USU Uniformed Services University | CHAMP Consortium for Health and Military Performance

# Department of Defense Nutrition Committee
# Energy Drinks and Energy Shots Position Statement

*Prepared by CHAMP and the Performance Nutrition Working Group under the DoD Food and Nutrition and Dietary Supplements and Other Self-Care Products Subcommittees*

## 1. Introductory Statement

Energy products are heavily used by many Military Service Members. When energy products are overconsumed and/or used inappropriately they can pose a risk to the Military Service Member's health and negatively impact mission readiness.

## 2. Recommended Position

- Military Service Members (enlisted and officers) should receive education about safe use of energy drinks and energy shots and caffeine early in their careers.
- Healthcare providers should be educated about energy drinks, energy shots, and caffeine and encouraged to talk to Military Service Members, their families, and their patients (both young and old) about safe use of these products.
- Healthcare providers should report any adverse events they note in association with energy drinks to the Food & Drug Administration through their portal for dietary supplements (https://www.safetyreporting.hhs.gov).
- Do not consume caffeine-containing products of any kind within 6 hours before sleep.
- Energy shots and consumption of more than one serving of an energy drink should be avoided immediately before, during, and after strenuous activities, until such time that additional safety and efficacy data are available.[1,2]
- An individual's total daily caffeine intake should be taken into account when ingesting energy drinks and energy shots; caffeine intake should be maintained to the daily 2–6 mg/kg per dose range or below 400 mg/day unless it is being used to sustain performance during extended wakefulness.
- The impact of energy drinks, energy shots, and other products containing caffeine on fine motor skills should be considered, as some previous research has reported consumption of energy drinks and shots (~200 mg) can have adverse effects on military-relevant tasks such as marksmanship.[3,4] However, other studies have reported caffeine enhances marksmanship in sleep-deprived Military Service Members.[5,6]

## 3. Significance

Healthcare providers, leaders, and Warfighters need clear guidance on how to best use these products during training, missions, and everyday activities to maintain optimal performance.

## 4. Background

Energy drinks and shots are beverages often marketed as "enhancing " mental and physical performance. They typically contain caffeine and other ingredients with some or all ingredients contained in a proprietary blend. Energy drinks contain a range of caffeine doses from 70 to >200 mg per 8 ounces, similar to the amount in an equal volume of coffee.[7] Energy shots contain

much more caffeine per serving (200 – >400 mg) and per ounce.[7] Although most also contain carbohydrates in the form of sugar, many are available without sugar. A convenience sample of 988 deployed Soldiers in 2012 noted that 44.8% consumed energy drinks daily. Of those, 56.6% consumed more than one energy drink per day and 13.9% consumed three or more per day.[8] Another survey of 1,706 Military Service Members indicated at least 50% had used energy drinks in the past 30 days.[9] Moreover, the primary self-reported reasons for using energy drinks were a need for an energy boost and an increase in mental alertness.[9] Additionally, in a recent survey of deployed Soldiers in combat units, more than 60% reported consuming energy drinks, and 55% (284 mg/day) of their total average caffeine intake came from such beverages.[10]

Based on the available evidence it is important for the Department of Defense (DoD) to take a position on such products. Below we outline the safety considerations about energy drinks reported in the literature and the potential cognitive and physical performance effects these caffeine-containing substances might have. Finally, we outline how Military Service Members can use them safely until policies can be developed and research gaps filled to ensure energy drinks do not compromise Force readiness.

***Safety Considerations***

According to the U.S. Food & Drug Administration (FDA), 400 mg per day, or about four or five cups of coffee (two or three energy drinks), is the amount of caffeine "not generally associated with dangerous, negative effects" for healthy adults.[11] Intakes substantially over that amount could potentially cause serious problems. The acceptable doses of caffeine for children and adolescents are lower.

