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ORIGINAL RESEARCH

Understanding the Behaviors and Attitudes of Athletes Participating in the 2016 Rio Olympics Regarding Nutritional Supplements, Energy Drinks, and Doping

Sulaiman Omar Aljaloud

College of Sports Sciences and Physical Activity, King Saud University, Saudi Arabia

***Corresponding author:** *Sulaiman Omar Aljaloud, College of Sports Sciences and Physical Activity, King Saud University, Riyadh, 11441, Saudi Arabia, Tel: 011-8063325, Fax: 011-8063375, E-mail: a_soj@hotmail.com*

Abstract

Objective: The objective of this study was to understand the behavior and attitudes of professional athletes who participated in the 2016 Rio Olympics regarding nutritional supplements, energy drinks, and doping, within the context of sport nutrition.

Methods: Our research team traveled to Brazil to collect the data for this study. Olympic athletes participating in the 2016 Rio Olympics were randomly selected to participate in this study. Participants were asked to complete a questionnaire, and this activity took about 20 minutes. The survey contained nine questions including frequency of use, knowledge, and perception of nutritional supplements, energy drinks, and doping. Descriptive statistics were run to summarize the data collected and the results were displayed in frequencies and percentages. Data were expressed as means ± standard deviation and data were analyzed using a two-way ANOVA.

Results: A majority of athletes (*n* = 129; 78.66%) gave positive responses regarding nutritional supplements while, 73 athletes (44.51%) had neutral opinions toward energy drinks. On the other hand, 118 athletes (71.95%) gave negative responses to questions about doping. Relating to the frequency of product use, the results showed that a large percentage of athletes (*n* = 66; 39.76%) used nutritional supplements, and 59 athletes (35.98%) used energy drinks once per week. A majority of athletes (*n* = 157; 95.73%) reported that they were not doping. In the question relating to the main reason for consuming these products, the results showed that athletes use the products for different reasons. For example, 54 athletes (32.93%) believed that nutritional supplements could be used to improve speed, strength, and power. Similarly, 65 athletes (39.63%) reported using sports drinks for speed, strength, and power. Additionally, 98 athletes (59.76%) reported that they use doping for other purposes that were not listed on our questionnaire.

Conclusion: Our results showed that response for taking nutritional supplements, energy drinks and doping and the reasons and the frequency of the use for taking these products differ significantly ($p \leq 0.001$). Nutritional supplements, energy drinks, and doping are being globally marketed to professional athletes for a wide variety of inappropriate uses. Consequently, it is important to educate athletes regarding the proper use and potential physiological side effects of supplements. Our study also indicated that coaches need to be educated and better informed in order to help athletes make appropriate choices regarding the use of these supplements.

Keywords

Behavior, Attitude, Nutritional Supplements, Energy Drinks, Doping, Athletes, Rio Olympics

Introduction

The 2016 Summer Olympics, officially known as the Games of the 31st Olympiad, was an international multi-sport event in Rio de Janeiro, Brazil, from August 5-21, 2016. A record number of countries participated in a record number of sports. With more than 11,000 athletes from 207 National Olympic Committees, the games featured 28 Olympic sports that took place at 33 venues in the host city, and at five locations in São Paulo, Belo Horizonte, Salvador, Brasília, and Manaus [1].

The nutritional intake of Olympic athletes can directly influence their performance. A clinical study to deter-

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mine the relationship between nutrition knowledge and physical fitness in semi-professional players conducted by Nikolaidis and Theodoropoulou [2] found that the level of nutrition literacy could help with dietary choices that can positively impact the body's composition. Another study emphasized that nutrition education programs should be provided for soccer players of all ages [3]. Goral, et al. [4] conducted a study with amateur and professional Olympic athletes to investigate the level of nutrition knowledge and found that a nutrition education program should be provided for athletes as well as trainers [4]. In recent years, sports nutrition and dietary supplementation have become increasingly popular as athletes and other sports professionals search for viable dietary ergogenic aids to enhance physical power and performance. Athletes typically want to enhance their endurance, strength, performance, and muscle mass, and they use several types of ergogenic aids to achieve these goals [5]. Many studies support the benefits of consuming sports drinks to supply carbohydrates and fluid during exercise [6]. Overdosing of supplements can sometimes result in poisoning. Research supports documented cases of deaths and medical problems caused by the improper use of tryptophan supplements as well as products containing Ephedra and caffeine [7].

