

Energy Drink Consumption and Its Association with Sleep Problems Among U.S. Service Members on a Combat Deployment — Afghanistan, 2010

Beverages marketed as energy drinks have become a popular form of caffeine consumption targeted at young males, with some brands containing the caffeine equivalent of 1–3 cups of coffee or cans of soda (1). Energy drinks also include other ingredients intended to boost physical energy or mental alertness, such as herbal substances, amino acids, sugars, and sugar derivatives; however, caffeine is the main active ingredient (1). Approximately 6% of adolescent and young adult males in U.S. civilian and military populations consume energy drinks daily (2,3). These products generally are unregulated and can have negative side effects (e.g., caffeine intoxication, overdose, withdrawal, and poor interactions with alcohol) (1). Paradoxically, excess consumption also can increase sleep problems and daytime sleepiness, which can impair performance (1). To determine the extent of energy drink use and the association with sleep problems and sleepiness during combat operations, Walter Reed Army Institute of Research analyzed data collected by Joint Mental Health Advisory Team 7 (J-MHAT 7) to Operation Enduring Freedom in Afghanistan in 2010. The analysis showed that 44.8% of deployed service members consumed at least one energy drink daily, with 13.9% drinking three or more a day. No differences by age or rank were found. Service members drinking three or more energy drinks a day were significantly more likely to report sleeping ≤ 4 hours a night on average than those consuming two drinks or fewer. Those who drank three or more drinks a day also were more likely to report sleep disruption related to stress and illness and were more likely to fall asleep during briefings or on guard duty. Service members should be educated regarding the potential adverse effects of excessive energy drink consumption on sleep and mission performance and should be encouraged to moderate their energy drink consumption in combat environments.

Mental Health Advisory Teams conduct comprehensive mental health surveillance of U.S. service members in combat environments and have administered the Deployment Well-Being Survey in Iraq during 2003–2009 and Afghanistan during 2005–2010 and 2012. The survey version used by J-MHAT 7 to collect data in Afghanistan during the summer of 2010 asked about demographic characteristics, deployment history, combat experiences, mental health, deployment stressors, family and relationship concerns, work environment, sleep difficulties and daytime sleepiness, health-care utilization, and various health behaviors, including energy drink consumption. The J-MHAT 7 survey was the first to inquire about the use of energy drinks.

In total, 1,249 service members were surveyed using a cluster sample of randomly selected U.S. Army and Marine combat platoons deployed to Afghanistan. All participants were male, because of the type of unit surveyed. Of those surveyed, 1,000 consented to have their data used for research purposes and 988 answered the following question: “How many energy drinks (e.g., Monster, Red Bull, 5-Hour Energy) do you use per day?” The six response options ranged from zero to five or more drinks per day. Service members also were asked about their use of sleep medication, average number of hours of sleep per day, concerns regarding lack of sleep, disruptions to sleep, and work impairment associated with sleepiness (Table 1). The number of sleep hours was dichotomized at ≤ 4 hours (reported by 24.2% of the persons sampled); in comparison, 50.2% of those sampled reported sleeping ≤ 5 hours. For comparison across sleep outcomes, energy drink use was divided into the following categories: no drinks, one to two drinks, and three or more drinks per day. These cutoffs were chosen because previous research demonstrated that 200 mg of caffeine, the equivalent of one to two energy drinks, improved cognitive performance in a military population (4). Prevalence rates of energy drink use are reported. Chi-square tests were used to determine significant differences between groups for sleep variables, using $p < 0.05$ for significance. Post hoc analyses of the chi-square tests were conducted by examining discrepancies between observed and expected values for standardized residuals to produce z-scores and identify those cells contributing to the significant differences. The Sidak-Bonferroni correction was used to account for conducting multiple post hoc tests.

Service members surveyed were predominantly on active duty (93.2%), of junior enlisted rank (E1–E4; 71.2%), on their first deployment (60.8%), in the Army (75.5%), aged 18–24 years (66.6%), single (54.5%), not parents (70.9%), in the military < 5 years (81.2%), and had been on this deployment < 6 months at the time of the survey (54.3%). The prevalence of daily energy drink use was 44.8%; 13.9% consumed three or more per day (Table 2). Of those reporting daily energy drink use, 56.6% consumed more than one energy drink per day. No associations were found between the proportion of service members reporting the number of drinks used per day (i.e., 0, 1, 2, 3, 4, or ≥ 5) and rank category, number of deployments, branch of service, age, marital status, or being a parent. In the same comparison, however, service members in the National Guard or Reserves were significantly more likely to use energy drinks than their active duty counterparts ($p = 0.002$).

