

The Consumption of Energy Drinks Among a Sample of College Students and College Student Athletes

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Abstract To assess energy drink (ED) consumption, potential ED correlates, and ED-related motivations among a sample of college students to determine differences based on athlete status (student athlete vs. non-athlete). Six hundred and ninety-two college students completed surveys at a large private university in the United States. Participants completed a paper based questionnaire assessing ED and ED-related variables. Over thirty-six percent (197 non-athletes, 58 student athletes) of participants reported ED consumption in the preceding 30 days. Multivariately, there was no difference in ED consumption based on athlete status. Heavy episodic drinking and prescription stimulant misuse were both correlated with increased ED consumption. ED motivations differed based on the frequency of ED consumption. ED use was common among student athletes and non-athletes in our sample. It is important to be aware of the correlation between heavy episodic drinking, prescription stimulant misuse, and ED consumption among college student populations because of the adverse consequences associated with these behaviors.

Keywords Energy drink · College students · Athletes

Introduction

Energy drinks (ED) are a type of dietary supplement that claim to enhance athletic performance and assist with weight loss [1]. However, research suggests that the majority of the benefits from the consumption of EDs are derived from their caffeine content [1]. Caffeine is a central nervous stimulant that has been shown to increase motor activity, reduce the sensation of fatigue, and increase alertness [1, 2]. However, the use of energy drinks and associated caffeine content for sports performance has been linked to unintended consequences such as cardiac events, anxiety, seizures, tremors, vomiting, and death [3–5].

Because caffeine has the potential to enhance sports performance and cause adverse health reaction, its consumption among student-athletes is monitored by the National Collegiate Athletic Association (NCAA) [6–8]. Student athletes testing positive for excessive caffeine concentrations could receive punishments ranging from disqualification from a game/event to a loss of athletic eligibility for multiple offenses [9]. Despite the consequences, the potential ability of EDs to increase mental acuity and motor activity makes their use attractive to both college student athletes and non-athletes.

Energy Drink Use Among College Students

Studies estimating past year ED use among college student populations have found rates that vary from 22.6 to 65.6 % [4, 10, 11]. Some research among college students has found that males are more likely to consume EDs [11–13]; however, another study found higher rates of use among females [4]. Similarly, the association between ED use and race is conflicted. Some studies indicate that Caucasian students are more likely to use EDs [13, 14], while another

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failed to identify an association [11]. Involvement with Greek organizations (i.e. fraternities, sororities) has been associated with the use of EDs among college students [11, 14]. In addition, research has found that ED consumption is correlated with other adverse health behaviors including tobacco use [11, 13], frequent heavy episodic drinking [14, 15] and the misuse of prescription stimulants (MPS) [11, 16].

With regard to motivations associated with ED consumption, college students have reported a need to complete a major assignment, feel less tired, and decrease fatigue [4, 12, 17]. Additionally, students have reported being motivated to use EDs to drive long distances, mix with alcohol, increase physical performance, and to become more involved with friends [4, 12, 17]. Although motivations for ED consumption have been explored among the general undergraduate student population, a comparison of motivations between student athletes and student non-athletes has not been reported in the peer-reviewed literature.

Associations between health behaviors and college student athletic status (student athlete vs. non-athlete) vary. Studies have found higher rates of alcohol use [18, 19] and performance enhancing drug use [20–22] among college student athletes compared to non-athletes. Conversely, athletic participation has been identified as a protective factor against the use of illicit drugs [18, 23] and tobacco use [24, 25] in the college student population.

