

USE OF DIETARY SUPPLEMENTS AMONG ELITE ATHLETES

Elma Omeragić¹, Jasmina Đedibegović¹, Miroslav Sober¹,
Aleksandra Marjanović¹, Mirza Dedić¹, Haris Niksić¹, and Mahir Fidahić²

¹Faculty of Pharmacy, University of Sarajevo, Bosnia and Herzegovina

²Medical Faculty, University of Tuzla, Bosnia and Herzegovina

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SUMMARY

Many athletes use supplements in their diet as part of regular training or competition, thus enabling more intense training by encouraging faster recovery between workouts, minimizing interference caused by disease or injury and increasing competitive performance. These supplements, unlike medications, are not subject to rigorous efficiency and safety checks and tests. There is a risk with regard to those supplements which include positive doping test result as a consequence of presence of the prohibited substances not listed in the declaration of the preparation.

The aim of this study was to examine the use of supplements among elite athletes by analyzing the forms for doping control, issued by the Agency for Anti-doping control of Bosnia and Herzegovina, performed in the period from 2010 to 2012. The study includes supplements whose use was reported by athletes in the period of the last 7 days (prior testing).

The study results indicate the frequency of dietary supplements use of 34.5%. The most dominant group among users of dietary supplements were men aged between 18 and 29 years. From 152 users of dietary supplements 62.3% of them have used more than one product. The number of used supplements was an average of 2.9 ± 2.8 products. Amino acids and proteins are the most commonly used dietary supplements.

This study confirmed excessive use of dietary supplements among elite athletes and pointed to the need of necessary education and ensuring the availability of scientific and unbiased information, about the benefits and risks of dietary supplements use, to athletes.

Key Words: athletes, dietary supplements, sport.

INTRODUCTION

The U.S. Food and Drug Administration [FDA] defines the term “dietary supplement” to mean: “a product (other than tobacco) intended to supplement the diet that bears or contains one or more of the following dietary ingredients: a vitamin, a mineral, an herb or other botanical, an amino acid, a dietary substance for use by man to supplement the diet by increasing the total dietary intake, or a concentrate, metabolite, constituent, extract, or combination of any of the aforementioned ingredients” (Dietary Supplement Health and Education Act of 1994, 2013).

There are a large number of published studies on the frequency of use of dietary supplements among

athletes. Meta-analysis of 51 such study indicates that use of dietary supplements is present among 46% of athletes, while this frequency of use among elite athletes is even higher, at around 59%, depending on the type of sport, athletes’ age, gender and level of competition (Maughan, 2004).

The benefit of supplementation in sports is still controversial. A well-designed diet that ensures optimal intake of energy, building and protective substances is the basis of a well-planned training and sports results. However, there is not enough evidence to prove that dietary interventions which imply potentiation of dietary supplements could improve the efficiency of training and sports results (Molinero & Marquez, 2009). On the other hand, inadequate and

excessive use of dietary supplements can lead to significant side effects and interactions and distortion of the health status of athletes (Maughan, Doug & Trevor, 2004).

Since these products are not subject to strict production standards and labeling and that there is no harmonized legislation by which their distribution would be controlled, there are no guarantees that supplements do not contain prohibited substances that can harm the health of consumers and lead to a positive drug test result. Numerous studies demonstrated persistence of counterfeit dietary supplements on the free market that contained banned substances whose presence is not indicated on the product declaration (Maughan, 2004).

Although many authors have considered excessive intake of supplements, there is little data on the frequency, type, quantity and age and gender distribution of dietary supplements among elite athletes from Bosnia and Herzegovina.

The aim of our study was to quantitatively and qualitatively analyze the intake of dietary supplements by elite athletes.

METHODS

We analyzed a total of 442 forms for doping control done on national and international competitions and out of competition during the period from 2010 to 2012. The study included supplements whose

use was reported by athletes in the last 7 days prior testing.

