

A survey of energy drink consumption patterns among college students

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Abstract

Background

Despite aggressive marketing strategies of energy drink producers and media interest in the energy drink craze, there has been limited research regarding energy drink consumption patterns of young adults in the United States. Because many college students lead sleep-deprived lives of constant stress entwined with hiatuses of partying, this is likely a population that takes advantage of the stimulating effect offered by energy drinks. The purpose of this study was to determine energy drink consumption patterns of college students and side effects experienced by users.

Methods

Based on the responses from a 32-member college-student focus group and a field test, a 19-item survey was used to assess energy drink consumption patterns of 253 college students (146 females, 107 males) attending a state university in the Central Atlantic region of the United States.

Results

Fifty-one percent of participants reported drinking more than one energy drink each month (defined as energy drink user), with significantly more female (53%) than male (42%) users. Weekly “jolt and crash” episodes were experienced by 31% of users, 76% of jolt-and-crashers experienced one or two weekly episodes, the remainder averaged three or more on a weekly basis, 21% reported ever having headaches and 18% ever having heart palpitations from drinking energy drinks. Popular situations for using energy drinks included insufficient sleep (67% of users), to increase energy (65%), mix with alcohol (54%) and while studying or preparing a major course project (50%). Using three or more energy drinks at a time with alcohol was a common practice (49% of users) while partying.

Conclusions

Energy drink consumption is a popular practice among college students, particularly if the student has had insufficient sleep, if they need more energy in general and if they are studying for exams or working on major course projects. Jolt and crash episodes, headaches, and heart palpitations are side effects that 18% to 31% of college energy drink users experienced. A challenge facing healthcare professionals is communicating the message to college students that the caffeine in energy drinks can have dangerous consequences. Education efforts are warranted to aid college students in understanding that caffeine consumption in high amounts, as energy drinks, can pose a health hazard, particularly while socializing when alcohol is involved, when sleep deprived, and during periods of stress.

Key Words

caffeine, health behavior, sleep deprivation, alcohol, stress

Background

Energy drink consumption has continued to gain popularity since the 1997 debut of Red Bull, the current leader in the energy drink market [1]. More than 500 new energy drinks were launched worldwide in 2006 and beverage companies are reaping the financial rewards of the 5.7 billion dollar energy drink industry [1]. Among young adults, this versatile new breed of concoction “liquid candy with extra caffeine” is becoming the “pick-me-up” of choice and a necessary partying accessory that enhances the alcohol buzz.

Energy drinks, including Red Bull, Amp, Monster, Rock Star, Rip It, Full Throttle, and Cocaine, are designed to give the consumer a “jolt” of energy provided by the combination of stimulants and “energy boosters” that they provide, including caffeine, herbal extracts such as guarana, ginseng, and ginkgo biloba, B vitamins, amino acids such as taurine, amino acid derivatives such as carnitine, and sugar derivatives, including glucuronalactone and ribose [1]. Energy drinks typically contain 80 to 141 mg of caffeine per 8 ounces, the equivalent of five ounces of coffee or two 12-ounce cans of caffeinated soft drink such as Mountain Dew, Coca Cola, Pepsi Cola or Dr. Pepper [2]. Energy drinks have sugar-laden versions with consumers believing that sugar adds to the energy high. For example, Monster Energy provides 24 grams of sugar per 8 ounces (11.25% sugar concentration) and Rip It A’Tomic Pom provides 33 grams (13.75% concentration) [3,4]. Sugar-free “low carb” varieties are available for the weight-conscious consumer. Similar to the booming energy drink market, the size of the energy drink container has increased over 300-fold; Monster energy offers consumers a whopping 23 ounces option [3].

Do energy drinks provide the consumer an extra burst of energy as the advertisements would have you believe? Yes, they do. Smit and colleagues found that energy drinks, as compared to placebo, had energizing effects among 18 to 55 year old participants, with effects being strongest 30 to 60 minutes after consumption and sustained at least 90 minutes [5]. Caffeine was found to be the primary constituent responsible for these effects. Although there is no human requirement for caffeine, even low doses of caffeine (12.5 to 100 mg) improve cognitive performance and mood [6]. However, caffeine has been found to have detrimental health consequences. Riesenhuber and colleagues found that the caffeine (but not taurine) in energy drinks promotes diuresis and natriuresis [7]. Further, acute caffeine consumption reduces insulin sensitivity [8] and increases mean arterial blood pressure [9]. High caffeine consumption is associated with chronic daily headaches, particularly among young women (age < 40 years) and among those with chronic episodic headaches and of recent onset (< 2 years) [10]. Central nervous system, cardiovascular, gastrointestinal, and renal dysfunction have been associated with chronic caffeine ingestion [11]. In sum, the caffeine in energy drinks will provide the consumer the desirable effects of increased alertness, improved memory, and enhanced mood. However, caffeine can have harmful physical consequences.