There are few examinations of ED consumption (including the prevalence and motivations) among college student athletes. The NCAA reported that 44.5 % (of 20,474) collegiate athletes indicated that they consumed EDs while in college [6]. In an examination of the use of prescription drugs and EDs for performance enhancement, Hoyte et al. [21] found that 89.4 % of athletes (i.e., collegiate, semiprofessional, club) in their sample had used an ED in the past year to improve athletic performance. However, the study failed to examine other motivations that may have been associated with the consumption of EDs among those athletes. Woolsey et al. [26] examined ED use and ED combined with alcohol use among a sample of student athletes. Of the 401 athletes in the sample, 194 (48.4 %) had used EDs in the past year and 150 (37.4 %) had combined EDs with alcohol. However, the sample of athletes was not compared to student non-athletes to examine potential differences. Identifying if differences in ED consumption exist based on athletic status is important because student athletes are subject to penalties (e.g. NCAA penalties) and benefits (e.g. enhanced sports performance) for excessive consumption in ways that are distinctly different from their non-athlete counterparts.

Purpose

There were two purposes of this study: (1) to examine whether there were differences in ED consumption and ED-related motivations based on athletic status (student athlete vs. non-athlete); and (2) to identify other potential ED correlates (i.e. gender, race, year in school, Greek affiliation, past-year MPS, current tobacco use, heavy episodic drinking) in a sample of college students.

Methods

Procedure

This study received Institutional Review Board approval and the data was collected from a sample of college student athletes and non-athletes at a large, private Southwestern university in spring 2014. To obtain class time to recruit participants, we first identified athletic trainers associated with the university and course instructors responsible for teaching general education courses required to fulfill the universities' degree requirements. This review identified 32 instructors responsible teaching these general education courses and 17 athletic trainers working in the athletic department. We then sent emails to these instructors and athletic trainers to request time during class or practice to recruit participants to complete a paper-and-pencil survey. This email explained the purpose of the study and stated that the instructor or athletic trainer was not obligated to donate their time for this study. From the instructors that we contacted, 25 allowed us to collect data in a total of 34 classes. Fifteen of the 17 athletic trainers donated time for participants to complete the survey.

Prior to distributing the surveys to potential participants, we explained the study's purpose, selection criteria (i.e., 18–25 years old; undergraduate status) and indicated that students would not be asked to provide any identifiable information linking them to the responses provided. It was also explained that participants could discontinue the survey at any time and were free to skip any question in the survey. To reduce coercion and increase the likelihood of honest responses, varsity athletes completed the survey away from coaches and instructors were asked to leave the room while surveys were being completed. Students participating in the study were issued a \$5 gift certificate.

A review of class roles revealed that 77.3 % of students enrolled in the courses used for recruitment were in attendance on the day that data was collected. Ten student athletes declined to participate in the study, six completed a survey in class, and one did not complete a survey in class because they had previously participated at practice. Also,

three non-athletes declined to participate and six had already participated in another class and did not complete the survey a subsequent time. We received a total of 490 (99.4 %) surveys from the 493 college student non-athletes that were recruited for participation. A total of 207 (95.4 %) completed surveys were received from the 217 student-athletes that were recruited for participation. Of note, to complete the analyses needed for this study (i.e., examining differences based on athletic status), we purposefully oversampled student athletes. Overall, 697 (98.1 %) of the 710 students that were recruited completed the survey.

An initial review of the 697 completed surveys identified and removed two subjects for failing to meet the study selection criteria (i.e., older than 25). Three students were removed because they did not respond to the question assessing ED use. Removing these participants resulted in a sample of 692 to be used for analyses (205 student athletes and 487 student non-athletes).

Measures

Survey Development

Questions examining ED consumption and associated behaviors were adapted and modified from items included in previous surveys [4, 10, 12, 16, 27, 28]. To increase the face validity and readability, an initial version of the survey was reviewed by content and survey design experts. This review identified several minor errors (e.g., formatting issues, typographical errors) that were subsequently revised. Then the instrument was pilot tested among a small sample of college students. This process identified potential confusion with the wording of some questions and confirmed a student's ability to complete the survey in the desired time frame. Revisions were made based on the feedback received and the final version of the survey was submitted for IRB approval.

