SA1-274: Energy Drinks on College Campuses: Motivations, Risky Behaviors, and Health Concerns

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Objectives:
1. Describe demographics of energy drink consumption in college students.

2. Discuss motivations for energy drink consumption.

3. Describe the relationship between energy drink consumption and risk-taking behaviors.

4. Identify health concerns associated with energy drinks.

Disclosers:
We are grateful to the University of St. Thomas Young Scholars program for funding and the to ACHA for a student travel award (CK). We have no conflict of interests to report.
About us

University of St. Thomas
• Catholic, urban private liberal arts university
• 10,316 total enrollment: 6k undergrad, 4k graduate
• Division III Athletics

The start of this project:
A Research Paper in PSYC 207: Alcohol, Other Drugs, & Behavior

Outline

1. Brief History of Caffeine & Herbal Stimulant Use
2. Energy Drink History & Regulations
3. Pharmaceutical Information
4. Marketing & Motivations
5. Risk Taking Behaviors
6. Health Concerns & User Demographics
7. Campus Recommendations
1. HERBAL STIMULANT HISTORY

Legend: Bodhidharma brought stimulant tea & intense combat training to the Shaolin monastery.
History of Caffeinated Tea

3000 B.C. - Tea discovered in China or introduced from India
350 B.C. - First written description of Tea drinking in China.
450 A.D. - Turkish traders bargain for Tea and the Silk road is born.
1610 - Dutch bring Tea to Europe
1773 - Boston Tea party, rebellion against England’s tea tax
1776 - England sends first Opium to China to help pay for tea.
1835 - First experimental tea plantations in Assam, India.

History of Coffee
~850 - Coffee beans discovered - Ethiopia
~1100 - First coffee trees and roasting of coffee beans.
1475 - Constantinople – the world’s first coffee house.
1600s - Coffee enters Europe and moves quickly to the Americas
1700s - Coffee house open throughout Europe.
1723 - First coffee plants are introduced into the Americas.
1822 - First espresso machine is created in France.
1938 - First instant coffee invented by the Nestlé company.

“The Pleasures and Pains of Coffee”
Honore de Balzac

Coffee roasts your insides. Many people claim coffee inspires them, but, as everybody knows, coffee only makes boring people even more boring. Think about it: although more grocery stores in Paris are staying open until midnight, few writers are actually becoming more spiritual.

1830's translated from French by Robert Onopa.
Coffee sets the blood in motion and stimulates the muscles; it accelerates the digestive processes, chases away sleep, and gives us the capacity to engage a little longer in the exercise of our intellects. Coffee affects the diaphragm and the plexus of the stomach, from which it reaches the brain by barely perceptible radiations that escape complete analysis; that aside, we may surmise that our primary nervous flux conducts an electricity emitted by coffee when we drink it.

Coffee's power changes over time. For a while - for a week or two at most - you can obtain the right amount of stimulation with one, then two cups of coffee brewed from beans that have been crushed with gradually increasing force and infused with hot water. For another week, by decreasing the amount of water used, by pulverizing the coffee even more finely, and by infusing the grounds with cold water, you can continue to obtain the same cerebral power....

Finally, I have discovered a horrible, rather brutal method that I recommend only to men of excessive vigor, men with thick black hair and skin covered with liver spots, men with big square hands and legs shaped like bowling pins. It is a question of using finely pulverized, dense coffee, cold and anhydrous, consumed on an empty stomach. This coffee falls into your stomach, a sack whose velvety interior is lined with tapestries of suckers and papillae.

The coffee finds nothing else in the sack, and so it attacks these delicate and voluptuous linings; it acts like a food and demands digestive juices; it wrings and twists the stomach for these juices, appealing as a pythoness appeals to her god; it brutalizes these beautiful stomach linings as a wagon master abuses ponies; the plexus becomes inflamed; sparks shoot all the way up to the brain.

From that moment on, everything becomes agitated. Ideas quick-march into motion like battalions of a grand army to its legendary fighting ground, and the battle rages. Memories charge in, bright flags on high; the cavalry of metaphor deploys with a magnificent gallop; the artillery of logic rushes up with clattering wagons and cartridges; on imagination's orders, sharpshooters sight and fire; forms and shapes and characters rear up; the paper is spread with ink - for the nightly labor begins and ends with torrents of this black water, as a battle opens and concludes with black powder. I recommended this way of drinking coffee to a friend of mine, who absolutely wanted to finish a job promised for the next day: he thought he'd been poisoned and took to his bed, which he guarded like a married man. He was tall, blond, slender and had thinning hair; he apparently had a stomach of papier-mâché...

