

PREVALENCE OF THE USE OF EFFECTIVE ERGOGENIC AIDS AMONG PROFESSIONAL ATHLETES

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ABSTRACT

Background. Athletic performance can be substantially enhanced with supplements and functional food which are considered by scientists as efficient, safe and legal, such as protein, carbohydrate and protein-carbohydrate supplements, isotonic sports drinks, carbohydrate-protein bars, carbohydrate bars, creatine and caffeine.

Objective. The study is aimed at an analysis and evaluation of the prevalence of using effective ergogenic aids (creatine, caffeine, isotonic drinks, carbohydrates, and proteins) in a group of Polish professional athletes.

Material and Methods. The research was conducted on 600 athletes (216 women, 384 men) practicing various sports disciplines; the younger group (18-23 years old) consisted of 307 people, while the older one (24-35 years old) was comprised of 293 subjects. A questionnaire was used with questions concerning the frequency and types of consumed supplements.

Results. Nearly half of the athletes (48,2%) admitted to taking supplementation, of which 36.7% consumed the supplements occasionally and 11.5% continually. The majority of the group (75.4%) claimed to be consuming isotonic drinks, which were the most commonly chosen nutritional aid enhancing physical performance, most frequently supplementing the diet in a continuous manner (41.2%). The least frequently used supplement was creatine, chosen by only one in three interviewees (34,5%). The ergogenic aids were used more often by men than women (50.5% vs. 44.1%), and so were nutrients based on proteins (51.8% vs. 32.0%), carbohydrates (60.7% vs. 46.8%), protein-carbohydrates (45.6% vs. 32.9%), as well as creatine (39.8% vs. 25.0%). The studies showed the inessential difference in the frequency of taking supplementation based on the interviewees' age (0.4%).

Conclusions. Competitors who use supplements over those who choose not to, seems to reflect the continuous lack of the athletes' sufficient awareness of the effectiveness, safety, and health benefits of dietary supplementation that enhances physical performance.

Key words: *supplements, dietary supplementation, sport, performance-enhancing substances, athletes*

STRESZCZENIE

Wprowadzenie. We wspomaganiu zdolności wysiłkowych istotną rolę odgrywają suplementy i odżywki bezsprzecznie uznane przez środowiska naukowe za skuteczne, bezpieczne i legalne, tj. odżywki białkowe, węglowodanowe, białkowo-węglowodanowe, płyny izotoniczne, batony węglowodanowo-białkowe, węglowodanowe, kreatyna i kofeina.

Cel. Celem badań była analiza i ocena rozpowszechnienia stosowania skutecznych substancji ergogenicznych (kreatyna, kofeina, płyny izotoniczne, węglowodany oraz białka) w grupie polskich sportowców trenujących wyczynowo.

Material i Metody. Badania zostały przeprowadzone wśród 600 sportowców (216 kobiet i 384 mężczyzn), w tym 307 młodszych (18-23 lata) i 293 starszych (24-35 lat), uprawiających zróżnicowane dyscypliny. W grupie badawczej przeważały osoby trenujące piłkę ręczną (15,3%), nożną (14,7%) i siatkową (13,3%). Narzędziem badawczym był kwestionariusz ankiety dotyczący częstości przyjmowania i rodzaju stosowanych suplementów. Analizę statystyczną zebranych wyników przeprowadzono za pomocą pakietu statystycznego PQStat ver. 1.6.

Wyniki. Blisko połowa sportowców (48,2%) deklarowała korzystanie z suplementacji, w tym 36,7% w sposób okresowy, a 11,5% stały. Większość grupy (75,4%) przyjmowała płyny izotoniczne, które były najczęściej wybieranym środkiem wspomagającym zdolności wysiłkowe, uzupełniającym dietę w sposób ciągły (41,2%). Najczęściej stosowanym suplementem była kreatyna, z przyjmowania której korzystał co trzeci ankietowany (34,5%). Mężczyźni istotnie częściej niż kobiety (50,5% vs 44,1%) suplementowali dietę środkami ergogenicznymi, częściej wybierając odżywki białkowe (51,8% vs 32,0%), węglowodanowe (60,7% vs 46,8%), białkowo-węglowodanowe (45,6% vs 32,9%), a także kreatynę (39,8% vs 25,0%). Wykazano nieistotną różnicę częstości stosowania suplementacji w zależności od wieku sportowców (0,4%).