Survey Overview

We assessed ED use, ED-related motivations, and potential correlates (i.e. athletic status, gender, race, year in school, Greek affiliation, past-year MPS, current tobacco use, heavy episodic drinking) of increased ED consumption among college students using a 68-question survey. The paper-and-pencil survey was distributed during class time or practice time at the institution where the research was conducted. The survey included questions assessing a plethora of health-related behaviors (e.g., sleep, gambling). The portions of the survey that are relevant to the present study are discussed below.

ED Use

Participants were asked to report the number of occasions they had consumed an ED or ED shot in the previous 30 days. For purposes of this study, an "occasion" was defined as the consumption of one energy drink or shot at one point in time. This question was modeled from a question assessing MPS used by McCabe and Teter [29] (*On how many occasions during the previous 30 days have you consumed an energy drink or energy shot?*). Respondents were provided examples of common energy drink brands (e.g., Red Bull, Monster, Venom, Amp, NOS) as a point of reference. Items on the response scale were: (0) none, (1) 1–2 occasions, (2) 3–5 occasions, (3) 6–9 occasions, (4) 10–19 occasions, (5) 20–39 occasions, and (6) 40 or more occasions.

Demographics

Participants responded to questions that assessed their age, gender, year in school, race, and Greek status (i.e., member of a fraternity or sorority).

Athlete Status

We assessed whether respondents participated in organized college athletics during the previous 12 months. This was a 'select all that apply' question and response options included *varsity (division I) sports*, *club sports*, *intramural sports*, *recreational sports*, and *no sports participation*. Respondents reporting participation in varsity (division I) sports were considered student athletes and all other participants were considered student non-athletes (0 = student non-athlete; 1 = student athlete).

The Misuse of Prescription Stimulants (MPS)

We assessed MPS via one question: *On how many occasions in the previous 12 months have you used someone else's prescription stimulant or your own medication in excess or for a purpose other than what the medication was prescribed for?* As part of this question, we provided the following examples for common stimulant brand name medications: Vyvanse, Adderall, Ritalin, Concerta, Dextro-drine, and Provigil. Response options were identical to those used in a previous study [29] and included: none, 1–2 occasions, 3–5 occasions, 6–9 occasions, 10–19 occasions, 20–39 occasions, and 40 or more occasions. To better group the responses provided, we conducted a cluster analysis (k-means procedure) to determine logical segments in the level of MPS reported. Results indicated that this variable should be dichotomized into two groups:

Those indicating no MPS use and those indicating any MPS use (0 = no use; 1 = MPS).

Tobacco Use

We assessed the number of times in the previous 30 days that participants had used a tobacco product, including the use of cigars, cigarettes, e-cigarettes, and smokeless tobacco. Response options included: *Never*, *1–2*, *3–5*, *6–9*, *10–19*, *20–29 days*, and *every day*. Because of the limited number of students reporting greater than 19 days of tobacco use, we again conducted a cluster analysis (k-means procedure) as we did for MPS. This procedure indicated three separate cluster groups: No use, low use (using between 1 and 5 days), and high use (using for 6 or more days).

Heavy Episodic Drinking

We assessed heavy episodic drinking frequency by having participants estimate the number of times they had five or more standard drinks for males or four or more standard drinks for females on one occasion. The question included a visual display of common standard drinks. Response options included: *Never*, *less than monthly*, *monthly*, *weekly*, and *daily or almost daily*. Respondents who reported heavy drinking never or less than monthly were classified as a none/infrequent heavy episodic drinker and those engaging in behavior at least once a month were classified as frequent heavy episodic drinkers (0 = none/infrequent heavy episodes; 1 = frequent heavy episodes).

Motivations for ED Consumption

ED users were asked to indicate all of the motivations for consuming an ED in the previous 30 days. Because recent findings [10, 16] have identified a relationship between ED consumption and MPS, a list of possible motivations were compiled based on research examining MPS-related motivations [27, 28] and ED-related motivations [4, 12]. Response options included: (1) *To concentrate better in class*, (2) *to concentrate better while studying*, (3) *to study longer/complete major assignments*, (4) *feel less restless in class/while studying*, (5) *to improve mental focus/alertness*, (6) *need for more energy*, (7) *to drive for a long period of time*, (8) *prolong the effects alcohol or other substances*, (9) *lose weight*, (10) *to exercise longer*, (11) *to improve my athletic performance*, (12) *because I am addicted*, and (13) *not getting enough sleep*. Respondents were also provided an open text box in which they could provide “other” motivations for the behavior.

