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Assessment of the implementation of energy needs and the participation of macroelements in the diet of professional athletes and amateur athletes training at the gym

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Key words: sports nutrition, nutritional status, exercise capacity.

Abstract

Introduction. In sport, a key role in achieving success is the right training unit combined with the rational nutrition. Both professional and amateur sports require the delivery of an increased amount of energy and nutrients compared to people not making physical efforts. The aim of the work was to assess the energy value and the level of consumption of basic nutrients among professional athletes and amateurs at the gym.

Material and methods. The research was conducted among 30 athletes who were at a sports camp in the "Zawisza" center and 30 amateur athletes training at the "Jatomi Fitness Drukarnia" gym in Bydgoszcz. The average age of the respondents was 20 ± 10.9 years. The energy value of the diet and the supply of macroelements were assessed on the basis of a 24-hour interview.
Results. Energy supply for athletes accounted for 84.8% of the recommended norm of energy demand (women: 82.5%, men: 88.6%). The energy value of food intake consumed by amateur athletes training at the gym covered 81.1% of their 24-hour energy expenditure (women: 74.1%, men: 88.0%). The proportion of macronutrients in the diet of men and women training athletics was a well-defined level of the recommended standard: protein 92.9% and 85.8%, fats 126.3% and 117.7% and carbohydrates 77.9% and 72.8%, while for amateur trainers: 146.8% and 107.8% protein, 102.4% and 90.7% fats and 71.9% and 63.9% carbohydrates.
Conclusions. An important element is the need for nutrition education of athletes. Nutritional intervention may increase the dietary awareness of people performing physical activity and help in proper balance of the menu.

Introduction

Proper nutrition is one of the most important elements affecting the functioning of the body. The increased needs of the athletes' body require proper balance of daily food rations. Therefore, both professional and amateur athletes require the delivery of an increased amount of energy and nutrients in comparison with people not making physical efforts. The nutritional plan should be developed individually for each of the athletes, including sports discipline, duration and intensity of training. In the case of professional athletes, in contrast to people who train in an amateur way, it is necessary to use the right supplements to ensure the right amount of energy, so that the meals consumed are low-volume and easily digestible [1]. A properly composed diet can lead to an increase in glycogen reserves accumulated in muscles and liver [2], thus contribute to better exercise capacity [3] (tab.I).

The aim

The aim of the work was to assess the implementation of energy needs and the proportion of macroelements in the energy value of the diet of professional athletes and amateurs at the gym.

Material and methods

The research was conducted among 60 people practicing sports. Thirty athletes were examined (average age: 20.2 ± 2.6, gender: 19 women, 11 men), who were at a sports camp in the "Zawisza" resort. The group of 30 people practicing amateur sports at the gym "Jatomi Fitness Drukarnia" in Bydgoszcz (average age: 24.0 ± 6.9 sex: 17 women, 13 men). The energy value of the diet and the supply of macronutrients of the subjects were evaluated on the basis of a 24-hour interview. To analyze the results of the research, computer databases prepared on the basis of "Tables of composition and nutritional value of food" [4] were used. The obtained results were compared with the current diets for people with high physical activity [5, 6]. The statistical analysis of the collected material was carried out in the Statistica 13.1 program by StatSoft. To assess the difference between actual and predicted values, Student's t-test for dependent variables was used. Comparisons of the obtained results towards the standards were made using the Student's t-test for a single sample. The choice of parametric tests was conditioned by the fulfillment of their basic assumptions, i.e. the conformity of the distributions of the tested variables with the normal distribution, which were verified by the W Shapiro-Wilk test. The statistical significance was assumed to be $p < 0.05$.

Results

The average energy supply for athletes was 3230.9 kcal, which accounted for 84.8% of the energy demand. During the day, women delivered an average of 3067.7 kcal with meals, and men 3512.7 kcal, which accounted for 82.5% and 88.6% of the energy demand respectively (Table II and Table III). Differences between consumed energy and total metabolism were statistically significant at $p < 0.05$ for women ($p = 0.0312$) and for men ($p = 0.0434$). For the whole group of athletes, the results differed statistically significantly between $p < 0.01$ ($p = 0.0048$) (Table IV). The average caloric value of meals taken during the day by amateur athletes training at the gym was 2163.5 kcal, and the energy value of consumed food rations covered in 81.1% their 24-hour energy expenditure. Women covered 74.1% of the energy demand (they provided 1739.5 kcal), which was a lower result by 13.9% compared to men (88.0%, they provided 2717.9 kcal). The obtained data showed that consumed energy was statistically significantly lower than the predictive value for all tested subjects ($p = 0.0003$), and also for the group of women ($p = 0.0030$). There was no statistically significant difference between the actual energy and the energy predicted for the group of men ($p = 0.0516$) although the obtained p-value was close to the statistical threshold significance (Table IV). Both in professional athletes, as well as in amateur training, the share of energy from carbohydrates is lower than the particular demand (~ 70% ± 5% of energy, they consumed respectively: women 406.1g and 225.3g carbohydrates men 463.1g and 332.8g carbohydrates). Professional athletes consumed too much fat, which constituted 121% of energy needs from fat (128.0g) (Table II and Table III). The share of energy from fat in the group of women athletes was lower by 8.6% than in the case of professional men athletes. The differences for the whole group of athletes were statistically significant at $p < 0.001$ ($p = 0.0000$) for carbohydrates, statistically significant at $p < 0.01$ for fat ($p = 0.0032$) and significant at $p < 0$, 05 for proteins ($p = 0.0337$) (Table IV). Amateur athletes exceeded the amount of consumed protein, which accounted for 127.4% of the energy needs from protein (127.5g). Women consumed a much smaller amount of protein (95g, which accounted for 107.8% of the energy requirement from this nutrient) than men (170g, which was 146.8% of the energy requirement from the aforementioned nutrient). It was confirmed that the number of consumed calories for carbohydrates was statistically lower than normal ($p = 0.0000$). The protein-derived energy turned out to be statistically higher than normal ($p = 0.0267$). Statistically significant ($p = 0.7069$) energy derived from fat in comparison with normal values did not differ significantly (Table IV).

