

Evaluation of Ergogenic Aids Usage and Their Encountered Health Problems among Coaching and Physical Education Teaching Students at Marmara University Physical Education and Sports College, Turkey

Sena Nur Keskin¹, Cafer Ikbal Gulsever¹, Betül Ozpolat¹, Cihat Kurt¹, Seyhan Hidiroglu² and Melda Karavus²

1. Department of Basic Medical Sciences, University of Marmara, Istanbul 34854, Turkey

2. Department of Public Health, University of Marmara, Istanbul 34854, Turkey

Abstract: In the recent years, usage of ergogenic aids by sportsmen in order to improve their performance is increasing rapidly. The goal of this research is to evaluate ergogenic aids usage and their encountered health problems at Marmara University Physical Education and Sports College (M.U. PESC) students. It is a descriptive study from which a standard questionnaire with 23 questions is applied to M.U. PESC, Coaching and Physical Education Teaching involved 1-4th. year class students on February-March, 2015. It is applied to 325 students among 1150. Data is analyzed by using Chi-square, independent T-test, and logistic regression. Approximately 70% of the participants are males, and 30% are females. Mean age is 22 ± 3.94 . The participants who joined the lecture, which is related with ergogenic aids, are greatly in 3rd and 4th classes ($P = 0.000$), and they know the term ergogenic aid better ($P = 0.000$). Finally, 39.25% of the students answered questions about proteins and amino acids incorrectly; this value is 48.67% for vitamins, 53.73% for bicarbonate, 66.56% for nicotine, and 44.46% for caffeine. The participants who joined the lectures know the term ergogenic aid better and use the aids more than the others. Despite the lectures, a large proportion of the students answered questions related to ergogenic aids incorrectly.

Key words: Amino acid, steroid, nutrition, ergogenic, diet.

1. Introduction

Up to date sportsmen have been improving their skills each day. Even small changes in performance may influence their rank in the competition [1, 2]. This caused trainers, sportsmen, and scientists to search for further methods, such as using ergogenic aids, in various sports branches [1-6].

Human beings have been struggling to success for centuries. Many methods have been used, which were believed to enhance performance. It is seen from the records that, in 3rd century B.C. athletes used mushrooms for running faster, gladiators took

inductive supplements for fighting better and inhabitants of South America chewed cocaine sprouts for increasing their performance. In the year of 1865, in Amsterdam, canal swimmers used doping making agents; and in 1869 at a bicycle race, participants used excess amount of drugs for the same purpose. First death from a supplement occurred in 1886, when British cyclist took high dose of caffeine [1, 7]. In 1960, at Olympic games, cyclist K. Jensen died due to high dose of amphetamine consumption [7]. This made the authorities start to consider about the hazards of the supplements. In 1964, in Olympics, sportsmen became to be more muscular than ever, and records were broken successively. Sports committee started to

Corresponding author: Cafer Ikbal Gulsever, B.S., research field: public health.

make arrangements and elicit new laws, which stating that doping usage was strictly banned. The list of these matters was declared later on [7]. Many pharmacological and physiological aids increase performance artificially. International Olympic Committee (IOC) banned some of these supplements. At the beginning of every year, World Anti-Doping Agency (WADA), sub-committee of IOC, declare a list of supplements, methods used as a doping concept and leave elite athletes with few choices of legal ergogenic aids that have the potential to substantially improve performance. The sportsmen, who use illegal supplements, were punished. This led people to find more natural ways. Ergogenic aids term emerged by then [1, 8].

The term ergogenic aids are derived from Greek words. "Ergon" means work and "Genon" to generate [1, 3, 7]. The goal is to increase, fasten and improve the performance. Mechanism of action is still unexplored for many of those. However, it is known that, they affect muscle fibers; get rid of products, which cause O₂, nutrients and wastes to circulate more rapidly; affect respiratory system; affect nervous system to delay the time of fatigue, affect central nervous system to increase the level of maximal contraction of skeletal muscles [3, 7, 9, 10].