A review of the data found that multiple levels of consumption (i.e., 10–19 occasions, 20–39 occasions, 40 or

more occasions) did not contain enough cases to statistically evaluate motivations between student athletes and non-athletes. To facilitate the statistical analyses of the motivations associated with varying levels of ED consumption based on athletic participation, we conducted a cluster analysis (k-means procedure) in the same manner described with tobacco use and MPS. Results suggested clustering ED consumption into two levels: Low use (one to nine occasions of ED consumption), and high use (10 or more occasions of ED consumption).

Data Analysis

We entered the data from 692 completed surveys into SPSS 20.0. First, we calculated descriptive statistics for ED consumption and all of our independent variables of interest: Athlete status, gender, race, year in school, Greek affiliation, past-30 day ED, past-year MPS, past-30 day tobacco use, heavy episodic drinking. Next, we examined each independent variable with ED consumption bivariate via Cramer’s V tests. Then, we examined the Akaike information criteria (AIC) and Bayesian information criteria (BIC) for both Poisson and negative binomial (nb) distributions to determine which type of multiple regression analysis was most appropriate to examine the relationship between the significant independent variables and increased ED consumption (i.e., none, 1–2 occasions, 3–5 occasions, 6–9 occasions, 10–19 occasions, 20–39 occasions, 40+ occasions). To evaluate differences in ED-related motivations based on athlete status, we grouped participants into a low ED use (one to nine occasions of ED consumption) or a high ED use (ten or more occasions of ED consumption) category. Then, we used Chi square analyses to determine differences in ED motivations between student athletes and non-athletes in each group.

Results

The final sample was comprised of 692 undergraduate college students between the ages of 18 and 25 (participant demographics and behaviors are listed in Table 1). Our sample was comprised of 397 females (57.4 %), 205 student athletes (29.7 %), and had a mean age of 20.4 years (SD = 1.42). The majority of the sample was Caucasian (64.6 %) and 172 (24.9 %) were affiliated with a Greek organization. The sample demographics used were similar to the entire student body at the university this research was conducted with regards to gender, year in school, and Greek affiliation. With regard to race, the sample had an overrepresentation of African-American students (12.2 vs. 7.3 %), and an underrepresentation of Hispanic students (8.7 vs. 13.1 %). Because student athletes were purposely

Table 1 Demographic characteristics of the sample by athletic status

	Non-athletes		Student-athletes		Total	
	n = 487	%	n = 205	%	n = 692	%
<i>Gender</i>						
Male	213	43.8	82	40.0	295	42.6
Female	274	56.2	123	60.0	397	57.4
<i>Race</i>						
Caucasian	306	62.9	140	68.6	446	64.6
African-American	41	8.5	43	21.1	84	12.2
Hispanic	56	11.5	4	2.0	60	8.7
Asian	53	10.9	3	1.5	56	8.1
Multiracial	27	5.6	10	4.9	37	5.4
Other	3	0.6	4	2.0	7	1.0
<i>Year of undergraduate education</i>						
1st year	76	15.6	51	25.0	127	18.4
2nd year	113	23.2	55	27.0	168	24.3
3rd year	129	26.5	49	24.0	178	25.8
4th year	147	30.2	39	19.1	186	26.9
5th year	22	4.5	10	4.9	32	4.6
<i>Greek affiliation</i>						
Greek	150	30.8	22	10.7	172	24.9
Non-Greek	337	69.2	183	89.3	520	75.1
<i>Energy drink use frequency (categorical)</i>						
None	292	60.1	147	71.7	439	63.5
1–2 Occasions	90	18.5	32	15.6	122	17.7
3–5 Occasions	51	10.5	10	4.9	61	8.8
6–9 Occasions	20	4.1	3	1.5	23	3.3
10–19 Occasions	21	4.3	7	3.4	28	4.1
20–39 Occasions	8	1.6	6	2.9	14	2.0
40+ Occasions	4	0.8	0	0.0	4	0.6
<i>Current tobacco use</i>						
None	390	80.4	185	90.2	575	83.3
Low use (1–5 days)	68	14.0	14	6.8	82	11.9
High use (6+ days)	27	5.6	6	3.0	33	4.8
<i>Heavy alcohol consumption frequency</i>						
Less than monthly	373	76.7	173	85.6	546	79.4
Monthly or more	113	23.3	29	14.4	142	20.6
<i>Past-year prescription stimulant misuse</i>						
No	403	82.8	185	93.0	588	86.2
Yes	80	16.4	14	7.0	94	13.8