Statistical analysis was performed using the software Minitab 13.0 (Minitab Inc., USA). Data are presented as frequencies. The significance of the proportion differences between appropriate age-gender groups in the total sample and the users of dietary supplements was tested by chi-square test (χ^2). Difference between the mean values of continuous variables was tested by Student's *t*-test. Probabilities of $p < .05$ were considered statistically significant.

RESULTS

Data were provided by the Agency for Anti-doping control of Bosnia and Herzegovina [BiH]. In the period between 2010 and 2012 data were collected from a total of 441 athletes with a mean age of 23.7 ± 5.8 years (range 13-45 years), of whom 352 (79.8%) were citizens of BiH. Most athletes were aged between 18 and 23 years (both genders), while a significant percentage of women was noted among athletes younger than 18 years of age (Figure 1).

In the total sample, the most common sports were athletics (10.4%) and basketball (10.2%), followed by handball (8.8%), volleyball (8.2%) and soccer (7.3%), while the remaining 55.1% was consisted of 28 different sports with a single representation of $<5.5\%$. Descriptive statistics of the sample is shown in Table 1.

FIGURE 1

Distribution of athletes of both genders by age groups.

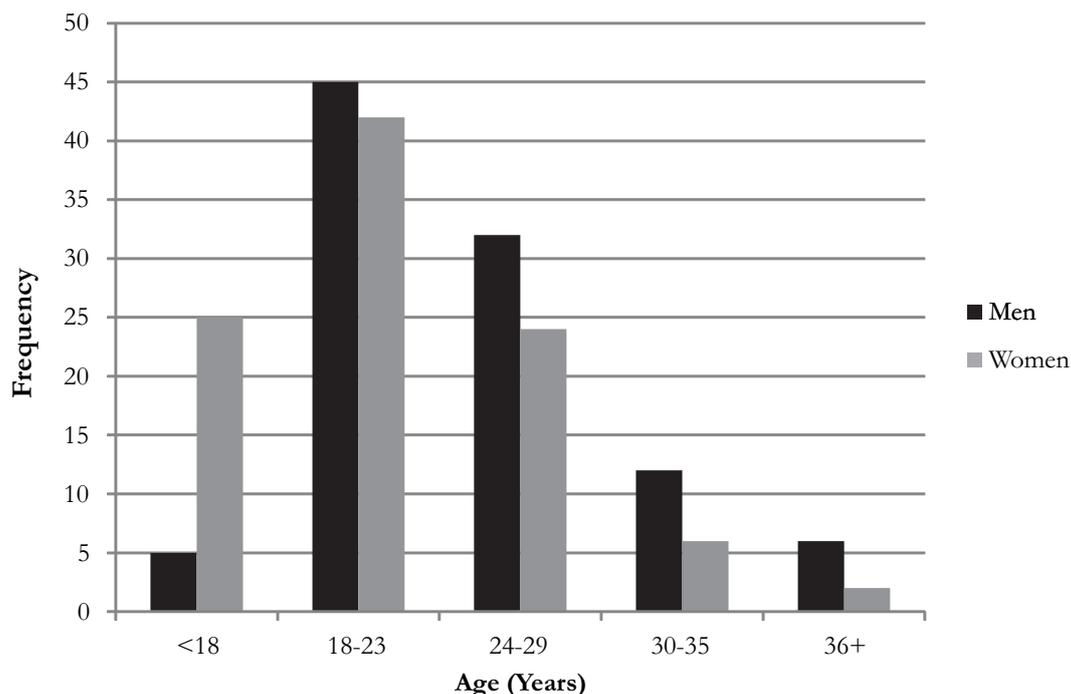


TABLE 1*Descriptive statistics of the sample.*

Vriables	Category	<i>n</i>	%
Gender	Men	283	64.2
	Women	158	35.8
Athletes wth coach	Yes	407	92.3
	No	31	7.0
	Unknown*	3	.7
Athletes with a doctor/physician	Yes	184	41.7
	No	254	57.6
	Unknown*	3	.7
In competition	Yes	250	56.7
	No	188	42.6
	Unknown*	3	.7

* Data is not entered in the doping control form

A total of 152 (34.5%) athletes have reported a consumption of dietary supplements [DS]. Men aged between 18 and 29 years (Figure 2) dominate among the DS users. Distribution by gender-age groups in the total sample did not differ significantly with respect to users of dietary supplements. However, the representation of two gender-age groups differed significantly in the total sample and among the DS users (Figure 2).

