

CONSUMPTION, KNOWLEDGE, AND OPINIONS OF EXERCISERS AND ATHLETES ABOUT ENERGY DRINKS: A PUBLIC HEALTH PERSPECTIVE

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Introduction: The energy drinks (EDs) are beverages that contain caffeine and are consumed by students, children, adolescents, and young adults to enhance their athletic and cognitive performance. Significant adverse effects have been reported. They vary from mild symptoms to death. The present study attempts to assess the risk of using EDs by exercisers and athletes.

Methods: The sample consisted of 234 exercisers or athletes (148 men and 84 women). The data collection tool was a structured questionnaire made from scratch. Individuals were approached at mass sports venues, mostly gyms. Inclusion criteria were to exercise regularly at least once a week and ability to communicate fluently (understanding the language is too important).

Results: The 35.5% of participants consumed EDs. They consumed 3.6 cans per month for 4.5 years. The dominant reasons for consumption were taste and physical performance. Most participants (92%) believe that they have sufficient knowledge about EDs, but the actual knowledge score on the subject is 10.12/18. As measures to tackle EDs problems, 96.6% recommend better public education, 94.8% recommended more information on the product label. About 89.6% believe that law should set an upper limit of primer ingredient and 53% consider that restrictions should be put on sale. Finally, 13.1% believe that the sale of EDs should be completely banned.

Discussion: One-third of the participants consume EDs. That is within the literature range. The users of ED believe that have sufficient knowledge about ED but that seems not to be true. Therefore, the need for further information is clear. The measures that are suggested to tackle ED problems are public education, more information on the label and legislative ceiling set of the principal ingredient.

Conclusion: The need to take measures regarding ED is evident. Due to the high prevalence of EDs among young people and athletes, this issue needs to be tackled effectively to avoid negative consequences in the future.

Keywords: Feeding behavior, Diet assessment, Sports nutrition, Health knowledge, Attitudes, Central nervous system stimulant, Substance abuse risk, Surveys and questionnaires, Cross-sectional.

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INTRODUCTION

The first energy drink (ED) appeared in Austria in 1987 and in the USA in 1997 [1]. Sales have grown exponentially since then. There is a vast variety of such products on the market. The market part of EDs in the US was around \$650 million (2005) and sales increased by 35% pro year [2]. In 2010, the ED market was \$6.7 million [3].

EDs are aiming primarily at young individuals by applying highly aggressive marketing. It promotes their psychoactive, stimulating, and enhancing performance abilities [1,4]. Athletes are looking for a legitimate ergogenic tool to increase their performance. Ergogenic aids are substances, techniques, or sports equipment that enhance performance. Caffeine is an ergogenic aid [5] and the principal ingredient of EDs. They are promoted as a factor that increases energy, alertness, and athletic performance [1,6]; therefore, it seems like a good choice for athletes.

Drinking EDs associated with high-risk behaviors such as marijuana use, risky sex practices, involvement in conflicts, alcohol abuse, and use of illegal substances [7,8]. The practice of mixing EDs with alcohol is common [9], and this leads to high-risk behaviors [10]. Many studies have highlighted the negative effects of alcohol over-consumption [8,11,12].

The term "ED" refers to any product that is a beverage or concentrated liquid and contains a mixture of ingredients such as caffeine, taurine, guarana, and vitamin B [12,13] and may have a positive effect on physical

and mental performance [14,15]. Besides the caffeine found in most EDs, they often contain guarana, which has caffeine and theobromine, ginseng that is considered safe, taurine an intracellular amino acid with positive isotropic effects and antioxidant activity, sugars usually in high concentrations [12], and carnitine with impact on physical and mental hypertension [16]. They may also contain other substances, such as glucuronolactone and vitamins [3].

A lot of placebo-controlled crossover studies have showed the efficacy of EDs as contributing factors to mental function and physical performance [17,18]. Several studies have found that EDs improve endurance, although this effect can be attributed to caffeine or carbohydrates [19]. They were also found to improve performance on female soccer players [20] and jumping ability in badminton [21] and in basketball [22], but in the latter, they did not improve shoot performance. EDs can improve women's volleyball performance with a consequent improvement in accuracy during the competition [23]. They also improve 5 km road performance [24] and cycling performance [25] and strength and endurance in general [26].

