Perceived Stress, Energy Drink Consumption, and Academic Performance Among College Students

Michele L. Pettit, MPH, PhD, CHES; Kathy A. DeBarr, MS, PhD

Abstract. Objective: This study explored relationships regarding perceived stress, energy drink consumption, and academic performance among college students. Participants: Participants included 136 undergraduates attending a large southern plains university. Methods: Participants completed surveys including items from the Perceived Stress Scale1 and items to describe energy drink consumption, academic performance, and demographics. Results: Positive correlations existed between participants’ perceived stress and energy drink consumption. Participants’ energy drink consumption and academic performance were negatively correlated. Freshmen ($M = 0.330$) and sophomores ($M = 0.408$) consumed a lower number of energy drinks yesterday than juniors ($M = 1.000$). Males reported higher means than females for selected energy drink consumption items. Statistically significant interactions existed between gender and year in school for selected energy drink consumption items. Conclusions: Results confirm gender differences in energy drink consumption and illuminate a need for education regarding use of energy drinks in response to perceived stress.

Keywords: health education, mental health, other drugs

American college students face a host of stressors that precipitate a variety of health risk behaviors. According to the American College Health Association’s National College Health Assessment,2 stress, sleep disturbances, anxiety, and depression are among the top 5 threats to academic performance among college students. Energy drink consumption represents an evolving health risk behavior among college students. The recent surge in energy drink consumption among American students has alarmed public health professionals.3 The ingredients and lack of regulation for energy drinks especially are worrisome for public health professionals.4

Researchers have indicated that within the current regulatory void, energy drinks are aggressively marketed, appealing particularly to the niche of young males seeking performance enhancement and other stimulant-related effects.4 Examples of popular energy drinks include Red Bull, Monster, and SoBe. Active ingredients in these drinks include, but are not limited to, carbohydrates, taurine (ie, an amino acid that assists with neurological development and regulation of water and mineral salt concentrations in blood),5 glucuronolactone (ie, a natural product resulting from metabolism of glucose),6 and caffeine.7 The latter ingredient poses concern for public health professionals because long-term consequences of excessive caffeine consumption are unknown. The sequelae of acute caffeine intoxication are better known and are cause for more immediate alarm. For example, a 3-year retrospective study of caffeine conducted by Northwestern University researchers in cooperation with the Illinois Poison Control Center revealed that 12% of 265 caffeine abuse cases aged 10 and older (excluding cases from tea or coffee consumption, over-medication, or suicide attempts) required hospitalization. Moreover, two-thirds of cases requiring hospitalization were admitted to the intensive care unit.8

Caffeine concentrations of leading energy drinks are marked and substantial. For example, McCusker, Goldberger, and Cone9 measured caffeine concentrations of leading energy drinks, carbonated soda, and other beverages. Results from their analysis revealed that selected energy drinks contain almost 3 times more caffeine than the average carbonated soda.

The excessive proportion of caffeine in energy drinks offers benefits, including increased attention, emotional
states,\textsuperscript{10,11} endurance, and physical performance.\textsuperscript{7} However, these benefits pale in comparison to the adverse effects of caffeine-containing energy drinks, including increased blood pressure\textsuperscript{3,12} and elevated blood glucose.\textsuperscript{10} Additional side effects of caffeine-containing energy drinks include potential to foster dehydration and/or dependence.\textsuperscript{4} The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR)\textsuperscript{13} and the International Classification of Diseases (ICD)-10 Classification of Mental and Behavioural Disorders\textsuperscript{14} both recognize caffeine-related psychiatric disorders. The DSM-IV-TR specifically lists caffeine intoxication, caffeine-induced anxiety disorder, caffeine-induced sleep disorder, and caffeine-related disorder not otherwise specified.\textsuperscript{13} Energy drinks contain higher concentrations of caffeine than coffee and thus potential for addiction exists among those who regularly consume them. Caffeine toxicity poses serious threats to one’s health including tachycardia, myocardial infarction, seizure, coma, and renal and musculoskeletal problems.\textsuperscript{15}

In addition to risks inherent in excessive caffeine consumption, energy drinks pose behavioral risks for college students. For example, Miller\textsuperscript{16} examined relationships between energy drink consumption and selected health risk behaviors among college students. Results from her study revealed a statistically significant predictive relationship between energy drink consumption and risky sexual practices. Statistically significant predictive relationships also were found between energy drink consumption and use of alcohol, marijuana, cigarettes, and prescription drugs. These relationships were most pronounced among males and white students.