Female athletes under the age of 18 years were significantly ($p = .04$) underrepresented among DS users (4.8%), than in the total sample (9.5%). Representation of athletes aged ≥ 36 years was also sig-

nificantly ($p = .01$) lower among the DS users (1.4%), than in the total sample (4.0%). The established differences suggest that the characteristics of the groups (defined by combination of gender and age) are associated with the use of the DS in the tested athletes. When it comes to female athletes, the results show a trend of slight increase in the use of the DS after 24 years, while in men the DS consumption was most intensive between the age of 18 and 29 years, after which it declines.

The largest number of athletes (92.3%) had their own coach. Therefore, the distribution of gender-age groups among athletes having a coach (Figure 3)

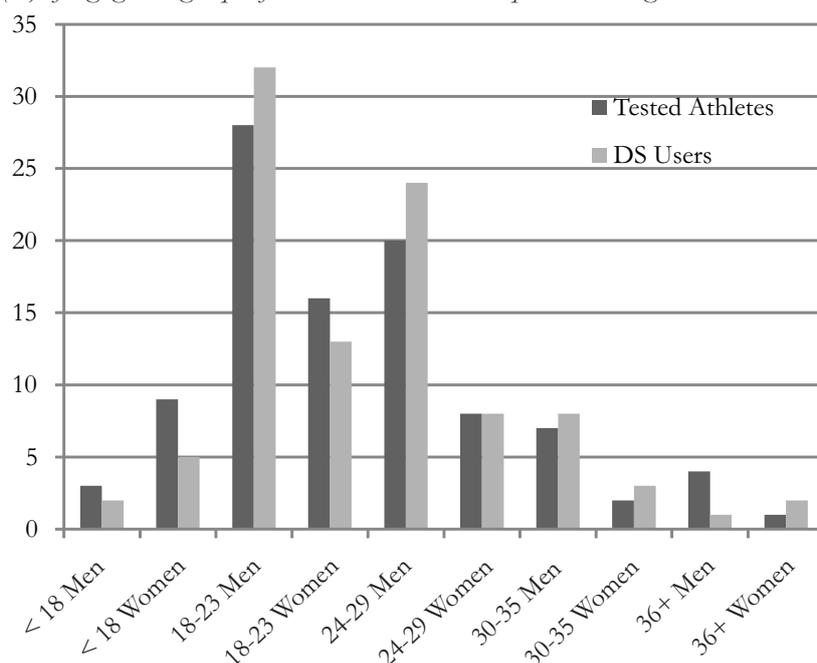
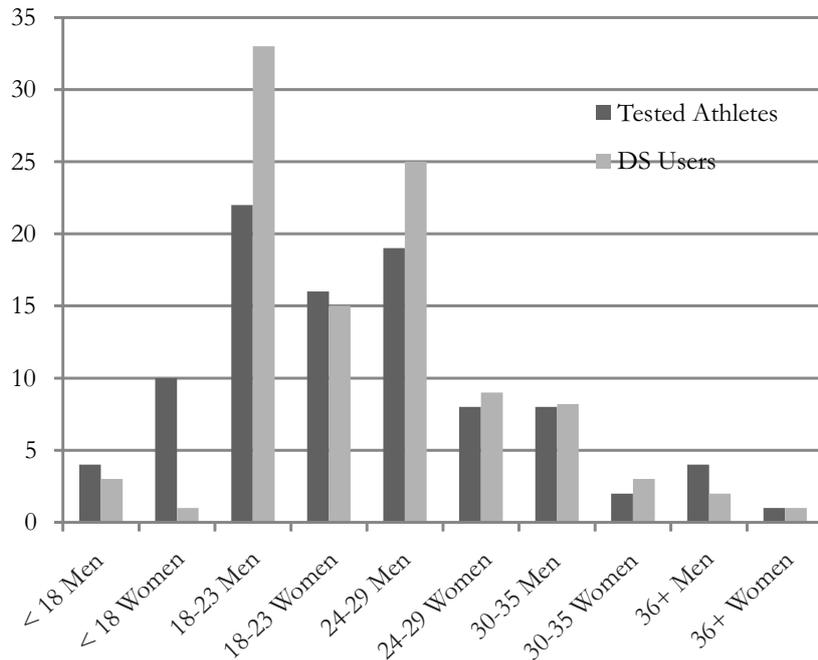
FIGURE 2*Representation (%) of age-gender groups of athletes in the total sample and among users.*