When you have reached the point of consuming this kind of coffee, then become exhausted and decide that you really must have more, even though you make it of the finest ingredients and take it perfectly fresh, you will fall into horrible sweats, suffer feebleness of the nerves, and undergo episodes of severe drowsiness.
### Worldwide coffee consumption

#### World coffee consumption per capita

<table>
<thead>
<tr>
<th>Country</th>
<th>Annual coffee consumption - kilograms per capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>11.9</td>
</tr>
<tr>
<td>Germany</td>
<td>8.6</td>
</tr>
<tr>
<td>Italy</td>
<td>5.8</td>
</tr>
<tr>
<td>Brazil</td>
<td>5.7</td>
</tr>
<tr>
<td>U.S.</td>
<td>4.1</td>
</tr>
<tr>
<td>Japan</td>
<td>3.4</td>
</tr>
<tr>
<td>China</td>
<td>0.1</td>
</tr>
<tr>
<td>India</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Source: International Coffee Organization, Reuters data

### History of Amphetamines
• In China, the ma huang plant (*Ephedra vulgaris*) used for centuries to treat asthma.

• Amphetamine was first synthesized by German chemist Edeleano in 1887.

• 1930's amphetamines were first marketed as 'benzedrine' in an OTC inhaler

• 1939: prescribed for the treatment of narcolepsy

• 1971: prescriptions became required

1947 Jazz Song
Harry “The Hipster” Gibson

Who put the Benzedrine in Mrs. Murphy's Ovaltine?
Sure was a shame, don't know who's to blame
Cause the old lady didn't even get his name

Where did she get that stuff
Now she just can't get enough
It might have been the man who wasn't there
Now Jack, that guy's a square

She stays up nights making all the rounds
They say she lost about 69 pounds
Now Mr. Murphy claims she's getting awful thin
And all she says is, "Give me some skin."
200 million Pervitin pills were given to Nazi troops between 1939-45. Hitler took daily methamphetamine injections from 1942 on.

History of Coca & Cocaine
• Used since 800 A.D. & cultivated by the Inca

• 1860s - Isolated from coca leaf by Albert Nieman

• 1886 - Coca Cola a non-alcoholic medicinal tonic from Atlanta Georgia

• 1890s – Cocaine containing medicine

• 1922 – Narcotic Drug Import and Export Act restricted coca imports

Erythroxylon coca, cocaine content of the leaves ranges from 0.1% to 0.9%

Endorsed by the leading physicians of the day

1880s - Sigmund Freud’s Uber Coca

"Woe to you, my Princess, when I come, I will kiss you quite red and feed you till you are plump. And if you are forward you shall see who is the stronger, a gentle little girl who doesn't eat enough or a big wild man who has cocaine in his body...." - Sigmund Freud, in a letter to his fiancee, Martha Bernays (June 2, 1884)

"Among the persons to whom I have given coca, three reported violent sexual excitement which they unhesitatingly attributed to the coca."
Humans have a long history of cultivating plants & extracting active ingredients with the goal to “chase away sleep.”

Until the late 1800’s, these were mostly fairly innocuous.

On the bright side, at least today’s energy drinks don’t contain cocaine and amphetamine.
Progressive Case Study- Brittney

What approach would you take with this student?

Brittney’s organic chemistry professor Dr. D walks her to the counseling office for immediate crisis referral. Immediately after an exam, Brittney approached the professor with concerns about her performance. She started crying uncontrollably, breathing rapidly, catastrophizing about the future.

Dr. D. doesn’t have time to play momma or cheer leader.

Background Info

– **Identity**: Sophomore Pre-Med student, 3.4 GPA

– Star on the cross-country team until recently diagnosed pelvic & tibia stress fractures have kept her from running.

– **History**: She says she doesn’t have any background with mental health problems, and used running to relieve anxiety.

– **Currently medications**: oral contraceptives (to regulate menstrual cycle, she wants you to know!) and extra-strength Excedrin Migraine for pain associated with the fractures. She’s very health conscious so she never uses any drugs, and drinks “minimally (~10 / week”)
What was Brittney’s day like yesterday?