The consumption of energy drinks has become a popular practice worldwide, especially among professional athletes participating in the Olympic games. Sports drinks are flavored beverages that often contain carbohydrates, minerals (sodium, potassium, calcium, and magnesium), electrolytes, and sometimes vitamins (vitamin B12, vitamin B6, vitamin B6) or other nutritional supplements. Marketing strategies for sports drinks suggest the following benefits of consuming the products: optimization of athletic performance and replacement of fluid and electrolytes lost in sweat during and after exercise, energy boost (speed, strength, power), decreased fatigue, enhanced concentration, enhanced tolerance for additional training, enhanced ability to cope with pain, and mental alertness [8]. Although the term "energy" can be perceived to imply calories, energy drinks typically contain stimulants, such as caffeine, taurine, and guarana, with varying amounts of carbohydrate, protein, vitamins, and other minerals [9].

The use of drugs to enhance physical performance has been observed for thousands of years [10], and substance abuse is a major health problem facing sports today. In sports, doping refers to the use of performance-enhancing drugs. Although inversely related to sports performance and health status [11], doping is a real-world problem that affects international sporting events worldwide. Increasingly, new, more powerful and undetectable doping techniques and substances are now abused by professional athletes, and sophisticated networks of distribution have developed concomitantly. Professional athletes are frequently role models for adolescent and young adult populations, who often mimic the athletes' behaviors, including, unfortunatley, the abuse of drugs [12]. Doping is definitively one of the most dangerous and health-threatening behaviors in contemporary sports [13].

The purpose of this study was thus to consider the behavior and attitude of professional athletes in the 2016 Rio Olympics regarding nutritional supplements, energy drinks, and doping. In addition, this study provides information regarding the nutrition behavior of these athletes, nutritional supplements, energy drinks, and doping practices. To the best of our knowledge, our study is novel as it is the first to assess the behavior of Olympic athletes regarding nutritional supplements, energy drinks, and doping. Information collected during this study could help to improve knowledge of dietary supplement usage among professional athletes. This study has the potential to have beneficial effects, not only within the scientific community as related to professional athletes but within every aspect of the athletic community with regard to advising athletes about their choices and use of nutritional supplements. A study such as this one that documents nutrition behavior and attitudes toward nutritional supplements of athletes competing at the professional level could provide valuable information to athletes all over the world.

Materials and Methods

Our researcher team from the Riyadh city, College of Sports Science and Physical Activity at King Saud University traveled to Brazil during the 2016 Rio Olympics to collect the data for this study. The professional athletes who participated in the 2016 Rio Olympics were randomly selected to participate in this study. Study subjects were asked to fill out surveys that took about 20 minutes to complete. The survey consisted of nine questions ranging from frequency of usage to knowledge and perception of nutritional supplements, energy drinks, and doping. The Statistical Package for Social Science (SPSS) was used to analyze the data for all variables. Descriptive data were expressed as means ± standard deviation, and data were analyzed using a two-way ANOVA. The significance level, also denoted as alpha of 0.05 ($p \leq 0.05$), was accepted as statistically significant.

Sampling and survey questionnaire

Respondents who qualified for the inclusion criteria ($N = 164$) were recruited for the study and included. The recruitment process included advertisement of the study via word of mouth and announcements at athletes' meeting room. The date and location of the survey meeting was communicated in the recruitment information. Athletes were provided an overview of the study and an opportunity to consent to participate. Consenting athletes completed a preparticipation questionnaire to document information on their age, gender, race and sports categories they are participating. Male and female professional athletes from the 2016

Rio Olympics with ages ranged from 20 to 26 or older. The study subjects participated in either team sports (soccer, hockey, volleyball, and basketball) or individual sports (100-meter dash, boxing, 100-meter swimming, and weightlifting). With regard to race, a majority of respondents self-identified as Black or African American, followed by Middle Eastern, Asian, White, American Indian or Alaskan, and Native Hawaiian. Finally, 164, a representative sample size of total populations reported usage, knowledge, and perceptions of nutritional supplements, energy drinks, and doping.