Although many studies demonstrate that acute ingestion of various energy products is well tolerated in healthy individuals, concerns have been expressed. In 2018 the American College of Sports Medicine came out with a *Contemporary Issue Paper* in their journal *Current Sports Medicine Reports*.[1] The paper stated that "After reports of adverse events associated with energy drink consumption, concerns including trouble sleeping, anxiety, cardiovascular events, seizures, and even death, have been raised about their safety."[1] The article focused on the ingredients and side effects associated with consuming energy drinks, suggested recommendations, and called for education, regulatory actions, changes in marketing, and additional research.

A recent comprehensive systematic review of potential adverse effects of caffeine concluded that up to 400 mg of caffeine per day (three or four cups of coffee or several servings of energy drinks) was safe for healthy adults.[12] During periods of substantial unavoidable sleep loss, which often occurs in military operations, higher doses of caffeine (up to 800 mg per 24 hours) can be consumed for limited periods of time.[13] With regard to energy drinks, the majority of studies demonstrate acute ingestion is well tolerated in healthy individuals.

The cardiovascular risks posed by energy drink products are well described, but mixed with regard to changes in QT and QTc intervals: some show significant QT/QTc prolongations,[14-17] whereas others do not.[18-20] In contrast, increases in heart rate and blood pressure are routinely observed. Importantly, the literature indicates that cardiovascular responses to energy drinks are not consistent with the effects of caffeine alone or in other beverages.[15,17,21-26] This suggests that caffeine alone is not responsible, and the other ingredients likely contribute to the heightened cardiovascular effects of energy drinks.[2,27] Given that Military Service Members regularly participate in moderate to strenuous activity under various challenging environmental conditions, the potential cardiovascular effects of energy drinks and shots indicate a need for caution.

Other types of adverse effects have been noted. A Canadian survey of energy drink use by 2,055 youth and young adults identified 78.3% as using energy drinks, and 55.4% of "users" reported experiencing at least one adverse event.[28] Events included "jolt and crash" episodes, headaches, jitters or shakes, rapid heartbeat, and difficulty sleeping. Importantly, the prevalence of adverse events reported was significantly greater among those using energy drinks as compared to coffee users.[28]

Disrupted sleep is not uncommon.[8,28-30] Military Service Members who drink three or more energy drinks a day are far more likely to report sleep disturbances related to stress, illness, and falling asleep during briefings or on guard duty than those who do not consume energy drinks.[8] However, other studies of Military Service Members have concluded that individuals who use more energy drinks do so because their duties require them to maintain alertness.[10] Although nervousness, agitation, and nausea have been reported with caffeine doses as low as 250–300 mg[31-33] other research reports indicate that moderate daily caffeine intake up to 400 mg of caffeine per day (equivalent to 6 mg/kg body weight per day in a 65-kg person) is not likely to have serious adverse events.[34] Thus daily doses below 400 mg or 6mg/kg would be prudent to avoid adverse events.

***Energy Drinks, Energy Shots, and Performance***

Caffeine has been studied for decades in both field and laboratory conditions, and particularly as a performance enhancer under conditions of restricted sleep, including by a number of military laboratories.[7,13,35-40] It enhances vigilance and reaction time in rested individuals and has been shown to improve marksmanship in studies of simulated sentry duty.[6,7,13,35-40] Its regular use during sustained and simulated military night operations to maintain vigilance and mental alertness is well recognized.[7,35,36,41,42] Caffeine has positive effects on cognitive function and mood in rested and sleep-deprived individuals, and investigators have reported improvements in information-processing speed and alertness.[5,7,13,34,35,38,43-45] Individuals report enhanced mood after consuming moderate doses of caffeine, such as increased vigor, mental alertness and endurance, elation, pleasantness, and combinations of these.[5,13,38,42] Caffeine maintains cognitive capabilities during situations that impair vigilance such as sentry duty, nighttime operations, or simulated long-range reconnaissance U-2 flights.[6,44,46] The dose required for enhancing vigilance, as well as muscular, sprint-type, and endurance exercise, generally ranges from 2–6 mg/kg body weight,[47-49] with "more" not being beneficial. If the dose is too high (more than 400 mg), it can have adverse behavioral effects.[12] Kamimori et al.,[13] in a study of Soldiers participating in a field exercise conducted with a Special Forces unit, showed that a total daily dose of 800 mg caffeine (divided over 24 hours into four doses of 200 mg) during successive overnight periods of wakefulness was effective at maintaining cognitive function when sleep was restricted over three days. As such, caffeine is provided in the First Strike Ration in the form of gum, mints, chocolate pudding, and the mocha-flavored First Strike Bar, and is recognized as an important cognitive and ergogenic aid.[5,7]