Table 1: List of Caffeine-Related Disorders

<table>
<thead>
<tr>
<th>Caffeine-Related Disorders</th>
<th>DSM-IV-TR</th>
<th>ICD-10</th>
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<tbody>
<tr>
<td>Caffeine Intoxication</td>
<td>✓</td>
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<tr>
<td>Caffeine-Induced Anxiety</td>
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<td>✓</td>
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<td>Caffeine-Induced Sleep</td>
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<tr>
<td>Caffeine-Related Disorder</td>
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Although researchers have examined cognitive, physiological, and behavioral effects of energy drink consumption, few, if any, studies have investigated predisposing determinants of energy drink consumption. That said, the purpose of this study was to explore relationships regarding perceived stress, energy drink consumption, and academic performance among college students. A secondary purpose of this study was to evaluate differences in perceived stress and energy drink consumption based on gender and year in school.

Research questions for this study were as follows: (a) Does a relationship exist between perceived stress and energy drink consumption among college students? (b) Does a relationship exist between energy drink consumption and academic performance among college students? (c) Does perceived stress differ by gender and year in school? and (d) Does energy drink consumption differ by gender and year in school?

METHODS

Participants

This study was approved by the institutional review boards at a large southern plains university and a midwestern university. The sample for this study consisted of 136 undergraduate students enrolled in courses at a large southern plains university. Nine participants were excluded from data analyses because they did not respond to 5 or more survey items. Similarly, 1 participant was considered an outlier and was excluded from data analyses because her age was reflective of a nontraditional student.

A convenience sampling technique was used to obtain participants for this study. Specifically, students enrolled in courses associated with an extended undergraduate research pool were eligible for involvement in the study. All participating students were at least 18 years of age. Eligible participants were presented with an online recruitment script. Students who consented to participate in the study were directed to a Web link that included an informed consent document indicating that their participation was voluntary and anonymous. All participating students received course credit for involvement in the research as determined by their respective instructors. Instructors who registered their courses for inclusion in the undergraduate research pool were required to offer alternative assignments for students to earn equivalent credit such as research papers, colloquia, and cultural events.

Instrumentation

Data for this study were collected via a survey designed to ascertain information regarding demographics, energy drink consumption, perceived stress, and academic performance. The Perceived Stress Scale,\textsuperscript{1} a 14-item instrument, was used to assess the extent to which events in students’ lives were perceived as stressful. Each item of the Perceived Stress Scale is measured via a 5-point Likert scale (0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, and 4 = very often). Items indicative of positive perceptions of stress (eg, “In the last month, how often have you felt confident about your ability to handle your personal problems?”) were reverse coded. The Perceived Stress Scale culminates in a total score. Predictive and concurrent validity for the Perceived Stress Scale were established through a study conducted by Cohen, Kamarck, and Mermelstein.\textsuperscript{1} Results from their study revealed internal consistency reliability estimates ranging from .84 to .86. Consistent with previously reported reliability measurements for the Perceived Stress Scale, the internal consistency reliability estimate for this study was .84.

