

# Caffeinated Energy Drinks Boost Physical Performance In Several Sport Modalities: Should They Be Considered By Antidoping Authorities?

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Caffeine has been consumed by man for centuries although the manner of consumption has varied among different geographical zones, according to the source of caffeine present in natural foods (e.g., coffee, tea, mate, guaraná, kola, etc.). By the end of XIX century, John S. Pemberton created the first non-natural caffeinated-beverage that contained caffeine form the kola nut. The use of this beverage – universally known as Coca-Cola- increased exponentially worldwide and favored the apparition of hundreds of commercial caffeinated drinks with similar characteristics. Although first energy drinks were marketed in Thailand in the 1970s, these drinks became widely popular when they were introduced in the European in the 1990s. Despite the commercial availability of numerous caffeinated beverages and foods, energy drinks have gained popularity in the last years, likely because they provide a higher dose of caffeine per serve.

Regardless of their name, energy drinks do not contain higher amounts of energy than other caffeinated drinks or sodas and this denomination seems more related to the “energizing” –e.g., stimulating-effect that produce in the human body. Energy drinks typically contain 32 mg of caffeine per 100 mL of product (while most caffeinated sodas contain 7 mg/100mL of product) in addition to carbohydrates, taurine, glucuronolactone and B-group vitamins [1]. Among these ingredients, caffeine and carbohydrates are considered the most active constituents while the effectiveness of the remaining ingredients has not been scientifically tested with acute intake [2]. The amount of caffeine in a classic energy drink (250 mL=80 mg of caffeine) is not very different from the amount of caffeine present in a cup of coffee or tea. However, energy drinks companies have recently increased the amount of drink per serve and these days, it can be easily found new 500 mL-cans that rise the caffeine dosage per serve.

In a recent report of the European Food Safety Authority (EFSA) [3], it was certified that approximately 30% of adults were consumers of energy drinks, with 12% of them consuming energy drinks on 4-5 days a week or more. However, the alarm of the EFSA was related to the high prevalence of energy drinks consumption in adolescent and children. Approximately 68% of adolescents with ages between 10 and 18 years were considered as regular consumers of caffeinated energy drinks while 18% of children between 3 and 10 years were reported ingestion of energy drinks in a regular manner. The massive use of these beverages requires exceptional scientific attention to determine the accuracy of the purported benefits associated to these drinks and possible side-effects associated to the intake of caffeinated energy drinks, especially in vulnerable populations. In fact, energy drinks have changed the manner of caffeine consumption in several settings, although it has specially affected the use of caffeine in sports.

Caffeine per se is the most consumed substance-with non-nutritional- value in sports; a recent investigation determined the presence of caffeine in the post-competition urine of 74% of elite athletes of different sport disciplines [4]. This popularity is related to the removal of caffeine from the list of prohibited substances of the World Antidoping Agency in 2004 [5]. Due the well-recognized ergogenicity of caffeine and the accessibility low cost of these beverages,

the intake of energy drinks has become the most popular manner of supplementing before exercise [6,7]. Caffeinated energy drinks have been found effective to significantly improve performance in several sport modalities. During simulated or real games, the pre-exercise ingestion of energy drinks, to obtain an individual dose of 3 mg of caffeine per kg of body mass, increased the running distance covered at high- and/or sprint-intensity in male and female soccer players [2,8] and the running distance covered at high-intensity in rugby players[9,10]. The ingestion of energy drinks has also improved jump performance in basketball players[11], the frequency of successful actions during volleyball games [12,13], the number of movements during a badminton game [14] and the distance covered at high-intensity running and the number of sprints during a tennis match in junior players[15]. Interestingly, the ergogenicity of caffeinated energy drinks is not present when the amount of energy drink ingested only provides only 1 mg/kg of caffeine [16,17]. On the other hand, energy drinks intake in the sport setting might be accompanied by several negative side effects, including insomnia, nervousness and activeness, with similar incidences in both male and female athletes [18].

According to the World Antidoping Code [5], a substance –or method- will be included in the prohibited list whether its meets two of the following three criteria: 1) medical or other scientific evidence that the substance has the potential to enhance sport performance; 2) medical or other scientific evidence that the use of the substance represents a potential health risk to the athlete; 3) determination that the use of the substance or method violates the spirit of sport. Caffeinated energy drinks, when ingested in an amount to provide 3 mg/kg of caffeine, have the potential to enhance sport performance in several modalities. On the other hand, this same dose of caffeine in the form of energy drink increases the prevalence of side effects associated to caffeine consumption. Health and antidoping authorities must weigh the positive and negative effects produced by the ingestion of caffeinated energy drinks to decide whether the use of these beverages should be controlled/limited in sports. To the opinion of these authors', the existing scientific information suggests that energy drinks do not fulfill the inclusion criteria to be included in the list of banned substances, because there is no medical or scientific proof that indicates that energy drinks as potential harmful for athletes, apart from increased insomnia

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and nervousness. However, antidoping authorities should track the trends of use and abuse of these beverages in sports.

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