



# Underlying Beliefs Associated With College Student Consumption of Energy Beverages

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## Abstract

College students are heavy consumers of energy beverages, yet further study is needed to better understand determinants of use. The purpose of this cross-sectional study ( $N = 283$ ) was to identify beliefs explaining unsafe consumption practices. A principal components analysis revealed three eigenvalues  $>1$  explaining approximately 55% of the variance (health and appearance, performance and fatigue, and recreation and alcohol). Multiple regression analysis explained 75% of the variance for intent to consume. Standardized beta for attitude and subjective norms was  $p < .001$ ; perceived behavioral control was  $p < .05$ . MANOVA was used to determine the effect of gender on eight dependent variables (Wilks's lambda = 3.78,  $p < .001$ ). Attitudes and subjective norms influenced the intent to consume energy beverages, particularly in males. Students viewed energy beverages as useful for managing health and appearance and performance and fatigue, and as a way to enhance recreation and alcohol consumption.

## Keywords

energy drinks, college students, Theory of Planned Behavior

Energy beverages (EBs), their potential for causing adverse effects, and how they are regulated has been heavily scrutinized, drawing the attention of health

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care professionals, researchers, and policy makers (Jackson et al., 2013; Sepkowitz, 2013; Thorlton, Colby, & Devine, 2014). Despite their popularity, critical gaps remain in our understanding of factors contributing to individual differences, social influence, perceptions, and attitudes regarding consumption practices (Piotrowski, 2014; Sorkin & Coates, 2014). In the symposium “Energy Drinks: Current Knowledge and Critical Research Gaps,” scientists summarized that further study is needed to better understand the determinants of EB consumption (Sorkin & Coates, 2014). With a better understanding of underlying beliefs and behaviors driving EB consumption, interventions can be designed to inform college students, potentially leading to safer consumption practices—hence, the rationale for this study.

## Conceptual Framework

A goal of this study is to design theoretically informed interventions to support safe consumption of EBs, as those based on a health behavior theory are more likely to produce desired outcomes (Fishbein & Ajzen, 2015). The Theory of Planned Behavior (TPB) is widely used for exploring relationships between behavioral, normative, and control beliefs, and how these beliefs influence the likelihood of performing a behavior (Fishbein & Ajzen, 2015). Various publications, systematic reviews, and meta-analyses of the TPB (Cooke, Dahdah, Norman, & French, 2014; Downs & Hausenblas, 2005) provide evidence supporting the extent to which its constructs effectively predict behavioral intent and behavior. In this model, behavioral intent indicates one’s readiness to perform a behavior, and is considered to be the immediate antecedent of the behavior (Fishbein & Ajzen, 2015). Intent is based on three constructs: one’s *attitude* (i.e., underlying beliefs, values) about a particular behavior, by *subjective norms* (i.e., beliefs about whether key people such as friends might approve or disapprove of the behavior), and *perceived behavioral control* pertains to one’s beliefs (e.g., fatigue, not enough time) about ability to exercise control over carrying out a behavior (Fishbein & Ajzen, 2015). The theory assumes that factors such as culture and environment operate within the constructs of the TPB and do not independently explain the likelihood of certain behavior (Fishbein & Ajzen, 2015). In summary, the TPB posits that a causal chain of beliefs, attitudes, and intentions drive a person’s behavior (Fishbein & Ajzen, 2015).

## EB Consumption in College Students

Prevalence rates of EB consumption range from 34% to 75% in college students (Berger, Fendrich, & Fuhrmann, 2013; Malinauskas, Aeby,

Overton, Carpenter-Aeby, & Barber-Heidel, 2007; Seifert, Schaechter, Hershorin, & Lipshultz, 2011). Young adults consume energy drinks to fight fatigue, enhance performance and concentration, and use them as mixers with alcohol, fueling concerns related to adverse stimulant effects and potential toxic effects from excess B-vitamin consumption (Jackson et al., 2013; Seifert et al., 2011; Sepkowitz, 2013; Substance Abuse and Mental Health Services Administration [SAMHSA], 2013). Aside from sugar and caffeine, EBs often contain the herbal stimulant guarana, and assorted vitamins which may work together to stimulate central nervous and cardiovascular systems, resulting in mild to severe side effects (Institute of Medicine, 2014; SAMHSA, 2013). A combination of heightened stimulation and impaired behavioral intention may contribute to high-risk consequences in college students who mix alcohol with energy drinks (Miller, 2008; Peacock, Bruno, Martin, & Carr, 2013; U.S. Food and Drug Administration [USFDA], 2010).