Ergogenic aids consist of 5 subtitles; pharmacological, physiological, psychological, mechanical and biomechanical and nutritional aids. Steroids, alcohol, amphetamine, beta blockers, bicarbonate, caffeine, cocaine, diuretics etc. are pharmacological; erythropoietin, oxygen etc. are physiological; carbohydrate, fat, protein, vitamin, mineral, creatine etc. are nutritional; hypnosis, stress management etc. are psychological; dressings, matters etc. are mechanical and biomechanical aids [7, 9].

In recent years, prevalence of ergogenic aids usage has been increased significantly [4, 11, 12]. Misusage of these aids has been mentioned in media with a more detailed manner starting from 1980s. At virtually all sport branches, there is an increase in using ergogenic

aids without knowing what it really is [1, 12].

Many researches indicate that people use ergogenic aids without being informed [11]. It is shown that people use these aids by taking advice from their trainers, friends and family members [1, 10]. Using them without a professional opinion may lead to health problems. When choosing these products, age, gender, sport branch, and health problems should be considered [3, 13, 14].

In our country and in the world, most prevalent substances used among ergogenic aids are caffeine, energy drinks, and vitamins [12, 15, 16]. Creatine is also catching up. At Barcelona Olympics, sportsmen, who were participating at competitions that require high speed in little time, were reported to use creatine [4]. By then, creatine became to be more popular. However, misusage of these substances can cause major health problems [3, 7, 17]. For instance; requirement of vitamin can be provided by balanced diet, whereas excess amount of vitamin has serious side effects. Similar to vitamin; using steroid, amphetamine, and protein inappropriately can lead to severe health problems [1, 2, 17].

In this research, our aim was to determine the kind of ergogenic aids that students were using, their knowledge about them, and the encountered health problems in Marmara University Physical Education and Sports College (M.U. PESCS).

2. Methods

In this descriptive study, data was collected by applying questionnaire to students. Questionnaire is composed of 23 questions. The goal of the questionnaire was clearly stated to each student and it was also written at the top of the questionnaire. In the first part of the questionnaire, the questions were related with demographic features such as age, gender, weight, height, class, department, sport branch, family income level and accommodation. Second part composed of questions that inquire the knowledge of the participant. There were statements that are known

to be true or false, so we could evaluate their level of knowledge according to their correct or incorrect answers; furthermore, participants were asked to evaluate their own level of knowledge in a scale that extends from low to high. Third part aimed to detect the ergogenic aids (energy drinks, creatine, amino acids, bicarbonate, cocaine, alcohol, amphetamine, caffeine, sauna/massage, vitamins, minerals, steroids, nicotine and others) that are used and from whom the advice was taken (doctor, dietician, friends and family, trainer) and consequent health problems.

Frequency and percentage distributions are taken. Chi-square test is used, *P* values, which are below 0.05, are considered significant. In addition, Mann-Whitney U and logistic regression tests are applied. Correlation between ergogenic aids usage and age, gender, class, department, training hours, income and educational levels of parents, knowledge, having a chronic disease or not, health problems, from whom the advice was taken are evaluated.

Before applying the questionnaire to students in M.U. PESC, it was distributed to 12 medical students in the same University to do the final corrections. Among 1150 M.U. PESC students, 325 students who agreed to answer our questionnaire participated in our study. Sampling method was not used, questionnaires were distributed almost equally in number among departments and classes; however, it was applied randomly in each department and class. Questionnaires were applied haphazardly, which might have caused a limitation as to not being able to generalize our findings to the whole school. Ethics committee approval (70737436-050.06.04-) was received for this study from Ethics Committee of Marmara University Medical School.

Questionnaires were distributed by the researchers on February-March, 2015. It was applied at lecture halls by taking permission from the lecturer. The participants were observed while filling. Questionnaire sections and the questions were discussed before distribution, and empty spaces were requested to be

filled properly.