Energy drinks are targeted to the 18 to 35 year old consumer [12]. Despite the aggressive marketing strategies among energy drink producers and media interest in the energy drink craze, there has been little research regarding energy drink consumption patterns among young adults in the United States. Because many college students lead sleep-deprived lives and have constant stress entwined with hiatuses of partying, this is likely a population that will take advantage of the stimulating effects offered by energy drinks. The purpose of this study was to determine (1) energy drink consumption patterns among college students, (2) prevalence of adverse side effects of energy drinks among college energy drink users, (3) prevalence of energy drink use for six situations, namely for insufficient sleep, to increase energy (in general), while studying, for driving long periods of time, for drinking with alcohol while partying, and to treat a hangover, and (4) the number of energy drinks consumed and the frequency of consumption (average number of times each month) users consume energy drinks for these situations.

Methods

A Registered Dietitian and a Health Educator designed a questionnaire that assessed consumption patterns of energy drinks among college students. We initially interviewed a focus group of 32 college students who were enrolled in a senior-level course. We asked these students open-ended questions regarding situations in which college students use energy drinks, the most common energy drinks college students were using, frequency patterns (number of energy drinks usually consumed for each situation the focus group identified and the average number of times per month throughout a semester students use energy drinks for each situation), and side effects experienced from using energy drinks.

Based on the focus group responses we developed a 19-item questionnaire that assessed demographic information, identified energy drink users (those who, on the average, drank more than one energy drink per month), type of energy drink usually consumed (regular or sugar-free), side effects experienced by users (jolt and crash episodes, headaches, heart palpitations), and six situations for energy drink use on an average day (insufficient sleep, needing more energy (in general), studying for an exam or to complete a major course project, driving an automobile for a long period of time, drinking with alcohol while partying, and to treat a hangover). For the purpose of this study, a jolt and crash episode was in reference to a feeling of increased alertness and energy (the jolt) followed by a sudden drop in energy (the crash) that occurs in response to drinking energy drinks. Each of the six situation questions had two follow up questions that assessed the average number of energy drinks consumed for that situation (for example, on average, how many energy drinks do you drink at one time following a night of not getting enough sleep?) and the average number of times per month the student consumes energy drinks for that situation (for example, on average, how many days per month do you drink energy drinks following a night of not getting enough sleep?). To provide a frame of reference regarding what constituted an energy drink, the introduction of the questionnaire included examples of energy drinks that were popular on the campus and in social establishments in the immediate geographic region when the survey was administered, these included Red Bull, Rock Star, Amp, and Full Throttle. The

questionnaire was field tested among 10 randomly chosen students who were in a public location on campus. The questionnaire took approximately two minutes to complete and modifications to the questionnaire were not necessary based on the field test responses.

From mid-November to the first week of December 2006, 11 trained research assistants (undergraduate and graduate college students) recruited students at a single college from public locations across campus to participate in the study. The institution is a state university, located in the Central Atlantic region of the United States, with an undergraduate enrollment of approximately 18,000 students. To diversify our sample, research assistants varied the time of day and days of the week during weekdays to recruit participants. In compliance with the university's Institutional Review Board for Research with Human Subjects (University and Medical Center Institutional Review Board number 06-0718), students were informed of the study protocol and those willing to participate anonymously completed the self-administered questionnaire. The project was carried out in compliance with the Helsinki Declaration.

Analyses were performed using JMP IN® software [13]. Descriptive statistics included means, standard deviations, and frequency distributions. Pearson χ^2 was used to evaluate differences in frequency distribution of responses by sex. An alpha level of .05 was used for all statistical tests.

Results

A total of 253 participants completed the questionnaire. In regard to the first research question, energy drink consumption patterns among college students, 51% of participants reported drinking greater than one energy drink each month, with significantly more female (53%) than male (42%) energy drink users reported, $\chi^2 (1, N = 496) = 6.46, p = .01$. The majority (74%) of users drank sugar-containing versions with significantly more females (35%) than males (12%) drinking sugar-free versions, $\chi^2 (1, N = 247) = 16.56, p < .01$.