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Wnioski. Nieznaczna przewaga zawodników stosujących suplementy diety nad respondentami rezygnującymi ze wspomaganie wysiłku fizycznego świadczy o ciągle niewystarczającej wiedzy sportowców na temat skuteczności i bezpieczeństwa zdrowotnego oraz korzyści wynikających z suplementacji diety wspomagającej wysiłek fizyczny.

Słowa kluczowe: *suplementy, suplementacja żywieniowa, substancje ergogeniczne, sportowcy*

INTRODUCTION

Contemporary athletic training challenges the boundaries of human body capabilities. Homeostasis, if intentionally disturbed with physical exercises, is typically restored during the rest period. Athletic performance can be substantially enhanced with supplements and functional food which are considered by scientists as efficient, safe and legal, such as protein, carbohydrate and protein-carbohydrate supplements, isotonic sports drinks, carbohydrate-protein bars, carbohydrate bars, creatine and caffeine [36,5]. Numerous scientific studies have evaluated the effects of individual substances, knowledge of supplementation principles among athletes and prevalence of supplementation across various populations [38,7,26,32,]. The study is aimed at an analysis and evaluation of the prevalence of using effective ergogenic aids (creatine, caffeine, isotonic drinks, carbohydrates, and proteins) in a group of Polish professional athletes

MATERIALS AND METHODS

A questionnaire survey was conducted in a group of 600 athletes from various sports, including 216 female and 384 male athletes. The respondents' age ranged from 18 to 35 years (mean age: 24.2 years). Most of study participants were handball players (15.3%), soccer players (14.7%) and volleyball players (13.3%). Among women, the most numerous group was female volleyball players (7.3%), whereas the biggest group of male athletes were soccer players (14.2%). The research tool was an anonymous questionnaire concerning the frequency of supporting the physical exercise and type of supplements used. The questionnaire was composed of two parts. The first part contained personal data (gender, age, type of sport). The second part contained items concerning ingesting frequency for supplements regarded as effective, such as protein supplements, carbohydrate supplements, protein-carbohydrate supplements, isotonic sports drinks, carbohydrate-protein bars, carbohydrate bars, creatine and caffeine. The respondents were asked to choose one of the three answers: "never", "periodically" and "constantly". Statistical analysis of the results was performed using PQStat 1.6 software package. The *Chi*-squared test was used to examine the correlations between frequency of using individual ergogenic aids and (1)

gender and (2) age. The differences in the frequency of supplementation were analysed with *Friedman* test and post-hoc *Dunn* test. The significant test probability was set at $p < 0.05$ whereas highly significant was set at $p < 0.01$ and $p < 0.001$.

RESULTS

The analysis of the results revealed that 48.2% of respondents declared using the ergogenic aids, including 36.7% periodically and 11.5% regularly. Every second athlete ingested effective dietary supplements to enhance their performance. Proportion of the number of Polish athletes who used supplementation to non-users was 1.3:1. Periodical supplementation (36.7%) was almost 3 times more frequent than constant (11.5%) (Table 1). Isotonic sports drinks were found to be most often used ergogenic aid among all the supplements (75.4%, $p < 0.001$), enhancing diets usually in a constant manner (41.2%) (Table 1, Table 2). The highest, highly significant difference in the frequency of using was observed between creatine and isotonic sports drinks, with the latter chosen almost twice more often than creatine (40.7%, $p < 0.001$) (Table 2). The second supplement which was most often chosen to support athletic performance were carbohydrate supplements (55.7%) (Table 1), used by athletes significantly more often than other effective supplements, such as protein supplements (11.0%), protein-carbohydrate supplements (14.7%), carbohydrate-protein bars (17.3%), carbohydrate bars (15.1%) and creatine (21.2%) ($p < 0.001$) (Table 2). Caffeine was the third supplement chosen by the athletes from the study group (55.1%) (Table 1). Athletes decided significantly more often to ingest caffeine compared to carbohydrate-protein bars (16.7%), carbohydrate bars (14.5%) and creatine (20.6%) ($p < 0.001$) (Table 2). Among all the supplements, periodical consumption of ergogenic aids concerned most often caffeine (43.3%), with other aids being less popular. The least frequently ergogenic aid was creatine, used by every third respondent (34.5%) (Table 1). It was ingested significantly less often than carbohydrate supplements (22.2%), isotonic sports drinks (40.7%) and caffeine (20.6%) ($p < 0.0001$). In general, highly significantly ($p < 0.0001$) difference between frequency of the use of individual ergogenic aids was found, concerning 54% of the relationships analysed (Table 2).