Table 1: Social, cultural, and category of sports characteristics of the subjects in the present study (N = 164).

Response	*n* (%)
Age	
20 or younger	27 (16.46)
21-25	115 (70.12)
26 or older	22 (13.41)
Category of Sports Team sports	
Basketball	18 (10.98)
Soccer	46 (28.05)
Volleyball	24 (14.63)
Hockey	32 (19.51)
Individual sports	
Boxing	12 (7.32)
Weightlifting	8 (4.88)
100-meter dash	14 (8.54)
100-meter swimming	10 (6.10)
Gender	
Female	69 (42.07)
Male	95 (57.93)
Race Categories	
American Indian or Alaska	10 (6.10)
Asian	35 (21.34)
Black or African American	48 (29.27)
Native Hawaiian	6 (3.66)
White	26 (15.85)
Middle East	39 (23.78)

Note. Significance: $p < 0.001$. The response does differ significantly ($p < 0.0001$) from the hypothesized value (0.05) indicating the responses obtained from athletes differ.

Data collection and statistical analysis

The survey administration and data collection were completed during June, July, and August of 2016. Surveys were conducted at pre-arranged times and locations. Approximately, 10 minutes were needed to distribute the surveys and provide instructions, while it took about 20 minutes for participants to complete them. The Statistical Package for Social Science (SPSS) was used to analyze the data for all variables. All the questions related to behaviors and attitudes toward nutritional supplements, energy drinks, and doping included in the survey represent independent variables while the outcome of response for each question were dependent variables as listed in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6. Descriptive statistics were run to summarize the data collected and the results were displayed in frequencies and percentages. Data were expressed as means ± standard deviation and data were analyzed using a two-way ANOVA. The significance level, also denoted as alpha of 0.05 ($p \leq 0.05$) was accepted as statistically significant.

Results

This study focused on the behavior and attitude towards nutritional supplements and doping by athletes participating in the 2016 Rio Olympics. Table 1 shows descriptive statistics for the 164 respondents who qualified for the inclusion criteria for the survey. Participants consisted of male and female professional athletes competing in the 2016 Rio Olympics with ages ranging from 20 or younger (n = 27; 16.46%), 21-25 years (n = 115; 70.12%), and 26 or older (n = 22; 13.41%). The profes-

Table 2: Overall impression and Usage of Nutritional Supplements, Energy Drinks, and Doping of subjects in the present study (N = 164).

Response	Nutritional supplements *n* (%)	Energy Drinks *n* (%)	Doping *n* (%)
1. What is your overall impression and attitude toward these products?			
Positive	129 (78.66)	36 (21.95)	3 (1.83)
Negative	11 (6.71)	55 (33.54)	118 (71.95)
Neutral	24 (14.63)	73 (44.51)	43 (26.22)
2. How often do you consume or use these products?			
Every day	52 (31.33)	32 (19.51)	0 (0.00)
Once per week	66 (39.76)	59 (35.98)	1 (0.61)
Once per month	12 (7.23)	36 (21.95)	2 (1.22)
Rarely	27 (16.27)	25 (15.24)	4 (2.44)
Not used	9 (5.42)	12 (7.32)	157 (95.73)
3. What is the main reason for consuming these products?			
Provide energy (speed, strength, power)	54 (32.93)	65 (39.63)	23 (14.02)
Recover from an injury or illness	18 (10.98)	14 (8.54)	7 (4.27)
Improve endurance	31 (18.90)	29 (17.68)	16 (9.76)
Enhance tolerance for add'l training	8 (4.88)	33 (20.12)	9 (5.49)
Enhance ability to cope with pain	14 (8.54)	2 (1.22)	11 (6.71)
Other	39 (23.78)	21 (12.80)	98 (59.76)

Note. Significance: $p < 0.001$. The response does differ significantly ($p < 0.0001$) from the hypothesized value (0.05) indicating reasons for taking of nutritional supplements, energy drinks, and doping differ from each.