Regarding the second research question, prevalence of side effects from drinking energy drinks among college energy drink users, weekly jolt and crash episodes were experienced by 31% of users, 76% of jolt-and-crashers experienced one or two weekly episodes, the remainder averaged three or more episodes on a weekly basis. Twenty-one percent of energy drink users reported ever having headaches and 18% ever having heart palpitations from drinking energy drinks, which did not differ significantly by sex, $\chi^2 (1, N = 252) = 0.45, p = .50$ for headaches, $\chi^2 (1, N = 234) = 0.37, p = .54$ for heart palpitations.

Regarding the third research question, of the six situations assessed, insufficient sleep was the most common reason to drink energy drinks, with 67% of energy drink users reporting use because they were sleep-deprived. The majority of users consumed energy drinks to increase their energy (65% of total users), to drink with alcohol while partying (54%), while studying or completing a major course project (50%), and to treat a hangover (17%). There were no significant differences in use of energy drinks for the six situations assessed by sex, as reported in Table 1.

Regarding the fourth research question, the percent of users drinking one, two, and three or more energy drinks by situation are reported in Table 2. The majority of energy drink users drank one to treat a hangover, for insufficient sleep, to increase energy, and while driving an automobile for long periods of time. Using three or more was a common practice (49% of users) to drink with alcohol while partying. The percent of users drinking energy drinks 1 – 4, 5 – 10, and 11 or more days per month are reported in Table 3. For the six situations assessed, the majority of users (73% to 86%) used energy drinks 1 – 4 days in a month.

Discussion

Energy drinks are marketed to young adults and marketing efforts are particularly appealing among college students. For example, Cocaine energy drinks, with Cut Cocaine and Free Cocaine varieties, have been marketed as a “legal alternative” to the class A drug. The Food and Drug Administration has recently issued a warning to Drink Reboot, the firm that markets Cocaine, citing numerous marketing violations, including promoting this product as a street drug alternative [14]. Red Bull energy drink is reportedly a “functional beverage” that was designed to increase physical and mental performance and “is appropriate to drink during sports, while driving, and during leisure activities” [15] whereas Monster energy provides a “double shot of our killer energy brew. It’s a wicked mega hit that delivers twice the buzz of a regular energy drink...” [3]. The purpose of this study was to identify energy drink consumption patterns and side effects associated with consumption of energy drinks among college students. We found that energy drink consumption is a popular practice among college students, particularly if the student has had insufficient sleep, if they need more energy in general, if they are studying for exams or working on major course projects and if they are driving an automobile for a long period of time.

Improvements in mental functioning are of interest among college students, many who suffer from sleep deprivation. The American College Health Association reported that 71% of college students whom they surveyed reported insufficient sleep and not feeling rested for at least five of the past seven days [16]. Sleep deprivation is associated with selecting less difficult cognitive tasks and college students who have sleep difficulties report a greater frequency of stress [17,18]. Findings from our study support the premise that college students use energy drinks to treat sleep deprivation and while studying for exams or completing major course projects. College students are under a great deal of stress, and increased caffeine consumption has been found to occur during times of stress in an attempt to relieve the stress [19]. On the other hand, caffeine consumption has not been found to affect academic performance among college students [20].

The primary ingredient in energy drinks that has a cognitive stimulating effect is the caffeine [5], whereas high sugar content (17.5% concentration) does not improve reaction times slowed by sleep deprivation [21]. Further, the combination of caffeine and taurine has no effect on short-term memory [9]. Although low doses of caffeine (12.5 to 50 mg) have been found to improve cognitive performance and mood [6] and 200 mg doses have been found to improve cognitive task speed and accuracy and increase alertness among young adults [22], the amount of caffeine provided in energy drinks can easily far exceed the amount necessary to promote cognitive

functioning [23]. This is especially true if a student is consuming 16- or 23-ounce cans or multiple cans of energy drinks for a given situation. Although we did not assess the size of the energy drink cans that participants normally consumed, results from our study indicate that in many situations while students are consuming energy drinks, the amount of caffeine that they consume far exceeds the amount needed simply to promote cognitive stimulation. For example, 50% of energy drink users in our study drank two or more energy drinks while studying for an exam or working on a major course project, and 36% to 37% drank two or more following insufficient sleep, when they needed energy throughout the day, or while driving an automobile for a long period of time. Further, drinking multiple energy drinks with alcohol was a popular practice among 73% of energy drink users. The practice of consuming greater amounts of caffeine while socializing has also been documented among American youth [24] and an alcoholic setting is considered by many college students a primary locus to socialize and to meet people [25].