Additional survey items were developed by the investigators to assess demographics (age, gender, race, and year in school), energy drink consumption, and academic performance. Academic performance was measured via a self-reporting of cumulative grade point average (GPA). Six survey items were designed to assess participants’ energy drink consumption. Four items were coded as ratio data (eg, “Yesterday, how many energy drinks did you consume?”), whereas 2 items were coded as ordinal data (eg, “During the past 30 days, on average, how many days per week did you consume energy drinks?” 0 = 0 days, 1 = 1 day, 2 = 2 days, and so on). These items did not comprise a scale and thus, reliability statistics were not calculated for them. Missing data were corrected by reporting mean values for survey responses.
**Data Analysis**

Data for this study were analyzed via the Statistical Package for the Social Sciences (SPSS) version 17.0. Frequencies and percentages were used to describe the sample and participants’ energy drink consumption, whereas measures of central tendency and dispersion were used to describe participants’ perceived stress and energy drink consumption. This study represented an exploratory analysis and thus, Pearson correlation coefficients were used to assess relationships regarding perceived stress, energy drink consumption, and academic performance. Two-way analyses of variance (ANOVs) were conducted to evaluate differences in perceived stress based on gender and year in school. Two-way ANOVAs also were conducted to determine potential differences in energy drink consumption based on gender and year in school. Alpha levels were set at .05 for all analyses.

**RESULTS**

Participants included in data analyses ranged from 18 to 24 years of age. Over half (61%, *n* = 78) of the sample consisted of females, and the majority of participants (79%, *n* = 100) were white. Approximately half (52%, *n* = 66) of the sample was ≤ 19 years of age, and 61 (48%) participants were categorized as freshmen.

Almost one-third (*n* = 37, 29.1%) of participants consumed at least 1 energy drink yesterday. More than half (*n* = 75, 59.1%) of participants consumed an energy drink on at least 1 of the past 7 days, and 70.1% (*n* = 89) of participants consumed at least 1 energy drink during the past 30 days. Almost two-thirds (*n* = 63.8%) of participants consumed an energy drink on at least 1 day per week during the past 30 days, and 70.9% (*n* = 90) of participants drank at least 1 energy drink on days when energy drinks were consumed during the past 30 days. Over three-fourths (*n* = 78, 61.4%) of participants consumed a maximum of 1 to 3 energy drinks and 11 (8.7%) participants consumed a maximum of 4 to 6 energy drinks on any occasion during the past 30 days. Descriptive statistics are presented in Table 1.

Pearson correlation coefficients indicated statistically significant positive relationships between participants’ perceived stress and days on which at least 1 energy drink was consumed during the past 30 days (*r* = .241, *p* < .01), average days per week on which energy drinks were consumed during the past 30 days (*r* = .181, *p* < .05), and largest number of energy drinks consumed on any occasion during the past 30 days (*r* = .235, *p* < .01). A statistically significant inverse relationship also was found between participants’ academic performance and largest number of energy drinks consumed on any occasion during the past 30 days (*r* = −.202, *p* < .05). Results from Pearson correlation coefficients are provided in Table 2.

Two-way ANOVAs were conducted to evaluate effects of gender and year in school on perceived stress, number of energy drinks consumed yesterday, days on which an energy drink was consumed during the past 7 days, days on which at least 1 energy drink was consumed during the past 30 days, average days per week on which energy drinks were consumed during the past 30 days, approximate number of energy drinks consumed on days when energy drinks were consumed during the past 30 days, and largest number of energy drinks consumed on any occasion during the past 30 days. Means and standard deviations for the aforementioned variables in relation to gender and year in school are presented in Table 3.

Main effects for gender and year in school were not statistically significant for perceived stress, *F*(1, 118) = 0.305, *p* = .582, partial *η*² = 0.003, and *F*(3, 118) = 0.750, *p* = .524, partial *η*² = 0.019, respectively. The interaction effect between gender and year in school also was not statistically significant for perceived stress, *F*(3, 118) = 1.004, *p* = .394, partial *η*² = 0.025.

In relation to number of energy drinks consumed yesterday, significant main effects emerged for year in school, *F*(3,
During the past 30 days, on how many of the past 7 days did you consume an energy drink?  

*PS = perceived stress; GPA = academic performance; ED1 = number of energy drinks consumed yesterday; ED2 = days on which energy drinks were consumed during the past 7 days; ED3 = days on which at least 1 energy drink was consumed during the past 30 days; ED4 = average days per week on which energy drinks were consumed during the past 30 days; ED5 = approximate number of energy drinks consumed on days when energy drinks were consumed during the past 30 days; and ED6 = largest number of energy drinks consumed on any occasion.