- 2:00 AM: Finishes studying for Organic Chemistry exam
- 3:30 AM: Finally able to get to sleep
- 6:30 AM: Woken up by roommate, can’t get back to sleep for 2 hours
- 10:00 AM: Misses first class due to oversleeping.
  - Breakfast: 25 Blue Diamond Almonds, apple, 2 Excedrin
- 11:00 AM: Pool exercise to calm nerves, Vitamin Water
- 12:30 PM: Boost Protein shake
- 1:00 PM: Takes Organic Chemistry exam. Drinks V-8 V-Fusion Energy during exam. Getting headache, so takes 2 more Excedrin
- 1:30 PM: Arrives in professor’s office

Upon further questioning...

- She’s concerned about gaining weight with not exercising
- She’s really not sleeping well

What’s next for Brittney (3 minutes)?
2. Modern Energy Drinks: History & Regulations

FDA Regulations

- FDA regulates dietary supplements under a different set of regulations than those covering "conventional" foods and drug products. Under the Dietary Supplement Health and Education Act of 1994 (DSHEA):
  
  - The **manufacturer** of a dietary supplement or dietary ingredient is responsible for ensuring that the product is safe before it is marketed.
  
  - FDA is responsible for taking action against any unsafe dietary supplement product **after** it reaches the market. [Adverse events](#)
  
  - This year, Durbin plans to Reintroduce the Dietary Supplement Labeling Act,
What’s in a name?  
Supplement vs. Beverage

- Not required to label contents.
- Ingredients are limited to “safe” levels
- Burden of safety proof is on company
- No age limit
- Must report adverse events to the FDA.

- Required to label contents.
- Caffeine is limited limit 71 mg/ per 12 fl ozs for a soda.
- Can use food stamps to purchase
- Burden of safety proof is on FDA
- Company doesn’t need to report adverse events.

Completing the Stimulant-Sedation Marketing Loop....

Nutritional Sleep “Shots” & “Brownies”
What happens when you send a “stressed and tired” student undercover to a nutritional supplement store?

THE Vitamin Shoppe
SINCE 1977
So, what do energy drinks & supplements actually do?

PHARMACEUTICAL INFORMATION
A Great Review

Health Effects of Energy Drinks on Children, Adolescents, and Young Adults.

Seifert SM, Judith L. Schaechter, Eugene R. Hershorin and Steven E. Lipshultz.

_Pediatrics_ 2011;127;511;

METHYLXANTININES

- Caffeine: Coffee, Tea, Cocoa, Yerba Matte
- Theophylline: Tea and cocoa
- Theobromine: Cocoa and guarana

**Mechanism of Action:** Block Adenosine 2A Receptor
Caffeine Range of typical drinks

<table>
<thead>
<tr>
<th>Item</th>
<th>Typical (mg)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee (8 oz)</td>
<td>100</td>
<td>60 – 180</td>
</tr>
<tr>
<td>Tea (8 oz)</td>
<td>40</td>
<td>20 – 90</td>
</tr>
<tr>
<td>Some soft drinks (8 oz)</td>
<td>24</td>
<td>20 – 40</td>
</tr>
<tr>
<td>Cocoa beverage (8 oz)</td>
<td>6</td>
<td>3 – 32</td>
</tr>
<tr>
<td>Milk chocolate (1 oz)</td>
<td>6</td>
<td>1 – 15</td>
</tr>
<tr>
<td>Energy Drink (8 oz)</td>
<td>200</td>
<td>???</td>
</tr>
<tr>
<td>Energy Shot (2 oz)</td>
<td>200</td>
<td>???</td>
</tr>
</tbody>
</table>

**Desired & Adverse Effects**

**Desirable effects Low Doses** 50-250mg, CNS stimulant, increased alertness, concentration, energy, bronchial dilator

**Mild Toxicity- High Doses** 250-600mg, restlessness, jitters, anxiety, insomnia, elevated heart rate, tremor, headache, palpitations, GI distress

**Toxicity at Very High Doses** > 700 mg, Tachycardia and arrhythmia; overt excitement, delirium, clonic seizures, palpitations, upset, vomiting, abdominal pain, rigidity, hypokalemia, paralysis, hallucinations, increased intracranial pressure, cerebral edema, seizures, rhabdomyolysis, supraventricular and ventricular tachyarrhythmias
Caffeine Pharmacokinetics