Table 1. Consumption of of effective ergogenic aids in research group (n- number of athletes, %-percentage of athletes)

Types of supplements	Studied group (n=600)							
	Never		Periodically		Constantly		No answer	
	n	%	n	%	N	%	n	%
Protein supplements	240	40	229	38.2	39	6.5	92	15.3
Carbohydrate supplements	174	29	241	40.2	93	15.5	92	15.3
Protein-carbohydrate supplements	262	43.7	207	34.5	39	6.5	92	15.3
Isotonic drinks	59	9.8	205	34.2	247	41.2	89	14.8
Carbohydrate-protein bars	277	46.2	208	34.7	22	3.7	93	15.3
Carbohydrate bars	266	44.3	218	36.3	26	4.3	90	15
Creatine	325	54.2	192	32	15	2.5	68	11.3
Caffeine	198	33	260	43.3	71	11.8	71	11.8
Average		37.5		36.7		11.5		14.3

Table 2. Differences in the consumption of effective ergogenic aids (%- percentage of athletes)

Types of supplements	Protein supplements	Carbohydrate supplements	Protein-carbohydrate supplements	Isotonic drinks	Carbohydrate-protein bars	Carbohydrate bars	Creatine	Caffeine
Protein supplements	-	11.0***	3.7	30.5***	6.3	4.1	10.2	10.4
Carbohydrate supplements	11.0***	-	14.7***	19.5***	17.3***	15.1***	21.2***	0.6
Protein-carbohydrate suppl.	3.7	14.7***	-	34.2***	2.6	0.4	6.5	14.1
Isotonic drinks	30.5***	19.5***	34.2***	-	36.8***	34.6***	40.7***	20.1***
Carbohydrate-protein bars	6.3	17.3***	2.6	36.8***	-	2.2	3.9	16.7***
Carbohydrate bars	4.1	15.1***	0.4	34.6***	2.2	-	6.1	14.5***
Creatine	10.2	21.2***	6.5	40.7***	3.9	0.8744	-	20.6***
Caffeine	10.4	0.6	14.1	20.1***	16.7***	14.5***	20.6***	-

Statistical significance: ***p<0,001

Distribution of statistical data indicates differentiation in the frequency of the use of supplements depending on the athlete's gender. Men used dietary supplements to enhance their athletic performance more often than women (50.5% vs 44.1%) Men chose more often (p<0.001) protein supplements

(51.8% vs 32%), carbohydrate supplements (60.7% vs 46.8%), protein-carbohydrate supplements (45.8% vs 32.9%) (using them periodically) and creatine (39.8% vs 25%), used least frequently. Frequency of the use of other ergogenic aids did not show differentiation with respect to gender (Table 3).

