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ORIGINAL ARTICLE

SENSE OF SELF-EFFICACY AND THE CONTENT OF ENERGY AND NUTRIENTS IN THE DIET OF ELITE POLISH BASKETBALL PLAYERS

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ABSTRACT

Background. In research on the subject, the predictive importance of personal resources is indicated for diet quality.

Objective. The aim of the study was quantitative assessment of diet depending on the level of generalised self- efficacy among elite Polish basketball players.

Material and Methods. Food diaries (2 training days and 1 no training day) of 48 basketball players were analysed. Further assessed were 144 food rations based on the Diet 6.0 program, and the results were compared to the current Polish nutritional standards. The Generalised Self-Efficacy Scale (GSES) was also used. Statistical analyses were performed by estimating Spearman's rank correlation coefficients ($p<0.05$).

Results. The share of energy from proteins, fats and carbohydrates was 18.2%, 29.4% and 52.4%, respectively. Of the mineral salts, the average diet contained: 2,107.6 mg sodium, 2,918.3 mg potassium, 736.3 mg calcium, 1,372.2 mg phosphorus, 380.1 mg magnesium, and 11.6 mg iron. Of the vitamins, the average diet contained: 1,100.3 µg of vitamin A, 5.3 µg of vitamin D, vitamin E in the amount of 8.2 mg, 78.1 mg of vitamin C, 1.1 mg vitamin B1, 1.3 mg vitamin B2, 1.9 mg of vitamin B6, 271.7 µg of vitamin B9 and 4.7 µg of vitamin B12. It was also shown that as the sense of self-efficacy developed, the supply of energy, water, protein, digestible carbohydrates, energy from carbohydrates, sucrose and PUFAs also increased in the players' diets. At the same time, along with the increase in self-efficacy, the supply of: Na, K, Ca, Mg, P, Fe, Cu and iodine as well as vitamins: A, E, B1, B3, B6 and C, also increased in the players' diets.

Conclusions. Incomplete diet balance has been demonstrated, as well as significant relationships between the level of self-efficacy and the supply of certain nutrients in the diet of elite Polish basketball players. The obtained results indicate the legitimacy of diet monitoring and nutritional education as well as considering personality traits in activities promoting maintaining a proper diet among athletes.

Key words: *athletes basketball training, sense of self-efficacy, quantitative nutrition evaluation*

STRESZCZENIE

Wprowadzenie. Badania wskazują na predykcyjne znaczenie zasobów osobistych dla jakości diety, która jest jednym z czynników warunkujących sukces sportowy.

Cel. Celem badań była ilościowa ocena sposobu żywienia w zależności od poziomu własnej uogólnionej skuteczności elitarnych polskich koszykarzy.

Materiał i metody. Analizie poddano dzienniczki żywieniowe (2 dni treningowe i 1 beztreningowy) 48 koszykarzy. W oparciu o program Dieta 6.0 oceniono 144 racje pokarmowe, a wyniki odniesiono do aktualnych norm polskich żywieniowych. Zastosowano także Skalę Uogólnionej Własnej Skuteczności (GSES). Analizy statystyczne przeprowadzono szacując współczynniki korelacji rangowych Spearmana ($p<0,05$).

Wyniki. Udział energii z białek, tłuszczów i węglowodanów wynosił odpowiednio: 18,2%, 29,4% i 52,4%. Spośród soli mineralnych, przeciętna dieta zawierała: 2107,6 mg sodu, 2918,3 mg potasu, 736,3 mg wapnia, 1372,2 mg fosforu, 380,1 mg magnezu i 11,6 mg żelaza. Spośród witamin, przeciętna dieta zawierała: 1100,3 µg witaminy A, 5,3 µg witaminy D, 8,2 mg witaminy E, 78,1 mg witaminy C, 1,1 mg witaminy B1, 1,3 mg witaminy B2, 1,9 mg witaminy B6, 271,7 µg witaminy B9 i 4,7 µg witaminy B12. Wykazano ponadto, że wraz z nasianiem się poczucia samoskuteczności, w diecie zawodników zwiększała się podaż energii, wody, białka, węglowodanów przyswajalnych, energii z węglowodanów ($p<0,001$) oraz sacharozy ($p=0,021$) i PUFA ($p=0,017$). Zarazem wraz z nasilaniem się poczucia samoskuteczności, w diecie koszykarzy zwiększała się podaż sodu ($p=0,042$), potasu ($p<0,001$), wapnia ($p=0,045$), magnezu ($p=0,007$), fosforu ($p=0,026$), żelaza ($p=0,013$), miedzi ($p<0,001$) i jodu ($p=0,042$) oraz witamin: A ($p=0,002$), E ($p=0,034$), B1 ($p<0,001$), B3 ($p<0,001$), B6 ($p<0,001$) i C ($p=0,049$).