Table 3: Safety Perception of Nutritional Supplements, Energy Drinks, and Doping of subjects in the present study (N = 164).

Response	Nutritional supplements *n* (%)	Energy Drinks *n* (%)	Doping *n* (%)
4. Do you believe there are any side effects associated with these products?			
Yes	43 (26.22)	67 (40.85)	128 (78.05)
No	86 (52.44)	39 (23.78)	11 (6.71)
Do not know	35 (21.34)	58 (35.37)	25 (15.24)
5. Do you consider these products are safe to use?			
Yes	78 (47.56)	61 (37.2)	5 (3.05)
No	37 (22.56)	75 (45.73)	146 (89.02)
Do not know	49 (29.88)	28 (17.07)	13 (7.93)
6. How do you obtain information about these products?			
Coach or Physician	58 (35.37)	17 (10.37)	80 (48.78)
Nutritionist or Dietician	54 (32.93)	16 (9.76)	73 (44.51)
Family or friend	7 (4.27)	59 (35.98)	0 (0)
Online	6 (3.66)	8 (4.88)	0 (0)
Retail Store	8 (4.88)	28 (17.07)	0 (0)
Other	31 (18.90)	36 (21.95)	11 (6.71)

Note. Significance: $p < 0.001$. The response does differ significantly ($p < 0.0001$) from the hypothesized value (0.05) indicating that reasons for taking nutritional supplements, energy drinks, and doping differ from each.

Table 4: Type of Nutritional supplements and Use among subjects in the present study (n = 164).

Category of Nutritional Supplements	*n* (%)
7. Which of nutritional supplements have you used most frequently?	
Sports Supplements	
Sports drinks	26 (15.85)
Health bars	4 (2.44)
Vitamins	
Vitamin B Complex	7 (4.27)
Vitamin C	9 (5.49)
Vitamin D	10 (6.10)
Vitamin E	0 (0.00)
Multivitamins	0 (0.00)
Other Nutrients	
Iron	23 (14.02)
Calcium	4 (2.44)
Others Minerals	0 (0.00)
Carbohydrates Supplements	9 (5.49)
Protein Supplements	24 (14.63)
Fish Oils: Omega 3,6	7 (4.27)
Herbals	22 (13.41)
Ergogenic Aids	0 (0.00)
Other	10 (6.10)
Not used	9 (5.49)

Note. Significance: $p < 0.001$. Since the *p*-value is 0.0001, we can conclude that there is statistically significant difference between the use of nutritional supplements among Olympic athletes.

Table 5: Type of Energy Drinks Use among subjects in the present study (n = 164).

Category of Energy Drink (E.D.)	*n* (%)
8. Which of these Products have you used most frequently?	
Red Bull	41 (25.00)
Code Red	17 (10.37)
Bison	9 (5.49)
Bugzy	11 (6.71)
Power Horse	28 (17.07)
Double Horse	0 (0.00)
Blu Day	5 (3.05)
Black	14 (8.54)
Boom Boom	0 (0.00)
Shark	5 (3.05)
Full AMP	0 (0.00)
Other	22 (13.41)
Not used	12 (7.32)

Note. Significance: $p < 0.001$. Since the *p*-value is 0.0001, we can conclude that there is a statistically significant difference between the frequency of use of energy drinks among Olympic athletes.

Table 6: Types of Doping and Frequency of Use among subjects in the present study (N = 164).