PS GPA ED1 ED2 ED3 ED4 ED5 ED6  
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1.000 −0.156 0.124 0.122 0.241** 0.181* 0.104 0.235**  
−0.144 −0.076 −0.127 −0.060 −0.074 −0.202*  
0.783** 0.717** 0.668** 0.195* 0.636**  
0.907** 0.876** 0.244** 0.726**  
0.845** 0.250** 0.741**  
0.298** 0.715**  
0.415**  
1.000  

* *p < .05.  
** *p < .01.

TABLE 2. Pearson Correlation Coefficients Depicting Relationships Regarding Perceived Stress, Energy Drink Consumption, and Academic Performance

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<td>0.907**</td>
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<td>0.845**</td>
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<td>ED6</td>
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TABLE 3. Means and Standard Deviations for Perceived Stress and Energy Drink Consumption Items

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*PS = perceived stress; GPA = academic performance; ED1 = number of energy drinks consumed yesterday; ED2 = days on which energy drinks were consumed during the past 7 days; ED3 = days on which at least 1 energy drink was consumed during the past 30 days; ED4 = average days per week on which energy drinks were consumed during the past 30 days; ED5 = approximate number of energy drinks consumed on days when energy drinks were consumed during the past 30 days; and ED6 = largest number of energy drinks consumed on any occasion.

* *p < .05.  
** *p < .01.
ing the past 30 days, $F(3, 118) = 3.015$, $p = .033$, partial $\eta^2 = .071$.

The main effect for gender was statistically significant with males reporting a higher mean for largest number of energy drinks consumed on any occasion during the past 30 days, $F(1, 118) = 11.130$, $p = .001$, partial $\eta^2 = .086$. However, the main effect for year in school was not statistically significant, $F(3, 118) = 1.438$, $p = .235$, partial $\eta^2 = .035$. The interaction between gender and year in school was statistically significant for largest number of energy drinks consumed on any occasion during the past 30 days, $F(3, 118) = 3.416$, $p = .020$, partial $\eta^2 = .080$. Means and standard deviations for 2-way ANOVAs are presented in Table 3.

**COMMENT**

**Conclusions**

Consistent with the investigators’ hypotheses, relationships existed between perceived stress and selected energy drink consumption items. Specifically, participants who indicated higher levels of perceived stress reported more days on which at least 1 energy drink was consumed during the past 30 days. Participants with higher levels of perceived stress also revealed higher averages for days per week during the past 30 days on which energy drinks were consumed. Lastly, participants characterized by higher levels of perceived stress reported larger numbers of energy drinks consumed on any occasion during the past 30 days.

As evidenced by the aforementioned results, perceived stress may be a plausible determinant of energy drink consumption among college students. The association between perceived stress and energy drink consumption is commensurate with previous research linking stress to substance use. For example, researchers have substantiated the role of stress in contributing to use of tobacco, alcohol, and drugs. Like tobacco, alcohol, and drugs, energy drinks may be a preferred coping source for many college students.

The relationship between participants’ academic performance and largest number of energy drinks consumed on any occasion during the past 30 days was intriguing. Interestingly, the relationship was negative, thus suggesting an energy drink consumption on any occasion decreases, academic performance increases. Perhaps the relationship was indicative of students’ propensity to procrastinate and consume more energy drinks when preparing for stressful events such as examinations or deadlines for major projects. Researchers have indicated that students perform optimally when they approach academics via “distributed” versus “mass” practice and when they engage in healthy habits (eg, maintaining exercise, adequate nutrition, sufficient sleep, etc). Caffeine obviously interferes with the latter health habit.

In essence, students’ gravitation toward energy drinks is comparable to the reliance on coffee embraced by previous generations of college students. Because energy drinks are more potent and contain higher levels of stimulants, a couple of impending questions warrant discourse and forthcoming investigation. First, what factors distinguish contemporary
college students from previous generations of college students? Second, are today's college students afflicted with more stress and/or different sources of stress than previous generations of college students? Contemporary college students arguably have access to a wider variety of substances for coping with stress.