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Wnioski. Wykazano niepełne zbilansowanie diety oraz istotne zależności pomiędzy poziomem poczucia własnej uogólnionej skuteczności a podażą niektórych składników pokarmowych w diecie elitarnych polskich koszykarzy. Wskazuje to na zasadność monitoringu diety i edukacji żywieniowej oraz uwzględnianie cech osobowości w oddziaływaniach promujących prawidłowy sposób żywienia sportowców.

Słowa kluczowe: *sportowcy trenujący koszykówkę, poczucie samoskuteczności, ilościowa ocena sposobu żywienia*

INTRODUCTION

The sporting success of basketball players is conditioned by a wide range of motor and mental abilities [3, 15]. Basketball players undertake high-intensity efforts, usually with short intervals for post-exercise regeneration [3, 14, 21]. In the energy of exercise in team sports (including basketball), in connection with the "stop-and-go" game model, it is particularly important to increase carbohydrate reserves before exercise, ensure their replenishment during exercise and effective re-synthesis of glycogen in the liver and muscles during recovery following exertion [23]. Therefore, achieving certain goals in sports requires special care for a varied and well-balanced diet. A diet that takes into account the increased demand for energy, fluids and some nutrients (carbohydrates, proteins, B vitamins, antioxidants and minerals) is one of the key factors contributing to the improvement of exercise capacity and the effective post-exercise recovery of athletes [13, 20].

The diet of athletes is determined by various individual factors, including psychological ones [2, 17]. One of the significant factors is the sense of self-efficacy, a defined personal resource, related to the belief in the ability to achieve intended goals, including health and nutritional ones [12]. Within this context, research allowing to confirm the predictive nature of personal resources for the quality of the nutritional behaviour among athletes, including those training team sports, can be cited [5-7].

As indicated by various authors, the subject of basketball players' diet has not been exploited in research [16, 22]. The available studies concern nutritional behaviour, and therefore, the qualitative aspects of a diet [7]. In order to present the quality of the basketball players' diet more fully, research was undertaken on the quantitative assessment of the diet and its selected individual conditions. In this regard, the sense of self-efficacy factor was adopted due to its predictive importance for the quality of the diet of athletes [6]. The research was undertaken in the belief that the obtained results, apart from cognitive value, may also have applicative importance and contribute to the individualisation of educational impact and the improvement of the effects in sports training of basketball players.

The aim of the research was to quantify the diet depending on the level of generalised sense of self-efficacy in a group of elite Polish basketball players.

MATERIAL AND METHODS

Research was conducted in a group of 48 men - Polish athletes practicing basketball professionally. The basic selection of criteria for inclusion in the study group was practicing sports at a competitive level, at the level of the highest league in Poland, for at least 3 years. The research was conducted among 8 basketball clubs. The mean age of the participants was 26.6 years (±4.5), and the average sports experience was 8.6 years (±4.8). The average level of BMI was 24.3 kg/ m^2 (±0.9).

Nutrition was assessed by the method of current recording on the basis of food diaries kept for 3 days (2 training and 1 non-training day). Therefore, 144 athletes' daily food rations were evaluated. Energy intake, as well as macronutrients and regulating ingredients (vitamins and minerals), was assessed using the Diet 6.0 nutritional program. The content of nutrients was tested in relation to the current Polish nutritional standards for men aged 19-30 [11]. The following standards were adopted for the assessment of nutrition at the level of: EAR (Estimated Average Requirement) or AI (Adequate Intake) and reference numbers for the share of individual macronutrients in the energy pool of food rations [11]. The results, in line with the methodology, were interpreted as the percentage of subjects meeting the standard of demand for individual nutrients.

Self-efficacy was measured using the Generalised Self Efficacy Scale (GSES) [12]. The GSES scores were within the range of 10-40 points (the higher the score, the higher the sense of generalised self-efficacy). The values on the GSES scale for the studied basketball players were: 30.4 (±2.7), Me=31.0 (within the 24.0-32.0 range).

Statistical analyses were performed using the PQStat 1.8.2.182 statistical package. The correlations between the scales were analysed by estimating *Spearman's* rank correlation coefficients. The test probability at a level of $p<0.05$ was assumed as statistically significant while probability at the level of $p<0.01$ was considered highly significant.