FIGURE 3

Representation (%) of age-gender groups of athletes in the total number of athletes with a coach and among DS users with a coach.



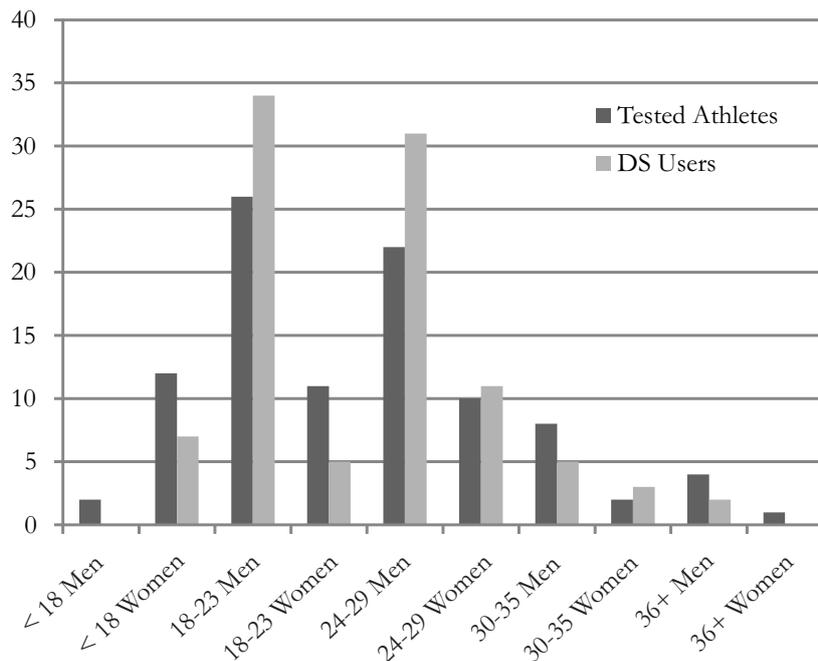
expectedly follows the distribution found in the total sample (Figure 2).

There was no significant difference in the distribution in the total number of athletes with a coach and among DS users with a coach ($p = .36$), suggesting

that coaches do not play a significant role in advising on the DS consumption among athletes. Similarly, it was not established a significant influence of doctors/physicians ($p = .25$) on the DS consumption among athletes (Figure 4).

FIGURE 4

Representation (%) of age-gender groups in the total number of athletes with a doctor/physician and among DS users with a doctor/physician.



Participation in the competition also does not affect significantly ($p = .73$) on the DS consumption among athletes (Figure 5).

Among DS users ($n = 152$), the number of used supplements varied in the range of 1 to 21 (a mean of 2.9 ± 2.8) in the week before the test. Concomitant

FIGURE 5

Representation (%) of age-gender groups in the total number of competitors and among DS users on competition