Some of the ergogenic aids are forbidden in Turkey. This might have caused limitations in answering the questions, and might affect the results.

3. Results

Approximately 43.5% of the participants were in teaching department and 56.5% of them were in training department. Average age was 22 ± 3.94 years. 228 of them were males, and 97 were females. 29.1% were in their first, 21.9% in second, 23.8% in third, and 25.2% were in fourth and final year. Mean height was 177 ± 8.6 cm, and weight was 72 ± 13.2 kg.

About 69.8% of the participants know the term “ergogenic aids”. Students think that they know mechanical and biomechanical, nutritional aids better than others (Fig. 1).

3rd and 4th year students have taken lectures related with ergogenic aids. 49% of students were in their 3rd and 4th year. Chi-square and frequency tests indicate that 88% of students who have taken the lectures know the term “ergogenic aids” and its subtitles, and the percentage of correct answers they have given are higher. While it is 51.9% of those who have not taken the lectures yet. 49.2% of all students have already taken the lectures, and 88.1% of all students think that the lectures should take part in their curriculum.

Virtually half of the participants have taken the lectures (48.1%), yet most of the participants answered the statements given incorrectly (Table 1).

Vast majority of students are using energy drinks, caffeine, sauna/massage, vitamin, and mineral. Alcohol usage is almost half among the students (Fig. 2). Males are using ergogenic aids much more than females, which can be attributed to the fact that males are more willing to increase their muscle mass. For example the *P* value for amino acids is 0.007. 3rd and 4th year students are using these aids more than the others. For students who have families gaining more than 3000TL (Turkish Liras) per month are using ergogenic aids more than the others. Students who are