Table 3. Consumption of effective ergogenic aids in relation to sex (n-number of athletes, %- percentage of athletes)

Types of supplements	Woman (n=216)								Men (n=384)							
	Never		Periodically		Constantly		No answer		Never		Periodically		Constantly		No answer	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Protein supplements	123	56.9***	63	29.2	6	2.8	24	11.1	117	30.5	166	43.2***	33	8.6	68	17.7
Carbohydrate supplements	91	42.1***	71	32.9	30	13.9	24	11.1	83	21.6	170	44.3***	63	16.4	68	17.7
Protein-carbohydrate supplements	121	56***	57	26.4	14	6.5	24	11.1	141	36.7	150	39.1***	25	6.5	68	17.7
Isotonic drinks	27	12.5	72	33.3	93	43.1	24	11.1	32	8.3	133	34.6	154	40.1	65	16.9
Carbohydrate-protein supplements	110	50.9	71	32.9	10	4.6	25	11.6	167	43.5	137	35.7	12	3.1	68	17.7
Carbohydrate supplements	102	47.2	77	35.6	13	6	24	11.1	164	42.7	141	36.7	13	3.4	66	17.2
Creatine	144	66.7***	49	22.7	5	2.3	18	8.3	181	47.1***	143	37.2	10	2.6	50	13
Caffeine	68	31.5	96	44.4	35	16.2	17	7.9	130	33.9	164	42.7	36	9.4	54	14.1
Average		45.5		32.2		11.9		10.4		33		39.2		11.3		16.5

Statistical significance: *p<0,05; **p<0,01; ***p<0,001

The difference between the frequency of supplementation to support athletic performance by younger athletes (18 to 23 years) and older athletes (24 to 35 years) was insignificant (0.4%). It was observed, however, that older athletes declared significantly more often taking creatine (38.6% vs. 30.6%, $p<0.05$) and protein supplements (48.1% vs 41.4%, $p<0.05$). The use of other supplements was similar in both age groups. More differences were observed in terms of the method of supplementation. Protein supplements (41.6% vs 34.9%, $p<0.05$) and protein-carbohydrate supplements (39.6% vs 29.6%, $p<0.01$) taken periodically was significantly more observed in older athletes. The most of the athletes did not use creatine supplementation, which was more often observed in the younger group (61.9% vs 46.1%, $p<0.05$). The reverse situation was observed in the case of caffeine, which was more often ingested periodically by the younger group (47.6% vs 38.9%, $p<0.05$) (Table 4).

Table 4. Consumption of effective ergogenic aids in relation to age (n- number of athletes, %-percentage of athletes)

Types of supplements	Younger athletes (n=307)								Older athletes (n=293)							
	Never		Periodically		Constantly		No answer		Never		Periodically		Constantly		No answer	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Protein supplements	140	45.6*	107	34.9	20	6.5	40	13	100	34.1	122	41.6*	19	6.5	52	17.7
Carbohydrate supplements	98	31.9	114	37.1	55	17.9	40	13	76	25.9	127	43.3	38	13	52	17.7
Protein-carbohydrate supplements	150	48.9	91	29.6**	26	8.5	40	13	112	38.2	116	39.6**	13	4.4	52	17.7
Isotonic drinks	25	8.1	111	36.2	132	43	39	12.7	34	11.6	94	32.1	115	39.2	50	17.1
Carbohydrate-protein bars	145	47.2	107	34.9	15	4.9	40	13	132	45.1	101	34.5	7	2.4	53	18.1
Carbohydrate bars	134	43.6	118	38.4	16	5.2	39	12.7	132	45.1	100	34.1	10	3.4	51	17.4
Creatine	190	61.9*	86	28	8	2.6	23	7.5	135	46.1*	106	36.2	7	2.4	45	15.4
Caffeine	110	35.8	146	47.6*	26	8.5	25	7.5	88	30	114	38.9*	45	15.4	46	15.7
Average		40.4		35.8		12.1		11.6		34.5		37.5		10.8		17.1

Statistical significance: * $p<0,05$; ** $p<0,01$; *** $p<0,001$

DISCUSSION

Popularity of dietary supplementation has substantially increased over the last decade [1, 10]. Both professional and amateur athletes have become convinced that ergogenic aids are indispensable to improve athletic performance [8]. Our study also demonstrated that substantial part of athletes use ergogenic aids (48.2%). High percentage of athletes (86.5%) ingesting ergogenic aids was also found in other study among 156 Polish athletes [13]. In a study carried out two years before, the percentage of athletes using ergogenic aids was 76% [14]. Over 50% popularity was also shown among other athletes, including combat sport athletes (65%) [37], Canadian swimmers (56%) [19], canoe athletes, field hockey players, rowers, water polo players, swimmers, track and field athletes and volleyball players (64%) [8], 1625 Iranian athletes