Category of Doping	*n* (%)
9. Which of these doping has you used most frequently?	
Anabolic Agents	0 (0.00)
Peptide Hormones	0 (0.00)
Beta-2 Agonists	0 (0.00)
Hormone & Metabolic Modulators	0 (0.00)
Diuretics & Other Masking Agents	1 (0.61)
Stimulants	2 (1.22)
Narcotics	0 (0.00)
Cannabinoids	0 (0.00)
Glucocorticosteroids	4 (2.44)
Substances Prohibited in particular sports	0 (0.00)
Other	0 (0.00)
Not used	157 (95.73)

Note. Significance: $p < 0.001$. Since the *p*-value is 0.0001, we can conclude that there is a statistically significant difference between the frequencies of use of doping among Olympic athletes.

sional athletes in our study participated in either: team sports or individual sports. Team sports include soccer (*n* = 46; 28.05%), hockey (*n* = 32; 19.51%), volleyball (*n* = 24; 14.63%), and basketball (*n* = 18; 10.98%). Individual sports include the 100-meter dash (*n* = 14; 8.54%), boxing (*n* = 12; 7.32%), 100-meter swimming (*n* = 10; 6.10%), and weightlifting (*n* = 8; 4.88%). Of the 164 participants, 57.93% (*n* = 95) were male and 42.07% (*n* = 69) were female. A majority of the participants declared themselves as Black or African American (*n* = 48; 29.27%), followed by Middle Eastern (*n* = 39; 23.78%), Asian (*n* = 35; 21.34%), White (*n* = 26; 15.85%), Ameri-

can Indian or Alaskan (*n* = 10; 6.10%), and Native Hawaiian (*n* = 6; 3.66). The survey consisted of nine questions ranging from frequency of use to knowledge and perception of nutritional supplements, energy drinks, and doping practices.

Table 2 shows the responses of the surveyed athletes regarding the overall impression and usage of nutritional supplements, energy drinks, and doping. In the first question, we asked about overall impressions and attitudes toward these products. A majority of athletes (*n* = 129; 78.66%) reported an overall positive attitude toward nutritional supplements, followed by neutral (*n* = 24; 14.63%), and negative (*n* = 11; 6.71%). However, 73 participants (44.51%) indicated they were neutral towards the use of energy drinks, 55 participants (33.54%) held a negative attitude, and 36 participants (21.95%) had a positive impression of energy drinks. These results showed that the overall impression and attitude of athletes toward these products differed significantly ($p < 0.001$) among each other. Regarding doping, 118 participants (71.95%) had a negative impression of doping, 43 participants (26.22%) were neutral, and three participants (1.83%) held a positive view towards doping. We found that the response for each category differed significantly ($p < 0.001$).

With regard to the populations with which participants consumed or used these products, the results revealed a high percentage of athletes (*n* = 66; 39.76%) used nutritional supplements once per week followed by once per day (*n* = 52; 31.33%), rarely (*n* = 27; 16.27%), once per month (*n* = 12; 7.23%) and did not consume or use any of the products (*n* = 9; 5.42%). Fifty-nine participants (35.98%) used energy drinks once per week, followed by once per month (*n* = 36; 21.95%), once per day (*n* = 32; 19.51%), rarely (*n* = 25; 15.24%), and did not use any of the products (*n* = 12; 7.32%). A majority of athletes (*n* = 157; 95.73%) did not do doping, four athletes (2.44%) rarely did it, two athletes (1.22%) did doping once per month, and one athlete (0.61%) did doping once per week. For frequency category, athletes were significantly ($p < 0.001$) more likely to consume nutritional supplements and energy drinks once per week. In the question related to the main reason for consuming the target products of our study, our survey results showed that athletes used these products for different reasons. Athletes were significantly ($p < 0.001$) more likely to use nutritional supplements and energy drinks to gain energy. For example, 54 athletes (32.93%) believed that enhancing speed, strength, and power was the main reason for taking nutritional supplements, and 39 athletes (23.78%) indicated that there were other reaons for the consumption of these products. Similarly, 31 athletes (18.90%) believed that nutritional supplements improved endurance while 18 athletes (10.98%) believed nutritional supplements help them to recover from an injury or illness. Similarly, 65 athletes (39.63%) reported using energy drinks to gain speed, strength, and power, 33 athletes (20.12%) believed that energy drinks enhance tolerance for additional training, and 29 athletes (17.68%) thought that these drinks would improve an athlete's endurance.