- Readily absorbed through intestines, 30 minutes peak

- Half-life varies according to individual
  - Average adult – 3-5 hrs
  - Child less that 6 months – 24 hrs
  - Oral Contraceptive Users / Pregnant – 7-8 hrs
  - Smoker – 2-3 hrs

- Distributes into all body compartments; passes easily into brain, breast milk and crosses placenta

- Metabolized in the liver; changed to di- and mono-methylxanthines

- Excreted in the urine

 Guarana

- **Origin:** A South American plant that contains large amounts of caffeine, theobromine, and theophylline and tannins

- **Marketing:** Stimulant, mainly through the effects of caffeine, and weight loss

- **Safety:** Generally considered safe by the FDA Center for Food Safety and Applied Nutrition
Taurine

- **Information:** An abundant CNS acid; involved in neural growth and protection, cell metabolism; estimated daily intake is 400 mg/d

- **Uses:** to treat symptoms alcohol withdrawal, congestive heart failure, cystic fibrosis, palpitations, dysrhythmias, hypertension, diabetes, seizure disorders, hepatitis

- **Safety:** Generally considered safe by the FDA. Infant formula has been supplemented with taurine since the 1980s

L-Carnitine

- An amino acid involved in -oxidation of fatty acids

- **Medical Uses:** therapeutic supplement in congenital and acquired-deficiency states

- **Marketing:** promote fat metabolism and increase endurance

- **Health Concerns:** In high doses, can cause nausea, vomiting, abdominal pain, and diarrhea; has been reported to cause seizures in patients with no known disease and to increase seizure frequency in patients with seizure disorder
Ginseng

- An East Asian herb made from the plant roots
- **Believed** to improve memory, increase stamina, and stimulate immune function, improve physical performance
- **Medical concerns toxicity**: include diarrhea, vaginal bleeding, headache, vertigo, mania, hypertension, rashes, insomnia, irritability, Stevens-Johnson syndrome, and agranulocytosis

Yohimbine

- An alkaloid found in the plants *Pausinystalia yohimbe* and *Rauwolfia serpentina*
- **History**: An herbal supplement believed to be an aphrodisiac and to relieve chest pain, diabetic complications, depression, and erectile dysfunction
- **Marketing**: Increase energy, metabolism, and stamina; promotes well-being
- **Side Effects**: Can cause hypertension at usual doses and hypotension at high
So, what is the ethical response of health professions toward regulation of energy drinks & supplements?

“Energy drink regs will offer no relief to exhausted Generation Y” says Fox News Commentator

Today’s youth manage the brutal hours, rejection and emotional ups and downs in many ways, including an increasing reliance on energy drinks. They fuel up on supercharged beverages like Monster, Red Bull and Rockstar to get them through the long days and longer nights. Generation Y is a huge reason why energy drink global sales rose to a stunning $37 billion in 2011.

It’s a win-win relationship, fueling the economy and the spirits of young America. It may not be the healthiest dietary choice, but it’s a lot smarter than many of the alternatives.

Read more: http://www.foxnews.com/opinion/2012/04/13/energy-drink-regulations-will-offer-no-relief-to-exhausted-generation-y/#ixzz2UXB6LHGc
2011 NBJ Stock Award to Monster

2011 Stock Performance: Hansen Natural Corp. vs. S&P 500

Source: Yahoo! Finance. Indexed company stock prices on the first trading day of the month.
Anais Fournier

• 14 year old
• Minor mitral valve prolapse (10% might have some form)
• Drank 2-24 oz Monsters, 480 mg in 24 hours
• Died of cardiac arrhythmia due to caffeine toxicity

Lawsuits

• In October 2012, Anais’ parents filed a wrongful death lawsuit against Monster Beverage Corp.
• Yesterday, a California court ordered the case into mediation.
• Anais’ parents are frustrated that despite mounting evidence that energy drinks are dangerous and should not be consumed by children or anyone with an underlying heart condition, Monster continues to sell thousands of energy drinks to young people every day," said Kevin Goldberg, the attorney representing the Fournier family.
• The city of San Francisco is suing Monster for marketing to children.
1. The sleepy student

Sleepy, stressed students who never feel there’s enough time in the day. 1 of every 10 purchases at our campus store is an energy drink.
Teachers’ reports of pupils whose learning suffers from sleep deprivation.