The significant interactions between gender and year in school for (a) approximate number of energy drinks consumed on days when energy drinks were consumed during the past 30 days and (b) largest number of energy drinks consumed on any occasion during the past 30 days suggest that various combinations of gender and year in school bring about unique levels of energy drink consumption among college students. For example, male sophomores, juniors, and seniors reported a higher mean number of energy drinks consumed on days when energy drinks were consumed during the past 30 days than females within their respective years in school. However, female freshmen reportedly consumed a higher number of energy drinks on days when energy drinks were consumed during the past 30 days. Similarly, male juniors reported a higher mean for largest number of energy drinks consumed on any occasion during the past 30 days than male seniors. However, female juniors reported a lower mean for largest number of energy drinks consumed on any occasion during the past 30 days than female seniors.

Interestingly, upperclassmen, namely juniors, reported greater consumption of energy drinks than their younger cohorts. A plausible explanation for greater energy drink consumption among upperclassmen may be that as students become increasingly involved in their major courses, they are more susceptible to stress and unhealthy coping methods.

In relation to gender, males reportedly consumed energy drinks more often and in greater quantities than females. This finding confirms research conducted by Miller that linked greater energy drink consumption among college males to adherence to "jock identity, conformity to masculine norms, and risk-taking behavior."

Reasons for gender disparities in energy drink consumption should be further explored through forthcoming research. A potential avenue for research involves the prevalence of alcoholic energy drink consumption among males and females. Researchers have documented higher frequencies of alcohol use, binge-drinking, and related behaviors among male college students. As such, there is a distinct possibility that males are more prone to alcoholic energy drink consumption. The combined effects of alcohol and energy drinks are particularly alarming for individuals prone to addiction and other risky behaviors.

Limitations

This study was characterized by several limitations including those inherent in survey research and self-reported instruments (eg, social desirability and recall bias). One limitation of this study involved selected statistical procedures. This study represented an exploratory analysis and thus, statistical inferences were limited. Moreover, selected statistically significant relationships were modest. Future research is needed to further explore the nature of relationships among perceived stress, energy drink consumption, and academic performance among college students. For example, is perceived stress predictive of energy drink consumption among college students? And/or, is energy drink consumption predictive of perceived stress among college students?

Additional limitations of this study resulted from the sample of convenience. As a result of the selected sampling method, a disproportionate number of participants were female, white, and freshmen. Future studies should address prevalence and determinants of energy drink consumption among culturally diverse samples. Moreover, future studies should examine the extent to which energy drink consumption exists among other target groups such as youth and adolescents. There is a distinct possibility that energy drink consumption primarily is a growing phenomenon among the millennial generation.

Results from this research represent an impetus for future research regarding perceived stress, energy drink consumption, and academic performance among college students. Future research is needed to explore additional factors that potentially contribute to energy drink consumption among college students. Future research also is needed to assist health educators with developing programs, interventions, and strategies to address energy drink consumption among college students.

This study illuminates the emergence of an important public health trend. Health educators historically have utilized the Diffusion of Innovations Model to understand and describe the manner in which health-related trends manifest and spread within a population. That said, health educators should apply theories and models to investigate use of energy drinks among college students. For example, it might behoove future investigators to examine predisposing, reinforcing, and enabling factors from the PRECEDE-PROCEED Model to glean additional perspective regarding energy drink consumption among college students and determine forthcoming prevention and educational strategies.

In relation to predisposing factors, an investigation of college students’ perceived risks associated with energy drink consumption is warranted. There is a distinct possibility that students are unaware of adverse health effects posed by energy drinks. Although many students who matriculate into college are aware of health risks associated with tobacco, alcohol, and drug use, there may be a need to educate them about accompanying dangers of energy drinks.

Results from this study suggest that perceived stress may serve as a predisposing factor for energy drink consumption among college students. As such, health educators should strive to encourage college students to recognize and respond to perceived stress in ways that are health enhancing.

NOTE

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REFERENCES