There are cases where the results of using an ED were not better, such as in isometric contraction [27] or sprinting of female athletes [28]. Modern meta-analysis has revealed that caffeine intake does not improve performance in maximum running distance and muscle power, but it seems to improve time trial performance. The result is dose-related [5,29]. It is also unclear whether EDs are the vehicle for caffeine delivery when large doses are required [19].

A systematic review has shown that the ingredients of EDs that have an ergogenic action are caffeine and possibly glucose. For the latter, the documentation is weak [3]. Caffeine (1,3,7- trimethylxanthine) is one of the most established ergogenic aids that enhancing the performance [30] in a wide range of sports [31] and is widely used by athletes of all levels [32]. Caffeine seems to improve endurance [32,33], anaerobic performance [34], and strength [35] in different exercises. Examples of ergogenic action of caffeine are positive effect on young soccer players [36], on strength athletes [37] etc., but the use of caffeine in sports has also many disadvantages such as nervousness and insomnia [38]. Therefore, sometimes it is not suitable for use as an ergogenic factor.

The consumption levels reported in the literature are 15.7% [39] and 33% [40] in Turkey, 51% [9] in the USA, 24.8% [41] in Taiwan, and 38% [42] in the Caribbean. The differences observed are due to the different definition of "ED consumer" and the particular cultural and economic characteristics of each group. A study of students that take part in sports found that 85.9% consumed EDs, dietary supplements or prescription drugs to increase performance. EDs had the highest prevalence of 80.1% [28].

It has been reported that many students consume EDs to improve their athletic performance [43]. Another study found that the reasons for consumption are taste, focus on study or work, alertness, social reasons, increased athletic performance, etc. [44]. Studies revealed that athletes have little knowledge about diet and disease [45,46]. It was also found that athletes who consumed EDs had less knowledge than those who did not [44].

The side effects and toxicity of EDs are due to caffeine and synergy with other ingredients [1]. The most affected systems are cardiovascular and nervous systems [47]. The effects varied from mild to death [48]. Cardiovascular system has been reported increased blood pressure [49-53] and heart rate [50]. There are also more serious conditions such as arrhythmias [54,55], and heart attacks [56,57].

From the nervous system, we encounter psychopathology symptoms [58], aggression [59], anxiety [60], and sleep disorders [61]. More serious conditions, such as manic episode [62], psychosis [63], epilepsy [64], and transient stroke [65] are also reported. There are also effects on other systems, but of lower importance. It should be noted that EDs are associated with problem behavior syndrome. Frequent consumption of EDs is an indicator of people at risk of substance abuse [8].

The purpose of the present article is to evaluate the exercisers and athletes' health risk due to consumption of EDs. The danger is related to the level of consumption, the knowledge that ensures EDs' proper use and the level of regulation of the ED market. This study has the following research questions: What is the level of ED consumption in the group of exercisers and athletes? What is the level of knowledge of exercisers and athletes about EDs? What public health measures, according to exercisers and athletes should be taken to minimize problems due to the use of EDs? What are the sources of information about EDs? What are the characteristics of those who consume EDs with alcohol?

METHODS

This is a primary, quantitative study. In this study, "EDs" are considered beverages or concentrated liquids, containing caffeine or other stimulant and a mixture of other substances, and may have a physical or mental effect. "Athlete" is someone who trains regularly, is a member of a sports club, and takes part in competitions, and his primary activity is sports [66]. A "exerciser" is someone who is trained to entertain himself or improve his mental state. In this study, "ED consumer" is someone who consumes one can of ED at least once a month.