(66,7%) [26], track and field athletes (85%) [25] and 216 volleyball players and weightlifters (64%) [22]. More than half (51.3%) of students from the Athletic Championship School in Police, Poland also declared the use of ergogenic aids [30]. Similar results were obtained for a group of 55 basketball players (58%) and 990 soldiers from the US army (53%) [29,24]. The use of supplementation to enhance athletic performance was declared by 80% of people from a group of male jiu-jitsu athletes, Norwegian athletes from the Olympic team 2002 and 83% of respondents from a group of 52 Norwegian Olympians 2004 [3,18, 32]. The use of dietary supplements to enhance athletic performance was declared by all bodybuilders (127 people) [17]. A study by *Dietz* et al. demonstrated the wide-scale use of dietary supplementation by German elite athletes [11]. Another study on dietary supplementation among 113 athletes aged 15 to 35

years in Sri Lanka also found substantial popularity of such substances. Most of athletes (94%) of various sports (badminton, soccer, swimming, cycling, karate) used dietary supplementation [9]. Most of studies have reported on the widespread use of ergogenic aids, although there have been also studies which have demonstrated lower popularity of supplementation [4, 27, 31]. Insignificant popularity of supplementation was also found in a group of 209 basketball players and volleyball players as it concerned only one third of the group [31]. Similar pattern was observed in studies performed by foreign research centres. Less than 30% of people from the group of 561 Italian athletes who trained regularly in a gym and 817 Brazilian runners were found to use dietary supplementation [4, 27]. The most recent survey of supplementation in a group of 253 Iranian university students from sports schools who participated in Summer Olympic Games in 2012 showed that 70.7% of the athletes would be willing to ingest supplementation, with the most frequent athletes being wrestlers (82.5%) and track and field athletes (76%) [1].

The most of studies showed differences in the frequency of the use of supplementation between women and men [16,30,4]. In our study, men used dietary supplementation more often than women (50.5% vs 44.1%) to enhance physical capacity, although the differences were relatively insignificant. More frequent use of supplementation by women was also observed in a group of 210 volleyball players aged 13 to 25 years from sports clubs in Poland in Ostrołęka, Myślenice, Bydgoszcz and Warsaw [16]. Similar results were obtained in a study by Seidler and Sobczak, where the use of supplementation was declared by 67.6% boys and 35.9% girls from the Athletic Championship School in Police, Poland [30]. High percentage of men (54.1%) who used supplementation was also found in a study by Bianco et al.[4]. Other pattern, connected with higher popularity of dietary supplementation among women, was revealed in a group of 156 professional athletes across various sports (91%) [13]. In a group of athletes from the Norwegian Olympic Team 2002, differences between supplementation among women and men were insignificant (79% vs 81%). However, two years later the diet was more often supplemented by women compared to men (94% vs 77%) [3,18].

Our own study showed that the differences concerning the use of dietary supplementation with regards to age were insignificant: the supplementation was used by 48.3% of older athletes (24-35 years) and 47.9% of younger athletes (17 to 23 years). More frequent dietary supplementation in older athletes was also observed in the previous studies by Frączek and Gacek in a group of 70 athletes [14]. On the other hand, more frequent use of supplementation by younger

people was found in a group of 1625 Iranian athletes who regularly attended fitness clubs [26].