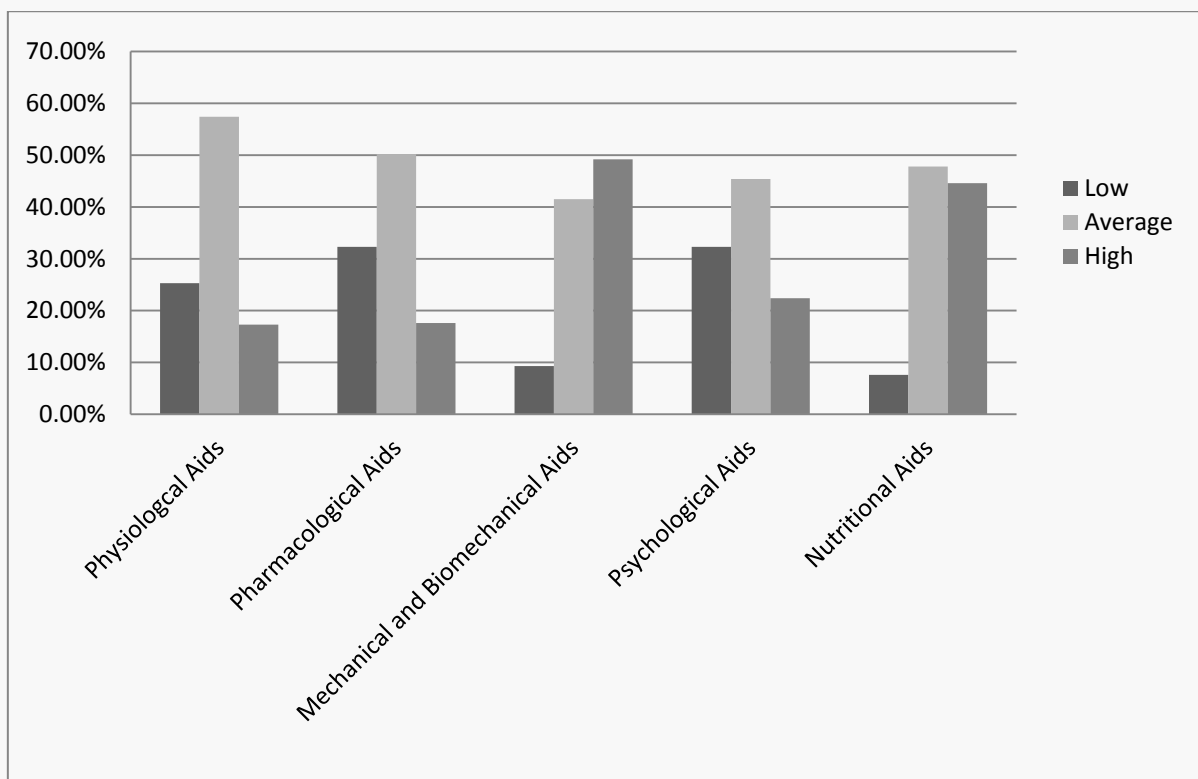


Fig. 1 Evaluation of level of knowledge by the students themselves.

Table 1 Statements that are known to be true or false, and percentages of students' response.

Statements	True (%)	False (%)	Does not know (%)
Using excess amount of protein and amino acids cause extra muscle	40.7	58.7	0.6
Using protein and amino acids continuously increases muscle mass. (False)	70.5	27	2.5
Vitamins are energy source for the body. (False)	55.9	41	3.1
Vitamins are requirement for those who are exercising. (False)	78.9	18.9	2.2
Vitamin supplementation is not needed if following balanced diet. (True)	54.3	43.2	2.5
Bicarbonates lead to lactic acid accumulation, and delays fatigue. (False)	38.2	41.6	20.2
Bicarbonate has an inductive capability. (False)	42.9	33.9	23.2
Nicotine has an inductive capability. (False)	74.5	18.3	7.2
Small amount of nicotine usage increases sportive activity. (False)	37.3	54	8.7
Nicotine has a sedative effect (False)	63.4	28	8.6
Caffeine prevents fatigue, and increases mental awareness. (True)	63.1	30.6	6.3
Caffeine has an addictive effect. (False)	85	11.8	3.2

using alcohol, amphetamine, mineral, amino acids, creatine, caffeine, steroids, sauna/massage, bicarbonate ($P = 0.00$), vitamin ($P = 0.009$) also recommend them.

Almost 62.1% of students recommend the usage of the aids overall. However, for each one specifically, most of the students don't recommend it at all. For instance, 55.3% don't recommend protein powder, this value is 69.3% for energy drinks, 64.1% for creatine,

67.3% for amino acids, 93.2% for bicarbonate, 97.1% for cocaine, 75.7% for caffeine, 71.2% for sauna/massage, 59.2% for vitamin, 75.1% for mineral, 95.5% for steroid, 97.7% for nicotine, 93.9% for alcohol, 97.1% for amphetamine, 95.8% for cigarette, and 98.1% for diuretic. More than 28% of students are recommending protein, vitamin, creatine, amino acids, energy drinks, and sauna/massage. 3rd and 4th year students recommend the aids more, specifically vitamin