RESULTS

The average daily food rations of elite Polish basketball players contained: 1,795.5 kcal, 79.3 g of protein, 58.5 g of fat, 258.2 g of total carbohydrates and 21.7 g of dietary fibre. The share of energy from proteins, fats and carbohydrates was 18.2%, 29.43% and 52.5%, respectively. The mean water consumption was 1,682.8 ml/day. The supply of analysed nutrients is presented in Table 1.

Quantitative assessment of the basketball players' diet compared to the Polish standards allowed to show that almost all athletes met the reference values in terms of energy share from proteins and fats (95.8%

Table 1. Supply of water, energy, macronutrients, vitamins and mineral salts in the diet of Polish elite basketball players (descriptive statistics) compared to Polish nutritional standards for men aged 19-30

Variables	M	SD	Norms	% of realising participants
Energy (kcal)	1795.5	547.9	3350***	8.33
Water (g)	1682.8	713.8	2500**	18.0
Total protein (g)	79.3	23.4	-	-
Animal protein (g)	49.6	14.3	-	-
Plant protein (g)	28.7	15.8	-	-
Energy from protein (%)	18.2	3.0	10-20	95.8
Total fat	58.5	24.5	-	-
Energy from fats (%)	29.4	9.4	20-35	95.8
Saturated fatty acids (g)	17.1	7.8	-	-
MUFA (g)	23.6	12.6	-	-
PUFA (g)	12.3	6.5	-	-
Cholesterol (mg)	315.5	142.1	<300 mg	58.3
Total carbohydrates (g)	258.2	105.9	-	-
Assimilated carbohydrates (g)	234.7	92.9	-	-
Saccharose (g)	38.4	20.8	-	-
Energy from carbohydrates (%)	52.4	9.2	45-65	83.3
Fibre (g)	21.7	16.5	>25 g**	22.9
Sodium (mg)	2107.6	930.9	1500**	50.0
Potassium (mg)	2918.3	1285.5	3500**	32.6
Calcium (mg)	736.3	358.6	800*	34.7
Phosphorus (mg)	1372.2	571.5	580*	100.0
Magnesium (mg)	380.1	207.0	330*	46.5
Iron (mg)	11.6	5.2	6*	95.8
Zinc (mg)	11.1	3.7	9.4*	77.2
Copper (mg)	0.9	0.4	0.7*	56.2
Manganese (mg)	5.9	3.5	2.3**	95.8
Iodine (μg)	24.6	28.1	95*	25.9
Vitamin A (μg)	1100.3	1033.9	630*	63.9
Vitamin D (μg)	5.3	7.1	15**	11.8
Vitamin E (mg)	8.2	4.6	10**	37.5
Vitamin B1 (mg)	1.1	0.5	1.1*	40.3
Vitamin B2 (mg)	1.3	0.2	1.1*	71.5
Vitamin B3 (mg)	17.8	8.4	12*	80.5
Vitamin B6 (mg)	1.9	0.9	1.1*	90.3
Vitamin B9 (μg)	271.1	105.8	320*	25.7
Vitamin B12 (μg)	4.7	3.3	2.0*	87.5
Vitamin C (mg)	78.1	57.6	75*	50.0

*EAR, **AI, ***EER [11]

of the subjects), and the vast majority also in terms of the share of carbohydrates (83.3% of the participants). A smaller percentage of the athletes consumed 2,500 ml of fluids (18% of the respondents), cholesterol up to 300 mg a day (58.3% of the subjects) and fibre in the amount of at least 25 g per day (22.9% of the athletes). Among the assessed mineral salts, athletes met the needs for phosphorus (100%) and iron and manganese (95.8%) in the greatest percentage, while in the smallest percentage, the norms for iodine (25.9% of respondents), potassium (32.6% of subjects) in the smallest percentage of respondents, calcium (34.7% of respondents) and magnesium (46.5% of subjects) were met. Among the assessed vitamins, athletes met the requirements for vitamin B6 (90.3%) and B12 (87.5%) in the highest percentage, and in the smallest percentage, for vitamin D (11.8% of the subjects), folates (25.7%), vitamin E (37.5%), B1 (40.3%) and C (50%) (Tab. 1).

