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Original research paper

ANALYSIS OF THE USE OF DIETARY SUPPLEMENTS AMONG STUDENTS OF THE FACULTY OF SPORT AND PHYSICAL EDUCATION

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Abstract. *Supplements are products widely used among athletes to improve sports performance and reduce fatigue symptoms. The aim of the study was to determine the differences of the use of dietary supplements among students of the Faculty of Sport and Physical Education, University of Niš (by year of study and gender), as well as the differences between the frequency and duration of physical activity with the use of dietary supplements. The survey was conducted on a sample of 201 students of both genders, all four years of undergraduate studies, aged 19 to 23. The respondents completed questionnaire containing questions related to dietary supplementation, physical activity and the existence of fatigue symptoms. Survey results show that 40.8% of respondents use supplements. Male students used dietary supplementation more often than female. Students most commonly take vitamins (68.3%), proteins and amino acids (15.1%) whereas 5.6% of them use minerals. The results have shown that with the increase of the year of study, the number of students taking supplements decreases significantly. Also, the analysis of the results by gender showed that male students were more likely to take amino acid supplements. No differences were found between the duration and frequency of physical activity and the use of supplements. It could be concluded that with the increase of the year of study, we note positive changes in students' attitudes to the use of supplements, which could be explained by the acquisition of knowledge in the field of sports nutrition and supplementation through the curriculum contents of the study program.*

Key words: *ergogenic aids, students, attitudes, proteins, vitamins*

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1. INTRODUCTION

Nutrition has always been regarded as one of the key factors influencing an athlete's sports performance (Birkenhead & Slater, 2015; Maughan & Shirreffs, 2012). Variation in food intake has been shown to have a positive impact on sports performance in the last few decades due to scientific advancements and the need to identify factors that influence sports performance, specifically with the understanding of human metabolism and the physiology of physical exercise (García-Rovés, García-Zapico, Patterson, & Iglesias-Gutiérrez, 2014; Guest, Horne, Vanderhout, & El-Sohemy, 2019). Also, it can be said that the foundation for health preservation and disease prevention lies in obtaining adequate nutrition (Cristina & Lucia, 2021). Namely, an adequate supply of the nutrients, vitamins and minerals needed for the body's regular operations can be obtained via a well-balanced diet (Block et al., 2007). Supplements, often known as dietary supplements, are goods whose active components can support, reinforce, or improve the body's natural processes (Santana-Gálvez, Cisneros-Zevallos, & Jacobo-Velázquez, 2019). Due to its importance as a source of vital nutrients, dietary supplements are used by millions of people worldwide (Archer et al., 2005; Cencic & Chingwaru, 2010). Furthermore, it can be said that among all the dietary supplements used to increase muscle mass, proteins are the most popular (Morton, et al., 2018; Rodriguez-Lopez, et al., 2022). Dietary supplement adoption originated predominantly among athletes, emerging as the most prevalent and widely recognized practice in this domain (Maron, et al., 2007). This observation is confirmed by a study which found that 87.5% of athletes from seven different sports use one or more dietary supplements (Çelik & Dağdeviren, 2022; Dascombe, Karunaratna, Fergie & Goodman, 2010).

Dietary supplements have gained significant popularity as individuals seek to optimize their health and well-being (Bailey, Gahche, Miller, Thomas, & Dwyer, 2013). These supplements, ranging from vitamins and minerals to amino acids, are widely marketed for various health purposes (Lopes, Coimbra, Costa, & Ramos, 2023). Since they are often perceived as beneficial for improving overall health, their effects on individual organ systems remain a subject of intense scientific debate (Küllenberg, Taylor, Schneider, & Massing, 2012). On the positive side, dietary supplements offer several advantages (Küllenberg et al., 2012). Firstly, they provide a convenient and accessible means of supplementing essential nutrients that may be lacking in the diet (Cencic & Chingwaru, 2010; Küllenberg et al., 2012). Secondly, certain supplements are formulated to target specific health concerns or optimize organ function (Adadi, Barakova, Muravyov, & Krivoshapkina, 2019). Lastly, dietary supplements offer convenience and accessibility, especially in today's fast-paced lifestyle (Nichter & Thompson, 2006). They can be easily incorporated into daily routines, providing a simple and effective way to support health goals (Nichter & Thompson, 2006). However, the use of dietary supplements without medical supervision can also have negative consequences (Wierzejska 2021). First, there is a risk of nutrient toxicity (Ronis, Pedersen, & Watt, 2018). Next, supplements may interact with prescribed medications, leading to reduced efficacy or increased risk of side effects (nettle-rash, emesis and dizziness) (Wierzejska 2021). Therefore, while dietary supplements offer potential benefits, their use should be approached cautiously, with careful consideration of both the positive and negative implications for individual health and well-being (Adadi, Barakova, Muravyov, & Krivoshapkina, 2019; Wierzejska 2021).