A 2017 meta-analysis of energy drinks and physical performance suggested "ingestion improved performance in muscle strength and endurance, endurance exercise tests, jumping and sport-specific actions."[50] The performance benefits were correlated not with the caffeine content, but with the dose of taurine.[50] However, there is no other credible evidence that taurine enhances physical performance. Overall the energy drink and physical performance literature to date is inconsistent in part because of the different products used, the doses of caffeine provided,

the presence of various other ingredients, subject characteristics, outcome metrics, and study designs.[50-55]

In 2014 Childs et al.[56] published a review on the interactive effects of energy drink ingredients and caffeine on mood, attention, and memory. The overall conclusion was that the beneficial effects of energy drinks on cognitive performance lacked a sufficient body of empirical evidence to draw firm conclusions. However, some preliminary studies of interactions among caffeine and other energy drink ingredients showed promise.[56] McLellan et al. reported "Caffeine use, especially by consumption of energy drinks, was greater among soldiers directly involved with combat compared with those providing support roles and the general Army population," which led the researchers to report that caffeine use is a widely employed strategy to combat the negative impact of unavoidable sleep loss in combat Soldiers.[10] However, they went on to state that "higher caffeine consumption was associated with disrupted sleep from high operational tempo and nighttime duties of combat operations."[10] Current science-based recommendations for maintaining vigilance and performance during extended wakefulness are to ingest approximately 200 mg of caffeine every two to four hours to the recommended upper daily limit is 800 mg, but habitually high caffeine users may need more.[57]

It has been reported that caffeine can negatively impact performance on motor steadiness. Bovim et al.[3] reported significantly poorer motor steadiness after ingesting 300 mg of caffeine compared to placebo, and Monaghan et al.[4] showed that aiming accuracy and shot placement were significantly degraded after consuming an energy shot containing 200 mg of caffeine. However, studies of marksmanship with Military Service Members have also found that it might be improved by caffeine administration.[37,43] If caffeine has adverse effects on motor steadiness it could jeopardize the health and welfare of military personnel. Because military rations provide caffeine, it is important to monitor caffeine intake during operational deployments.

Several concerns remain with regard to energy drinks, energy shots, and performance. One is the effect caffeine in energy drinks and shots has on sleep.[8,58] Caffeine consumed before sleep can disrupt it.[8,58,59] Moreover, disrupted sleep can lead to fatigue and other health issues.[59,60]

Two further concerns relate to the amount of caffeine and the quality of some published studies. The amount of caffeine in many products is a concern because some products provide up to 480 mg per 12 oz, which greatly exceeds the FDA-imposed limit of 71 mg of caffeine per 12 fluid oz. in soda and up to 200 mg per dose every 3 to 4 hours for over-the-counter drugs.[61] The quality of the evidence is also a concern, and many factors interfere with quality, to include preparation and chemical analysis of the "dietary intervention," type of control used, baseline and control of diet during the intervention, bioavailability of intervention ingredients, and industry sponsorship.[62,63] Thus, although energy drinks might confer some performance benefit, sleep concerns, variable amounts of caffeine, unknown amounts of other ingredients, the inconsistent evidence, and industry sponsorship prevent dissemination of a consistent and clear message with regard to performance.

### *Current Guidelines and Recommendations Relating to Energy Products within DoD*

A search of current DoD and Service-specific policies and guidelines was conducted by DoD Dietary Supplement and Food and Nutrition Subcommittee members, with the findings presented in Appendix 1. Although we cannot be sure all were captured, they appear to be the primary relevant documents.