Assessment of the relationship between the content of water and nutrients in the diet and the level of GSES among the studied basketball players showed that as the level of self-efficacy of the players increased, so did the supply of energy, water, total protein, vegetable protein, total carbohydrates, assimilated carbohydrates and energy from carbohydrates (p<0.001), as well as the supply of sucrose (p=0.021) and PUFAs (p=0.017). At the same time, the share of energy from fat decreased (p<0.001). Furthermore, there was also an increase in the supply of vitamins and minerals with the increase in self-efficacy. These included: sodium (p=0.042), potassium (p<0.001), calcium (p=0.045), magnesium (p=0.007), phosphorus (p=0.026) and iron (p=0.013), as well as copper (p <0.001) and iodine (p=0.042), and vitamins A (p=0.002), E (p=0.034), B1 (p <0.001), B3 (p<0.001), B6 (p<0.001) and C (p=0.049) (Tab. 2).

Table 2. Correlations between the supply of water, energy, macronutrients, vitamins and minerals in the diet of basketball players and the level of self-efficacy (GSES) among elite Polish basketball players (*Spearman's* monotonic correlations)

VARIABLES	GSES	
	R	*p*
Energy (kcal)	0.3701	<0.001
Water (g)	0.346	<0.001
Total protein (g)	0.292	<0.001
Animal protein (g)	0.074	0.409
Plant protein (g)	0.402	<0.001
Energy from protein (%)	-0.035	0.697
Total fat	-0.045	0.614
Energy from fat (%)	-0.297	<0.001
Saturated fatty acids (g)	-0.128	0.154
MUFA (g)	-0.128	0.154
PUFA (g)	0.212	0.017
Cholesterol (mg)	-0.103	0.251
Total carbohydrates (g)	0.373	<0.001
Assimilated carbohydrates (g)	0.406	<0.001
Saccharose (g)	0.206	0.021
Energy from carbohydrates (%)	0.377	<0.001
Fibre (g)	-0.023	0.801
Sodium (mg)	0.181	0.042
Potassium (mg)	0.375	<0.001
Calcium (mg)	0.179	0.045
Phosphorus (mg)	0.198	0.026
Magnesium (mg)	0.239	0.007
Iron (mg)	0.220	0.013
Zinc (mg)	0.140	0.118
Copper (mg)	0.547	<0.001
Manganese (mg)	0.043	0.630
Iodine (μg)	0.181	0.042
Vitamin A (μg)	0.276	0.002
Vitamin D (μg)	0.113	0.206
Vitamin E (mg)	0.189	0.034
Vitamin B1 (mg)	0.565	<0.001
Vitamin B2 (mg)	0.134	0.123
Vitamin B3 (mg)	0.416	<0.001
Vitamin B6 (mg)	0.527	<0.001
Vitamin B9 (μg)	0.072	0.422
Vitamin B12 (μg)	0.037	0.680
Vitamin C (mg)	0.175	0.049

DISCUSSION

In the discussed research, partial imbalance was indicated for the diet and correlation between the consumption of certain nutrients and the level of self-efficacy among elite Polish basketball players.

Positive nutritional trends concerned the correct share of energy from basic nutrients, higher consumption of wholesome than non-wholesome protein, and the highest share of monounsaturated fatty acids (MUFAs) in the total fatty acid structure. The dietary imbalances particularly concerned the insufficient supply of energy, water and dietary fibre as well as some vitamins (especially D, E and folic acid) and mineral salts (especially potassium, calcium and iodine). The percentage of athletes covering the daily requirement for vitamins B1 and C and magnesium was also low.

The described deficit energy and water consumption among athletes is significant in the context of exercise physiology and the increased demand for these components. Energy and fluid deficiencies may significantly reduce exercise capacity and increase health risks, including those related to dehydration (e.g. hyperthermia). In view of the identified nutritional deficiencies, one should also point to the pleiotropic functions of vitamin D, the antioxidant properties of vitamins E and C, the hematopoietic role of folic acid and the metabolic function of vitamin B1 (e.g. regulation of carbohydrate metabolism). Within the context of the identified nutritional deficiencies, the participation of calcium, magnesium and potassium in the contractile function of skeletal muscles should also be indicated, as well as important aspects of physical exercise physiology, therefore, factors determining exercise capacity [13, 20].