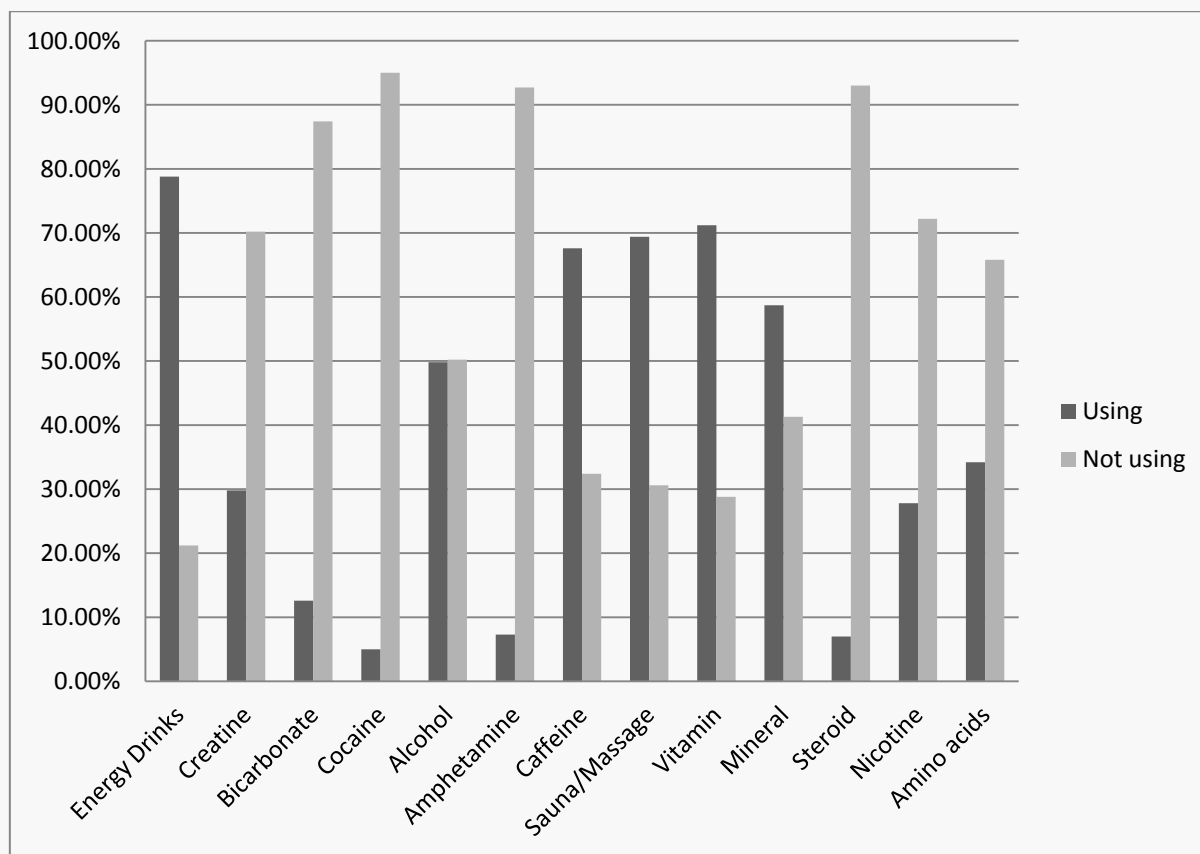


Fig. 2 Some ergogenic aids and their percentage of usage.

($P = 0.00$), amino acids ($P = 0.021$), energy drinks ($P = 0.004$), sauna/massage ($P = 0.002$), mineral ($P = 0.002$), and steroids ($P = 0.006$). And for students who have family income more than 3000TL per month recommend the aids more than the others, particularly protein powder, amino acids, steroids, vitamin, and energy drinks ($P < 0.05$).

Vast majority of students think that energy drinks, creatine, amino acids, bicarbonate, caffeine, sauna/massage, vitamin, mineral have more beneficial effect to the body than their harms, while cocaine, alcohol, amphetamine, steroid and nicotine have more hazardous effects to the body.

Most of the students who are using ergogenic aids haven't got advice from others. For those who have gotten advice declared that they took advice from trainers, friends or family. More than 19% of students were advised by trainers, and they were advised to use amino acids, creatine, sauna/massage, vitamin, mineral,

energy drinks, and steroid.

Supplements that were used by students' relatives were: L-carnitine, BCAA, glutamine, casein, weight gainer, deca durobulin, deca boldeon, propionate, testosterentath, winstrol, growth, mosteoron, dianebol, cleanbuterol, erythropoietin, ACL, and nox-plate.