***Research Gaps***

The intent of this position statement is not to provide an exhaustive list of research gaps relating to energy drinks and shots, but rather to focus on areas where research is needed before the recommendations in this paper would be changed. In addition, methodological concerns for past and future research need to be reconciled with regard to ingredient mixtures, responses based on dose and prior exposure history, individual variability in responses, tissue-specific differences, and genetic predisposition.[64] If methodologic issues could be addressed, other key research areas would include:

- Investigate, under military-relevant scenarios, the physical, mood, and cognitive effects of consuming energy drinks with well-defined amounts of ingredients, including caffeine, and at various intervals compared to appropriate controls. To date, the individual amounts of each ingredient (such as taurine, L-tyrosine, and L-phenylalanine) in the "proprietary blend" of commercial energy drink and energy shot products is rarely disclosed, so detailed information would be needed from the energy drink manufacturers to answer some of these questions.
- Investigate the effects of caffeine, alone and in combination with various ingredients known to enhance performance, to identify combinations that enhance performance more than caffeine alone.
- Ascertain how much caffeine in an energy drink is required to maintain vigilance and cognitive performance under conditions of limited sleep.
- When sufficient data are available, which will take many years to collect, develop a model to assess interactions among the various combinations of ingredients currently in energy drinks and energy shots to predict the likelihood of beneficial or adverse effects (or both). At this time the literature describes interactions among perhaps two combinations (caffeine and glucose, caffeine and taurine, caffeine and theanine), but rarely does a product only contain two ingredients. In fact, some include as many as 18 ingredients.

**Summary**

Energy drinks and energy shots are heavily used by many Military Service Members, but when overconsumed or otherwise used inappropriately they can negatively impact mission readiness. Much research suggests that energy drinks and energy shots are relatively safe when used appropriately, and we know caffeine is a well-documented ergogenic agent when used properly. The use of energy drinks and shots by Military Service Members should continue to be monitored, and specific research gaps should be addressed in militarily-relevant studies. Healthcare providers, leaders, and Warfighters need clear guidance on how to best use these products during training and missions and in everyday activities to maintain optimal performance. Use by Military Service Members should continue to be monitored, and the specific research gaps highlighted above should be a priority for DoD research initiatives. Based on the information above, the Committee offers the position recommended above as energy drink and energy shot guidelines for both Military Service Members and providers.

## *Appendix 1. Regulations, Guidance, and Policies related to Energy Drinks across DoD*

### *Appropriated Fund Food Policies*

**Army Regulation 40–25, OPNAVINST 10110.1, AFI 44–141, MCO 10110.49 Nutrition and Menu Standards for Human Performance Optimization, 3 January 2017:**

2–6. Department of Defense menu standards and additional nutrition guidelines:
b. Appropriated fund food service operations will not offer dietary supplements such as energy drinks, shots, and/or gels (T–0). Appropriated fund food service operations will not offer dietary supplements or any products that have fortification or enrichment in excess of 100 percent of the daily value or contain more than 100 mg of caffeine per single serving.

**Department of Defense Manual Number 1338.10 DoD Food Service Program, (DFSP) 9 November 2017:**

Enclosure 7 – JSPB DoD Menu Standards,
11 BEVERAGES:

k. Appropriated fund foods service operations will not offer energy drinks, energy shots, energy gels, ….

### *Air Force Policies*

**Air Force aircrew are not authorized dietary, herbal, or nutritional supplements without flight surgeon approval IAW Medical Standards Directory:**

**Air Force Instruction 40-104, Health Promotion Nutrition, 18 June 2015:**

4.1. OPSS is the DoD initiative to educate healthcare providers and Service members on dietary supplement safety, including energy drinks.

**Official Air Force Aerospace Medicine Approved Medications Policy, 13 June 2017:**

Dietary, herbal, and nutritional supplements can only be used with the approval of a flight surgeon. The flight surgeon should consider aeromedical implications of the supplement.