### *Sex Differences*

In a survey of college students ( $N = 496$ ), Malinauskas et al. (2007) found that females (53%) consumed more EBs per month than males (42%,  $p = .01$ ) and preferred sugar-free versions of EBs ( $n = 247$ ,  $p < .01$ ). In this survey, energy drink consumption patterns for six situations were assessed: insufficient sleep, need energy, studying, driving car for long periods, mixing with alcohol, and to treat hangovers. There were no significant sex differences in use of EBs for these six situations (Malinauskas et al., 2007). However, in a study of college students ( $N = 136$ ) conducted by Pettit and DeBarr (2011), females reported lower consumption rates than males.

### *Unsafe Consumption Practices*

Spending on energy drinks and shots grew 60% in the United States during the past 5 years (Natural Products Insider, 2013). Energy drink-related emergency department visits doubled during this period of time, with the largest number of visits occurring in 18- to 25-year-olds; about one third of these visits involved consumption in combination with alcohol or other drugs (SAMHSA, 2013). EBs may contain high levels of caffeine, with excess consumption causing increased heart rate and blood pressure, potentially resulting in caffeine toxicity (Seifert et al., 2011; SAMHSA, 2013). Arria et al. (2010) reported increased alcohol consumption, non-medical prescription drug use, and illicit drug use are associated with energy drink consumption in college students.

## Product Labeling

Product ingredient labeling is inconsistent and can vary by manufacturer, making it challenging to gauge actual caffeine content and product safety (Institute of Medicine, 2014). Manufacturers are legally permitted to market and sell vitamin-enhanced products as dietary supplements, even when ingredients (e.g., vitamins B6, B12) exceed recommended daily allowances and known safety issues exist (McCormick, 2010; Miller, 2008). Simon and Mosher (2007) reported that although product labels warn those under 18 years of age and anyone with health concerns to not consume them, young adults may not read the labels, or find them confusing and misleading, prompting lobbying for change in labeling laws to alert consumers as to the risks associated with consuming alcohol with caffeinated EBs.

## Purpose

Using the TPB, as an organizing framework, we sought to better understand the chain of beliefs and attitudes influencing the intent to consume energy drinks and/or energy shots—from this point forward, referred to as “energy beverages” (EBs). Our research questions were as follows:

**Research Question 1:** What underlying beliefs are associated with college student intent to consume EBs?

**Research Question 2:** Are there sex differences in college student beliefs regarding EBs?

## Method

### *Research Design, Sample, and Data Collection*

Upon institutional review board approval, a convenience sample of students ( $N = 283$ ) from a large public university were recruited to participate in an online, cross-sectional survey from April to September 2014. Students  $\geq 18$  years of age were recruited to participate through a research participation system allowing students to select from a range of possible research projects for extra credit in participating courses. Because this system supported general education required courses, the student pool drew from students in majors across campus. The survey was anonymous, but the research participation system awarded 0.5% extra credit for those participating in the protocol. Students were informed they could refuse to answer any of the questions. Upon volunteering to participate, students were directed to an online survey.

## Survey Development

We sought to measure psychological and social phenomena that would assess EB consumption, following Fishbein and Ajzen's (2015) recommended process for questionnaire construction in the reasoned action tradition. Survey items captured demographics, EB consumption practices, brief medical history, and intent to consume EBs (i.e., attitude, subjective norms, and perceived behavioral control). We formulated items measure beliefs potentially underlying intent to consume EBs, using a five-item Likert-type scale (1 = *strongly disagree*, 5 = *strongly agree*). Belief statements were derived from a review of literature and open-ended question results. Initial items were judged, modified, and trimmed by three researchers.