oversampled, they were overrepresented (29.7 % of the sample).

ED Consumption

A total of 252 (36.4 %) participants indicated consuming at least one ED in the preceding 30 days. Of those, 122 (90 non-athletes, 32 athletes) consumed an ED on 1–2 occasions, 61 (51 non-athletes, 10 athletes) on 3–5 occasions, 23 (20 non-athletes, 3 athletes) on 6–9 occasions, 28 (21

non-athletes, 7 athletes) on 10–19 occasions, 14 (8 non-athletes, 6 athletes) on 20–39 occasions, and 4 (4 non-athletes, 0 athletes) on 40 or more occasions.

Bivariate Analyses

Independent Cramer's V analyses found that non-athletes had significantly higher rates of ED consumption ($\Phi = 0.148$, $p < .05$). In addition, these analyses found significant associations existed between increased ED use

and the following independent variables: male gender ($\Phi = 0.134$, $p < .05$), Greek affiliation ($\Phi = 0.163$, $p < .01$), current tobacco use ($\Phi = 0.163$, $p < .01$), frequent heavy episodic drinking ($\Phi = 0.245$, $p < .001$), and past-year MPS ($\Phi = .203$, $p < .001$). Bivariate analyses did not find significant associations between increased ED consumption and the following variables: race ($\Phi = 0.110$, $p = .100$) and the student's year in school ($\Phi = 0.106$, $p = .147$).

Multivariate Analyses

A review of the AIC and BIC values indicated that the negative binomial distribution provided the best multivariate analysis because the predicted values were much closer to actual reported frequencies of ED consumption. Specifically, the AIC and BIC values for the Poisson model were 1761.4 and 1797.6, respectively. The AIC and BIC values for the negative binomial model were 1587.0 and 1622.8, respectively. Relatively lower values of AIC and BIC indicate better model fit. The negative binomial model was the better approximating model according to AIC and BIC also; consequently, we chose to interpret the negative binomial model.

Based on these results, we conducted a negative binomial regression analysis with ED consumption (0 = None, 1 = 1–2 occasions, 2 = 3–5 occasions, 3 = 6–9 occasions, 4 = 10–19 occasions, 5 = 20–39 occasions, 6 = 40 or more occasions) as the outcome variable. The predictor variables included all those found to be significant in the preceding bivariate analyses (i.e., athletic status, gender, Greek affiliation, frequent heavy episodic drinking, past-

year MPS, current tobacco use). In the model (See Table 2), increased ED consumption was positively associated with frequent heavy episodic drinking (IRR = 1.65, CI = 1.18–2.32, $p = .003$) and MPS (IRR = 1.62, CI = 1.12–2.34, $p = .01$). The model indicated that ED consumption was lower for athletes than non-athletes (IRR = .75), but that difference was not statistically significant. However, based on the confidence interval for athlete status, we can conclude with 95 % confidence that rate of ED use among athletes is *at most* the same as non-athletes (i.e., $CI_{upper} = 1.03$).