Discussion

The obtained results showed that menus in both groups were characterized by energy deficit. Amateur athletes training at the gym despite less energy demand than professional athletes did not provide the right amount of energy along with the diet. Włodarek et al. [7], when examining long-distance runners, also noticed insufficient energy consumption in relation to the demand. Irregularities in the share of energy in daily food rations were also proved by the authors of other studies investigating groups of athletes training karate, recreational long-distance runners, or people practicing various forms of physical activity recreationally [8, 9, 10]. Incorrectly balanced diet, characterized by too little energy, leads to the use of proteins for energy needs, not for building materials. This is a disadvantageous phenomenon because carbohydrates are the main source of energy [11]. They belong to the basic and best used energetic substrate of the body. A certain level of free glucose is present in the blood, while sugars as a reserve material are in the

form of glycogen in the liver and muscles [2]. When the glycogen stores are depleted, the amount of glucose in the blood is reduced and the body is unable to perform the appropriate work, and the function of working muscles is impaired [3]. In the current study, in both groups of subjects the share of energy from carbohydrates is lower than the specific demand. Studies of Beata Szczepańska and Jadwiga Malczewska also showed too little carbohydrate, amounting to 55-60% of the recommended amounts for athletes [12]. Similar results were obtained by Tota et al. who studied medium- and long-distance runners [13], as well as the previously mentioned Włodarek et al. [7]. Inadequate supply of carbohydrates leads to decreasing of athlete's exercise capacity. Proper protein supply in daily food rations is essential. The combination of carbohydrates and proteins enables regeneration of the body, and also slows catabolic processes associated with long-term endurance effort by up to 83% [14]. Muscle reconstruction and stimulation of protein synthesis is better when the proportion of proteins consumed with carbohydrates is 3: 1 [15]. Sports classes determine the standards of protein demand. High-performance sport, in which the energy expenditure is larger, in comparison to players practicing recreationally, requires increased protein supply [16]. The results of our own study indicate that only amateur athletes exceeded the recommended amount of consumed protein (127,4%.) In studies of Naliwajko et al., which concerned the nutrition of young men practicing amateur sports, increased intake of protein was also demonstrated [17]. This could be due to the theory of increased protein demand in physical exercise. According to studies by Magdalena Przepiórka and Światosław Ziemlański, athlets' diets are often characterized by an increased amount of protein [18]. The protein excess in the diet can be harmful. High protein diets can cause significant renal and liver load. The reason for increased protein intake may also be increased calcium loss from the body [16, 19]. The analysis of menus showed that sportsmen consumed too much fat in general (121% of the recommended standard). Similar results were obtained in the previously presented study of Izabela Michnowska and Andrzej Tomczak. They assessed the energy expenditure of people recreationally practicing various forms of physical activity [10]. Athletes' diet should be easily digestible with low fat content and a lack of hard to digest products [5]. According to the work of Michael Gurr and Lucjan Szponar, practicing physical activity requires not only an adequate supply of carbohydrates, but also fats as a source of energy. Proteins are not used for muscle contractions [20]. Therefore, it is necessary to ensure proper proportions of nutrient intake, in order to enable the achievement of sports successes and proper body functioning.

Conclusions

1. Both the feeding of professional athletes and amateur athletes training at the gym requires control because an inadequate supply of energy (energy deficit) results in insufficient use of the competitor's abilities.
2. Both groups need nutritional education that will allow them to increase their sport efficiency and thus enable better sporting results.

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Table I. Maximum time of physical exercise due to the type of diet (2)

Type of diet	Maximum time of physical effort [min.]
Traditional diet	115
High-carbohydrate diet	168
Low carb diet	59

Table II. Average energy consumption, basic nutrients in the daily food rations of professional athletes and amateur training in the gym

Component	Athletes perform			Athletes amateur training at the gym		
	Altogether	Women	Men	Altogether	Women	Men
Energy [kcal]	3230,9	3067,7	3512,7	2163,5	1739,5	2717,9
Carbohydrates [g]	427,0	406,1	463,1	271,9	225,3	332,8
Protein [g]	126,4	119,7	138,0	127,5	95,0	170,0
Fat [g]	128,0	121,6	139,1	71,7	59,2	87,9

Table III. The degree of coverage of the norm for energy and basic nutrients by professional athletes and amateur training in the gym

Component	Athletes perform % of norm			Athletes amateur training at the gym % of norm		
	Altogether	Women	Men	Altogether	Women	Men
Energy [kcal]	84,8	82,5	88,6	81,1	74,1	88,0
Carbohydrates [g]	74,7	72,8	77,9	67,9	63,9	71,9
Protein [g]	88,5	85,8	92,9	127,4	107,8	146,8
Fat [g]	121	117,7	126,3	96,6	90,7	102,4

Table IV. The level of significance between energy and the basic nutrients taken with the diet, and the demand for the above-mentioned ingredients

Component	Athletes perform Severity level (p)			Athletes amateur training at the gym Severity level (p)		
	Altogether	Women	Men	Altogether	Women	Men
Energy [kcal]	0,0048	0,0312	0,0434	0,0003	0,0030	0,0516
Carbohydrates [g]	0,0000	0,0012	0,0036	0,0000	0,0002	0,0001
Protein [g]	0,0337	0,0839	0,1996	0,0267	0,5788	0,0195
Fat [g]	0,0032	0,1019	0,0001	0,7069	0,4805	0,8448