### *Current Navy "Policies"*

**1. Naval Air Training and Operating Procedures (NATOPS) General Flight and Operating Instructions Manual (Commander, Naval Air Forces (CNAF) M-37 10.7) 5 May 2016:**

8.3.2 Factors Affecting Aircrew Performance
(5) Caffeine – excessive intake of caffeine from coffee, tea, cola, etc. can cause excitability, sleeplessness, loss of concentration, decrease awareness, and dehydration. Caffeine intake of 450 mg per day (3 to 4 cups of drip coffee) is the recommended maximum intake. Caffeine use when managed appropriately, can aid in maximizing performance during long sorties or periods of sustained operations, however, the caffeine effect is maximized in individuals who are not habituated to its effect as regular users.
Use of nutritional/dietary and other OTC supplements/products by flight personnel except those approved by BUMED is prohibited. Page 8-17 of NATOPS 8.3.2.3.1 Nutritional Supplements

**2. U.S. Navy Aeromedical Reference and Waiver Guide**

19.0 NUTRITIONAL AND ERGOGENIC SUPPLEMENTS
19.1 AIRCREW GUIDANCE AND POLICY
CLASS C Supplements for Flying Classes I, II, III and IV: Not authorized for use. Use of these substances is CD (considered disqualifying).

Energy Beverages / Energy Shots: Class C. For the purposes of this guide, Energy Beverages (EBs) are beverages that (typically) contain as main ingredients caffeine, taurine, glucuronolactone, B vitamins, guarana, l-carnitine, sugars, antioxidants, and trace minerals.
Energy shots are 2-3 oz beverages that contain as much caffeine as regular energy drinks as well as mega doses of vitamins and other compounds such as taurine, l-tyrosine, phenylalanine, and guarana.
EBs and derivatives (shots, gels, gum, chews, inhalers, nasal sprays, etc.) are not authorized for use by personnel on flight status who are actively performing duties in an aircraft. Personnel consuming EBs should be grounded for at least 24 hours before resuming flight duties.

***Current Army "Policies"***

**Army Regulation 40-8: "Temporary Flying Restrictions Due to Exogenous Factors Affecting Aircrew Efficiency": 6b. Use of Dietary Supplements, Herbal and Dietary Aids and Performance Enhancers:**

3. Dietary Supplements, Herbal Aids, Performance Enhancers. All supplements, herbal and dietary aids and preparations, and performance enhancers are prohibited unless cleared by the flight surgeon or Aeromedical Physician Assistant in consultation with applicable Aeromedical Policy Letters.

**References**

1. Higgins JP, Babu K, Deuster PA, Shearer J. Energy drinks: A contemporary issues paper. *Curr Sports Med Rep.* 2018;17(2):65–72.

2. Higgins JP, Babu KM, Deuster PA, Shearer J. Stimulant-containing energy drinks: What you need to know. *ACSM's Health & Fitness Journal.* 2018;22(3):17–21.

3. Bovim G, Naess P, Helle J, Sand T. Caffeine influence on the motor steadiness battery in neuropsychological tests. *J Clin Exp Neuropsychol.* 1995;17(3):472-476.

4. Monaghan TP, Jacobson BH, Sellers JH, Estrada CA. Effects of Energy Beverage Consumption on Pistol Aiming Steadiness in Law Enforcement Officers. *J Strength Cond Res.* 2017;31(9):2557-2561.

5. McLellan TM, Kamimori GH, Bell DG, Smith IF, Johnson D, Belenky G. Caffeine maintains vigilance and marksmanship in simulated urban operations with sleep deprivation. *Aviat Space Environ Med.* 2005;76(1):39-45.

6. Johnson RF, McMenemy DJ. Target Detection, Rifle Marksmanship, and Mood during Three Hours of Simulated Sentry Duty. *Proceedings of the Human Factors Society Annual Meeting.* 1989;33(20):1414-1418.

7. McLellan TM, Caldwell JA, Lieberman HR. A review of caffeine's effects on cognitive, physical and occupational performance. *Neurosci Biobehav Rev.* 2016;71:294-312.