Due to the previous achievements, dietary supplements are now made to meet various needs in various kinds of physical activity (Maughan, et al., 2018; Maughan, Depiesse, & Geyer,

2007). Specifically, because they are more widely available, dietary supplements are taken by recreational and professional athletes alike (Knapik, et al., 2016; Miteva, Kundurdzhiev, & Valchev, 2023; Slater, Tan, & Teh, 2003). Moreover, the consumption patterns of dietary supplements among students diverge from those of the general population, potentially attributable to the distinctive student lifestyle characterized by academic commitments, engagement in sports, and the usage of tobacco and alcohol (Kosendiak, Adamczak, Kuźnik, & Makles, 2024; Paffenbarger, Kampert, & Lee, 1997; Schnell, Mayer, Diehl, Zipfel, & Thiel, 2014). Therefore, educating students to adopt healthy eating habits aligned with nutritional guidelines, while discouraging reliance on supplements to compensate for poor choices, is crucial for establishing lasting patterns of nutritious eating in early adulthood (Lieberman et al., 2015). Due to their lack of understanding the proper use of dietary supplements and their compatibility with various foods and nutrients, students frequently take them without consulting a doctor (Kowalik et al., 2016).However, it can be said that knowledge about the consumption of dietary supplements among the younger population is important. Therefore, the aim of the study was to determine the differences of the use of dietary supplements among students of the Faculty of Sport and Physical Education, University of Niš (by year of study and gender), as well as the differences between the frequency and duration of physical activity with the use of dietary supplements.

2. METHOD

2.1. Sample of participants

The study was conducted on a sample of 201 students (130 male and 71 female) of undergraduate studies at the Faculty of Sports and Physical Education, University of Niš. The respondents were aged 19 to 23. All participants were informed about the purpose and the aim of this study. The questionnaire contained questions that analyzed the following domains: the use of dietary supplements, the level of physical activity and the presence of fatigue symptoms. The study was transversal. All participants voluntarily participated in the survey.

Participants had to meet the appropriate criteria for inclusion in this study. The first criterion was to attend the Faculty of Sports and Physical Education, University of Niš. Another criterion was to play a certain sport (professional or recreational) and that they were physically active. Also, the criterion for inclusion in this study was that they already had some acquired knowledge about the use of supplementation in sports. Students who did not meet these criteria were not part of the study sample. Demographics of the participants were presented in Table 1.

Table 1 Participants (gender and year of study)

Year of study	Male	Female	Age	Total number of students per year of study	Total number of students
I	40	12	19±0.5	52	201
II	23	25	20±0.6	48	
III	28	26	21±1.0	54	
IV	39	8	22±0.8	47	

The sample of participants consisted of students from all four years of undergraduate studies at the Faculty of Sports and Physical Education, University of Niš. Two hundred and one students of both genders participated in the survey 2.2. Sample of measuring instruments

Participants provided information by answering questions about their use of dietary supplements, level of physical activity, and presence of fatigue symptoms. Data will be obtained from the following questions:

1. Do you use dietary supplements?
2. What dietary supplements do you use?
3. How many hours per week are you physically active?
4. How many days a week are you physically active?
5. Are there any symptoms of fatigue?

To assess physical fitness, we analyzed participants' reported weekly frequency of physical activity and evaluate the average number of exercises performed per week (Dickinson, Bonci, Boyon, & Franco, 2012; Fogelholm et al., 2006).

2.3. Data processing

The data were processed with the statistical package SPSS (v17.0, SPSS Inc., Chicago, IL, USA). First, the basic descriptive parameters were determined. Also, the normality of the data distribution was confirmed by The Kolmogorov-Smirnov Test. Finally, the chi-square test was used to determine the differences between the frequency and duration of physical activity and the presence of fatigue symptoms with the use of dietary supplements. The level of significance was set at $p<0.05$.