**Demographics and EB consumption practices.** Participants were asked, "Have you ever drunk an energy drink and/or shot?" (yes/no), age, sex (male/female), college year, race/ethnicity, reasons for drinking/not drinking EBs, side effects experienced, to rate familiarity with ingredients and product labels, and reasons for mixing with alcohol.

**Brief medical history.** Questions asked were regarding height/weight, medical conditions that require seeing a health care provider (e.g., diabetes, heart, asthma, and attention deficit/hyperactivity disorder), and weekly cigarette smoking/alcohol consumption. Students were asked to indicate which of the following topics their health care provider had ever mentioned or discussed with them: use of EBs, vitamin/mineral supplements, dietary supplements, caffeine, and alcohol.

**Planned behavior constructs.** Three items measured future *intent* to consume EBs (i.e., It is likely that I will consume EBs on a daily basis; I intend to consume EBs on a daily basis; and I am certain I will drink EBs on a daily basis). Three items were developed to measure general *attitude* toward EB consumption (i.e., Consuming EBs on a daily basis is helpful to me; Drinking EBs on a daily basis is enjoyable; It is good to drink EBs on a daily basis). Three items were developed to measure *subjective norms* for consuming EBs (i.e., Other people like me drink EBs on a daily basis; People whose opinion I respect want me to drink EBs on a daily basis; People close to me drink EBs on a daily basis). Four items were developed to assess student *perceived control* over EB consumption behavior (i.e., I am able to drink EBs on a daily basis if I want to; Drinking EBs on a daily basis is easy for me; It is my decision whether or not I drink EBs on a daily basis; and, Drinking EBs on a daily basis is within my power). We focused on "daily" EB use to identify the

extent to which students might engage in potentially problematic consumption most likely to negatively affect health.

*EB belief statements.* Finally, students rated to what extent they agreed or disagreed with a variety of statements (Table 1) pertaining to EB consumption. These statements were developed to reflect a broad range of possible beliefs about EB consumption that may underlie general EB consumption intentions, attitudes, norms, or behavioral control.

## Results

Freshmen students comprised the largest number of responses (35%), followed by seniors, juniors, and sophomores, respectively; no graduate students responded. The majority were Caucasian, followed by Asian (21%), Hispanic/Latino (5%), African American (4%), and Other (2%). More than half of the respondents were female (59%). The mean age was 20 years ( $SD = 1.8$ ), and 91% reported having ever consumed EBs. In this sample, 16% reported seeing a health care provider for diabetes, about one fourth reported attention deficit/hyperactivity disorder, history of a heart condition, and about one third reported having asthma. A small percentage reported taking prescription medication for the aforementioned medical conditions. Five percent reported that their health care provider mentioned/discussed their use of EBs, and 17% discussed alcohol use with them. About 65% reported taking vitamins, minerals, or dietary supplements at least daily or monthly. Despite high rates of use, nearly 80% reported they did not believe or were unsure as to the safety of EBs.

The top three reasons for mixing EBs with alcohol were as follows: It tastes good (47%), hides the flavor of the alcohol (29%), and for an energy boost (24%). The top three side effects experienced from EB consumption were trouble falling asleep (46%), tachycardia (36%), and headaches (34%). When asked, "If you no longer consume EBs, why did you discontinue use?" 27% reported that they did not like the taste, 21% experienced an upset stomach or nausea, and about 21% reported EBs did not boost energy and were too expensive. Less than 5% reported mixing EBs with alcohol as a means of reducing hangovers, being able to drink more alcohol and not feel as drunk, and to enhance mental alertness while drinking. When asked how many times did you mix EBs with alcohol this past month, 69% reported zero or never, while the remainder reported having done so one or more times.