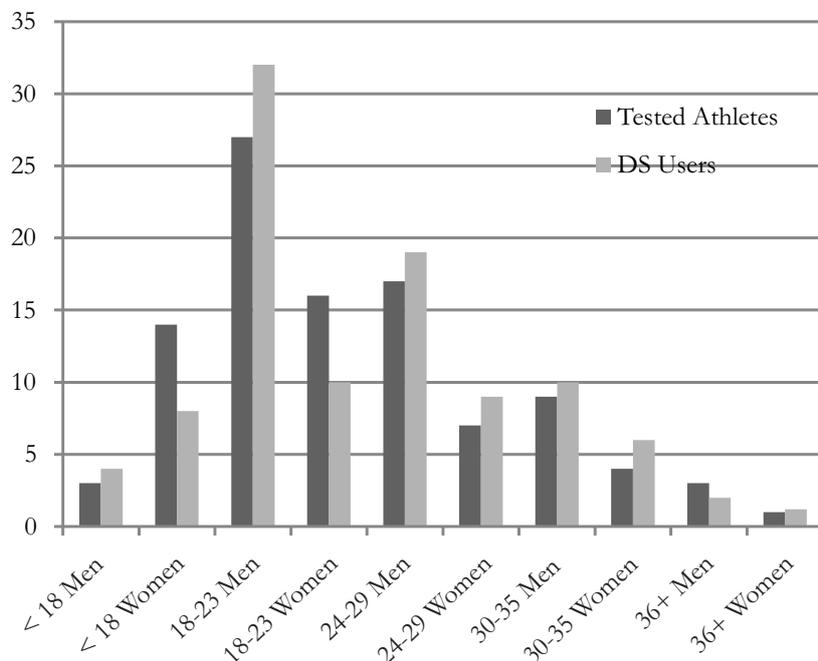


TABLE 2

Distribution (%) according to the number of used supplements in the total sample and among DS users.

Number of DS	Total sample ($n = 441$)			DS Users ($n = 152$)		
	Men	Women	Total	Men	Women	Total
1	9.50	3.20	12.70	27.60	9.20	36.80
2	5.70	3.20	8.80	16.40	9.20	25.70
3	3.60	.70	4.30	10.50	2.00	12.50
4	1.40	.90	2.30	3.90	2.60	6.60
5	1.60	.50	2.00	4.60	1.30	5.90
6	.50	.50	.90	1.30	1.30	2.60
7	.50	.70	1.10	1.30	2.00	3.30
8	.90	.50	1.40	2.60	1.30	3.90
11	.20	.00	.20	.70	.00	.70
13	.00	.20	.20	.00	.70	.70
16	.00	.20	.20	.00	.70	.70
21	.00	.20	.20	.00	.70	.70
Total	23.80	10.70	34.50	69.10	30.90	100.00

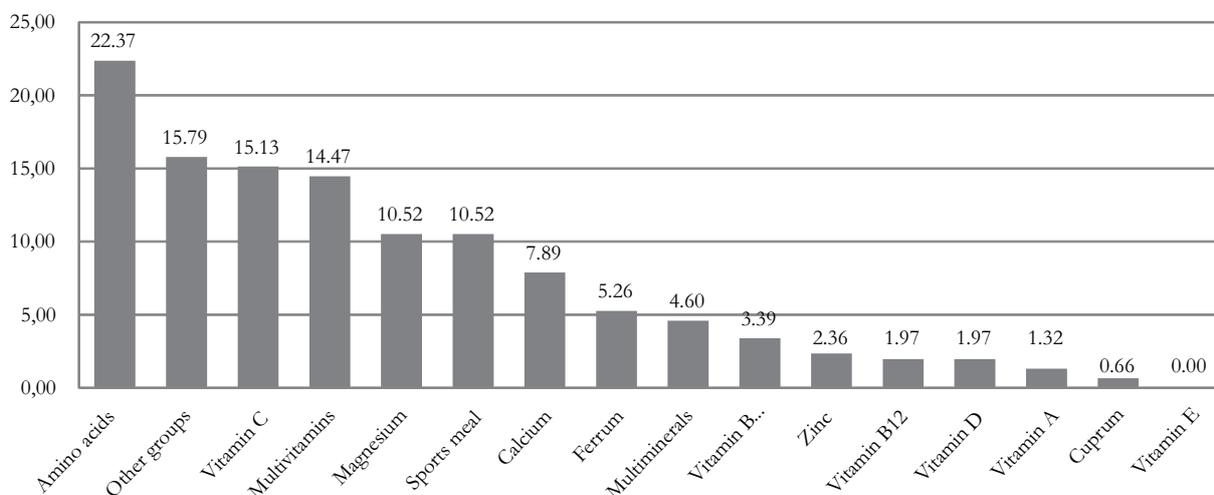
consumption of two or more of the supplements was noted/recorded in 96 (63.2%) DS users (Table 2).