3. RESULTS

The data in Table 2 indicate that 40.8% of students who were surveyed used supplements. These findings suggest that a higher percentage of participants have never used dietary supplements (59.2%). Also, according to findings in Table 2, participants primarily use vitamins (68.3%), followed by proteins and amino acids (15.1%) and least minerals (5.6%).

Table 2 The use of dietary supplements among students.

Do you use dietary supplements?	Number	%	What dietary supplements do you use?	Number	%
yes	82	40.8	minerals	7	5.6
no	119	59.2	vitamins	86	68.3
total	201	100.0	protein and amino acid	19	15.1

The results in Table 3 show the use of dietary supplements among students of the Faculty of Sports and Physical Education, University of Niš according to the year of study. Chi-square test was used to determine whether there was a difference between taking supplements and years of studying. It could be concluded that there were statistically significant differences in each of the three examples based on the level of significance ($p=0.002$). Based on the responses to the first question, it could be concluded that students who have completed higher study year used dietary supplements less frequently ($p=0.000$).

It also could be concluded that vitamins or protein were used by students of all years of studying.

Table 3 The use of dietary supplements per year of study.

		Year of study						
		I	II	III	IV	Total	Chi-square	Sig
Do you use dietary supplements?	Yes	36	20	22	4	82	37.71	0.000
	No	16	28	32	43	119		
What dietary supplements do you use?	minerals	4	1	1	1	7		
	vitamins	29	18	19	20	86		
	protein and amino acids	5	6	3	5	19		
	none	14	0	0	0	14	25.59	0.002

The results shown in Table 4 indicated that there were no significant differences in the use of supplements by gender (p=0.55). "However, it could be said that there were statistically significant differences in the types of supplements used (p=0.01). Protein and amino acids were used more frequently by male students. Furthermore, it could be stated that students of both genders consume vitamins more than other dietary supplements.

Table 4 The most frequently used supplements (stratification by gender).

		Gender				
		Male	Female	Total	Chi-square	Sig
Do you use dietary supplements?	Yes	55	27	82	0.35	0.55
	No	75	44	119		
What dietary supplements do you use?	minerals	6	1	7	12.33	0.01
	vitamins	52	34	86		
	protein and amino acids	19	5	24		
	none	9	0	9		

The data presented in Table 5 indicated that there were no differences between dietary supplement consumption and duration of physical activity (p=0.65). Also, it can be said that there were no differences between the duration of physical activity and the use of certain types of dietary supplements (p=0.11). Namely, it could be said that vitamins, proteins, and amino acids were more commonly used by those participants who trained more frequently compared to those who did not train very often, but it was not statistically significant.

Table 5 Supplement use and physical activity duration.

		How many hours per week are you physically active?					Total	Chi-square	Sig
		none	1 hour	2-4 hours	5-7 hours	>8 hours			
Do you use dietary supplements?	Yes	0	4	23	26	29	82	2.49	0.65
	No	1	10	28	43	37	119		
What dietary supplements do you use?	minerals	1	3	2	1	0	7	14.30	0.11
	vitamins	5	22	31	28	0	86		
	protein and amino acids	1	2	3	13	0	19		
	none	2	5	3	4	0	14		

The data presented in Table 6 indicated that there were no differences between dietary supplement consumption and frequency of physical activity (p=0.28). Furthermore, it could be established that there were no statistically significant differences in the frequency of training and the use of certain types of dietary supplements (p=0.15). Specifically, it was clear that those students who exercised more frequently preferred dietary supplementation. It could be said that vitamins are used most commonly

Table 6 Supplement use and physical activity frequency.