8. Centers for Disease Control and Prevention (CDC). Energy drink consumption and its association with sleep problems among U.S. service members on a combat deployment – Afghanistan, 2010. *Morb Mortal Wkly Rep.* 2012;61(44):895–898.

9. Attipoe S, Delahanty L, Stephens M, Deuster PA. Energy Beverage Use Among U.S. Service Members. *Mil Med.* 2018;183(9-10):e554-e561.

10. McLellan TM, Riviere LA, Williams KW, McGurk D, Lieberman HR. Caffeine and energy drink use by combat arms soldiers in Afghanistan as a countermeasure for sleep loss and high operational demands. *Nutr Neurosci.* 2018:1-10.

11. Food and Drug Administration. Spilling the Beans: How Much Caffeine is Too Much? U. S. Food and Drug Administration. https://www.fda.gov/consumers/consumer-updates/spilling-beans-how-much-caffeine-too-much. Published 2018. Updated 12/12/2018. Accessed 03/24/2020, 2020.

12. Wikoff D, Welsh BT, Henderson R, et al. Systematic review of the potential adverse effects of caffeine consumption in healthy adults, pregnant women, adolescents, and children. *Food Chem Toxicol.* 2017;109(Pt 1):585-648.

13. Kamimori GH, McLellan TM, Tate CM, Voss DM, Niro P, Lieberman HR. Caffeine improves reaction time, vigilance and logical reasoning during extended periods with restricted opportunities for sleep. *Psychopharmacology (Berl).* 2015;232(12):2031-2042.

14. Basrai M, Schweinlin A, Menzel J, et al. Energy Drinks Induce Acute Cardiovascular and Metabolic Changes Pointing to Potential Risks for Young Adults: A Randomized Controlled Trial. *J Nutr.* 2019;149(3):441-450.

15. Shah SA, Lacey CS, Bergendahl T, Kolasa M, Riddock IC. QTc interval prolongation with high dose energy drink consumption in a healthy volunteer. *Int J Cardiol.* 2014;172(2):e336–337.

16. Mangi MA, Rehman H, Rafique M, Illovsky M. Energy Drinks and the Risk of Cardiovascular Disease: A Review of Current Literature. *Cureus.* 2017;9(6):e1322.

17. Kozik TM, Shah S, Bhattacharyya M, et al. Cardiovascular responses to energy drinks in a healthy population: The C-energy study. *Am J Emerg Med.* 2016;34(7):1205-1209.

18. Steinke L, Lanfear DE, Dhanapal V, Kalus JS. Effect of "energy drink" consumption on hemodynamic and electrocardiographic parameters in healthy young adults. *Ann Pharmacother.* 2009;43(4):596–602.

19. Ragsdale FR, Gronli TD, Batool N, et al. Effect of Red Bull energy drink on cardiovascular and renal function. *Amino Acids.* 2010;38(4):1193-1200.

20. Elitok A, Oz F, Panc C, et al. Acute effects of Red Bull energy drink on ventricular repolarization in healthy young volunteers: a prospective study. *Anatol J Cardiol.* 2015;15(11):919-922.

21. Fletcher EA, Lacey CS, Aaron M, Kolasa M, Occiano A, Shah SA. Randomized controlled trial of high-volume energy drink versus caffeine consumption on ECG and hemodynamic parameters. *J Am Heart Assoc.* 2017;6(5):e004448.

22. Shah SA, Occiano A, Nguyen TA, et al. Electrocardiographic and blood pressure effects of energy drinks and Panax ginseng in healthy volunteers: A randomized clinical trial. *Int J Cardiol.* 2016;218:318-323.

23. Shah SA, Nguyen NN, Bhattacharyya M. Energy implications of consuming caffeinated versus decaffeinated energy drinks. *J Pharm Pract.* 2015;28(5):482–483.

24. 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(10):808–815.

25. Phan JK, Shah SA. Effect of caffeinated versus noncaffeinated energy drinks on central blood pressures. *J Hum Pharm Drug Therapy.* 2014;34(6):555–560.