The sample consisted of 234 individuals, of which 148 were men and 84 were women (Table 1). These were exercisers or athletes, namely,

Table 1: Demographics and habits

Sex	(%)
Man	148 (63.8)
Woman	84 (36.2)
Education	
Incomplete high school	6 (2.6)
High school graduate	169 (74.1)
Higher education graduate	41 (18)
Master's degree holder	12 (5.3)
Training (times per week)	
1	28 (12.6)
2	37 (16.6)
3	63 (28.3)
4	64 (28.7)
5 or more	31 (13.9)
Concurrent consumption with alcohol	
Yes	41/77 (53.2)
No	36/77 (46.8)
Smoker	
Yes	44 (18.8)
No	190 (81.2)
Supplements consumer	
Yes	23 (9.8)
No	211 (90.2)
Illness	
Yes	16 (6.9)
No	216 (93.1)

individuals who did some form of exercise at least once a week. The data collection tool was a structured questionnaire. It comprised demographic questions (gender, education, etc.), habits such as training frequency, concurrent EDs and alcohol consumption, smoking, and use of food supplements. There were also questions about sources of information about EDs and, finally, their perception of the adequacy of knowledge of EDs. However, the questionnaire is not limited to the subjective view of participants, but through 18 question mini questionnaire, it is attempted to clarify the subject's actual knowledge about EDs.

The questions of this mini questionnaire were chosen to reveal the basic knowledge of EDs. The mini questionnaire includes questions about the most important substance in EDs, the maximum recommended dose of the principal ingredient, if EDs and soft drinks or sport drinks are identical and whether they affect athletic or mental performance. Furthermore, if they increase body weight or they interact with drugs and if they can cause addiction or death, etc. Each of the 18 questions contributed to one point to the creation of a knowledge index for Eds (minimum 0, and maximum 18) and represents the subject's knowledge about EDs.

Individuals were approached at mass sports venues, mainly gyms, and were asked to take part in the study. Inclusion criteria were to exercise regularly at least once a week and ability to communicate fluently (understanding the language is too important). A researcher was present when the individuals were completing the questionnaire for answering questions and assisting in questionnaire competition. To improve the questionnaire, a pilot study was carried out, but it offered little, as the questionnaire was already at a satisfactory level.

In the present work, the categorical variables are presented as relative and sometimes absolute frequencies, while the continuous ones are presented as average and in a parenthesis standard deviation. Logarithmic regression was performed to determine the effect of gender, age, training frequency, and knowledge score on the likelihood of consuming ED. All statistical calculations were performed using SPSS, 17.0 (SPSS Inc, Chicago, IL, USA).

The principles of the Helsinki Declaration were considered in conducting the study. All participants were informed about the scope

Table 2: Information - Knowledge

Obtain information from Advertisements	(%)
Yes	162 (69.2)
No	72 (30.8)
Obtain information from gyms	
Yes	22 (9.4)
No	212 (90.6)
Obtain information from friends	
Yes	69 (29.5)
No	165 (70.5)
Obtain information from sport and health professionals	
Yes	19 (8.1)
No	215 (91.9)
Subjective knowledge for ED	
Yes	207 (91.2)
No	20 (8.8)
Knowledge score	
M	10.12
SD	1.93

ED: Energy drink

Table 3: Aspects

Better public education	(%)
Yes	225 (96.6)
No	8 (3.4)
More information on the label	
Yes	221 (94.8)
No	12 (5.2)
Restrictions on advertising	
Yes	142 (61.5)
No	89 (38.5)
Legislative ceiling set of energy drink's principal ingredient	
Yes	206 (89.6)
No	24 (10.4)
Restrictions on sale	
Yes	122 (53)
No	108 (47)
Total ban of ED	
Yes	30 (13.1)
No	199 (86.9)

ED: Energy drink

of the study, its purpose and objectives and agreed to take part without hesitation. Participation was anonymous, and the data collected were used solely for the purpose of the survey and were not transferred to third parties. The researchers involved did not have any financial gain to carry out the study.

RESULTS

The men who took part in the study (148, 63.8%) were more than women (84, 36.2%) and the majority were high school graduates (169, 71.1%). High school graduates are followed by higher education graduates (41, 18%) and holders of postgraduate degree or doctorate (12, 5.3%). In the last place is the group of the individuals that have not finished high school (2.6%).