Motivations for Energy Drink Consumption

We examined ED-related motivations between two groups of ED users: Low use (one to nine occasions of ED consumption), and high use (10 or more occasions of ED consumption). Of those classified in the low use group, 182 participants (141 non-athletes; 42 athletes) identified a total of 486 motivations for ED consumption (see Table 3).

Low Use

Non-athletes in the low use group most commonly cited the need for more energy (64.5 %), and a desire to study longer (47.5 %) as reasons for ED consumption. Of note, nine students (6.4 %) reported the desire to prolong the effects of alcohol or other substances while seven reported “other” as a motivation. However, only one student non-athlete provided an alternative motivation, which was “the taste”. Low ED use student athletes most commonly identified a need for more energy (61.5 %), and in order to drive for

Table 2 A negative binomial regression analysis to predict increased energy drink consumption among a sample of college students (N = 692)

	B	S.E.	Z	IRR	95 % C.I.	
<i>Gender</i>						
Male	0.231	0.144	1.608	1.260	0.950	1.67
<i>Greek affiliation</i>						
Yes	−0.003	0.158	−0.019	1.000	0.730	1.360
<i>Athletic participation</i>						
Varsity athlete	−0.283	0.159	−1.782	0.750	0.550	1.030
<i>Heavy episodic drinking**</i>						
Frequent heavy episodes	0.503	0.159	2.921	1.650	1.180	2.320
<i>Past-year stimulant misuse*</i>						
1 or More occasions	0.481	0.189	2.538	1.620	1.12	2.340
<i>Current tobacco use</i>						
Low use	0.160	0.208	0.770	1.174	0.780	1.765
High use	0.064	0.309	0.206	1.066	0.581	1.955

Akaike information criteria = 1587.0; Bayesian information criteria = 1622.8

IRR incident rate ratio

* $p < .01$; ** $p < .001$

Table 3 Comparison of reported motivations for energy drink consumption by frequency of use

Motivations	Low use		High use	
	Non-athlete n = 141 (%) ^a	Varsity athlete 42 (%) ^b	Non-athlete n = 53 (%) ^c	Varsity athlete n = 16 (%) ^d
I needed more energy	91 (64.5)	19 (46.3)	35 (66.0)	10 (62.5)
In order to study longer/complete major assignments	67 (47.5)	8 (19.5)	34 (64.2)	6 (37.5)
I did not get enough sleep	49 (34.8)	8 (19.5)	38 (71.7)	7 (43.8)
To concentrate better while studying	56 (39.7)	5 (12.2)	28 (52.8)	7 (43.8)
To improve mental focus/alertness	40 (28.4)	5 (12.2)	26 (49.1)	8 (50.0)
To concentrate better in class	20 (14.2)	3 (7.3)	18 (34.0)	7 (43.8)
To feel less restless in class/while studying	23 (16.3)	2 (4.9)	14 (26.4)	5 (31.2)
To drive for a long period of time	35 (24.8)	12 (29.3)	16 (30.2)	*
To improve my athletic performance	6 (4.3)	4 (9.8)	8 (15.1)	7 (43.8)
To exercise longer	7 (5.0)	2 (4.9)	10 (18.9)	5 (31.2)
To feel good or get high	1 (0.7)	1 (2.4)	7 (13.2)	*
To prolong the effects of alcohol or other substances	9 (6.4)	*	6 (11.3)	*
Other	4 (2.8)	5 (12.7)	3 (5.7)	1 (6.2)
To lose weight	1 (0.7)	*	4 (7.5)	2 (12.5)
Because I am addicted	2 (1.4)	1 (2.4)	3 (5.7)	1 (6.2)

* Not identified as a motivation

^a 411 Motivations were reported

^b 75 Motivations were reported

^c 250 Motivations were reported

^d 65 Motivations were reported

long periods of time (29.3 %). No low ED use student athletes reported a desire to lose weight or to prolong the effects of alcohol or other substances.

