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ASSESSMENT OF INTAKE OF ESSENTIAL NUTRIENTS, VITAMINS AND MINERALS AND SELECTED INDICES OF NUTRITIONAL STATUS IN SHORT-DISTANCE RUNNERS

INTRODUCTION

Proper nutrition and regular physical activity during young age are very significant for growth and development. During intense physical activity, energy and macronutrient intake must be sufficient to maintain body mass, replenish glycogen stores, and provide adequate protein for building and repairing tissues. Physical activity also increases the need for some vitamins and minerals, and a diet inadequate in micro-nutrients may cause many deleterious effects [7].

It has been well documented that the nutritional intake of an elite athlete is a critical determinant of physical performance [7]. A suitably composed diet in various types of physical activity and during systematic training is crucial to optimize recovery in elite athletes [1]. Meeting nutrient needs can be difficult for young athletes, therefore, proper nutritional intervention may be important for promoting healthy dietary habits [1].

Major nutritional interventions in runners were conducted in endurance athletes [4]. However, there has been little information on the dietary habits and nutritional status of short-distance runners. Therefore, the aim of the study was to assess the intake of essential nutrients and examine the nutritional status of selected indices in elite short-distance runners.

METHODS

The study was performed in seventeen male elite athletes, aged 19 to 27 years (mean 21.6±2.21) practicing short-distance running for 8±2.3 years on the average. At the time of the study they had been training regularly and were in the first half of the preparatory phase. During the preparatory phase (8 weeks on the average), the athletes trained every day for 2-3 hours.

The measurement of body mass and body height was used to estimate the body mass index (BMI). The content of fat mass (FM), fat-free mass (FFM), total water and extracellular water were measured by means of bioimpedance analysis using 101/S analyzer (Akern, Italy). The blood for the analysis was drawn from the ulnar vein in the morning, in a fasting state. The venous blood serum was used to determine concentrations of iron (Fe), magnesium (Mg) and total calcium (Ca) using the Cormay tests (Poland). Hemoglobin concentration was measured with the Roche OMNI C analyzer (Roche Diagnostics, Switzerland).

The nutrition mode assessment was based on the 24-hour dietary history and was made with the three-day recall method [2]. Diet records were analyzed using "Dietetyk 2003" software package.

The study was approved by a Local Committee of Ethics in Research.

RESULTS

Table 1 presents mean values of somatic parameters and serum concentrations of biochemical indices in athletes. The BMI values (Body Mass Index) show regular body mass in fourteen subjects (from 20.0 kg/m^2 to 25.0 kg/m^2). BMI values were higher than 25 kg/m^2 in three athletes (from 25.3 kg/m^2 to 27.7 kg/m^2). The mean values of iron, calcium, and magnesium serum concentration as well as hemoglobin level were consistent with reference values. However, in

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six individuals, concentrations of magnesium were lower than reference values (reference range 0.8 – 1.0 mmol/l). With respect to iron and calcium concentrations irregular values were found only in one and two athletes, respectively.

The dietary assessment analysis showed that the mean protein and carbohydrate intake calculated per 1 kg of body mass amounted to 1.5±0.54 g/kg/day and 5.7±1.84 g/kg/day, respectively. The analysis of daily vitamin and mineral intake compared with the dietary reference intakes [8, 11] showed the deficit of vitamin B_2 (mean by 10.8%), B_6 (mean by 11.2%) and excess of sodium intake (mean by 22.4%) and phosphorus intake (mean by 185%) in diet of athletes. The consumption of other micronutrients was regular.

Table 1. Descriptive statistics of somatic parameters and biochemical indices concentration in the blood serum of short-distance runners

	Body weight (kg)	Height (cm)	BMI (kg/m^2)	FM (%)	FFM (%)	Total water (%)	Fe (mmol/l)	Ca (mmol/l)	Mg (mmol/l)	Hb (g/l)
$\bar{X}$	77.9	183.7	23.2	12.3	87.7	64.2	21.4	2.32	0.84	15.5
SD	6.81	7.49	2.01	4.57	4.56	3.34	4.717	0.315	0.131	0.87
max	89.3	198.0	27.7	20.3	95.5	69.9	28.50	3.00	1.10	14.0
min	62.1	168.4	20.0	4.5	79.7	58.3	10.83	2.10	0.64	16.8

Average diet energy values and macronutrient intake of short-distance runners are presented in Table 2. Mean values of vitamins and minerals intake are presented in Tables 3 and 4, respectively.

