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SPORTS NUTRITION PRINCIPLES IN TRAINING STAGES

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ABSTRACT. In maintaining good health and sports performance, nutrition plays an important role. Rational diet allows optimal development of athletes, helping them to achieve desired performance. Such a diet should be set according to metabolic processes in various sports branches and is determined by the particularities of substance exchange and the intensity of physical effort. Athletes' diets must be sufficient, in terms of quality and quantity, and compensate for energy and plastic loss of the body. They must provide an intake of calories that will cover the energy consumed by daily sporting activities, both in training and in competitions. A series of recommendations are meant to assist performance athletes with regard to their everyday diet, intake of liquids, and correct distribution and configuration of meals, depending on training or competition. To support performance sport and guide athletes towards a healthy lifestyle, to achieve exceptional results, a series of general valid directions are proposed for a balanced in the life of a performer.

Keywords*: sports performance, nutrition, health, exercise*

REZUMAT. ***Principiile nutriției sportive în etapele de antrenament.*** În menţinerea sănătăţii şi a performanţei sportive, nutriția are un rol foarte important. Alimentația rațională permite dezvoltarea optimă a sportivilor, ajutându-i în obținerea performantelor dorite. Aceasta trebuie să fie stabilită în funcție de procesele metabolice în diferitele ramuri sportive și este determinată de particularitățile schimbului de substanțe și intensitatea efortului fizic. Alimentația sportivilor trebuie să fie calitativă și suficient cantitativă, pentru a putea să compenseze pierderile energetice și plastice ale organismului. Nutriția sportivilor trebuie să le furnizeze un aport de calorii în măsură să acopere consumul energetic legat de activitatea sportivă zilnică, atât la antrenament cât și în competiții. Pentru a veni în ajutorul sportivilor de performantă se vor întâlni o serie de recomandări privind compoziția dietei zilnice, consumului de lichide, repartizarea corectă și alcătuirea meselor în funcție de antrenament sau competiție. În scopul de a sprijini sportul de performanţă şi a orienta sportivii către un stil de viată sănătos, pentru obținerea unor rezultate deosebite, sunt propuse o serie de direcții orientative cu caracter general valabil pentru o alimentație echilibrată în viaţa unui performer.

Cuvinte-cheie*: sport, performanţă, alimentație, sănătate, exercițiu fizic*

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Introduction

The principles of eating healthily are also found in the nutritional recommendations issued for performance athletes. In their case, it is necessary to resort to specific caloric and nutritional adaptations, depending on several criteria which refer to the type of sport practised, age, stage, duration and manner of conducting physical effort. Athletes' diets should meet the following conditions (Zamora & Crăciun, 1999), thus covering:

- Energy consumption of basal metabolism
- Additional energy need due to everyday life
- The energy need imposed by consumption during training and competitions, as well as the one stemming from the recovery processes after effort
- Unforeseen energy consumption (special conditions related to environment, disease, stress)
- The protection of athletes from potentially avoidable illness

The nutritional intake in athletes ' diets differs depending on:

- Training
- Competition
- Recovery

With regard to the nutritional need for conservation, one opts for the formula which takes into account the quantity and quality of the effort spent during practice (length, intensity, complexity), the presumptive energy consumption (evaluated as kcal/hour of effort), along with the other aforementioned activities. It is obvious that all decisions regarding nutritional recommendations must take into consideration environmental conditions (temperature, humidity, wind, altitude). Another way of calculating nutritional need, starting from theoretical data, accounts for about 60-70 kcal/kg of body mass, depending on sport, gender, physical effort, duration and environmental factors (Drăgan, 1989).

When establishing the necessary number of calories, one has to consider basal metabolism, the specific dynamic action of food, the energy necessary for thermoregulation, energy loss resulting from food preparation, and most of all, energy metabolism upon effort (Drăgan, 1989/ 2002; Avramescu, 2010).

The latter represents the energy spent during physical activity and is, first and foremost, the result of the amount and nature of muscle activity. An increase in effort metabolism depends on the intensity of physical effort, the level of training and the conditions provided by the environment. The metabolism of physical effort is defined by specific changes depending on the nature of the effort spent in various sports branches, along with intensity, duration and weather conditions. Sport effort firstly refers to muscle activity, which is why muscle metabolism needs to be adapted to the actual needs of the body (Rusu, 2011).