A series of Chi square analyses were completed to compare motivations for ED consumption between low use student athletes and low use student non-athletes. Results indicated that a greater proportion of low use student non-athletes identified a desire to concentrate better while studying ($\chi^2 = 10.8$, $p < .01$), to study longer/complete major assignments ($\chi^2 = 10.3$, $p < .01$), improve mental focus/awareness ($\chi^2 = 4.6$, $p < .05$), and a need for more energy ($\chi^2 = 4.4$, $p < .05$) as a motivation for consumption. In contrast, low use student athletes were significantly more likely to report “other” ($\chi^2 = 5.9$, $p < .05$) as a motivation.

High Use

Sixty-nine participants (53 non-athletes; 16 athletes) in the high ED use group reported a total of 315 motivations. Student non-athletes most commonly cited a lack of sleep (71.7 %), and the need for more energy (66.0 %). Student athletes most commonly identified a need for more energy (62.5 %), and improving mental focus (50.0 %). Seven (43.8 %) student athletes also reported a desire to improve athletic performance. No high use student athletes reported

a desire to prolong the effects of alcohol or other substances. Chi square analyses revealed that a greater proportion of high ED use student non-athletes identified a lack of sleep ($\chi^2 = 4.2$, $p < .05$) and a desire to drive for a long period of time ($\chi^2 = 6.3$, $p < .05$) as a motivation for the behavior. A greater proportion of high ED use student athletes reported a desire to improve athletic performance ($\chi^2 = 5.9$, $p < .05$) as a motivation.

Discussion

The role of college sports participation has a varying association with substance use. In the use of alcohol and performance enhancing drugs, sports participation is associated with increased use [18, 19, 23, 25]. Conversely, sports participation is associated with decreased use of tobacco products and other illicit drugs [18, 23]. This investigation extends this work by examining the differences in ED consumption based on sports participation.

Over a third (36.5 %) of the study sample had consumed at least one ED in the previous 30 days. The rate of ED consumption among the sample was consistent with other college student samples in the literature [13, 15], but we did not detect a difference in ED consumption based on athletic status when controlling for other variables. It is

possible that there was no difference in ED use between these groups because beverage companies have purposefully marketed these drinks to active college aged populations [8]. In addition, both athletes and non-athletes who consume these beverages might share common personality traits, such as competitiveness [8]. For instance, Woolsey [26] stated that ED consumers are more likely to have a “jock identity”. The lack of significance based on sport participation could also be an artifact of a low prevalence of heavy episodic drinking among athletes in the sample (14.4 % among athletes, 23.3 % among non-athletes). Studies have linked ED consumption with heavy episodic drinking among student non-athletes [19] and student athletes [26]. Since alcohol consumption among student athletes typically exceeds that of student non-athletes [18, 19], it is possible that a sample of athletes consuming more alcohol might also display higher rates of ED consumption.

Results also supported existing research in that frequent heavy episodic drinking [13–15] and MPS [11, 16] were significantly associated with increased ED consumption. It is plausible that these associations along with the reported motivations (e.g. study longer, not enough sleep) in the sample suggest that students are using stimulants to compensate for lifestyles (e.g. partying frequently) that are not congruous with high academic achievement. In fact, examinations of these behaviors found that students use EDs and prescription stimulants in an effort to make up for infrequent class attendance and a lack of sleep [4, 11]. ED consumption has also been linked to concurrent use of other substances (e.g. marijuana) [13, 17]. Therefore, these relationships might exist among students struggling with substance use and dependence issues. Contrary to the literature [11, 14], we did not identify a significant association between ED consumption and current tobacco use when controlling for other variables.