The use of creatine as a dietary supplement was started in the nineties. Over years, and stimulated by more recent scientific research, the use of creatine has gained in popularity. Eventually, Kreider unequivocally demonstrated that creatine is one of the most effective and safe dietary supplements to improve strength, power, muscle mass and physical capacity of athletes [23]. Only one study, published by Kim et al. [21], suggested an unfavourable effect of creatine on health of swimmers, simultaneously demonstrating the substantial popularity of this ergogenic aid in this group of athletes. Despite the above conclusions, popularity of the use of creatine evaluated in our study was not high since it was not used by 54.2% athletes. Creatine was found to be the least frequently used supplement among the dietary methods to enhance athletic performance analysed in the study. Men and older athletes used creatine supplementation more often than women and younger athletes (39.8% vs 25% and 38.6% vs 30.6%, respectively). Another study of Polish athletes demonstrated the use of creatine declared by small number of people (7.8%) with women using this ergogenic aid more often than men (22.5% vs 12.5%) [13]. Similar results were observed in a group of Olympians participating in the Olympic Games in 2002 (7%) and 2004. (7%) and among 516 Italian athletes who regularly trained in a gym (14%) [3, 4, 18]. Creatine was found to be the second most frequent (32%) supplement in a group of 91 navy soldiers from the US army [28]. Similar observation was made among 490 bodybuilders (76.5%) [15]. In his study, Hackett et al. [17] demonstrated high popularity of the use of creatine among 127 bodybuilders. A widespread use of creatine was observed first and foremost in a group of bodybuilders, although ingesting creatine was also declared by athletes from strength sports and sprinters [35].

Caffeine is an ingredient of food products which is regularly consumed by most of the population. The market for caffeine products has been substantially growing in the last years, especially concerning energy drinks and supplements. Caffeine has a stimulating effect and enhances a number of metabolic and psychological functions [36]. Scientific studies have demonstrated an ergogenic effect of caffeine on aerobic exercise [2]. In our study, popularity of the use of caffeine was moderate: it was ingested by 55.1% of athletes (43.3% periodically and 11.8% constantly). The enhancement of performance with caffeine was used more often by women compared to men (60.6% vs 52.1%) and athletes from the younger group compared to the older group (56.1% vs 54.3%). In a group of 127 bodybuilders, only 24.3% declared the use of products with caffeine in the period of 6

weeks prior to competition [17]. The use of caffeine was not found in a study of 56 athletes from different sports [13]. Popularity of caffeine in food products is very high while its use as an ergogenic aid to improve athletic performance is much lower. This is likely to be connected with eating habits rather than knowledge of its ergogenic properties.

According to the American College of Sports Medicine, adequate fluid replacement helps maintain body hydration and, consequently, health, safety and optimal physical fitness in people who are regularly involved in physical activity [6]. The isotonic sports drinks have been developed to protect human body from dehydration, supply carbohydrates and replenish electrolyte deficiency which occurs during vigorous physical exercise [20]. An increasing popularity of the use of isotonic sports drinks has been observed for the last several years. Our study also demonstrated that the use of isotonic sports drinks was the most frequent type of ergogenic aid. They were periodically used by 34.2% of athletes and constantly by 41.2% of athletes. Despite small differences, a tendency was observed for women to take isotonic sports drinks more often than men (76.4% vs 74.7%). This was consistent with a study by Frączek who demonstrated that isotonic sports drinks were taken by 68% of athletes, with women taking them more frequently than men [13]. On the other hand, isotonic sports drinks were used in a group of 210 volleyball players more frequently by women (64% vs 32%) [16]. High popularity of isotonic sports drinks was found in a group of volleyball players (100%), soccer players (51.4%) and university students of the Academy of Physical Education and dancers from the folk song and dance ensemble aged 20 to 30 years (89%) [30,20]. Among 55 basketball players, 21.8% of the respondents used isotonic sports drinks as the second most frequent choice of supplement to enhance athletic performance [29]. Similar frequency of the use of sports drinks (23%) was found in a study of 990 soldiers [24]. Few reports have demonstrated a small scale of the use of sports drink. Only 20 of 1421 physically active children declared the use of this type of support. [34].