## Product Labels

About one fourth of the students reported that EB product labels were hard to read and understand, and 38% did not pay attention to labels. Although 34%

**Table 1.** Factor Loadings From Principal Components Factor Analysis: EB Beliefs.

Items and Factor Loadings	Health and Appearance	Perform and Fatigue	Recreation and Alcohol	M	SD
Drinking EBs helps me to lose weight	<b>.79</b>			1.84	.90
EBs help promote good health and nutrition	<b>.78</b>			1.70	.85
EBs enhance my appearance, attractiveness	<b>.77</b>			1.80	.95
EBs help stimulate my metabolism	<b>.76</b>			2.07	.97
An EB is a sports drink	<b>.76</b>			1.89	1.03
EBs help me relax	<b>.71</b>			1.92	.92
EBs help reduce stress	<b>.68</b>			2.11	.96
EBs help me stay hydrated and quench thirst	<b>.66</b>			1.87	.95
EBs enhance athletic performance	<b>.64</b>			2.30	1.13
I get better grades if I drink EBs while studying	<b>.64</b>			2.37	1.12
EBs enhance my performance at work	<b>.61</b>			2.52	1.18
EBs enhance sexual performance	<b>.56</b>			2.27	.99
An EB is a good hangover cure	<b>.53</b>			2.15	1.02
EBs are refreshing	<b>.51</b>			2.46	1.15
An EB is a drink for any occasion	<b>.49</b>			2.14	1.01
People drink EBs to perk up if they are tired		<b>.72</b>		3.95	1.01
Drinking too much (EBs) would not be good for you		<b>.62</b>		4.27	1.08
EBs boost concentration and alertness		<b>.59</b>		3.04	1.18
People drink them on a big night out			<b>.75</b>	3.20	1.11
EBs are good mixers for cocktails			<b>.74</b>	2.65	1.13
People drink EBs to perk up after too much alcohol			<b>.64</b>	2.78	1.03
People can drink more alcohol/party longer, if they drink EBs during the night			<b>.59</b>	2.57	1.09
EBs are fashionable and trendy			<b>.48</b>	2.45	1.13

Note. Secondary factor loadings are suppressed. Boldface indicates retained items. EB = energy beverage(s).

reported that labels were easy to read, only 21% felt they were easy to understand. Nearly 80% reported that they do not choose or are unsure if they are choosing zero-calorie EBs. Regarding serving size, only 18% followed label recommended dosages or were aware that some products are labeled single serving, while others are two servings. Students correctly reported that “Guarana is . . .” a natural stimulant (67%), and incorrectly reported that it is an herb that enhances longevity (27%), an herbal stress reducer (17%), and a low-calorie sweetener (25%).

*Factors associated with intent to consume EBs.* We conducted a principal components analysis of belief statements to investigate issues that might underlie EB perceptions and intent. No assumption of orthogonality was assumed; therefore, we used an oblimin rotation to facilitate interpretation. Table 1 lists item means and primary factor loadings for EB belief statements. Twenty-three items from our survey were subjected to the analysis, which identified three factors with eigenvalues exceeding 1, accounting for 54.1% of the variance among the variables. Health and appearance (Component 1) explained 37.6% of the variance, fatigue and performance management (Component 2) explained 11.02%, and recreation and alcohol use (Component 3) explained 5.49% additional variation. Items with loadings more than .5 were included in the creation of new variables representing each component.

Table 2 displays Pearson’s correlations between the major study variables and EB consumption intent, along with means, standard deviations, and Cronbach’s alphas for each. Attitudes, subjective norms, and perceived behavioral control were all significant, positive correlates of intent, with attitudes showing the strongest correlation, followed by subjective norms and perceived behavioral control. In addition, the three belief components were also significantly correlated with most of the planned behavior constructs, suggesting that these beliefs may play important roles in the formation of EB attitudes, norms, behavioral control, and intent. In particular, beliefs that EBs may be healthy and enhance appearance were strongly associated with intent, as well as beliefs about recreational benefits and alcohol consumption.

Hierarchical multiple regression analysis was used to examine the ability of the variables to collectively predict EB consumption intent. As we were interested in the extent to which the belief components predicted intent above and beyond the traditional planned behavior constructs, we entered attitudes, subjective norms, and perceived behavioral control in the first stage, and entered our three belief factors (health and appearance, performance and fatigue, recreation and alcohol) in the second stage. Results indicate that planned behavior predictors significantly predicted intent,  $R^2 = .75$ ,  $F(3, 272) = 272.1$ ,  $p < .001$ . The addition of the belief components significantly