Participants that trained 3 times a week were 63 (28.3%), 4 times were 64 (28.7%), and 5 or more times were 31 (13.9%). Forty-one out of 77 (53.2%) users of EDs consume EDs simultaneously with alcohol. Forty-four (18.8%) were smokers, while 23 (9.8%) received dietary supplements. Sixteen (6.9%) report the presence of a disease.

The 35.5% (77) of participants consumed EDs, while the remaining 64.5% did not. Users consumed 3.6 (3.50) cans per month for 4.5 (2.97) years. The reason for consumption was taste (57.1%), physical performance (31.2%), socialization (19.5%), and alertness (14.3%). Supply is made by gym (11.7%), kiosk (63.6%), and supermarket

(45.5%). The participants say that the coach is aware of ED consumption (24.7%), he does not know (26%), or there is no coach (49.3%).

The source of information about EDs is advertising (69.2%), gyms (9.4%), friends (29.5%), and sport or health professionals (8.1%). About 91.2% of participants believe that they have sufficient knowledge about EDs. However, the knowledge score on the subject is 10.12 (1.93) (maximum is 18) (Table 2). As measures to tackle EDs problems (Table 3), 96.6% recommend better public education, 94.8% recommended more information on the product label, while 61.5% advocate restrictions on advertising EDs. About 89.6% believe that an upper limit of primer ingredient should be set by law and 53% consider that restrictions should be put on sale. Finally, 13.1% believe that the sale of EDs should be completely banned.

DISCUSSION

The present study shows that 35.5% of the participants consume EDs. If we define the "ED consumer" as the individual who ingests EDs once a week, the percentage drops to 11.98%. These are within the literature's range. About 31.2% of the users consumed to improve physical performance, far below the taste (57.1%). Supply is not made by gyms but by kiosks and supermarkets, probably due to the lower prices. Most participants receive information on EDs from advertisements (69.2%) and not from sports and health professionals (8.1%), which shows the vast amount of invalid information being provided. About 91.2% believe that they have sufficient knowledge of EDs. However, the knowledge score is not in line with this view. The lack of knowledge is shown also by the fact that half of the ED users consume simultaneously alcohol, a health hazardous practice. Thus, the individuals believed that they had adequate knowledge, but that proved not true. The need for further information is clear to increase the objective score and to abandon the dangerous practice of co-administering sports drinks with alcohol.

Public education (96.6%), more information on the label (94.8%), and legislative ceiling set of principal ingredient (89.6%) are suggested almost by everyone. The measures that follow are advertising restrictions (61.5%), sales restrictions (53%), and a total ban (13.1%). Interventions without major consequences, such as better public information and more information on label, have many supporters. Less popular measures, due to their highly interventional nature, are sales restriction policies and ED ban. The overall response shows the need for action.

CONCLUSION

The level of consumption of EDs is not surprising, as it is within the bounds of the literature. The principal source of knowledge is the advertisement, which does not guarantee objective information. Thus, although athletes and exercisers believe that they have adequate knowledge on the subject, in fact this is not the case, with half of them consuming concurrently EDs and alcohol. The study emphasizes the need to take measures, especially those that are easier to implement. Due to the high prevalence of EDs among young people and athletes, this issue needs to be tackled effectively to avoid negative consequences in the future.

REFERENCES

1. Reissig CJ, Strain EC, Griffiths RR. Caffeinated energy drinks--a growing problem Drug and Alcohol Depend 2009;99:1-10.
2. Bryce DJ, Dyer JH. Strategies to crack well-guarded markets. Harvard Bus Rev 2007;85:84-92.
3. McLellan TM, Lieberman HR. Do energy drinks contain active components other than caffeine? Nutr Rev 2012;70:730-44.
4. Ballard SL, Wellborn-Kim JJ, Clauson KA. Effects of commercial energy drink consumption on athletic performance and body composition. Physician and sportsmedicine 2010;38:107-17.
5. Gonçalves RB, Morales AP, Jorge FS, Tinoco F, de Matos AA, Leite TC. Acute effects of caffeine intake on athletic performance a systematic review and meta-analysis. Rev Chil Nutr 2017;44:283-91.
6. Clauson KA, Shields KM, McQueen CE, Persad N. Safety issues associated with commercially available energy drinks: Safety issues