		How many days a week are you physically active?							
		Sometimes	Every day	4-6 days a week	2-3 days a week	1 weekly	Total	Chi-square	Sig
Do you use dietary supplements?	Yes	5	38	25	12	2	82		
	No	15	52	25	25	2	119	5.16	0.28
What dietary supplements do you use?	minerals	3	1	2	1	0	7		
	vitamins	6	43	22	13	2	86		
	protein and amino acids	1	9	8	1	0	19	16.92	0.15
	none	1	9	2	2	0	14		

4. DISCUSSION

The aim of the study was to determine the differences of the dietary supplements usage among students of the Faculty of Sport and Physical Education, University of Niš (by year of study and gender), as well as the differences between the frequency and duration of physical activity with the use of dietary supplements. Our study results indicated that the most commonly consumed supplements were vitamins, followed by proteins and amino acids. It was observed that male students consumed significantly more proteins and amino acids than female students. Additionally, no statistically significant difference was found between training duration per week and the use of dietary supplements. Similarly, no statistically significant difference was found between the frequency of monthly physical activity and the use of dietary supplements. This study revealed that 40.8% of participants consumed dietary supplements, aligning with findings from study conducted on medical students in Split (Kudrić, 2021). According to our study's findings, the highest usage among participants was for vitamins (68.3%), with proteins and amino acids following at 15.1%, which was in line with other studies (Đorđević-Nikić & Đorđević, 2006; Šoškić, Đorđević, Veljić, & Veljić, 2016). Đorđević-Nikić & Đorđević (2006) stated in their study that both male and female mostly used vitamins as dietary supplements. More precisely, female participants were more likely to choose supplements that help the recovery of the body, while male participants used supplements that contribute to increasing muscle mass, strength and power in addition to vitamins (Đorđević-Nikić & Đorđević, 2006). On the other hand, the study conducted in Japan showed different results from ours, there was no significant difference between the genders when it came to the use of dietary supplementation (Yonei, Takahashi, Hibino, Watanabe, & Yoshioka, 2008). Namely, 67% of students were male and 33% female in our study using a certain type of dietary supplement. This suggests that gender may play a more significant role in supplement

usage within our study population, emphasizing the need for further research to understand the underlying factors contributing to these differences.

The findings of the study indicated that as individuals progressed through their academic careers, their consumption of supplements decreased. These findings could be explained by the fact that many students gave up on a professional sports career to focus on their studies, and professional sports are typically linked to supplementing (Babiak & Wolfe, 2009). Additionally, as the number of study years increases, the usage of supplements decreases (Wierzejska 2021). This might be attributed to students learning more about sports nutrition and supplementation through the educational content (Patton-Lopez, Manore, Branscum, Meng, & Wong, 2018). Based on descriptive statistics, it was observed that students used more supplements when they dedicated additional time to training during the week. However, it should be noted that there was no statistical significance in this domain. More specifically, 29 participants who trained for eight hours or more used dietary supplements, while four participants who trained for an hour each week also did the same. This suggests a trend where those who spend more time training may be more inclined to use dietary supplements, possibly for reasons such as enhancing performance, supporting recovery, or meeting increased nutritional demands (Garthe & Maughan, 2018; Thomas, Erdman, & Burke, 2016). However, the lack of statistical significance indicates that this relationship may not be robust or consistent across the entire student population surveyed. Further investigation or a larger sample size may be needed to determine the strength and significance of these differences.

Furthermore, our study showed a statistically significant difference between male and female students in the use of protein and amino acids as a form of dietary supplementation. These results are partially anticipated, as male show a higher likelihood than female to focus on muscle mass development (Lafortuna, Tresoldi, & Rizzo, 2014; Vikmoen, et al., 2020). In addition, less than 3% of participants said that they had used doping substances. Reducing doping in later life may result from giving up professional sports, as well as from new knowledge acquired at the university (Morente-Sánchez & Zabala, 2013; Ntoumanis, Barkoukis, & Backhouse, 2014). Unfortunately, students often use supplementation without a sufficient understanding of its proper usage and its interaction with other nutrients (Sirico et al., 2018; Steele & Senekal, 2005). The authors assume that students' perspectives on dietary supplement usage evolve as they gain comprehensive knowledge in the field of nutrition and supplementation during their studies. Considering the scientific research and nutritional advice, it is crucial to pay increased attention to the use of supplements (Alonso & Fernández-García, 2020; Worsley 2002). Moreover, it is very important to underscore the significance of proper nutrition, ensuring adequate intake of vitamins, minerals, proteins, and amino acids through a balanced diet while complementing it with supplementation.. In particular, it is crucial to administer supplements appropriately when facing a deficiency of certain nutrients from food. Lastly, but equally important, is the need to educate individuals about the use of dietary supplements in order to prevent their health.