Athletes often decide to increase protein intake in their diet using protein supplements and amino acid supplements [5]. Popularization of the use of protein supplements among athletes in our study was moderate. Protein supplements were the fourth most frequent choice of dietary supplementation (44.7%), used by 38.2% of athletes periodically and by 6.5% constantly. Protein supplementation was significantly more often chosen by men compared to women (51.8% vs. 32%) and older compared to younger athletes (48.1% vs 41.4%). More frequent use of protein supplements by men compared to women (35.9% vs 28.2%) has been also observed in other studies that

have demonstrated protein supplements to be taken by every third athlete (32%), including all the gymnasts, short distance runners and cross-country skiers [13]. Protein supplements were found to be moderately popular in studies by *Schroder* et al. (12.7%) [29] and *Salgado* et al. (13.48%) [27]. Only 9% of professional athletes in a group of 582 Canadian athletes took protein supplements [12]. However, in a group of 209 basketball players and volleyball players [31] and a group of 990 soldiers, these supplements were the second most popular type of ergogenic aid [24]. In a group of 52 Norwegian Olympians 42% of them used protein supplementation [18]. Protein supplements are a very popular aid used to enhance athletic performance among bodybuilders and athletes training in a gym, which was demonstrated in studies by *Frączek* et al. (55.92%) [15], *Bianco* et al. (58.8%) [4], *Hackett* et al. (86.4% in the off-season and 73.6% before competition) [17].

Carbohydrates are the most essential component of an athlete's diet. In order to improve the ability to perform high-intensity endurance efforts, the glycogen stores should be replenished through ingesting high amounts of carbohydrates [36]. In our study, this was the second most frequent form of dietary supplementation (55.7%), used periodically by 40.2% athletes and constantly by 15.5% athletes. Carbohydrate supplements were significantly more frequently taken by men compared to women (60.7% vs 46.8%). Another study carried out among 156 Polish athletes from various sports demonstrated that carbohydrate supplements were used by 36.5% people. Carbohydrate supplements were used by all gymnasts, sprinters and ski jumpers and these ergogenic aids were least frequently taken by team sports athletes [13]. This was also demonstrated in a study carried out in a group of 55 basketball players, with carbohydrates chosen as the most frequent supplementation (12.7%) (12,7%) [29]. Similar results were observed among young players: only 10.6% took carbohydrate supplements [33]. This type of supplementation was the most frequently used (52.17%) in a group of 817 Brazilian runners [27]. Carbohydrate supplements were more often chosen by men compared to women (38.5% vs 34.6%) in a group of 156 Polish athletes from different sports [13].

CONCLUSIONS

1. The fact that nearly half of the surveyed athletes take ergogenic aids, which enhances exercise capacity, demonstrates their high level of knowledge about safety and efficacy of dietary supplements. However, demonstrated slight predominance of athletes taking supplements over the respondents who refused to support their efforts

- with them suggests that the level of awareness concerning efficacy, safety and benefits of dietary supplementation is still insufficient.
- The great popularity of isotonic sports drinks should be considered as a positive attitude that proves a high level of knowledge about the importance of isotonic drinks in the regulation of fluid and electrolyte balance in conditions of physical exertion.
 - Among the studied group of athletes, the least frequently used supplement was creatine which may indicate insufficient knowledge about the efficacy, safety and benefits of using this supplement, suggesting the need for education in this area.
 - Male athletes took dietary supplements often than female which indicates that men are more aware of the efficacy, safety and health benefits resulting from the use of ergogenic aids. The observed different preferences in the selection of individual supplements in the case of men and women may indicate different motives of ergogenic aids usage basing on gender. Women more often saw the need to fulfil the shortages caused by exercise (isotonic liquids) while men were more likely to expect improvement in exercise capacity by an increase in energy and power (carbohydrates, creatine).
 - Differences between the frequency of the use of dietary supplements by younger and older athletes indicated no association between the age of an athlete and the efficiency of supplementation on the exercise capacity. More frequent use of creatine by older athletes was probably due to more experience in supporting physical effort with aids containing creatine.

Conflict of interest

The authors declare no conflict of interest.

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Received: 04.02.2016

Accepted: 30.06.2016