The speciality literature informs us as to the energy spent in various types of sport effort. Thus, in a 100-metre run, one estimates a caloric consumption of 35 kcal; for 400 m ~ 100 kcal; for 800 m ~ 130 kcal; for 1500 m ~ 170 kcal; for 3000 m ~ 230 kcal; for 5000 m ~ 450 kcal; for 10,000 m ~ 750 kcal; for a 5 km march ~ 250 kcal; for a marathon ~ 2,500 kcal; for speed skating 500 m ~ 45 kcal; for rowing ~ 10 kcal/min; for football ~ 1,500 kcal/match; for basketball ~ 900 kcal/match; for volleyball ~ 10 kcal/min match; for wrestling ~ 8,5-9,5 kcal; for a boxing match (3x3 minutes) ~ 200 kcal. The Ministry of Health has set several norms regarding caloric intake, depending on the nature and intensity of professional effort, as follows: for light physical activities 75-100 kcal/hour; for medium physical activities ~ 100-300 kcal/hour (Drăgan, 1994/2002).

The structure of diets for performance athletes

The correct diet of athletes must respect an optimal ratio between proteins, carbohydrates and fats, specific to each sport, depending on the nature of the effort spent (Drăgan, 2002; Antonio,2001; Stout,2001). In general, this ratio should be 55-60% carbohydrates, 25-28% fats and 14-18% proteins. For athletes engaging in intense physical activities, it is necessary to have an intake of proteins amounting to 1,5-1,8 g/kg body mass/24 hours, which can increase, in the case of sports branches where force is predominant and considerable development of muscle mass is required (weightlifting, wrestling) to 2,3-2,5 g/kg body mass/24 hours.

The above-mentioned recommendations lie at the basis of the research conducted by specialists, who recommend extra carbohydrates prior to and during effort, to gain better endurance, while after effort this is advisable to replenish glycogen levels (Spagnoli, 2004). Other sources reveal that the protein intake should be of 12-25%/24 hours (Zamora & Crăciun, 1999). From the total proteins ingested, 60% should be of animal origin and 40% of plant origin. In athletes, protein needs are greater that in untrained adults and depend on the nature and intensity of the effort spent, as well as the preparation time and weather conditions in which the physical activity is conducted (Phillips & Van Loon, 2011). For an athlete weighing an average of 70 kg, the approximate amount of proteins is 160-180 g/day. The following is recommended for athletes who train on a daily basis:

- Proteins with high biological value
- To consume an appropriate amount of proteins, albeit not an excessive one
- To avoid protein sources that are rich in saturated fatty acids: red meat, minced meat, sausages.

In the period of intensive training and after, it is recommended to use a complex mix of amino acids: glycine, arginine, glutamine, serine, taurine, methionine and cysteine, and essential amino acids with ramified chains: valine, leucine and isoleucine. These

are very important for stimulating muscle recovery after intensive effort and for reducing post-effort fatigue (Potgieter, 2013).

An athlete's need for fats depends on age, profession and sports branch practised. An intake of 1,5 g/kg body mass/24 hours is recommended, while for athletes conducting activities in a low-temperature environment, the need for fats is greater: 2-2,3 g/kg body mass/24 hours. Fats must account for 25-30% of the total calories in performance athletes' daily food supply and should be divided qualitatively as follows: 70% of animal origin and 30% of plant origin (Debuigne, 1989). The tendency to remove fats from diets is unjustified and even harmful to performance. This potential diet profile is marked by the difficulty to increase the intake of proteins and carbohydrates during intense training, which could provide sufficient energy so as to maintain an optimal weight and muscle mass. A hypolipidemic diet may cause a relative state of malnutrition due to the absence of essential fatty acids (linoleic acid), as well as of liposoluble vitamins (Kreider & Wilborn,et. 2010).

Carbohydrates should account for at least 55% of the daily energy intake. A significant increase is recommended, up to 70% of the total number of calories, due to the need to promote, facilitate and ensure the glycogen supply. In short-term effort, with maximum intensity (sprint, throw, weightlifting), it is not necessary to have an additional dose of carbohydrates, either before, or during the competition, given that such efforts rely on the energy released by ATP and phosphocreatine, without the participation of carbohydrates. In efforts lasting between 10 seconds and 30 minutes, the higher the intensity, the greater the consumption of carbohydrates per time unit. For example: anaerobic efforts lasting between 10 and 60 seconds: 200-400-metre races, mixed efforts of great intensity lasting between 1 and 3 minutes: 400 or 1500-metre races, some stages of various matches, almost entirely anaerobic efforts, of average intensity and lasting 3-30 minutes: some trials in athletics, swimming, rowing, cycling, skiing, skating.

