synthesis of vitamin D. To this end, daily supplementing with 5000 UI appears to be a safe and tolerable dose to restore 25-hydroxyvitamin D circulation to sufficient levels over the course of six weeks, that is, approximately 100 nmol/l (Cierre et al., 2013). 25-hydroxyvitamin D (25(OH)D) constitutes the primary metabolite of vitamin D circulating in the blood and is therefore the one measured in blood tests. Current recommendations indicate optimal blood levels of 70 nmoles/l (2.5 nmol/l = 1 ng/ml).

In an attempt to promote training adaptation, as well as maintain bone and immune health, it is recommended for soccer players to correct any deficiency with an appropriate supplement during the winter months, when sun exposure is potentially difficult. Therefore, daily supplementing with 5000 UI appears to be a safe and relevant dose in practice, although players must also seek medical advice.

Composition

The Institute of Medicine (IOM) recommends between 400 and 800 IU/day (40 IU = 1 µg) for children, adults and individuals over 70, in order to maintain plasmatic levels above 50 nmol/l. Nevertheless, this appears to be insufficient for athletes, and the recommended dose is 2000 to 5000 IU per day from all sources (fresh salmon, fortified cereals, milk, solar exposure) to maintain plasmatic levels of 25-hydroxyvitamin D between 75 and 80 nmol/l.

In terms of solar exposure, the recommendation during summer months is 20 minutes that exposes 5% of the skin to UVB radiation of 290 to 315 nm, two or three times per week.

Applications

The applications of vitamin D is for the general population and athletes. It is important to monitor its levels with blood tests and to work with the ideal professional team (nutritionist, coach, and doctor) so that blood levels may meet recommended values for each case.

Australian Institute of Sport Usage Protocol

- It is possible to find small amounts of vitamin D in foods such as: oily fish, egg yolk, fortified foods such as milk, orange juice, cereals and margarine. However, foods on their own do not provide enough vitamin D.
- Vitamin D deficiency may cause different health issues, among which are: a higher risk of bone injury, chronic musculoskeletal pain, and viral respiratory tract infections.
- Additionally, there is growing evidence that supplementation with vitamin D in athletes with suboptimal levels of vitamin D may have beneficial effects in sports performance, particularly strength, power, reaction time and balance.
- There is no universally accepted definition for vitamin D deficiency, however, the following definitions based on serum levels of 25-hydroxyvitamin D are often cited:
 - Vitamin D deficiency: serum levels < 20 ng/ml (50 nmol/l).
 - Vitamin D insufficiency: serum levels < 32 ng/ml (75 nmol/l).
 - Vitamin D sufficiency: serum levels > 32 ng/ml (75 nmol/l).
- In athletes, higher levels are preferred to allow for a greater safety margin and to optimize performance. Certain agencies that work with elite athletes generally set their own thresholds for the desired concentration of vitamin D.

2.2.4 Ineffective or Dangerous Substances

The amount of ineffective or dangerous substances found in commercially available products is remarkable. In fact, most products include, alongside substances that are effective such as carbohydrates, caffeine or creatine, some ineffective substance in their formulation as a marketing purpose to attract the consumer who is apparently impressed by a formulation with a greater number of substances. In this scenario, both the professional and the athlete or the person interested in using a supplement are encouraged to consult the reference tables presented in module 3 with regards to classifications from the Australian Institute of Sport and the International Society of Sports Nutrition.

Below, we list some of these ineffective or dangerous substances:

1. Chrome.
2. L-carnitine.
3. Garcinia Cambogia.
4. Ginseng.
5. Tribulus terrestris.
6. Ribosa.
7. Inosine.
8. Choline.
9. Citrulline – citrulline malate.
10. Coenzyme Q10.
11. Ephedrine – ephedra alkaloids.
12. Medium-chain fatty acids (MCFA).
13. Ferulic acid.
14. γ -oryzanol.
15. Anabolic steroids.
16. Ephedrine.
17. Amphetamines.
18. EPO.
19. STH.

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