**Table 2.** Pearson's Correlations Among Measures of EB Consumption.

Measure	1	2	3	4	5	6	7	M	SD	$\alpha$
1. Intent	—							1.59	.84	.95
2. Attitude	.86**	—						1.85	.87	.83
3. Subjective norm	.58**	.57**	—					2.24	.86	.67
4. Perceived behavior control	.23**	.30**	.38**	—				3.22	.91	.68
5. Health and appearance	.70**	.70**	.48**	.28**	—			2.12	.74	.93
6. Performance and fatigue	.03	.10	.16*	.39**	.26*	—		3.74	.83	.61
7. Recreation and alcohol	.29**	.30**	.39**	.38**	.49**	.43**	—	2.81	.80	.71

\*Correlation is significant at the .05 level. \*\*Correlation is significant at the .01 level.

improved the prediction of intent,  $\Delta R^2 = .02$ ,  $\Delta F(3, 269) = 7.99$ ,  $p < .001$ . Overall, the model was strongly predictive of intent,  $R^2 = 0.77$ ,  $F(6, 269) = 150.54$ ,  $p < .001$ . Standardized coefficients for variables in the full model were attitude ( $\beta = .66$ ,  $p < .001$ ), subjective norm ( $\beta = .13$ ,  $p = .001$ ), perceived behavioral control ( $\beta = -.04$ ,  $p = .23$ ), health and appearance ( $\beta = .2$ ,  $p < .001$ ), performance and fatigue ( $\beta = -.09$ ,  $p = .01$ ), and recreation and alcohol ( $\beta = -.003$ ,  $p = .93$ ).

*Are there sex differences in college student's perceptions of EBs?* Our final research question explored differences between males and females on TPB constructs and EB beliefs. Table 3 displays results of a MANOVA for the dependent variables. Overall, this analysis was significant, explaining approximately 11% of the variation in the dependent variable. In all cases, men reported higher scores than women on the dependent variables with the exception of the performance and fatigue component.

## Discussion

The prevalence of EB consumption in this sample of students was greater than previously reported (Attila & Cakir, 2011; Berger et al., 2013; Seifert et al., 2011). Despite their popularity, the majority of students believed that EBs were unsafe or were unsure as to their safety. Although the vast majority of students have consumed EBs, most do not consume them on a daily basis. The rates of students who reported they had been diagnosed and prescribed medication for attention deficit/hyperactivity disorder or asthma mirror the

**Table 3.** MANOVA for Categorized Variables: Pairwise Comparisons, by Sex.

Dependent variable	Male (n = 110)		Female (n = 160)		Total (n = 270)		p	$\eta_p^2$
	M	SD	M	SD	M	SD		
EB consumption behavior <sup>a</sup>	0.96	0.21	0.87	0.34	0.90	0.29	.009	.025
Intent <sup>a</sup>	1.74	0.96	1.47	0.72	1.58	0.83	.007	.027
Attitude <sup>a</sup>	2.09	0.97	1.67	0.75	1.84	0.87	.000	.055
Subjective norm <sup>a</sup>	2.40	0.87	2.13	0.85	2.24	0.86	.012	.023
Perceived control <sup>a</sup>	3.41	0.90	3.09	0.88	3.22	0.90	.005	.029
Health/appearance <sup>a</sup>	2.31	0.99	1.96	0.86	1.87	0.93	.000	.055
Performance/fatigue	3.79	0.99	3.71	1.02	3.96	1.01	.442	.002
Recreation/alcohol <sup>a</sup>	3.01	1.02	2.67	1.18	3.21	1.12	.000	.044

Note. Adjustment for multiple comparisons: Holm–Bonferroni. Wilks's lambda = .89,  $F(8, 264) = 4.261$ ,  $p < .001$ ,  $\eta_p^2 = .114$ . EB = energy beverage.