26. Kurtz AM, Leong J, Anand M, Dargush AE, Shah SA. Effects of caffeinated versus decaffeinated energy shots on blood pressure and heart rate in healthy young volunteers. *Pharmacotherapy.* 2013;33(8):779–786.

27. Higgins JP, Ortiz BL. Energy drink ingredients and their effect on endothelial function – A review *Int J Clin Cardiolol.* 2014;1:1–6.

28. Hammond D, Reid JL, Zukowski S. Adverse effects of caffeinated energy drinks among youth and young adults in Canada: A Web-based survey. *CMAJ Open.* 2018;6(1):e19–e25.

29. Waits WM, Ganz MB, Schillreff T, Dell PJ. Sleep and the use of energy products in a combat environment. *US Army Med Dep J.* 2014:22–28.

30. Wesensten NJ. Legitimacy of concerns about caffeine and energy drink consumption. *Nutr Rev.* 2014;72 Suppl 1:78–86.

31. Howland J, Rohsenow DJ. Risks of energy drinks mixed with alcohol. *JAMA.* 2013;309(3):245-246.

32. Wolk BJ, Ganetsky M, Babu KM. Toxicity of energy drinks. *Curr Opin Pediatr.* 2012;24(2):243–251.

33. Clauson KA, Shields KM, McQueen CE, Persad N. Safety issues associated with commercially available energy drinks. *J Am Pharm Assoc (2003).* 2008;48.

34. Nawrot P, Jordan S, Eastwood J, Rotstein J, Hugenholtz A, Feeley M. Effects of caffeine on human health. *Food Addit Contam.* 2003;20.

35. Yarnell AM, Deuster PA. Caffeine and performance. *J Spec Oper Med.* 2016;16(4):64–70.

36. Seidl R, Peryl A, Nichman R, Hauser E. A taurine and caffeine-containing drink stimulates cognitive performance and well-being. *Amino Acids.* 2000;19(3-4):635–642.

37. Kamimori G, Penetar D, Headley D, Thorne D, Otterstetter R, Belenky G. Effect of three caffeine doses on plasma catecholamines and alertness during prolonged wakefulness. *Eur J Clin Pharmacol.* 2000;56(8):537–544.

38. Kamimori GH, Johnson D, Thorne D, Belenky G. Multiple caffeine doses maintain vigilance during early morning operations. *Aviation, Space, and Environmental Medicine.* 2005;76(11):1046–1050.

39. Kamimori GH, Karyekar CS, Otterstetter R, et al. The rate of absorption and relative bioavailability of caffeine administered in chewing gum versus capsules to normal healthy volunteers. *Int J Pharm.* 2002;234(1-2):159–167.

40. Beaumont M, Batejat D, Pierard C, et al. Slow release caffeine and prolonged (64-h) continuous wakefulness: Effects on vigilance and cognitive performance. *J Sleep Res.* 2001;10(4):265–276.

41. Lieberman HR, Carvey CE, Thompson LA. Caffeine. In: Coates PM, Betz JM, Blackman MR, et al., eds. *Encyclopedia of Dietary Supplements.* 2nd ed. New York, NY: Informa Healthcare; 2010:90–100.

42. Lieberman HR, Tharion WJ, Shukitt-Hale B, Speckman KL, Tulley R. Effects of caffeine, sleep loss, and stress on cognitive performance and mood during US Navy SEAL training. *Psychopharmacology (Berl).* 2002;164(3):250–261.

43. Alford C, Cox H, Wescott R. The effects of Red Bull energy drink on human performance and mood. *Amino Acids.* 2001;21(2):139–150.

44. Carvey CE, Thompson LA, Mahoney CR. Caffeine: mechanism of action, genetics, and behavioral studies conducted in task. In: Wesensten NJ, ed. *Sleep Deprivation, Stimulant Medications, and Cognition.* New York, NY: Cambridge Unversity Press; 2012:93–107.

45. McLellan TM, Kamimori GH, Voss DM, Bell DG, Cole KG, Johnson D. Caffeine maintains vigilance and improves run times during night operations for Special Forces. *Aviat Space Environ Med.* 2005;76(7):647-654.