In the last week, how many days did you wake up and feel completely rested?

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>Response</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 days</td>
<td>31</td>
<td>19%</td>
</tr>
<tr>
<td>2</td>
<td>1 day</td>
<td>31</td>
<td>19%</td>
</tr>
<tr>
<td>3</td>
<td>2 days</td>
<td>39</td>
<td>24%</td>
</tr>
<tr>
<td>4</td>
<td>3 days</td>
<td>22</td>
<td>14%</td>
</tr>
<tr>
<td>5</td>
<td>4 days</td>
<td>20</td>
<td>12%</td>
</tr>
<tr>
<td>6</td>
<td>5 days</td>
<td>14</td>
<td>9%</td>
</tr>
<tr>
<td>7</td>
<td>6 days</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>8</td>
<td>Everyday</td>
<td>3</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>162</td>
<td>100%</td>
</tr>
</tbody>
</table>
Within the last 12 months, have any of the following been traumatic or very difficult for you to handle?

42% of students report having **sleep difficulties**

2. The “healthy” health conscious student.
3. The college student with too much to do.

4. The risk-taker/athlete.
5. The Party Goer..
Nobody wants to be this guy at the party.
5. The Soldier

- 45% of deployed service members consumed at least one energy drink daily
- 14% drinking > 2/day.
- Significantly more likely to report sleeping ≤4
- More likely to fall asleep during briefings or on guard duty.

Dr. (Col.) Erin Edgar, command surgeon for U.S. Central Command, argues for more energy drink regulation.

Ideally, the loopholes in the law should be closed to limit the amount of caffeine that can be added to any food or supplement, and to ensure that the amount of added caffeine is clearly indicated on the label. If these changes are made, our troops will be able to make informed decisions for themselves about the merit and safety of consuming energy drinks and sports supplements.

In the meantime, the Defense Department should not appear to tacitly endorse ineffective and hazardous performance-enhancers. Until the legal loopholes are closed, stores on military bases should sell only performance-enhancing products that DOD considers safe and effective — these might include caffeinated gum, creatine and some individual amino acids. Our warriors deserve nothing less.
Take-Away

- Energy Drinks are marketed to students’ interests and vulnerabilities.
- They are too tired to stay awake to do all they want to do, party until the night.

Study 1: Method

**Purpose:** To identify students beliefs and motivations about ED use, and whether use correlates with certain behaviors

**Design:** Correlational study, anonymous online-based survey

**Participants:** 162 University of St. Thomas students (M=37, F=123)

**Survey Content:**
- Health and Behavior
- Sleep Habits
- Caffeine Habits
- Demographics
Participant Information
Mostly Reflective of our Demographic

• 15% Ethnic Minority
• 27% freshmen
• 20% sophomore
• 35% junior
• 14% senior

General Health:
7%: Poor
68%: Average
25%: Very good

Self Assessment of Weight:
1%: Very underweight
11% underweight
60% just about right
27% overweight
1% very overweight

Self Assessment of Stress:
0%: much less than average
6%: a little less than average
27%: average stress
53%: more than average
14%: tremendous
1. How often do you drink caffeinated drinks?

<table>
<thead>
<tr>
<th>Past Month Drink Frequency</th>
<th>0</th>
<th>1-2</th>
<th>3-5</th>
<th>6-9</th>
<th>10-15</th>
<th>16-20</th>
<th>21-25</th>
<th>&lt;26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Caffeine</td>
<td>22</td>
<td>31</td>
<td>25</td>
<td>22</td>
<td>26</td>
<td>17</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Coffee</td>
<td>58</td>
<td>17</td>
<td>21</td>
<td>9</td>
<td>21</td>
<td>14</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Tea</td>
<td>87</td>
<td>21</td>
<td>13</td>
<td>15</td>
<td>13</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Energy drink</td>
<td>102</td>
<td>34</td>
<td>9</td>
<td>8</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Espresso shot</td>
<td>110</td>
<td>23</td>
<td>6</td>
<td>7</td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

About 2/3 of the students sampled hadn’t used an energy drink in the last month.