<sup>a</sup>The mean difference is significant at the .05 level.

national prevalence rates of 11% and 8%, respectively (Centers for Disease Control and Prevention, 2016a, 2016b). Given the high rates of EB, dietary supplement, and vitamin use in this sample, a potential for drug–food interaction exists. However, surprisingly low rates were reported for health care providers discussing use of EBs, alcohol, caffeine, dietary supplement, and vitamin consumption. Food, caffeinated nutritional supplements, and alcohol can alter the way medications work, potentially creating side effects (USFDA, 2013) such as B-vitamin toxicity (Consumer Lab, 2015; McCormick, 2010). For these students, rates of mixing EBs with alcohol were similar to those reported in previous studies (Arria et al., 2010; Berger et al., 2013; USFDA, 2010), and about one fourth indicated mixing “for an energy boost.” Young adults with genetic and behavioral health disorders may be at increased risk of cardiac events when consuming stimulant-containing EBs, particularly when combined with alcohol and certain prescription medications (Arria & O’Brien, 2011). The USFDA (2010) banned the manufacture of pre-mixed caffeinated alcoholic beverages on grounds that they were not “generally recognized as safe,” further underscoring the importance of ongoing education about the risks associated with caffeine-containing EB consumption.

Some students mistakenly indicated that guarana was an herb that enhances longevity, an herbal stress reducer, and/or a low-calorie sweetener. Many students in this sample found product labels difficult to understand. Health care providers should discuss common EB ingredients and potential interactions, safety concerns, implications for those with comorbidities, or

those consuming prescription medications. Findings from this survey illuminate the need to raise awareness about risks associated with mixing EBs with alcohol, excess EB consumption, and the importance of reading product labels for caffeine, vitamin, and carbohydrate content, serving size, and to discourage consumption when taking vitamins to avoid potential vitamin toxicity (Miller, 2008).

The TPB was useful as an organizing framework for this study. Three distinct categories of beliefs about EBs were identified, which help to explain variation in intent, attitudes, normative pressure, and perceived behavioral control. Students see energy drinks as potentially useful for managing (a) health and appearance, (b) fatigue and cognitive performance, and (c) as a way to enhance recreational activities, particularly in the context of alcohol consumption. These three sets of beliefs were differentially associated with intent, attitude, subjective norms, and perceived behavioral control. Health and appearance and recreation and alcohol beliefs seem to exert the most influence on intent to consume EBs on a daily basis. Attitudes and subjective norms were key factors influencing intent to consume EBs in these college students. Attitude and daily intent to consume EBs seem to be at least moderately tied to social activities and the behaviors of others in their social networks. Social pressure to consume EBs for health reasons or to mitigate/enhance unhealthy behaviors (e.g., drinking alcohol) were most prominent.

Items associated with health and appearance from our principal components analysis reflected student beliefs that EB consumption may facilitate management of these goals. In particular, EB consumption was felt to be associated with weight loss, promoting health, and good nutrition. Given that health and appearance items loaded on the same component, it may be that students do not differentiate these two concepts very clearly. Good health, for many of these students, appears strongly related to weight management and physical appearance. It appears that students holding these beliefs may be aware that certain product ingredients (e.g., caffeine, guarana) or zero-calorie versions may stimulate metabolism and promote weight loss. Furthermore, they may connote vitamins and herbal ingredients commonly found in EBs with good health and nutrition, thereby enhancing health and appearance. It also appears that students holding these beliefs are more likely to think of EBs in the same category as sports drinks, and that they might enhance athletic ability. The items associated with fatigue management reflected beliefs that EBs perk one up when tired, and improve mental alertness. Unlike the first component, these beliefs reflect awareness that EBs may not actually be healthy, even though they address an immediate physiological need such as fatigue. In a study of Turkish college students (Attila & Cakir, 2011), about 20% thought of EBs as “unhealthy,” whereas our sample reported more than

twice this rate when asked if EBs were safe. Finally, recreation and alcohol (Component 3) included items related to recreational use of EBs, particularly in the context of alcohol consumption. Some students seem to view EBs as either a way to augment the intoxicating effects of alcohol or somehow mitigate the effects of alcohol. Beliefs associated with this component included items that link EBs to social activities, supporting findings from Malinauskas et al. (2007). Attitudes, subjective norms, perceived control, and intent were all significantly predicted by EB beliefs. In particular, almost half of the variance associated with attitudes and intent was associated with underlying beliefs regarding EBs. Attitudes toward EBs were most strongly predicted by health-related beliefs. Normative pressure to consume EBs was best explained by variation in health and recreation-related beliefs. Perceived behavioral control was best explained by fatigue- and recreation-related beliefs. Overall intent was best explained by health- and fatigue-related beliefs. Although true multicollinearity is rare, the multiple collinear relationships among the variables may confound the analyses conducted in this study.