The results of our study established that there were no statistically significant difference between training duration per week and the use of dietary supplements. Also, there were no statistically significant differences between the frequency of monthly physical activity and the use of dietary supplements. However, it was found that there were statistically significant differences when it came to these domains (Knapiket al., 2016; Lacerda, Carvalho, Hortegal, Cabral, & Veloso, 2015). In these studies, dietary supplement usage

grew with the longer duration and higher frequency of physical activity. Knapiket al., (2016) determined that there was a difference in the use of all types of dietary supplements (protein, amino acid, vitamin and minerals and combination of products) and the duration and frequency of resistance training. Namely, those who engaged in resistance training for longer durations and more frequently used more dietary supplements compared to those who trained less often. The disagreements between our findings and those of other studies (Knapiket al., 2016; Lacerda, Carvalho, Hortegal, Cabral, & Veloso, 2015) highlight the need for further research to explore the factors influencing dietary supplement usage in relation to physical activity. Understanding these relationships can inform targeted recommendations for supplement usage, ensuring that individuals receive appropriate guidance based on their training habits and nutritional needs. Additionally, these findings suggest the importance of personalized approaches in dietary supplementation, considering the varying impacts of different types and intensities of physical activity.

The limitation of the study is reflected in the small number of participants. It is advised that future studies include a larger number of participants. It is also believed that if the assessment of physical activity and the use of dietary supplements were conducted using a more objective instrument, the results of this study would be more precise. Furthermore, the sample could be more precisely defined in relation to the specific type of sport in which the students are engaged. Based on the information gathered in this way, it becomes more feasible to precisely identify the frequency and types of dietary supplements that are commonly consumed in particular sports.

5. Conclusion

The study indicated that only a small number of students do not take supplements, which is consistent with the majority of data gathered from regional studies. Also, it was found that the most consumed supplements were vitamins, followed by protein and amino acids. Namely, it was shown that male students consumed noticeably more protein and amino acids than female students. However, it can be said that no statistically significant difference was found between the training duration per week and the use of dietary supplements. Also, there was no statistically significant difference found between the frequency of monthly physical activity and the use of dietary supplements. Only 3% of participants used doping substances, and they were all first-year male students. In addition, as the academic year progresses, there was a notable decline in dietary supplement consumption. The use of dietary supplements seemed to diminish as individuals accumulate knowledge from studies and educational materials encompassing both the positive and negative effects of these supplements, coupled with the cessation of active sports.

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ANALIZA UPOTREBE DIJETETSKIH SUPLEMENATA MEĐU STUDENTIMA FAKULTETA SPORTA I FIZIČKOG VASPITANJA

Suplementi su proizvodi koje koriste sportisti za poboljšanje sportskih performansi i smanjenje simptoma umora. Cilj istraživanja bio je da se proceni upotreba suplemenata u ishrani i stavovi kod studenata Fakulteta sporta i fizičkog vaspitanja u Nišu. Istraživanje je sprovedeno na uzorku od dve stotine i jednog studenta oba pola, sve četiri godine osnovnih akademskih studija, uzrasta od 19 do 23 godine. Ispitanici su popunili upitnik koji je sadržao pitanja u vezi sa upotrebom suplemenata, fizičkom aktivnošću i postojanjem simptoma umora. Rezultati istraživanja pokazuju da 40,8% ispitanika koristi suplemente. Studenti muškog pola su češće koristili suplementaciju u odnosu na studentkinje. Studenti najčešće uzimaju vitamine (68,3%), proteine i aminokiseline (15,1%), dok 5,6% njih koristi minerale. Rezultati pokazuju da sa povećanjem godine studija značajno opada broj studenata koji uzimaju suplemente. Analiza rezultata po polu pokazuje da učenici muškog pola češće uzimaju protein i aminokiselinu. Učenici koji koriste suplemente ređe prijavljuju simptome i znake umora. Nije utvrđena korelacija između trajanja i učestalosti fizičke aktivnosti i upotrebe suplemenata. Sa povećanjem godine studija, uočavamo pozitivne promene u stavovima studenata o upotrebi suplemenata, što se može objasniti sticanjem znanja u oblast sportske ishrane i suplementacije kroz nastavne sadržaje studijskog programa.

Ključne reči: *ergogena sredstva, studenti, stavovi, proteini, vitamini*