A challenge facing healthcare professionals is communicating the message among college students that caffeine can have dangerous consequences. Perhaps because caffeine from dietary sources is widely distributed, the consumption of caffeine is generally thought to be safe and side effects of overconsumption are disregarded among both consumers and medical personnel [11]. College students may view caffeine as a ubiquitous nature-derived stimulant rather than as a drug. However, high caffeine consumption can have health consequences and is of public health concern. For example, Bridle [23] reported a case study of a middle-aged man who presented with atrial fibrillation that converted to normal sinus rhythm after significant reduction in his caffeine consumption. Lansdowne Market Research [26] conducted a survey of Red Bull consumption patterns and also assessed public concerns in the Republic and Northern Ireland. Nineteen to 24 year olds drank a weekly average of three cans, most frequently with friends while partying. Further, there were considerable public concerns regarding young adults consuming energy drinks with alcohol. Ferreira and colleagues [27] found that energy drink combined with alcohol ingestion reduced objective effects of motor coordination and visual reaction time but did not breathe alcohol concentration. Clearly, energy drink over consumption is a popular practice and a public health concern among young adults.

Conclusions

Considering the findings from the present study that 54% of college students surveyed consumed energy drinks while partying, 31% of users experienced jolt and crash episodes, primarily on a weekly basis, 21% experienced heart palpitations and 18% reported headaches from energy drinks, we concur that there is cause for concern regarding the energy drink consumption patterns among college students. Education efforts are warranted to aid college students in understanding that caffeine consumption in high amounts can pose a health hazard, particularly while socializing when alcohol is involved and during periods of life stress. Further research should identify if students recognize the amounts of caffeine that are present in the wide variety of caffeine-containing products they are consuming, the amounts and sources of caffeine that they are consuming, and the physical side effects associated with high caffeine consumption. Healthcare professionals should inquire about energy drink ingestion patterns and habits among young adults who present with symptoms of

caffeine abuse, including insomnia, tremors, gastrointestinal distress, cardiac dysregulation, and neurologic symptoms.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

BMM participated in the study design, performed the statistical analysis, and drafted the manuscript. VGA conceived of the study and drafted the manuscript. RFO, TCA, and KBH participated in coordination and data collection and helped to draft the manuscript. All authors read and approved the final manuscript.

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Table 1 - Situations of energy drink use among female and male energy drink users

Situation	% of Females	% of Males	χ^2	<i>p</i> (sex)
Insufficient sleep ^a	67	68	0.17	.68
Need energy (in general) ^a	62	69	1.27	.26
Studying or major project ^b	46	56	2.22	.14
Driving car for long period of time ^a	40	51	3.01	.08
Mix with alcohol while partying ^a	57	50	1.33	.25
Treat hangover ^a	16	18	0.18	.67

^a*n* = 146 females, 107 males, $\chi^2(1, N = 253)$; ^b*n* = 145 females, 104 males, $\chi^2(1, N = 249)$.

Table 2 - Percent of college energy drink users^a drinking one or more energy drinks by situation and amount

Situation	<i>n</i>	Number of Energy Drinks Consumed		
		1	2	3 or more
Insufficient sleep	169	64%	22%	14%
Need energy (in general)	165	63%	21%	16%
Studying or major project	125	50%	36%	14%
Driving car for long period of time	114	63%	23%	14%
Mix with alcohol while partying	136	27%	24%	49%
Treat hangover	42	74%	10%	16%

^a*n* = 253 college energy drink users.

Table 3 - Percent of college energy drink users^a drinking one or more energy drinks by situation frequency

Situation	<i>n</i>	Days per month		
		1 to 4	5 to 10	11 or more
Insufficient sleep	169	74%	18%	8%
Need energy (in general)	165	74%	18%	8%
Studying or major project	125	85%	10%	5%
Driving car for long period of time	114	86%	9%	5%
Mix with alcohol while partying	136	73%	18%	9%
Treat hangover	42	74%	14%	12%

^a*n* = 253 college energy drink users.