Men, more so than women, appear to hold more positive views of EBs across almost all variables, suggesting they may be at more risk relative to EB consumption than women. Study findings by Malinauskas and colleagues (2007) indicated that college students (both sexes) use energy drinks in a similar fashion. However, males accounted for more energy drink-related visits to emergency departments than females, between 2007 and 2011, suggesting that males may take more risks with mixing EBs with alcohol and/or prescription medications or illicit substances, such as marijuana (SAMHSA, 2013).

Limitations of our study include use of a convenience sample and self-reported data, making it difficult to gauge over- and under-reporting of information. Findings are not completely representative of all college students, as data only reflect behaviors of those attending one university. Consumption practices may vary in different populations, including those not attending college. The planned behavior questions focused on “daily use” of EBs, which may have excluded some responses.

College students are heavy consumers of EBs, yet little is known about what influences consumption. This is the first study, to our knowledge, to specifically attempt to identify underlying categories of beliefs that could help explain unsafe consumption practices. As such, it has meaningful implications for the design of theory-driven health campaigns and interventions targeted to reduce problematic EB consumption—particularly when mixed with alcoholic beverages. Students who view EBs as a way to mitigate the intoxicating effects of alcohol may be prone to over-consumption. This may also be the case for students who see EBs as potentially augmenting the

“buzz” associated with alcohol consumption. Future research should further focus on how student beliefs about EBs are formed. For instance, does student exposure to EB marketing material foster problematic student beliefs about health benefits of EBs, or increase perceptions that EBs augment social activities and enjoyment? Many students in this sample found product labels difficult to understand, highlighting potential policy implications.

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### References

- Arria, A. M., Caldeira, K. M., Kasperski, S. J., O’Grady, K. E., Vincent, K. B., Griffiths, R. R., & Wish, E. D. (2010). Increased alcohol consumption, nonmedical prescription drug use, and illicit drug use are associated with energy drink consumption among college students. *Journal of Addiction Medicine, 4*, 74-80. doi:10.1097/ADM.0b013e3181aa8dd4
- Arria, A. M., & O’Brien, M. C. (2011). The “high” risk of energy drinks. *Journal of the American Medical Association, 305*, 600-601. doi:10.1001/jama.2011.109
- Attila, S., & Cakir, B. (2011). Energy drink consumption in college students and associated factors. *Nutrition, 27*, 316-322. doi:10.1016/j.nut.2010.02.008
- Berger, L., Fendrich, M., & Fuhrmann, D. (2013). Alcohol mixed with energy drinks: Are there associated negative consequences beyond hazardous drinking in college students? *Addictive Behaviors, 38*, 2428-2432. doi:10.1016/j.add-beh.2013.04.003
- Centers for Disease Control and Prevention. (2016a). *Attention deficit/hyperactivity disorder data and statistics*. Retrieved from <http://www.cdc.gov/ncbddd/adhd/data.html>
- Centers for Disease Control and Prevention. (2016b). *FastStats: Asthma*. Retrieved from <http://www.cdc.gov/nchs/fastats/asthma.htm>
- Consumer Lab. (2015). *Product review: B vitamin supplements and energy drinks (including B complexes, niacin, B6, B12, biotin, thiamin, and folic acid)*. Available from <http://www.consumerlab.com>
- Cooke, R., Dahdah, M., Norman, P., & French, D. P. (2014). How well does the theory of planned behavior predict alcohol consumption? A systematic review and meta-analysis. *Health Psychology Review, 10*, 148-167. doi:10.1080/17437199.2014.947547