Approximately 87.5% of students' relatives and 96.7% of students think that they don't have health problems related with ergogenic aids usage. Encountered health problems were: acnes, gynecomastia, pubescence, cramp, renal disorders, hepatic disorders, cardiac disorders, psychological problems, thickening of the voice, organ failure, peptic ulcer, breast cancer etc.

4. Discussion

Previous researchers have shown that using protein and amino acids continuously doesn't increase muscle mass. It is suggested to beginners of sports for

development of muscle fibers [17]. A research done in 2014 shows that when carbohydrates are taken at optimal levels, protein uptake doesn't have an ergogenic effect [10]. However, in our study, 40.7% of participants think that protein and amino acids usage causes extra muscle development. Researches indicate that higher protein intakes than the recommendation are frequently seen among athletes [18]. 55.9% of students think vitamin is an energy source, and 90.7% think it is necessary to take beside normal diet. However, a research which is done in Nigeria, shows that 82.7% of the participants (82.7%) correctly responded to the statement "are vitamins good sources of energy" as false [19]. Vitamin is regulator component of the diet, and it is not an energy source [4, 17]. 78.9% of students think vitamin is necessary for doing exercise. Balanced diet is sufficient to supply vitamin for body, however, 43.2% of students do not agree [17]. Despite the fact that bicarbonate being an efficient ergogenic aid, it is not known well. Bicarbonate is a buffer for lactic acid, and it delays fatigue [3]. 70.4% of participants think nicotine has an inductive effect, whereas it is a tranquilizer [2]. 85% of participants think caffeine has an addictive effect. However, researches indicate that caffeine doesn't cause addiction. High dose caffeine has severe side effects. Low dose caffeine can provide awareness, affects central nervous system, and has fewer side effects [2, 15].

It has been reported by a research done in USA that the most popular supplements used among adolescents and young adults are energy drinks, and vitamins. In UK, among the athletes, the most popular supplement is recorded to be energy drinks [16]. Our results also show us, energy drinks and vitamins are the most popular ergogenic aids.

Ersoy and Hasbay studied on usage of ergogenic aids at various sport branches. They have recorded that 51.6% of males and 29.8% of females are using more than 50 different aids, some of which are vitamin-mineral complex (47.6%), amino acids (33.3%), creatine

(29.7%) [4]. Another research indicates that usage of multivitamin and calcium are greater among females, whereas ginseng, amino acid, glutamine and protein powder are greater among males [1]. In our study, only amino acid usage and giving advice about its usage are different between the genders. Vast majority of males are using amino acid for a long time period, while females are not using at all ($P < 0.05$). 38.2% of males and 19.2% of females are advising amino acids ($P < 0.05$). Especially in females, imbalance diet leads to calcium, iron, and zinc deficiency [17]. However, in our study there is no significant correlation between mineral usage and gender.

In our study, vast majority have not taken any advice, and other portion have taken advice from mostly trainers then family and friends. A research done on Gazi University physical education students shows that 56.8% of students who are using ergogenic aids have taken advice from trainers, 31.8% from doctors, and 4.5% from friends [1]. Coaches' interpersonal styles strongly influence athletes' need, satisfaction and motivation in competitive sports [20]. Research done in a Canadian university shows that coaches had low knowledge about nutrition scores, and still made recommendations about nutrition to athletes [21].

In our study, 3.3% of participants have exposed to side effects. This may be due to the related lectures, and being conscious. According to a research done by Kurkcu and his friends, 8% of participants have exposed to side effects of ergogenic aids, and 24% are partially exposed [12]. Athletes require sufficient knowledge about nutrition and skills to enable appropriate selection and consumption of food and fluids to meet their health, body composition and performance needs [22].

In our study, 69.8% of students were familiar with the term "ergogenic aids". This may be due to the lectures given at 3rd year. 3rd and 4th year students have higher knowledge than the others ($P < 0.05$). Kurkcu and his friends revealed smaller percentages [12].