2. In what situations do you drink Energy Drinks?

<table>
<thead>
<tr>
<th>Situation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needing more energy</td>
<td>46%</td>
</tr>
<tr>
<td>Studying for a test</td>
<td>43%</td>
</tr>
<tr>
<td>Not enough sleep</td>
<td>39%</td>
</tr>
<tr>
<td>With alcohol at a party</td>
<td>39%</td>
</tr>
<tr>
<td>For the taste</td>
<td>24%</td>
</tr>
<tr>
<td>For a long drive</td>
<td>22%</td>
</tr>
<tr>
<td>Other</td>
<td>22%</td>
</tr>
<tr>
<td>Sporting event</td>
<td>7%</td>
</tr>
<tr>
<td>Hangover</td>
<td>2%</td>
</tr>
</tbody>
</table>
3. What type of Energy Drinks do you use?

- Red Bull: 39%
- Monster: 13%
- 5-Hour Energy: 12%
- Amp: 9%
- Rockstar: 8%
- Gatorade: 1%
- XS: 1%
- Crystal Light Energy: 1%
- Four Loko: 1%
- Vemma: 1%
- Verve: 1%

4. What factors do you consider when buying energy drinks? (check all that apply):

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>Response</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flavor</td>
<td>89</td>
<td>66%</td>
</tr>
<tr>
<td>2</td>
<td>Calories</td>
<td>47</td>
<td>35%</td>
</tr>
<tr>
<td>3</td>
<td>Caffeine amount</td>
<td>39</td>
<td>29%</td>
</tr>
<tr>
<td>6</td>
<td>Eye-catching label</td>
<td>14</td>
<td>10%</td>
</tr>
<tr>
<td>4</td>
<td>Adequate warning label</td>
<td>6</td>
<td>4%</td>
</tr>
<tr>
<td>5</td>
<td>Other (cost)</td>
<td>35</td>
<td>26%</td>
</tr>
</tbody>
</table>
5. How much caffeine do you think is in each of the following drinks?

<table>
<thead>
<tr>
<th>Beverage</th>
<th>Actual Caffeine</th>
<th>Perceived Caffeine</th>
</tr>
</thead>
<tbody>
<tr>
<td>8oz Green Tea (35 mg)</td>
<td>15</td>
<td>28</td>
</tr>
<tr>
<td>12oz Mountain Dew (48 mg)</td>
<td>18</td>
<td>38</td>
</tr>
<tr>
<td>16oz Latte (150 mg)</td>
<td>18</td>
<td>42</td>
</tr>
<tr>
<td>2oz 5-hour Energy (207 mg)</td>
<td>19</td>
<td>33</td>
</tr>
<tr>
<td>8.4oz Red Bull (80 mg)</td>
<td>15</td>
<td>49</td>
</tr>
</tbody>
</table>

ENERGY DRINKS & RISK-TAKING BEHAVIOR
Previous Research:

• Evidence suggests a *positive correlational relationship* between energy drink consumption and risk taking behavior such as extreme sports, casual sex, and binge drinking.

• Participants were randomly selected leaving a bar. Those who had ED were 3x more likely to be legally drunk, and 4x more likely to drive drunk.


6. How frequently do you mix energy drinks and alcohol?

<table>
<thead>
<tr>
<th>(those who have had ED in last month)</th>
<th>Response</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>13</td>
<td>23%</td>
</tr>
<tr>
<td>Rarely</td>
<td>8</td>
<td>14%</td>
</tr>
<tr>
<td>Once every few months</td>
<td>21</td>
<td>37%</td>
</tr>
<tr>
<td>At least once a month</td>
<td>9</td>
<td>16%</td>
</tr>
<tr>
<td>Most of the Time I drink</td>
<td>6</td>
<td>10%</td>
</tr>
</tbody>
</table>
7. If you drink energy drinks with alcohol, what motivates you to do it?

<table>
<thead>
<tr>
<th>Answer</th>
<th>Response</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taste</td>
<td>51</td>
<td>82%</td>
</tr>
<tr>
<td>Enhanced feelings of intoxication</td>
<td>10</td>
<td>16%</td>
</tr>
<tr>
<td>Diminished feelings of intoxication</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>To stay awake</td>
<td>11</td>
<td>19%</td>
</tr>
</tbody>
</table>

In other words, there’s nothing really in energy drinks to protect you from ingesting more if you’ve had too much.
8. Does drinking an energy drink with alcohol change how the alcohol affects you?