- Downs, D. S., & Hausenblas, H. A. (2005). The theories of reasoned action and planned behavior applied to exercise: A meta-analytic update. *Journal of Physical Activity & Health, 2*, 76-97. doi:10.1123/jpah.2.1.76
- Fishbein, M., & Ajzen, I. (2015). *Predicting and changing behavior: The reasoned action approach*. New York, NY: Taylor & Francis.
- Institute of Medicine. (2014). *Caffeine in food and dietary supplements: Examining safety: Workshop summary*. Washington, DC: National Academies Press. Retrieved from <http://iom.nationalacademies.org/Reports/2014/Caffeine-in-Food-and-Dietary-Supplements-Examining-Safety.aspx>
- Jackson, D. A., Cotter, B. V., Merchant, R. C., Babu, K. M., Baird, J. R., Nirenberg, T., & Linakis, J. G. (2013). Behavioral and physiologic adverse effects in adolescent and young adult emergency department patients reporting use of energy drinks and caffeine. *Clinical Toxicology, 51*, 557-565. doi:10.3109/15563650.2013.820311
- Malinauskas, B. M., Aeby, V. G., Overton, R. F., Carpenter-Aeby, T., & Barber-Heidel, K. (2007). A survey of energy drink consumption patterns among college students. *Nutrition Journal, 6*, Article 35. doi:10.1186/1475-2891-6-35
- McCormick, D. (2010). Vitamin/mineral supplements: Of questionable benefit for the general population. *Nutrition Reviews, 68*, 207-213. doi:10.1111/j.1753-4887.2010.00279.x
- Miller, K. E. (2008). Wired: Energy drinks, jock identity, masculine norms, and risk-taking. *Journal of American College Health, 56*, 481-489. doi:10.3200/JACH.56.5.481-490
- Natural Products Insider. (2013, February 4). *Energy drink sales will skyrocket to \$21 billion by 2017*. Retrieved from <http://www.naturalproductsinsider.com/news/2013/02/energy-drink-sales-will-skyrocket-to-21-billion-b.aspx>
- Peacock, A., Bruno, R., Martin, F. H., & Carr, A. (2013). The impact of alcohol and energy drink consumption on intoxication and risk taking behavior. *Alcoholism: Clinical & Experimental Research, 37*, 1234-1242. doi:10.1111/acer.12086
- Pettit, M. L., & DeBarr, K. A. (2011). Perceived stress, energy drink consumption, and academic performance among college students. *Journal of American College Health, 59*, 335-341. doi:10.1080/07448481.2010.510163
- Piotrowski, C. (2014). Energy drinks: Topical domain in the emerging literature and neglected areas of research. *College Student Journal, 48*, 375-377. doi:10.1007/s10900-013-9653-5
- Seifert, S. M., Schaechter, J. L., Hershoin, E. R., & Lipshultz, S. E. (2011). Health effects of energy drinks on children, adolescents, and young adults. *Pediatrics, 127*, 511-528. doi:10.1542/peds.2009-3592
- Sepkowitz, K. A. (2013). Energy drinks and caffeine related adverse effects. *Journal of the American Medical Association, 309*, 243-244. doi:10.1001/jama.2012.173526
- Simon, M. R., & Mosher, J. F. (2007). *Alcohol, energy drinks, and youth: A dangerous mix*. San Rafael, CA: Marin Institute.

- Sorkin, B. C., & Coates, P. M. (2014). Caffeine-containing energy drinks: Beginning to address the gaps in what we know. *Advanced Nutrition, 5*, 541-543. doi:10.3945/an.114.006411
- Substance Abuse and Mental Health Services Administration. (2013). *The DAWN Report: Update on emergency department visits involving energy drinks: A continuing public health concern*. Rockville, MD: Author.
- Thorlton, J., Colby, D., & Devine, P. (2014). What action should the U.S. Food & Drug Administration take to minimize adverse effects associated with energy drink consumption? *American Journal of Public Health, 104*, 1175-1180. doi:10.2105/AJPH.2014.301967
- U.S. Food and Drug Administration. (2010). *Serious concerns over alcoholic beverages with added caffeine*. Retrieved from <http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm233987.htm>
- U.S. Food and Drug Administration. (2013). *Avoid food-drug interactions: A guide from the National Consumers League and the US Food & Drug Administration* (Publication no. FDA CDER 10-1933). Washington, DC: Author. Available from [www.fda.gov/drugs](http://www.fda.gov/drugs)