Similar to an Italian study [11], in our study students were using and advising creatine, bicarbonate, cocaine, alcohol, amphetamine, caffeine, sauna/massage, vitamin, mineral and amino acids. At previous years, amphetamine usage was common. Now a days, due to its serious side effects amphetamine usage has decreased. And it is still uncertain whether alcohol and caffeine are in the group of ergogenic aids or not [2]. Researches have shown that bicarbonate has an ergogenic effect on short and intense exercises [23].

Encountered health problems reported by our participants were acnes, gynecomastia, pubescence, cramp, renal disorders, hepatic disorders, cardiac disorders, psychological problems, thickening of the voice, organ failure, peptic ulcer, breast cancer etc. Excess protein and amino acid usage increase urinary discharge, thus cause dehydration. Also liver and kidneys work more than normal [17, 18]. Steroid usage may lead to paranoia, depression, aggression, voice thickening at females, and excessive hair growth at face and body [4].

The participants with high economical level reported to use alcohol, caffeine, sauna/massage more than the others in our study ($P < 0.05$). This may show that they have greater opportunity to afford the supplements.

5. Conclusion

Many students who agreed to participate in our study reported to use various types of ergogenic aids. Most probably as a consequence of the usage of ergogenic aids, they had confronted some health problems. The students need to be given education on to use these agents only after consulting a doctor or a dietician. This education can be advised to start as early as possible at the first grade.

Acknowledgements

Authors acknowledge all the students that participated in the study for their time and co-operation. The authors would like to thank Fethi Yuksel and Filiz Camliguney for their assistance in applying the

questionnaires to students. This study is not funded.

References

- [1] Çetin, E., Ertaş Dölek, B., and Orhan, Ö. 2008. "Determination of Gazi University Physical Education and Sport Department's Students' Knowledge and Usage Status of the Ergogenic Aids and Doping." *Sportmeter Journal of Physical Education and Sport Sciences* 6 (3): 129-32. (in Turkish)
- [2] Şen, İ. 2003. "Ergogenic Aids in Sport." *Journal of Physical Education and Sport Sciences* 5 (3): 26-31. (in Turkish)
- [3] Özmerdivenli, R., and Yıldırım, E. 2005. "Effects of Education Levels of Professionals and Amateur Footballers to Their Tendency of Acrogenic Help and Vitamin Uses." *Research Eastern Anatolian Region* 3 (2): 118-23. (in Turkish)
- [4] Ünal, M. 2005. "The Effects of Creatine Supplementation on Athletes and Exercise Performance." *General Medical Journal* 15 (1): 43-50. (in Turkish)
- [5] Rodriguez, C., Quezada-Feijoo, M., Toro, C., Barón-Esquivias, G., Segura, E., Mangas, A., and Toro, R. 2015. "Performance of Entero-Insular Axis in An Athletic Population: Diet and Exercise Influence." *Nutricion Hospitalaria* 31 (5): 2187-94.
- [6] Toscano, L. T., Tavares, R. L., Toscano, L. T., Silva, C. S., Almeida, A. E., Biasoto, A. C., Gonçalves Mda, C., Silva, A. S. 2015. "Potential Ergogenic Activity of Grape Juice in Runners." *Applied Physiology, Nutrition & Metabolism* 40 (9): 899-906.
- [7] Günay, M. 2014. "Doping." Presented at *Turkish Table Tennis Federation 3rd Table Tennis Workshop*, Antalya, Turkey.
- [8] Sinex, J. A., and Chapman, R. F. 2015. "Hypoxic Training Methods for Improving Endurance Exercise Performance." *Journal of Sport and Health Science* 4 (4): 325-32.
- [9] Yaman, M., Hergüner, G., and Yaman, Ç. 2003. "Historical Progression and Actual Dimension of Usage of Doping in High Performance Sports and Studies Against Doping." *Journal of Sakarya University Faculty of Education* 6: 360-85. (in Turkish)
- [10] McLellan, T. M., Pasiakos, S. M., and Lieberman, H. R. 2014. "Effects of Protein in Combination with Carbohydrate Supplements on Acute or Repeat Endurance Exercise Performance: A Systematic Review." *Sports Medicine (Auckland, N.Z.)* 44 (4): 535-50.
- [11] Tavani, A., Colombo, P., Scarpino, V., Zuccaro, P., Pacifici, R., and La Vecchia, C. 2014. "A Survey of Dietary Supplement Use Among Italian Sporting Club Athletes." *Nutrafoods* 13 (1): 29-34.
- [12] Kürkcü, R., Can, S., and Durukan, E. 2009. "The