The three most commonly used supplements were amino acids and proteins, preparations classified in the group of others (different preparations intended for strengthening the immune system), and vitamin

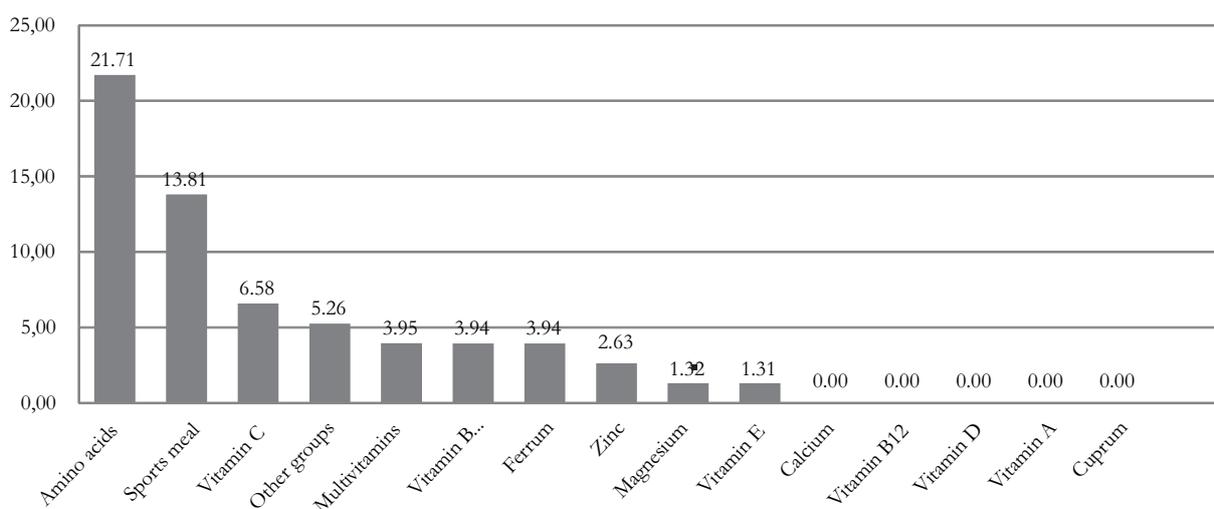
C (22.37; 15.79 and 15.73%, respectively) among athletes who were analyzed in the course of the competition (Figure 6), or amino acids and proteins, sports meals and vitamin C (21.71; 13.81 and 6.58%, respectively) among athletes analyzed out of competition (Figure 7).

FIGURE 6

A list of supplements used by athletes analyzed in the course of the competition.

**FIGURE 7**

A list of supplements used by athletes analyzed out of competition



DISCUSSION

Our study showed that 34.5% of athletes used dietary supplements. The total percentage of athletes who have used supplements was lower than in previous studies. Thus, the study conducted by the Anti-Doping Agency of Republic of Serbia, which monitored the frequency and quantity of consumption of dietary supplements and medications among athletes analyzed on the consumption of doping substances at national and international competitions from 2005 to 2008, stated that a total of 62.2% of athletes took supplements (Dikić, Suzić, & Radivojević, 2010). Furthermore, a study examining the consumption of

dietary supplements among university athletes in Singapore stated that 76.8% of the analyzed athletes were taking dietary supplements (Tian, Ong, & Tan, 2009), while a study examining the age-gender distribution of elite athletes who use dietary supplements in Great Britain found that 59.5% of tested athletes took supplements (Nieper, 2005). Other studies results are similar, which reported the total percentage of users of dietary supplements in a range of 46 to 100%. Such large variations can be partly explained by the different methodology used in the collection of data such as the definition of dietary supplements, the time period in which their consumption was examined

among athletes, the way the survey was done and so on.