Athletes (98, 59.76%) were significantly ($p < 0.001$) more likely to do doping for other reasons that are not listed in survey questionnaire. A total of 23 athletes (14.02%) felt that doping provides energy that helps them gain speed, strength, and power followed by 16 athletes (9.76%) who believed that doping helps improve endurance. Similarly, 11 athletes (6.71%) used doping to enhance their ability to cope with pain, and 9 athletes (5.49%) reported that the primary purpose of doping was to improve tolerance for additional training. Table 3 lists the questions related to the perceptions of athletes regarding the safety of these products (Questions 4-6). Of the 164 athletes, 86 athletes (52.44%) agreed that nutritional supplements have no associated negative side effects, whereas 43 athletes (26.22%) believed that these supplements have side effects, and 35 athletes (21.34%) had no idea about the products' side effects. On the other hand, most athletes (*n* = 67; 40.85%) agreed that energy drinks are safe to consume, and 58 athletes (35.37%) had no information about the safety of these products. Only 39 athletes (23.78%) thought that these products do not possess any side effects at all. Similarly, a majority of athletes (*n* = 128; 78.05%) agreed that doping is associated with side effects, followed by 25 athletes (15.24%) who had no information about the doping effects. Only 11 athletes (6.71%) believed that the use of doping had no side effects associated with it.

A large number of athletes (*n* = 78; 47.56%) were significantly ($p < 0.001$) more likely to believed that nutritional supplements and energy drinks (37.20%) are safe to consume. whereas 49 athletes (29.88%) had no idea about the products' safety. A total of 37 athletes (22.56%) believed that nutritional supplements were not safe to consume. On the other hand, 75 athletes (45.73%) believed that energy drinks are not safe to use, followed by 61 athletes (37.20%) who felt that energy drinks were safe to consume. Only 28 athletes (17.07%) had no information regarding the safety of energy drinks. A majority of athletes (*n* = 146; 89.02%) agreed that doping was not safe, whereas 13 athletes (7.93%) did not have any information related to the safety aspects of doping. A very small number of athletes (*n* = 5, 3.05%) reported that doping is safe.

Athletes were significantly more ($p < 0.001$) likely to obtain information from coach or family/friend regarding the use of nutritional supplements (35.37%) and energy drinks (37.20%) respectively. Likewise, 54 athletes (32.93%) received information from nutritionist or dietician, followed by 31 athletes (18.90%) who indicated that they had received information about nutritional supplements from other sources that were not included in our survey questionnaire. However, fewer than 10%

of the athletes reported their sources of information to be family member or friend, online, and retail store. In addition, most athletes (*n* = 59; 35.98%) had received information about energy drinks from family or friends, followed by 36 athletes (21.95%) who received the information from other sources, while 28 athletes (17.07%) received information from a retail store. A total of 153 athletes (93.3%) received information about doping effects either from their coach/physician or from a nutritionist/dietician. However, 11 athletes (6.71%) reported that they received information about doping from other sources. Table 4 shows a list of nutritional supplements and percentage of use among athletes reported during this study. These athletes reported using more than 13 different products.

The results showed that athletes were significantly ($p < 0.001$) more likely to take sports drinks (15.85%) followed by protein supplements (14.63%). We also noticed that fewer than 6% of athletes reported using Vitamin C, D, Vitamin B Complex, and Fish oil. Interestingly, nine athletes (5.42%) reported that they did not use any of the supplements listed on our survey. In the case of energy drinks (Table 5), a large percentage of atheltes (25%) were significantly ($p < 0.001$) more likely to consume red bull followed by power horse drink (17.07%). Some athletes (*n* = 12; 7.32%) responded that they did not use any energy drinks. Table 6 shows the type of doping products that athletes were using during the session. Athletes reported using only three different products: glucocorticosteroids (*n* = 4; 2.44%), stimulants (*n* = 2; 1.22%), and diuretics & other masking agents (*n* = 1; 0.61%) as performance enhancing products. Significantly ($p < 0.001$) higher number of athletes (*n* = 157; 95.73%) were not involved in the frequent use of any doping agents.