- Investigation of the Knowledge and the Application Levels University Athletes in Different Branches about Ergogenic Aids.” *e-Journal New World Sciences Academy* 4 (3): 198-209. (in Turkish)
- [13] Beck, K. L., Thomson, J. S., Swift, R. J., and von Hurst, P. R. 2015. “Role of Nutrition in Performance Enhancement and Postexercise Recovery.” *Open Access Journal of Sports Medicine* 6: 259-67.
- [14] MacKenzie-Shalders, K. L., Byrne, N. M., Slater, G. J., and King, N. A. 2015. “The Effect of A Whey Protein Supplement Dose on Satiety and Food Intake in Resistance Training Athletes.” *Appetite* 92: 178-84.
- [15] Spriet, L. L. 2014. “Exercise and Sport Performance with Low Doses of Caffeine.” *Sports Medicine* 44 (2): 175-84.
- [16] Campbell, B., Wilborn, C., La Bounty, P., Taylor, L., Nelson, M. T., Greenwood, M., Ziegenfuss, T. N., Lopez, H. L., Hoffman, J. R., Stout, J. R., Schmitz, S., Collins, R., Kalman, D. S., Antonio, J., and Kreider, R. B. 2013 “International Society of Sports Nutrition Position Stand: Energy Drinks.” *Journal of the International Society of Sports Nutrition* 10 (1): 1-16.
- [17] Ersoy, G., and Hasbay, A. 2008. *Nutrition in Sportsmen*. Ankara: Klasmat Matbaacılık.
- [18] Sousa, M., Fernandes, M. J., Carvalho, P., Soares, J., Moreira, P., and Teixeira, V. H. 2015. “Nutritional Supplements Use in High-Performance Athletes is Related with Lower Nutritional Inadequacy from Food.” *Journal of Sport and Health Science*: 1-7.
- [19] Folasire, O. F., Akomolafe, A. A., and Sanusi, R. A. 2015. “Does Nutrition Knowledge and Practice of Athletes Translate to Enhanced Athletic Performance? Cross-Sectional Study Amongst Nigerian Undergraduate Athletes.” *Global Journal of Health Science* 7 (5): 21-5.
- [20] Stenling, A., Ivarsson, A., Hassmén, P., and Lindwall, M. 2015. “Using Bifactor Exploratory Structural Equation Modeling to Examine Global and Specific Factors in Measures of Sports Coaches’ Interpersonal Styles.” *Frontiers in Psychology* 6 (September): 1303.
- [21] Danaher, K., and Curley, T. 2014. “Nutrition Knowledge and Practices of Varsity Coaches at a Canadian University.” *Canadian Journal of Dietetic Practice and Research* 75 (4): 210-3.
- [22] Andrews, M. C., and Itsiopoulos, C. 2016. “Room for Improvement in Nutrition Knowledge and Dietary Intake of Male Football (Soccer) Players in Australia.” *International Journal of Sport Nutrition and Exercise Metabolism* 26 (1): 55-64.
- [23] Koca, F., Stier, C., and Erol, E. 2004. “The Ergogenic Effect of the Sodium Bicarbonate on Short Term High Intensity Anaerobic Exercises in Which are at Different Altitude.” *E.Ü. Journal of Health Science* 13 (2): 39-45. (in Turkish)