Service members who drank three or more energy drinks per day were more likely to report ≤ 4 hours of sleep on average

TABLE 1. Survey questions used to assess sleep-related issues — Deployment Well-Being Survey, Joint Mental Health Advisory Team 7, Afghanistan, 2010

Survey question	Response options
Have you taken any medication for a sleep problem during this deployment?	No / Yes (specify medication)
Was the medication prescribed in theater?	No / Yes
On average, how many hours of sleep do you get per day?	≤3 / 4 / 5 / 6 / 7 / ≥8
Think about your experiences on this deployment. Rate how much trouble or concern has been caused by not getting enough sleep.	Very low / Low / Medium / High / Very high / Does not apply
How often have the following disrupted or interfered with your sleep over the past 30 nights?	Not at all / Few or several nights / More than half the nights / Nearly every night
Stress related to combat	
Stress related to personal life and problems	
Poor sleep environment (too noisy, bright, hot, cold, etc.)	
High operational tempo	
Nighttime duties	
Off-duty leisure activities (video games, movies, etc.)	
Illness	
Other (please specify):	
How often during this deployment, did you (even briefly) fall asleep during the following:	Never / Seldom / Sometimes / Often
Sitting in briefings*	
Riding in convoys	
On guard duty	
During this deployment, have you had an accident or made a mistake that affected the mission because of sleepiness?	No / Yes

* Referred to as “briefs” in survey questions and within the military.

TABLE 2. Daily energy drink consumption reported by service member and rank* during a combat deployment (N = 988) — Deployment Well-Being Survey, Joint Mental Health Advisory Team 7, Afghanistan, 2010

Energy drinks per day	All service members [†]		Junior enlisted (E1–E4)		Senior enlisted (E5–E9)		Officer/Warrant officer	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
0	545	(55.2)	385	(54.8)	142	(56.6)	17	(51.5)
1	192	(19.4)	139	(19.8)	41	(16.3)	12	(36.4)
2	114	(11.5)	83	(11.8)	27	(10.8)	4	(12.1)
3	65	(6.6)	50	(7.1)	15	(6.0)	0	—
4	26	(2.6)	17	(2.4)	9	(3.6)	0	—
≥5	46	(4.7)	29	(4.1)	17	(6.8)	0	—

* No significant differences were observed in numbers of energy drinks consumed per day across rank categories (i.e., junior enlisted ranks, senior enlisted ranks, or warrant officer/officer), $p=0.12$.

[†] Rank was missing for one participant.

per night (38.2%) than service members who drank one to two (18.4%) or zero (23.9%) energy drinks per day (Table 3). The groups did not differ in their levels of concern regarding not getting enough sleep. Service members drinking three or more energy drinks per day were significantly more likely than the other groups to report sleep disruption on more than half the nights in the past 30 days because of stress related to combat, stress related to personal life, and illness. However, no differences were noted in sleep disruption because of the sleep environment, high operational tempo, nighttime duties, or leisure activities. Service members who drank three or more energy drinks per day also were significantly more likely to report sometimes or often falling asleep while sitting in briefings or while on guard duty, but not while riding in convoys. No differences in energy drink consumption were found related to having had an accident or making a mistake that affected the mission because of sleepiness (Table 3). Despite a significant,

omnibus chi-squared association, after post-hoc analyses were conducted, no differences were found in sleep medication use or receiving prescriptions for sleep medications while deployed by levels of energy drink consumption (Table 3). Across sleep disruption and daytime sleepiness outcomes, service members who consumed one to two energy drinks did not differ from those not consuming energy drinks.

Reported by

Robin L. Toblin, PhD, Kristina Clarke-Walper, MPH, Brian C. Kok, Maurice L. Sapos, PhD, Military Psychiatry Br, Walter Reed Army Institute of Research; Jeffrey L. Thomas, PhD, US Army Medical Research Unit-Europe, US Army. Corresponding contributor: Robin L. Toblin, robin.l.toblin@us.army.mil, 301-319-2064.

What is already known on this topic?

The use of energy drinks containing high levels of caffeine is increasingly common among teens and young adults in the United States; an estimated 6% consume them daily. Too much caffeine can increase sleep problems, resulting in sleepiness and impaired performance.