Discussion

In the current study, we conducted a survey regarding the behavior and attitude towards nutritional supplements, energy drinks, and doping of athletes participating in the 2016 Rio Olympics (*N* = 164). The randomized response technique proved to be an effective means of obtaining data with a relatively high degree of reliability. Questions that were necessary to guarantee the anonymity of the interviewees also led to some specific limitations on the possible knowledge gain with respect to overall analysis. Based on our results, athletes most commonly appeared to have a lack of knowledge about popular nutritional supplements, energy drinks, and doping. Because athletes are typically under enormous pressure to perform well, some are always in need of nutritional supplements and energy drinks to enhance performance. Since doping is illegal, these athletes need legal nutritional guidelines, especially regarding health and safety concerns surrounding the virus and a doping scandal involving Russia, which affected the participation of its athletes in the 2016 Rio Olympics. There is a little published information regarding the consumption of nutritional supplements, energy drinks, and doping; thus, there is an inherent need to educate athletes in these areas. For example, each year, new nutritional supplements, energy drinks, and doping products are appearing in global markets, and intake of nutritional supplements and energy drinks among athletes has also been increasing [14].

Of the 164 athletes surveyed regarding nutritional supplements, energy drinks, and doping, we found that 118 athletes (71.09%) were currently taking nutritional supplements. Tian, et al. [15] also reported that the use of specific nutritional supplements among athletes ranged from 46% to 100%. In our survey, 91 athletes (55.49%) were using energy drinks. Trunzo, et al. [16] also reported that athletes consume energy drink at least two to five days per week. Similarly, results of this study also showed that 40% of athletes use energy drinks at least once a week and are likely to increase the frequency of use to twice a week (34%). On the other hand, professional athletes reported the frequency of energy drink consumption to be at least once per week (36%), with a likelihood of increased intake to more than three times per week [17]. Another study revealed that 18.8% of athletes consumed energy drinks at least weekly [18]. In our current study, 157 athletes (95.73%) were not doping. Our survey results showed that a majority of athletes use nutritional supplements and energy drinks throughout the year either to enhance performance or simply to improve their health. In an earlier study [17], it was noted that nutritional supplements and energy drinks were used among athletes primarily to enhance performance. Similarly, in a study involving Saudi athletes, 73% of athletes reported using nutritional supplements and energy drinks [8].

Regarding the primary reason for using nutritional supplements, energy drinks, and doping products, results showed that athletes use these products for different reasons. The results of the survey showed that a majority of athletes (*n* = 54; 32.93%) believed that speed, strength, and power were the main reason for using nutritional supplements, followed by 31 athletes (18.90%) who used nutritional supplements to improve endurance. Earlier studies [5,19], had already shown that the use of nutritional supplements among athletes was primarily to enhance performance and speed. Twenty-six athletes (50.98%) believed that the primary benefits of these drinks were to increase speed, strength, and power. However, 25 athletes (36.23%) reported using sports drinks in order to recover from an injury or illnesses. Similarly, energy drinks were used to enhance energy (50%), combat sleepiness (45%) improve academic performance (40%), and enhance performance during sports (23%) [20]. Most athletes reported using doping products in order to enhance one's to cope with pain and to enhance tolerance for additional training. Similar to the study by Rodek, et al. [21], it was found that the main reason for doping use was for training recovery and the improvement of muscle-protein synthesis.

Related to the perceptions of athletes regarding the safety of these products, of 164 athletes, 86 (52.44%) agreed that nutritional supplements did not have any harmful side effects. A majority of the athletes reported that supplements are safe and can be consumed without any harm [22,23]. Our results showed that a majority of athletes (*n* = 75; 45.73%) also agreed that energy drinks are safe to consume, which is similar to a previous study [24], in which the main reason given for using energy drinks was to gain energy in general and to help compensate for a lack of proper sleep (12.8%). Some studies also reported the stamina challenges of working overtime as being the main reason for taking these drinks [17]. In a study by Kim and Kim [25], reasons for energy drink consumption included enhancing fatigue recovery (79.9%), enhancing concentration (29.3%), and novelty/curiosity (22.0%).