Studies by other authors from various research centres also allowed to confirm numerous quantitative and qualitative irregularities among people training basketball (competitive and amateur). The insufficient water consumption found in our own research corresponds to the results of research among amateur basketball players aged 19-29, in whom fluids were properly replenished by approx. 55%, 74% and 77%, 76.5% athletes (respectively: before, during and after training) [1]. Among the studied Polish elite male basketball players, the correct share of carbohydrates and protein in the energy pool of the diet was described, while among women from the university basketball team, insufficient consumption of carbohydrates and protein was described [24]. Carbohydrate deficiency and excess fat have also been reported among elite Spanish wheelchair basketball players [4]. The trends described in the authors' own research are also supported by the results obtained among the Spanish elite basketball players in wheelchairs, who exhibited sufficient consumption of 5 B vitamins, phosphorus, selenium and iron, and a deficient supply of vitamin E (51% of the norm) and calcium (73% of the norm) [9]. The insufficient intake of vitamin D described in our own research corresponds to the results of studies among elite professional Spanish basketball players, which confirmed that 57% of subjects had too low levels of the vitamin D-25(OH)D metabolite in the blood during the winter period (<50 nmol/L). Vitamin D intake was also too low (3.47 µg/day). It was additionally shown that the serum 25(OH)D level was significantly correlated with the intake of vitamin D ($r=0.65$; $p=0.001$) and calcium ($r=0.82$; $p<0.001$) [8]. The low magnesium supply described in our current study was also demonstrated in the elite group of basketball, handball and volleyball players. Meanwhile, magnesium is associated with muscle strength, which may be due to its role in energy metabolism, transport across cell membranes, and in muscle contraction and relaxation [19]. The described quantitative irregularities in the diet of elite Polish basketball players correspond to the qualitative irregularities shown in studies carried out by various authors. And thus, among Polish basketball players, a low frequency of consumption of vegetables and fruit as well as fermented dairy products was described [7], which corresponds to a low supply of folates, vitamin C and potassium, magnesium and calcium in the discussed research. Also, among Greek basketball players, a low consumption of vegetables and grain products on training days was described [22].

The significant correlations between the level of self-efficacy and the consumption of nutrients indicated in the discussed research concerned the increase in the supply of energy, water, protein (including vegetable), assimilated carbohydrates (and sucrose), polyunsaturated fatty acids (PUFA) and energy from carbohydrates, and decreasing people energy from fats in food rations. Positive relationships were also found between the level of self-efficacy and the supply of antioxidant vitamins (A, E, C) and B vitamins (B1, B3, B6) as well as mineral salts (Na, K, Ca, P, Mg, Fe, Cu, I). The found dependencies generally confirm the tendency towards a greater supply of essential ingredients in the diet, with significant functional properties in conditions of vigorous physical effort, including those related to the energy of physical exertion, hydration, supply of building-block and energy substances, increasing the antioxidant potential, regulating the proper course of metabolic processes, water-electrolyte, acid-base and haematopoietic processes [13, 20].

The tendency towards a more balanced diet in basketball players with higher self-efficacy confirms their greater care for the quality of the diet as one of the key factors of sports success, thus fitting into the characteristics of this personality dimension. The tendency to make more intense rational nutritional choices among team sports athletes along with an increasing sense of self-efficacy has also been confirmed in other studies. Other trials conducted among Polish basketball players confirmed the tendency towards a larger scale of rational behaviour, including the consumption of vegetables and fruit, whole grain cereal products and fish, along with an increasing sense of self-efficacy [7]. The tendency for more rational choices related to the reduction of trans isomers and simple sugars in the diet among athletes with higher self-efficacy has been confirmed in meta-analysis research [10].

The obtained results, indicating incomplete balance of the diet of elite Polish basketball players and significant relationships between the quality of the diet (in the quantitative dimension) and the level of self-efficacy, confirm the legitimacy of further monitoring diet and nutritional education, and taking into account personality traits in activities promoting the proper nutrition of athletes, as indicated by others authors [7, 9, 24]. Meta-analytical studies have allowed to confirm that nutritional education of team sports athletes can be an effective strategy for improving their eating habits, nutritional knowledge and body composition [18].

CONCLUSIONS

Quantitative assessment of the diet allowed to show incomplete balance in the diet of elite Polish basketball players, with an indication of an insufficient supply of energy, water and dietary fibre as well as some vitamins (especially D, E and folic acid) and mineral salts (especially potassium, calcium and iodine). The percentage of athletes covering the daily requirement for vitamins B1 and C and magnesium was also low.

Significant correlations have been demonstrated between the level of self-efficacy and the consumption of nutrients in one's diet, showing a tendency towards a greater supply of ingredients with important functional properties under conditions of vigorous physical exercise, including energy, water, protein, assimilated carbohydrates and PUFAs, as well as some vitamins (antioxidants and group B) and mineral salts (Na, K, Ca, P, Mg, Fe, Cu, I) in basketball players with a higher level of self-efficacy.

The obtained results indicate the legitimacy of diet monitoring and nutritional education as well as considering personality traits in activities promoting maintaining a proper diet among athletes.

Conflict of interest

None declared.

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