<table>
<thead>
<tr>
<th>Answer</th>
<th>Response</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No I don't notice a difference</td>
<td>38</td>
<td>50%</td>
</tr>
<tr>
<td>Yes, I feel more alert with the energy drink</td>
<td>31</td>
<td>41%</td>
</tr>
<tr>
<td>Yes, I feel less alert with the energy drink</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Yes, I feel more drunk with the energy drink</td>
<td>13</td>
<td>17%</td>
</tr>
<tr>
<td>Yes, I feel less drunk with the energy drink</td>
<td>1</td>
<td>1%</td>
</tr>
</tbody>
</table>

Energy Drink Users More Likely to Drink and Drive

![Chart showing times driven after drinking in the last 30 days]
Energy Drink Users Less Likely to Always Wear a Seatbelt

Energy Drink Users engage in more high risk drinking.

- 82% of high energy drink users did something they regretted in the last month of drinking, versus just 35% of those who didn’t use energy drinks
- 68% of high energy drink users have experienced memory loss during drinking in the last month, versus just 38% of those who didn’t use energy drinks
So, do students who like risk drink energy drinks or do energy drinks make students to risky things?

Study 2:
The Relationship Between Energy Drinks and Risk Taking Behavior in College Students

Experiment performed by Caitlin Kelly, supported by Undergraduate Research
Purpose: Examine whether or not energy drink consumption increases risk taking behavior in college students immediately after consumption.

Background: Energy Drinks and Alcohol

• Participants randomly selected when leaving bar

• Those who consumed alcohol mixed with energy drinks were three times more likely of leaving a bar highly intoxicated (BAC > 0.08) and four times more likely to drive while drunk

**Method**

**Design:** Repeated measures, counter-balanced, double-blind laboratory test of risk taking

**Participants:** 30 University of St. Thomas students (M=9, F=21) who were pre-screened for medical conditions / medications which are sensitive to caffeine toxicity.

**Treatments received:**

- **Placebo**
  (Cranberry Pomegranate fruit juice)

- **Drug**
  Fruit juice with 1.753 mg caffeine/kg dose of 5-hour energy
Timeline

- Signing of consent form
- Weight intake
- Ingestion of drink
- **While waiting for drink to take effect:**
  Covariate Survey Information: The *Barratt Impulsivity questionnaire* and broader survey measuring past experience with energy drinks, sleep habits, and risky behaviors.

- **30 minutes after ingestion:**
  Two validated measures of risk taking behavior: *Iowa Gambling Task, Balloon Analogue Risk Test*

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**Iowa Gambling Task:**

<table>
<thead>
<tr>
<th></th>
<th>Bad Decks</th>
<th>Good Decks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>$100</td>
<td>$50</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>$100</td>
<td>$50</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>$1250</td>
<td>$250</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>$1250</td>
<td>$250</td>
</tr>
</tbody>
</table>

- **Gain/Deck:**
  - **A:** $100
  - **B:** $100
  - **C:** $50
  - **D:** $50

- **Loss/10 cards:**
  - **A:** $1250
  - **B:** $1250
  - **C:** $250
  - **D:** $250

- **Net/10 cards:**
  - **A:** -$250
  - **B:** -$250
  - **C:** $250
  - **D:** $250

- **Rewards/10 cards:**
  - **A:** 5
  - **B:** 1
  - **C:** 5
  - **D:** 1
2) Balloon Analogue Risk Test:

Participants performed no differently after drinking 5hr energy than after a placebo (Balloon test: $t=-0.207$, $p<0.838$; Iowa Gambling Tasking: $t=0.00$, $P=1.000$).
Women showed more risk-taking after taking the drug, whereas male performance was enhanced ($t=2.433$, $p<0.05$)

Possible explanations

• Isolated social setting of the experiment

• Testing measures are not the best predictors of real-life risk-taking behaviors in college students.
ENERGY DRINK HEALTH CONCERNS

Main symptoms of Caffeine overdose

Central
- Irritability
- Anxiety
- Restlessness
- Confusion
- Delirium
- Headache
- Insomnia

Visual
- Seeing flashes

Ears
- Ringing

Skin
- Increased sensitivity to touch or pain

Heart
- Rapid heartbeat
- Irregular rhythm

Respiratory
- Seizures
- Trembling
- Twitching
- Overextension

Gastric
- Abdominal pain
- Nausea
- Vomiting (possibly with blood)