In our study, the data were used concerning the use of supplements among athletes reported by them during the doping control, so the low percentage of athletes who use dietary supplements can be explained by a possible insincerity of athletes due to fear of sanctions which would be implied based on a positive doping control results. In addition to this, only supplements and medications used by athlete during the period of seven days prior to analysis were recorded in doping forms. Only study conducted by the Anti-doping Agency of Republic of Serbia examined the use of supplements for the period of last seven days prior to the moment of analysis, and all others during longer periods of time (6-12 months).

The most dominant group among DS users were men aged in range 18-29 years, while a trend was noted of slight increase of DS consumption among the female athletes only after 24 years of age. This agrees with the results of other studies that also state that the dominant gender-age group of athletes who use dietary supplements were men aged between 24 and 34 years and women aged between 24 and 29 years (Nieper, 2005).

Our study did not establish any significant advisory role of doctors/physicians and coaches/trainers to the use of the DS among athletes. This finding indicates the fact that decision of athlete, on the use of a dietary supplement, probably is not rational. By browsing through the available sources we did not find studies that examined the representation of athletes who have had their coach or doctor/physician, within the total number of athletes who use dietary supplements.

This study noted that the number of used supplements among DS users was a mean of 2.9 ± 2.8 . Co-administration of two or more DSs was observed among 63.2% of DS users. And other studies have also noted concomitant consumption of dietary supplements among athletes DS users. Thus, the study, which examined the age-gender distribution of elite athletes who use dietary supplements in Great Britain, found that 82.6% of athletes were taking two or more supplements at the same time, while a mean number of used supplements among athletes DS users was 3.22 to 4.03 (Nieper, 2005). A study conducted by the Anti-doping Agency of Republic of Serbia has come up with the data a mean number of dietary supplements among athletes DS users from 1.55 ± 0.9 to 5.29 ± 2.9 per athlete (Dikić, Suzić, & Radivojević, 2010). Such irrational use of supplements has no

founded scientific justification and it can lead to serious health disorders due to interaction, boosting the effects and overdosing.

Our study has shown that the most commonly used dietary supplements are amino acids and proteins, taken, in the group of athletes who use dietary supplements analyzed in the course of the competition, by 22.37% and 21.71% of athletes analyzed out of competition. This agrees with the results of other studies according to which proteins are one of the most popular dietary supplement among athletes and physically active individuals. However, most of the relevant organizations dealing with estimates of reference values for nutrients intake, state that, due to the lack of adequate evidence to the contrary, healthy adults engaged in sports (power and endurance events), have no need for higher doses of protein than the recommended daily dose (Eng. Recommended Dietary Allowance, RDA) (Maughan, Doug & Trevor, 2004). As for the amino acid supplementation, there are some clinical trials involving individuals who have experienced trauma (post-operative trauma, burns) which show that intake of amino acids may reduce the degree of loss of muscle mass, but the catabolic state is irrelevant for healthy athletes who by intake of amino acids are trying to increase muscle mass. There is a theory that amino acids increase physical performance, by increasing the secretion of anabolic hormones, changing the way of energy utilization, preventing the adverse effects of intensive training and preventing the mental fatigue. There is little evidence to support the benefit of amino acid supplements to the normal diet of athletes (Melvin, 2005).

CONCLUSION

Our study confirmed excessive use of dietary supplements among athletes regardless of age and gender category. Given the established mean number of used supplements among athletes who use dietary supplements, as well as the total percentage of athletes DS users with simultaneous consumption of two or more supplements the irrational use of supplements was demonstrated/proved. Since the study has not demonstrated/proved significant impact of coaches and doctors/physicians on the DS consumption among athletes, it was assumed that the decision of athlete as a person without any health education on the selection of individual supplement is probably scientifically unfounded. Because of all of this, it is necessary to have education and prevention strategy that will be geared toward athletes, doctors/physicians, coaches and others working with athletes.

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Correspondence to:

Elma Omeragić, PhD

Faculty of Pharmacy

Zmaja od Bosne 8

71000 Sarajevo

Bosnia and Herzegovina

Phone: 00387 61 98 92 67

E-mail: elma.omeragic1465@gmail.com