Table 2. Daily energy and macronutrient intake of short-distance runners

	Energy (kcal)	Proteins		Lipids		Carbohydrates	
		% energy intake	g	% energy intake	g	% energy intake	g
$\bar{X}$	3300.3	14.3	117.1	35.0	134.1	50.6	442.2
SD	1049.86	3.29	44.93	6.86	45.58	8.41	160.08
max	5528.2	21.5	218.5	54.2	273.1	71.0	694.8
min	3524.8	9.9	33.8	19.0	53.7	29.8	152.9

Table 3. Average daily vitamins intake of short-distance runners

	Vitamin A (µg)	Vitamin E (mg)	Vitamin C (mg)	Vitamin B_1 (mg)	Vitamin B_2 (mg)	Vitamin B_6 (mg)
$\bar{X}$	1249.7	11.6	126.4	2.2	2.5	2.3
SD	768.55	6.32	95.32	0.99	0.97	0.89
max	3758.5	23.5	328.4	4.3	5.4	4.4
min	375.3	3.6	2.9	0.9	0.5	1.1

Table 4. Average daily minerals intake of short-distance runners

	Calcium (mg)	Magnesium (mg)	Iron (mg)	Phosphorus (mg)	Sodium (mg)	Potassium (mg)
$\bar{X}$	1396.1	412.2	16.6	1999.1	3918.4	3918.0
SD	656.07	165.26	7.59	810.99	1644.98	1412.24
max	2833.4	779.5	36.9	4121.1	7593.3	7427.8
min	157.1	119.2	5.8	441.4	3829.6	1404.2

DISCUSSION

Nutritional intake is an important factor influencing athletes' performance. Proper diet in sport activity induces fast regeneration after training and adaptation to exercises with a decreased risk of traumas.

An adequate energy balance is very important to maintain body weight and body composition. Various sports require different body types for maximal performance. In their cross-sectional study Economos et al. [7] showed that the percent of body fat for elite male athletes ranged from 9.8% to 16.7% for anaerobic sports. The percent body fat in total body mass of short-distance runners investigated in our study amounted to mean 12.3% and remained in agreement with the recommended values.

Suitable energy supply helps to consume adequate macronutrients, vitamins and minerals. Although the total daily energy intake of athletes investigated in our study met the recommended values [7, 11], the consumption of carbohydrates was rather low but the athletes' diet was rich in fats and proteins. The current carbohydrate recommendation for athletes is 7 to 10 g/kg of body weight or 65 to 75% of total calories [7, 9], but the carbohydrate intake of athletes in our study was only 5.7 g/day (50.6% of total calories). Proper carbohydrate intake is necessary for replenishment of glycogen stores. Glycogen fuels muscle performance, especially during intense exercise [4]. Consumption of food rich in carbohydrates requires adequate amounts of B-group vitamins for proper metabolism [7]. However, the diet of athletes in our study was rather poor in vitamin B_2 and B_6.

Physical activity increases the need for some vitamins and minerals. Calcium and magnesium are the major components of the skeleton and they are very important for cellular function. The recommended calcium and magnesium intake for adolescents and young adults amounts to 1200-1300 mg/day and 350-400 mg/day, respectively [8, 11]. We found highly regular calcium intake and serum concentration in athletes in our study. Some authors suggest that adequate calcium intake is necessary for regeneration of bone microfractures after exercise [10]. Deuster et al. [5] noticed that high-intensity anaerobic exercise increased urinary excretion of magnesium. Magnesium is an abundant intracellular cation and it plays a vital role in glycolysis and the Krebs cycle. Although we found a regular mean value of magnesium serum concentration in athletes, in about 35% of subjects the magnesium levels were lower with respect to the reference value (from 0.64 mmol/l to 0.73 mmol/l) in spite of adequate magnesium consumption. The contents of other minerals in the athletes' diet covered the recommended values, but excess intake of sodium and phosphorus was found.

Some athletes suffer from iron deficiency because of increased haemolysis, losses with sweat, increased gastrointestinal bleeding and haematuria, decreased iron absorption and poor dietary intakes [3]. There has been a proposed determination of iron and hemoglobin concentrations to prevent sports anemia [6, 7]. Many athletes take iron supplements without medical supervision, and excess iron in diet may be dangerous because of its toxic effects [3]. In our study we observed a regular blood level and properly dietary intake of iron in the athletes. We may conclude that proper diet may be sufficient to provide the adequate amount of iron in short-distance running.

The results of the study lead us to conclude that nutrition in sport activity demands systematic control and proper nutritional education.

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