The consumption of glycogen reaches 150-200 g, far less than the one stored within the body (500 g). Hence, there is no need for a glycogen supplement prior to the competition, but one must make sure that the amount of glycogen stored in the muscles and liver is increased through specialised training, as well as an optimal diet. In the case of efforts lasting more than 30 minutes and of low intensity (marathon, skiing, cycling, football, volleyball, lawn tennis), there is a need for a larger amount of energy, which cannot be provided by the glycogen available inside the body. In such efforts, the intake of carbohydrates is quite useful and has important effects in achieving performance (Simu, Roman & Szilagy, 2000).

Vitamins and minerals are the first options of energotropic medication, for well-grounded reasons. Being first on the list of recovery substances (trophotropic). The explanation regarding their presence in this category of pharmaceuticals is that, on the one hand, they are consumed excessively due to physical effort, depleting

their supply, and on the other hand, they are eliminated through excessive sweating, also as a consequence of physical effort (Drăgan, 1989; Ionescu & Anton, 2004).

Vitamins are essential substances for the body and their presence relies almost entirely on exogenous sources (Powers&Nelson, 2011). Vitamin B_1 is necessary in the amount of 0,5-0,7 mg per 1000 kcal, vitamin B_2 0,6-0,8 mg/1000kcal, vitamin B_6 1 mg/1000kcal, and vitamin B_{12} of 50γ. In athletes wishing to increase their muscle mass, 150-200γ are recommended per day, along with a rich protein diet. The daily intake of vitamin C is 20-25 mg/1000kcal. During physical activity, the need for vitamin C increases to 150-200 mg/day, while during competitions, it does so to 300-400 mg/day. The vitamin D intake is 400 UI (1.5 mg).

In athletes, the need for vitamin E is 50-70 mg/day, which during training increases to 90-120 mg/day, and during competitions up to 150-200 mg/day. The daily need for minerals, overall, in mg, for every 1000 kcal, is: iron 5 mg, calcium 300 mg, magnesium 200 mg, phosphorus 500 mg, sodium 1500mg and potassium 1000mg (Zamora & Crăciun, 1999; Facts About Dietary Supplements, 2001).

Specific aspects of diets in various effort periods

Training diet

There are two maintenance diets: one which aims to increase energy supplies and another whose purpose is muscle mass growth. The diet for increasing the body's energy supplies relies on an increase in muscle and hepatic glycogen reserves. It is useful to athletes practising endurance effort. The following process occurs: during the week prior to competing, on days 7, 6, 5, 4 before the trial, high-intensity and long-lasting training is pursued. In this period, the intake of carbohydrates is decreased to 45-50% (carbohydrate depletion).

On days 3, 2, 1, trainings shall have a high intensity, but a medium duration. The intake of carbohydrates shall increase to 70% (carbohydrate oversaturation). Muscle and hepatic glycogen levels increase, for 100 g of active tissue, 2,3-2,6 times compared to initial values. The protein intake is aimed at increasing muscle mass and strength. It is boosted to 4g/kg body mass per day. (Zamora & Crăciun, 1999; Damian, 2011; Muraru, 2004)

Competition diet

This does not constitute a source of energy for the body. It mostly plays a psychological role. It is expected to be pleasant, in terms of aspect and taste, avoid hunger sensation and leave the stomach in 2 and a half - 3 hours (Zamora & Crăciun, 1999; Damian, 2011; Muraru, 2004).

Post-effort recovery diet

It must be: hypocaloric, hyperhydric, hyperglucidic, rich in alkaline radicals (to counteract the effort-induced acidosis) and rich in minerals and vitamins (to compensate for effort-induced losses and excessive consumption) (Drăgan, 1989, 2002; Avramescu, 2010).

Conclusions

Sports performance is the result of a few combined factors, such as genetic potential, training, sleep, high-performance equipment, emotional involvement and, most importantly, nutrition. An athlete's diet greatly influences their performance. It is recommended that an athlete, given the possibilities, should consider the fact that their diet plays a major role in their life as a performer and it must be customized depending on the stages of preparation and the type of effort.

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