46. Doan BK, Hickey PA, Lieberman HR, Fischer JR. Caffeinated tube food effect on pilot performance during a 9-hour, simulated nighttime U-2 mission. *Aviat Space Environ Med.* 2006;77(10):1034-1040.

47. Desbrow B, Barrett CM, Minahan CL, Grant GD, Leveritt MD. Caffeine, cycling performance, and exogenous CHO oxidation: A dose-response study. *Med Sci Sports Exerc.* 2009;41(9):1744–1751.

48. Jenkins NT, Trilk JL, Singhal A, O'Connor PJ, Cureton KJ. Ergogenic effects of low doses of caffeine on cycling performance. *Int J Sport Nutr Exerc Metab.* 2008;18(3):328-342.

49. Talanian JL, Spriet LL. Low and moderate doses of caffeine late in exercise improve performance in trained cyclists. *Appl Physiol Nutr Metab.* 2016;41(8):850–855.

50. 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(1):13-27.

51. Shearer J, Graham TE. Performance effects and metabolic consequences of caffeine and caffeinated energy drink consumption on glucose disposal. *Nutr Rev.* 2014;72 Suppl 1:121–136.

52. Johnson LA, Foster D, McDowell JC. Energy drinks: Review of performance benefits, health concerns, and use by military personnel. *Mil Med.* 2014;179(4):375–380.

53. Lara B, Gonzalez-Millan C, Salinero JJ, et al. Caffeine-containing energy drink improves physical performance in female soccer players. *Amino Acids.* 2014;46(5):1385–1392.

54. Eckerson JM, Bull AJ, Baechle TR, et al. Acute ingestion of sugar-free Red Bull energy drink has no effect on upper body strength and muscular endurance in resistance trained men. *J Strength Cond Res.* 2013;27(8):2248–2254.

55. Jeffries O, Hill J, Patterson SD, Waldron M. Energy drink doses of caffeine and taurine have a null or negative effect on sprint performance. *J Strength Cond Res.* 2017.

56. Childs E. Influence of energy drink ingredients on mood and cognitive performance. *Nutr Rev.* 2014;72 Suppl 1:48–59.

57. Ramakrishnan S, Wesensten NJ, Kamimori GH, Moon JE, Balkin TJ, Reifman J. A Unified Model of Performance for Predicting the Effects of Sleep and Caffeine. *Sleep.* 2016;39(10):1827-1841.

58. Higbee MR, Chilton JM, El-Saidi M, Duke G, Haas BK. Nurses Consuming Energy Drinks Report Poorer Sleep and Higher Stress. *West J Nurs Res.* 2020;42(1):24-31.

59. Toblin RL, Adrian AL, Hoge CW, Adler AB. Energy drink use in U.S. service members after deployment: Associations with mental health problems, aggression, and fatigue. *Mil Med.* 2018:usy205.

60. Kraak VI, Davy BM, Rockwell MS, Kostelnik S, Hedrick VE. Policy Recommendations to Address Energy Drink Marketing and Consumption by Vulnerable Populations in the United States. *J Acad Nutr Diet.* 2020:(in press).

61. Thorlton J, Colby DA, Devine P. Proposed actions for the US Food and Drug Administration to implement to minimize adverse effects associated with energy drink consumption. *Am J Public Health.* 2014;104(7):1175-1180.

62. Schuetz P, Meier MA, Bally MR, Gomes F, Mueller B. Industry sponsorship and outcomes of nutrition studies: Is there an association when looking at the trial level? *Clin Nutr.* 2017;36(2):616–618.

63. Lundh A, Sismondo S, Lexchin J, Busuioc OA, Bero L. Industry sponsorship and research outcome. *Cochrane Database Syst Rev.* 2012;12:MR000033.

64. Shearer J. Methodological and metabolic considerations in the study of caffeine-containing energy drinks. *Nutr Rev.* 2014;72 Suppl 1:137–145.