Urine
- Frequent urination

Systemic
- Dehydration
- Fever
Dangerous Energy Drink Ingredient Interactions

- **5-Hydroxy tryptophan**: Should not be combined with monoamine oxidase inhibitors

- **Vinpocetine**: Increases the risk for excessive bleeding and should not be combined with aspirin, clopidogrel, warfarin, pentoxifylline, vitamin E, garlic, and gingko

- **Yohimbine**: Affects cardiac function and should not be combined with tricyclic antidepressants, bupropion, phenothiazines, clonidine, stimulants, decongestants, or other blood pressure-lowering medications

- **Ginseng**: Prolongs bleeding time and should not be combined with warfarin; interacts with phenelzine sulfate in patients being treated for mania; may interfere with estrogens or corticosteroids; may impede digoxin metabolism; reduces blood glucose levels

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**EMERGENCY ROOM VISITS ASSOCIATED WITH ENERGY DRINKS ARE ON THE RISE**

58% of energy drink-related ED visits involved energy drinks only, and not other drug combos.

http://www.samhsa.gov/data/2k13/DAWN126/sr126-energy-drinks-use.htm
10. Have you experienced any of these side effects after consuming an energy drink?

<table>
<thead>
<tr>
<th>Observed Effects</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased anxiety</td>
<td>21%</td>
</tr>
<tr>
<td>Increased heart rate</td>
<td>63%</td>
</tr>
<tr>
<td>Increased dizziness</td>
<td>16%</td>
</tr>
<tr>
<td>Increased alertness</td>
<td>88%</td>
</tr>
<tr>
<td>Enhanced athletic performance</td>
<td>21%</td>
</tr>
</tbody>
</table>

Kelly & Prichard, in preparation

11. What other side effects have you experienced after consuming an energy drink?

- Feeling Jittery
- I need to stand
- Stomach Issues
- Shakes
- Shaky hands
- Irregular heartbeat
- Panic Attack
- Flushed
- Appetite Suppression
- Absent mindedness
- Headaches after discontinued use
- Makes me sleepy
Energy Drinks Among Students Diagnosed with Insomnia

- 50% of students with insomnia used energy drinks 3x/or more in last month, versus 11% baseline

- High energy drink users had later bedtimes, and more sleep onset insomnia.
HEALTH CONCERNS
ADHD

• Stimulant effect of energy drinks can interact with Rx stimulants
• Can have synergistic effects on sleep disturbance
• Jitters from ED can mimic distraction and hyperactivity.

Energy Drinks Among Students Diagnosed with ADHD

Regular Energy Drink users @ UST

<table>
<thead>
<tr>
<th></th>
<th>General Population</th>
<th>ADHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
HEALTH CONCERNS
EATING DISORDERS

• ED can mask the fatigue associated with insufficient calories

• ED can suppress appetite

• ED offer “vitamins and amino acids”

• Caffeine inhibits calcium absorption

• Very popular on pro-ana sights

BONE MINERALIZATION & FEMALE ATHLETE TRIAD
Energy Drinks Among Students Diagnosed with Anorexia

Regular Energy Drink users @UST

<table>
<thead>
<tr>
<th>Percentage</th>
<th>General Population</th>
<th>Anorexia</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HEALTH CONCERNS: ANXIETY/DEPRESSION

- Exaggerate preexisting sleep problems
- Mimic sympathetic nervous system response
- Trigger panic attacks
Energy Drinks Among Students Diagnosed with Depression

Regular Energy Drink users

![Chart showing the percentage of General Population and Depression among Regular Energy Drink users.]

Regular Energy Drink Users @UST

![Chart showing the percentage of General Population and Anxiety among Regular Energy Drink users at UST.]

Anxiety
Panic Disorder

Take-Away

- Populations with preexisting sleep, anxiety, nutrition, and mood problems are much more likely to be frequent energy drink users.

- These students are likely using ED to self-medicate, but don’t really understand behavioral pharmacology.
Suggestions for your Campus

• Don’t sell energy drinks
• If you do, use a “use this/not that” approach
• Use a “Nap— it’s Free!” or a “By the time the energy drink kicks in, you could have had a 20 minute nap” campaign
• Do more programming awareness around risks, “adverse events” and regulations
• Do social norming campaign
• Make sure health professionals are asking extensively about drinks/supplements.
• Other Ideas?

Questions?

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St. Paul, Minnesota