What is added by this report?

Among U.S. service members surveyed in a combat environment in Afghanistan in 2010, 45% reported consuming energy drinks daily. Service members using three or more energy drinks a day (14%) reported sleeping less, having more sleep disruptions from stress and illness, and falling asleep on guard duty and in briefings more frequently than those drinking two or fewer energy drinks a day.

What are the implications for public health practice?

Service members should be educated about the possible adverse effects of consuming high levels of energy drinks on sleep and mission performance, and they should be encouraged to moderate their energy drink consumption.

Editorial Note

Military and civilian findings show that more than half of adolescents and young adults drink at least one energy drink per month (5), with approximately 6% consuming energy drinks daily (2,3). In this study, 45% of service members reported consuming one or more energy drinks per day, a considerably higher prevalence. This might reflect the unique and extreme demands of a combat deployment and the widespread availability of energy drinks in the combat environment (e.g., free distribution in dining facilities and available for purchase in convenience stores). No differences in energy drink consumption by age or rank were observed, demonstrating the ubiquitous nature of energy drink consumption during deployment.

Consumption of three or more energy drinks per day was associated with negative sleep outcomes that included sleepiness on the job and sleeping ≤ 4 hours per night. This is a low number of hours of sleep even in the deployed environment, in which half of respondents averaged ≤ 5 hours of sleep. Although causality could not be ascertained from this cross-sectional study, this relationship is consistent with civilian studies demonstrating that caffeine use contributes to daytime sleepiness (6) and sleep problems (1,6), and that inadequate sleep and daytime sleepiness can impair work productivity (7). Further, this study suggests that high levels of energy drink consumption might indirectly impair performance in a military setting. Service members who consumed three or more energy drinks per day reported significantly greater sleep disruption because of combat stress, personal issues, and illness, but not because of external factors. This is similar to results found in a civilian

TABLE 3. Association between daily energy drink consumption and sleep variables that measured sleep problems and daytime sleepiness during combat among U.S. service members (N = 988) — Deployment Well-Being Survey, Joint Mental Health Advisory Team 7, Afghanistan, 2010

Sleep variable	p-value [†]	Energy drinks per day*		
		0 (n = 545)	1–2 (n = 306)	≥ 3 (n = 137)
Took sleep medication on deployment	0.02	7.7	12.2	14.3
Sleep medication prescribed on deployment [§]	0.60	60.5	54.3	68.4
Slept 3–4 hours per night	<0.001	23.9	18.4	38.2 [¶]
High concern about lack of sleep	0.68	28.9	31.8	29.5
Sleep disrupted on more than half the nights because of				
Stress related to combat	0.01	9.9	12.1	19.0 [¶]
Stress related to personal life	0.001	9.6	10.2	21.2 [¶]
Illness	0.01	1.8	1.3	5.9 [¶]
Sleep environment	0.41	36.9	40.7	41.6
High operational tempo	0.24	18.5	19.7	25.0
Nighttime duties	0.31	34.6	35.8	28.5
Leisure activities	0.17	3.7	5.2	7.4
Fell asleep sometimes/often while				
Sitting in briefings ^{**}	0.01	11.2	11.8	21.3 [¶]
On guard duty	0.02	7.4	6.6	14.0 [¶]
Riding in convoys	0.12	25.5	29.5	33.8
Had an accident or made a mistake because of sleepiness that affected the mission	0.44	3.5	3.6	5.8

* Percentage of service members reporting each energy drink level responding affirmatively to the sleep variables.

[†] Significant at the $p < 0.05$ value for the omnibus chi-square test.

[§] Among those answering that they had taken sleep medication on deployment (n = 92).

[¶] Significantly different from the expected value using the standardized residuals for post-hoc tests for chi-square analysis using a Sidak-Bonferroni correction ($Z \geq \pm 2.44$).

^{**} Referred to as “briefs” in survey questions and within the military.

study in which caffeine use caused an increase in nocturnal worry and sleeplessness (8) and a military study that found that mental health symptoms increased energy drink use (9). Because inadequate sleep can considerably influence a person's health, excessive energy drink consumption might indirectly contribute to poor health.