- associated with commercially available energy drinks. *J Am Pharm Assoc* 2008;48:e55-63.
7. Thombs DL, O'Mara RJ, Tsukamoto M, Rossheim ME, Weiler RM, Merves ML, et al. Event-level analyses of energy drink consumption and alcohol intoxication in bar patrons. *Addict Behav* 2010;35:325-30.
 8. Miller KE. Energy drinks race and problem behaviors among college students. *J Adolesc Health* 2008;43:490-7.
 9. Malinauskas BM, Aeby VG, Overton RF, Carpenter-Aeby T, Barber-Heidal K. A survey of energy drink consumption patterns among college students. *Nutr J* 2007;6:35.
 10. O'Brien MC, McCoy TP, Rhodes SD, Wagoner A, Wolfson M. Caffeinated cocktails energy drink consumption high-risk drinking and alcohol-related consequences among college students. *Acad Emerg Med* 2008;15:453-60.
 11. Seifert SM, Schaechter JL, Hershorn ER, Lipshultz SE. Health effects of energy drinks on children adolescents and young adults. *PEDIATRICS* 2011;127:511-28.
 12. Duchan E, Patel ND, Feucht C. Energy drinks a review of use and safety for athletes. *Phys Sports Med* 2010;38:171-9.
 13. Ehlers A, Marakis G, Lampen A, Hirsch-Ernst KI. Risk assessment of energy drinks with focus on cardiovascular parameters and energy drink consumption in Europe. *Food Chem Toxicol* 2019;130:109-21.
 14. Wolk BJ, Ganetsky M, Babu KM. Toxicity of energy drinks. *Curr Opin Pediatr* 2012;24:243-51.
 15. Itany M, Diab B, Rachidi S, Awada S, Al Hajje A, Bawab W, et al. Consumption of energy drinks among lebanese youth A pilot study on the prevalence and side effects. *Int J High Risk Behav Addict* 2014;3:e18857.
 16. Diel F, Khanferyan RA. Sports and energy drinks. *Foods Raw Mater* 2018;6:379-91.
 17. Klepacki B. Energy drinks a review article. *Strength Condit J* 2010;32:37-41.
 18. Hoffman JR. Caffeine and energy drinks. *Strength Condit J* 2010;32:15-20.
 19. Mora-Rodriguez R, Pallarés JC. Performance outcomes and unwanted side effects associated with energy drinks. *Nutr Rev* 2014;72:108-20.
 20. Lara B, Gonzalez-Millán C, Salinero JJ, Abian-Vicen J, Areces F, Barbero-Alvarez JC, et al. Caffeine-containing energy drink improves physical performance in female soccer players. *Amino Acids* 2014;46:1385-92.
 21. Abian-Vicen J, Puente C, Salinero JJ, González-Millán C, Areces F, Muñoz G, et al. A caffeinated energy drink improves jump performance in adolescent basketball players. *Amino Acids* 2014;46:1333-41.
 22. Abian P, Del Coso J, Salinero JJ, Gallo-Salazar C, Areces F, Ruiz-Vicente D, et al. The ingestion of a caffeinated energy drink improves jump performance and activity patterns in elite badminton players. *J Sports Sci* 2015;33:1042-50.
 23. Pérez-López A, Salinero JJ, Abian-Vicen J, Valadés D, Lara B, Hernandez C, et al. Caffeinated energy drinks improve volleyball performance in elite female players. *Med Sci Sports Exerc* 2015;47:850-6.
 24. Prins PJ, Goss FL, Nagle EF, Beals K, Robertson RJ, Lovalekar MT, et al. Energy drinks improve five-kilometer running performance in recreational endurance runners. *J Strength Condit Res* 2016;30:2979-90.
 25. Quinlivan A, Irwin C, Grant GD, Ano'lopkumar-Dukie S, Skinner T, Leveritt M, et al. The effects of red bull energy drink compared with caffeine on cycling time-trial performance. *Int J Sports Physiol Perform* 2015;10:897-901.
 26. Souza DB, Del Coso J, Casonatto J, Polito MD. Acute effects of caffeine-containing energy drinks on physical performance a systematic review and meta-analysis. *Eur J Nutr* 2017;56:13-27.
 27. Pai KM, Kamath A, Goel V. Effect of red bull energy drink on muscle performance an electromyographic overview. *J Sports Med Phys Fitness* 2015;55:1459-65.
 28. Astorino TA, Matera AJ, Basinger J, Evans M, Schurman T, Marquez R. Effects of red bull energy drink on repeated sprint performance in women athletes. *Amino Acids* 2012;42:1803-8.
 29. Hoyte CO, Albert D, Heard KJ. The use of energy drinks dietary supplements and prescription medications by United States college students to enhance athletic performance. *J Community Health* 2013;38:575-80.
 30. Graham TE. Caffeine and exercise metabolism endurance and performance. *Sports Med* 2001;31:785-807.
 31. Pickering C, Grgic J. Caffeine and exercise what next? *Sports Med* 2019;49:1007-30.
 32. Pickering C, Kiely J. What should we do about habitual caffeine use in athletes? *Sports Med* 2019;49:833-42.
 33. Southward K, Rutherford-Markwick KJ, Ali A. The effect of acute caffeine ingestion on endurance performance a systematic review and meta-analysis. *Sports Med* 2018;48:1913-28.