A majority of athletes (*n* = 146; 89.02%) agreed that doping is not safe, whereas 13 athletes (7.93%) did not have any information related to the safety aspects of doping. Less than 3.05% of athletes reported that doping is safe. Rodek, et al. [21] reported that more than half of the subjects believed that doping practices are safe, and that doping is used regularly in their sport, while only 22% of the subjects would avoid doping if doing so would assure sports success with no health hazards. In our study, most athletes (*n* = 58; 35.37%) had received nutritional supplements information from a coach or physician. However, less than 10% of athletes reported their sources of information to be a family or friend, online, or retail store. According to a study by Froiland, et al. [26], male athletes were more likely to obtain information about the use of supplements from a coach or physician, store nutritionist, fellow athletes, and friends. These results were similar to ours. Similarly, in a study by Kristiansen, et al. [27], health professionals and the Internet were the most common information sources, while coach or physician and friends and colleagues often recommended the use of supplements. A study by Emond, et al. [28] showed that athletes obtained information about energy drinks from the store, fellow college students and friends, and manufacturers that primarily advertise on television. These results were similar to our study in which, most athletes who used energy drinks (*n* = 59; 35.98%) had received information from family or friends, 36 athletes (21.95%) had received information from other sources which were not listed on our questionnaire, and 28 athletes (17.07%) reported that they had received product information from a retail store. Furthermore, most athletes had received information about the potential risk of doping from a coach or physician and a nutritionist or dietician. Since coaches play an important role in athletes' lives, coaches should be well-educated about the risks associated with drugs and doping.

Our results revealed that sports drink consumption was the highest among all the nutritional supplements followed by protein supplements, iron, and herbals. However, less than 6% of athletes reported using Vitamin C, Vitamin D, Vitamin B Complex, and Fish Oil. In this study, the most popular products were vitamins, minerals, and supplements, similar to the results in a study conducted by Tian, et al. [15]. In addition, the use of sports drinks shown in our study is similar to that found in an earlier study reported by Froiland, et al. [26] and [27] and Kristiansen, et al. [27]. Our results showed that Red Bull consumption was the highest among all sports drinks followed by Power Horse, Code Red, Black, and Bugzy. Similarly, Barcelona, et al. [17] reported Cobra, Red Bull, and Monster Energy as the most popular products used by student athletes. These authors reported that Cobra was significantly more popular among professional athletes (58%), while Red Bull and Monster were more popular among student athletes.

Regarding the question related to doping, our results showed that glucocorticosteroids, stimulants, diuretics, and other masking agents were the most frequently used doping products. However, a majority of athletes (*n* = 157; 95.7%) did not report doping practices. Rodek, et al. [21] reported that only 22% of the subjects believed that they would use doping products if doing so would assure sports success with no health hazards. Therefore, our results suggest that more professional athletes would not use doping and would tend to avoid any behavior that may be hazardous to the athletes' health (e.g., narcotics, cannabinoids, glucocorticosteroids). Avoiding the use of doping products not only preserves athletes' health, but also results in more positive role models for young athletes [29].

Conclusions and Future Directions

Many professional athletes in the Olympics consume nutritional supplements, energy drinks, and doping products as a part of their daily diet routines. These products are often used without the athletes having a full understanding of the potential benefits, negative side effects, and risks associated with the produts' use and without consultation with sports nutrition professionals. Other research and increased public consciousness are needed to bring about an improvement in the education of athletes in the area of nutritional supplements, energy drinks, and doping. This education must highlight the differences among nutritional supplements, energy drinks, and doping and any associated potential health risks.

Regarding the consumption of nutritional supplements, energy drinks, and doping by professional athletes in the Olympics, we should:

- Improve the education of athletes in nutritional supplements, energy drinks, and doping. This education must highlight the difference between nutritional supplements, energy drinks, doping, and their associated potential health risks.

- Make athletes aware that doping could pose potential health risks primarily because of stimulant content; consequently, these products are not appropriate for athletes and should never be consumed.
- Teach athletes that nutritional supplements and energy drinks have a limited usage.
- Conduct more research related to nutritional supplements, energy drinks, and doping, especially among professional athletes in the Olympics as abuse in these areas, has affected some countries and the participation of their athletes in these popular and historic, world-renowned games.

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