The findings in this report are subject to at least five limitations. First, cause and effect cannot be determined because the data are cross-sectional. It is unclear whether service members with sleep problems used more energy drinks to stay alert, or if heavy use of energy drinks led to sleep disruptions; published studies suggest a cyclical combination of both (1,5). Second, the survey did not allow for a true estimate of caffeine intake. The caffeine content in energy drinks varies by the size of the can and milligrams of caffeine per ounce (1). Leading brands contain 80–160 mg of caffeine in their smallest containers, similar to 1–2 cups of coffee, with some brands containing

up to 500 mg (1). In addition, the survey did not measure consumption of other caffeinated beverages (e.g., coffee, soft drinks, or tea). Third, the phrasing of the question about average number of energy drinks consumed per day might have resulted in an underestimate of energy drink use; a person who consumed several drinks a week, but did not consume them daily, might have answered zero to that question. Fourth, this study did not control for variables that might have confounded the relationship between energy drink consumption and sleep outcomes (e.g., mental health problems, physical injury, amount of time deployed, or peer group/unit effects). Nonetheless, survey data from questions about stress, illness, personal life, and leisure activities as reasons for sleep disruption might serve as proxies for those variables not analyzed. Finally, analyses did not control for sleep medication use, which also can cause daytime sleepiness. However, although groups differed in overall sleep outcomes, the groups did not differ in their prevalence of sleep medication use (approximately one in seven), suggesting that the main associations were not explained by use of sleep medication.

The widespread use of energy drinks across demographics and its association at high doses with sleep problems and work impairment, coupled with known associations between caffeine and sleep problems and sleepiness in the general population (1,6,7), support the need to educate service members about moderating consumption of energy drinks. Service members who used energy drinks in moderation (i.e., one or two per day) had similar levels of sleep problems and performance as those who did not use energy drinks. Based on the caffeine content of leading brands of energy drinks, this dosage is equivalent to the average caffeine consumption by men ages 20–29 years in the United States (10) and has been associated with cognitive performance (e.g., visual vigilance, reaction time, and alertness) (1,4). This also might explain the lack of a clear dose-response relationship between energy drink consumption and sleep problems.

The marketing of these types of drinks as energy boosters, together with their availability in the combat environment, makes it easy for service members to consume them in large

volumes. Energy drinks are relatively new, generally unregulated, and lack warning labels. Service members should be educated that the long-term health effects of energy drink use are unknown, that consuming high doses of energy drinks might affect mission performance and sleep, and that, if used, energy drinks should be consumed in moderation.

Acknowledgments

Study participants. Paul Bliese, Barry Adams, Michael Slack, Robert Heinssen, Edward Edens, Derrick Polk, Matthew McGinnis, Joint Mental Health Advisory Team 7; Randall J. Nett, MD, Office of Public Health Preparedness and Response, CDC.

References

1. Reissig CJ, Strain EC, Griffiths RR. Caffeinated energy drinks—a growing problem. *Drug and Alcohol Depend* 2009;99:1–10.
2. CDC. Beverage consumption among high school students—United States, 2010. *MMWR* 2011;60:778–80.
3. Schmidt RM, McIntire LK, Caldwell JA, Hallman C. Prevalence of energy drink and supplement usage in a sample of Air Force personnel: interim report. Wright-Patterson Air Force Base, OH: Air Force Research Laboratory; 2008. Available at <http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA514723>. Accessed November 5, 2012.
4. 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* 2002;164:250–61.
5. 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;6:35–41.
6. Roehrs T, Roth T. Caffeine: sleep and daytime sleepiness. *Sleep Med Rev* 2008;12:153–62.
7. Belenky G, Wesensten NJ, Thorne DR, et al. Patterns of performance impairment and restoration during sleep restriction and subsequent recovery: a sleep dose-response study. *J Sleep Res* 2003;12:1–12.
8. Omvik S, Pallesen S, Bjorvatn B, Thayer J, Nordhus IH. Night-time thoughts in high and low worriers: reaction to caffeine-induced sleeplessness. *Behav Res Ther* 2007;45:715–27.
9. Adler AB, Britt TW, Castro CA, McGurk D, Bliese PD. Effect of transition home from combat on risk-taking and health-related behaviors. *J Trauma Stress* 2011;24:381–9.
10. US Department of Agriculture. What we eat in america, NHANES 2007–2008. Table 1: nutrient intakes from food: mean amounts consumed per individual, by gender and age. Washington, DC: US Department of Agriculture, Agricultural Research Service; 2010. Available at <http://www.ars.usda.gov/ba/bhnrc/fsrg>. Accessed November 2, 2012.