 34. Grgic J. Caffeine ingestion enhances Wingate performance a meta-analysis. *Eur J Sport Sci* 2018;18:219-25.
 35. Del Coso J, Salinero JJ, González-Millán C, Abián-Vicén J, Pérez-González B. Dose response effects of a caffeine-containing energy drink on muscle performance a repeated measures design. *J Int Soc Sports Nutr* 2012;9:21.
 36. Hernández-Camacho JD, Vázquez-Carrión J, Fuentes-Lorca E, Moyano H. Caffeine supplementation improves countermovement jump in youth soccer players a pilot study. *Rev Esp Nutr Hum Dietet* 2017;21:155-63.
 37. Álvarez-Montero JI, Ordóñez FM, Domínguez R. Effects of caffeine supplementation on the production capacity of muscle strength. *Rev Andal Med Deporte* 2019;12:35-40.
 38. Salinero JJ, Lara B, Abian-Vicen J, Gonzalez-Millán C, Areces F, Gallo-Salazar C, et al. The use of energy drinks in sport perceived ergogenicity and side effects in male and female athletes. *Br J Nutr* 2014;112:1494-502.
 39. Borlu A, Oral B, Gunay O. Consumption of energy drinks among Turkish university students and its health hazards. *Pak J Med Sci* 2019;35:537-42.
 40. Attila S, Çakir B. Energy-drink consumption in college students and associated factors. *Nutrition* 2011;27:316-22.
 41. Chang YJ, Peng CY, Lan YC. Consumption of energy drinks among undergraduate students in taiwan related factors and associations with substance use. *Int J Environ Res Public Health* 2017;14:9.
 42. Reid SD, Ramsarran J, Brathwaite R, Lyman S, Baker A, Cornish DA, et al. Energy drink usage among university students in a Caribbean country Patterns of use and adverse effects. *J Epidemiol Glob Health* 2015;5:103-16.
 43. Paddock R. Energy drinks' effects on student-athletes and implications for athletic departments. *Sport J* 2008;11:4.
 44. Hardy R, Kliemann N, Evansen T, Brand J. Relationship between energy drink consumption and nutrition knowledge in student-athletes. *J Nutr Educ Behav* 2017;49:19-26.
 45. Spronk I, Heaney SE, Prvan T, O'Connor HT. Relationship between general nutrition knowledge and dietary quality in elite athletes. *Int J Sport Nutr Exerc Metab* 2015;25:243-51.
 46. Spendlove JK, Heaney SE, Gifford JA, Prvan T, Denyer GS, O'Connor HT. Evaluation of general nutrition knowledge in elite Australian athletes. *Br J Nutr* 2012;107:1871-80.
 47. Ali F, Rehman H, Babayan Z, Stapleton D, Joshi DD. Energy drinks and their adverse health effects a systematic review of the current evidence. *Postgrad Med* 2015;127:308-22.
 48. Avci S, Sarikaya R, Büyükkemal F. Death of a young man after overuse of energy drink. *Am J Emerg Med* 2013;31:1624.
 49. Miles-Chan JL, Charrière N, Grasser EK, Montani JP, Dulloo AG. The blood pressure-elevating effect of Red Bull energy drink is mimicked by caffeine but through different hemodynamic pathways. *Physiol Rep* 2015;3:2.
 50. Elitok A, Öz F, Panc C, Sarikaya R, Sezikli S, Pala Y, et al. Acute effects of red bull energy drink on ventricular repolarization in healthy young volunteers A prospective study. *Anat J Cardiol* 2015;15:919-22.
 51. Shah SA, Chu BW, Lacey CS, Riddock IC, Lee M, Dargush AE. Impact of acute energy drink consumption on blood pressure parameters a meta-analysis. *Ann Pharmacother* 2016;50:808-15.
 52. Shah SA, Szeto AH, Farewell R, Shek A, Fan D, Quach KN, et al. Impact of high volume energy drink consumption on electrocardiographic and blood pressure parameters a randomized trial. *J Am Heart Assoc* 2019;8:e011318.
 53. Svatikova A, Covassin N, Somers KR, Somers KV, Soucek F, Kara T, et al. A randomized trial of cardiovascular responses to energy drink consumption in healthy adults. *JAMA* 2015;314:2079-82.
 54. Busuttil M, Willoughby S. A survey of energy drink consumption among young patients presenting to the emergency department with the symptom of palpitations. *Int J Cardiol* 2016;204:55-6.
 55. Mattioli AV, Pennella S, Manenti A, Farinetti A. Energy drink overconsumption can trigger atrial fibrillation. *J Cardiovasc Med* 2016;17:902-4.
 56. Benjo AM, Pineda AM, Nascimento FO, Zamora C, Lamas GA, Escobar E. Left main coronary artery acute thrombosis related to energy drink intake. *Circulation* 2012;125:1447-8.
 57. Ünal S, Sensoy B, Yilmaz S, Ünal GG, Süleymanoglu M, Şen F, et al. Left main coronary artery thrombosis and acute anterior myocardial infarction related to energy drink. *Int J Cardiol* 2015;179:66-7.
 58. Marmorstein NR. Energy drink and coffee consumption and