We also did not identify significant differences in ED use based on race. This finding is consistent with some ED-related research [11] but not with other research that found that Caucasians were more likely to consume EDs [13, 14]. We also did not identify differences in ED consumption based on Greek affiliation, which is not consistent with previous findings [11, 14]. Finally, we did not find a significant difference based on gender. Previous studies [11–13] have found that males were more likely to consume EDs while another [4] found that females were more likely to consume EDs. It is possible that the consumption of EDs is becoming more popular among all college students and differences in consumption patterns based on gender and race are becoming less pronounced. It is also possible that the lack of significance is a byproduct of a sample with a disproportionately high number of females (57.3 %) and Caucasians (64.6 %).

Concerning ED-related motivations, consistent with other investigations [4, 12], the desire for more energy and a lack of sleep were the most commonly reported motivations for ED consumption among all students. However, analyses identified differences in the motivations between student athletes and student non-athletes in low use (1–9 occasions) and high use (10 or more occasions) ED groups. Low ED use student non-athletes were more likely to report a need for more energy and motivations related to academics (e.g. concentrate better while studying to study longer/complete major assignments, improve mental focus/awareness). Of note, low use student athlete motivations were more dispersive. No single motivation was identified by at least half of this group. Reasons as to why low ED use student-athletes might not have a prevailing motivation should be explored further.

Among high ED use participants, a greater proportion of non-athletes identified a lack of sleep and a desire to drive for a long period of time while a higher proportion of student athletes reported a desire to improve athletic performance. Almost as many student non-athletes among the high ED use group reported a lack of sleep as those in the low use group. Thus, it is possible that lifestyle choices (e.g. staying up late, partying) can lead to increased consumption. Finding that student athletes are using EDs to improve athletic performance is consistent with a previous study [21]. Hoyte et al. [21] also suggested that those using EDs to improve performance consume EDs more frequently. This is of concern because the consumption of EDs to enhance athletic performance has been known to cause insomnia, nausea, tachycardia and seizures [5]. Finally, despite the findings of others [13, 15] and our findings that link increased ED consumption with heavy episodic drinking, students in both high and low use groups did not commonly report a desire to prolong the effects of alcohol or other substances. In fact, no student athlete reported this as a motivation.

Limitations

A strength of our study is that it compares ED use and ED-related motivations between student athletes and student non-athletes, and differences between these groups have not been examined in the peer reviewed literature. However, there are important methodological limitations to note when interpreting the results. Participants of this study only included a convenience sample of college students at one large private university in the US. Therefore, this sample might not be representative of other populations of college students or college athletes at other institutions throughout the country.

The study is also limited because students self-reported their behavior. Students may have underreported behaviors and provided more socially acceptable responses to some survey items. The cross-sectional design of the study also limited the inferences that can be drawn, as this study design does not allow for us to establish causal relationships between ED use and ED correlates. In addition, participants did not indicate the sport they participated in. Based on the limited number of athletes on some teams, having participants identify their sport would have made individual identification possible. As a result, we were not able to examine differences based on participation in different sport-types. Finally, we only asked participants to report the consumption of an ED. The questions presented to students did not account for the different types of EDs, varying levels of caffeine in each ED, or the consumption of other caffeinated beverages (e.g., coffee, soda).

Conclusion

EDs are popular among college students as they provide an avenue to increase alertness, decrease fatigue, and increase motor activity. The consumption of EDs was prevalent in our sample; however, we did not find significant differences in consumption based on athletic participation. Concerning motivations for ED consumption, both student athletes and student non-athletes most commonly reported a need for energy as a motivation for the behavior. Compared to high use student non-athletes, a greater proportion of high use student athletes reported the desire to increase athletic performance as a motivation for ED consumption. As a result, college health professionals attempting to prevent increased ED consumption among student athletes might consider highlighting the adverse health risks associated with high levels of stimulants and physical activity. Future studies should consider exploring potential changes of ED consumption and related motivations over time. For instance, it is possible that ED consumption among student athletes can change based on the time of year (i.e. off-season vs. in season). Finally, examinations of ED consumption among specific athletes are needed. It is plausible that athletes participating in sports requiring heightened cognitive abilities (e.g. baseball, softball, sprinting) display higher rates of consumption than other athletes.

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