- psychopathology symptoms among early adolescents cross-sectional and longitudinal associations. *J Caf Res* 2016;6:64-72.
59. Toblin RL, Adrian AL, Hoge CW, Adler AB. Energy drink use in US service members after deployment associations with mental health problems aggression and fatigue. *Milit Med* 2018;183:e364-e370.
60. Trapp GS, Allen K, O'Sullivan TA, Robinson M, Jacoby P, Oddy WH. Energy drink consumption is associated with anxiety in Australian young adult males. *Depress Anxiety* 2014;31:420-8.
61. Marmorstein NR. Interactions between energy drink consumption and sleep problems associations with alcohol use among young adolescents. *J Caf Res* 2017;7:111-6.
62. Quadri S, Harding L, Lillig M. An energy drink-induced manic episode in an adolescent. *Prim Care Companion CNS Disord* 2018;20:18l02318.
63. Görgülü Y, Taşdelen Ö, Sönmez MB, Çınar RK. A case of acute psychosis following energy drink consumption. *Noro Psikiyatri Arsivi* 2014;51:79-81.
64. Calabò RS, Italiano D, Gervasi G, Bramanti P. Single tonic-clonic seizure after energy drink abuse. *Epilepsy Behav* 2012;23:384-5.
65. Dikici S, Saritas A, Kilinc S, Gunesu S, Gunes H. Does an energy drink cause a transient ischemic attack? *Am J Emerg Med* 2015;33:129.
66. Araújo CG, Scharhag J. Athlete A working definition for medical and health sciences research. *Scand J Med Sci Sports* 2016;26:4-7.