Cardiovascular Effects of Energy Drinks

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Objectives

- Why is This Important?
- Energy Drink Review
- Ingredients in Energy Drinks
- Discuss the Research
- What Can We Do?
How Can this Affect Us?

June 16, 2016
Energy Drink Review

- First energy drink introduced in 1997
- One of the fastest growing beverages worldwide
- Targeted towards adolescents and young adults
- Induce hypertension compared to placebo
  - More prominent in the elderly and those with underlying hypertension
- Adverse events of energy drinks affect the neurological and cardiovascular systems

Some Symptoms Include:
- Arrhythmias
- ST Elevation
- Coronary Vasospasm
- Reversible Postural Tachycardia Syndrome
- Accelerated Hypertension
- Cardiac Arrest
- QT Prolongation
- Myocardial Infarction
- Acute Coronary Thrombosis
- Cardiomyopathy

Effects of energy drinks on the cardiovascular system * Wassef, Kohanseia, Makaryus * 2017 November 26
Cardiovascular responses to energy drinks in a healthy population: the C-energy study * Koziek, Shah, Bhattacharyya, Franklin, Connolly, Chien, Charos, Pelter * 2019 January 5
QT Interval

The time from the beginning of the QRS complex to the end of the T wave.

Correlates with risks of life threatening arrhythmias

As heart rate decreases the QT Interval will increase, and vice versa

Photo Credit: https://egwaves.com/longt-qt-syndrome-interval-lqts-torsades-de-pointes/
Effects of energy drinks on the cardiovascular system * Wassef, Kohanseia, Makaryus * 2017 November 26

Ingestion of Energy Drink

- Increased Heart Rate
- Arrhythmias
- Increased Blood Pressure

Increased cardiovascular demand leading to possible adverse effects
Energy drinks are beverages containing caffeine and other herbal supplements.

What are the Ingredients?

- Each manufacturer has their own proprietary blend
  - Must only list total blend on label, not amount of individual ingredients

Why is it an issue?

- Emergency department visits related to energy drinks
  - ~1000 in 2005 to more than 20K in 2011
FDA Regulations

The Food and Drug Administration (FDA) regulates energy drinks under the Dietary Supplement Health and Education Act of 1994

- Energy Drinks considered dietary supplements so fall under different regulations than other beverages
- Only monitored if it contains a dietary ingredient that is proven to present a significant or unreasonable risk of illness or injury or poses an imminent hazard to public health or safety
  - Drink claims are not regulated so have not been proven
  - Safety is unknown
- If contains naturally occurring caffeine, label does not need to indicate that the food contains caffeine

Effects of energy drinks on the cardiovascular system * Wassef, Kohanseia, Makaryus * 2017 November 26
Caffeine

- Primary ingredient found in energy drinks
- One of the most widely used drugs in the world
- Is a psychoactive drug
  - Ease fatigue, alter performance, and improve endurance
- Stimulant effects seem to vary among individuals, and degree of tolerance likely inherited
- In large doses can cause blood pressure spikes, headaches, nausea, sleeplessness and/or tremors
- Possible cause for heart disease in some people

Effects of energy drinks on the cardiovascular system * Wassef, Kohanseia, Makaryus * 2017 November 26

Image credits Myriam / Pixabay
Taurine

▪ A conditional amino acid that acts as a neurotransmitter
▪ Found in high quantities in the brain, heart, eyes and skeletal muscle
▪ Used to improve mental performance
▪ Thought to have anti-hypertensive and sedative effect
▪ Taurine is likely safe in small doses
  • Little research on effects in humans

Effects of energy drinks on the cardiovascular system * Wassef, Kohanseia, Makaryus * 2017 November 26
Guarana

- A South American plant
  - Seeds 4-5% caffeine content
    - Coffee bean = 1-2%
  - Contains chemicals similar to caffeine
    - Theophylline and theobromine

- Safe dose is unknown
  - Can easily reach high doses with multiple drinks

❖ It should be assumed that the amount of caffeine in energy drinks is larger than the amount of caffeine noted, especially when guarana is present
L-Carnitine

- An amino acid produced by the body to help it produce energy
- Important for heart and brain function, muscle movement, and many other body processes
- Popular in energy drinks
  - Claims to burn more fat
  - Increase endurance during exercise
  - Studies have not proven its effect
- In high doses, side effects include nausea, vomiting, abdominal pain, diarrhea, and seizures
Ginseng

▪ East Asian herb that is one of the most popular supplements in the world
▪ Used in energy drinks to improve memory and increase stamina
  • Minimal research to prove these claims
▪ Excessive amounts of ginseng may cause diarrhea, vaginal bleeding, headache, vertigo, mania, hypertension, rashes, insomnia, irritability
Cardiovascular Effects of Energy Drinks in Familial Long QT Syndrome: A Randomized Cross-over Study

*Belinda Gray  *  Jodie Ingles  *  Caroline Medi  *  Timothy Driscoll  *
* Christopher Semsarian *

International Journal of Cardiology 2016
Purpose

Determine the cardiovascular effects of caffeinated energy drink consumption in patients with familial long QT Syndrome (LQTS)

Cardiovascular Effects of Energy Drinks in Familial Long QT Syndrome: A Randomized Cross-over Study
Gray et al., International Journal of Cardiology, 2016
Design

- 24 diagnosed LQTS patients ranging from 16-50 year old
  - Mean age 29 years
  - Recruited between 2014 and 2016
  - From Genetic Heart Disease Clinic in Sydney Australia
  - 8 proband

- 13 females
- 11 males

Cardiovascular Effects of Energy Drinks in Familial Long QT Syndrome: A Randomized Cross-over Study
Gray et al., International Journal of Cardiology, 2016
Procedure

Participants were caffeine-free for 48 hours

Randomized into energy drink (ED) or control drink (CD)
- ED: 2-500 ml Red Bull Sugar Free cans to equal 160 mg caffeine, 2000mg taurine
- CD 2-500 ml drinks without caffeine or taurine

Administered one drink at 0 and one at 30 minute marks

ECG and blood pressures recorded every 10 minutes

Observed for 90 minutes

Cardiovascular Effects of Energy Drinks in Familial Long QT Syndrome: A Randomized Cross-over Study
Gray et al., International Journal of Cardiology, 2016
Blood Pressure Energy Drink vs Control

Cardiovascular Effects of Energy Drinks in Familial Long QT Syndrome: A Randomized Cross-over Study
Gray et al., International Journal of Cardiology, 2016
ECG at Baseline and 90 Minutes

Fig. 3. Patient 2 ECG at baseline (A) and 90 min (B) after ED showing QTc prolongation of 60 ms.
Conclusions

Caffeinated energy drinks have significant hemodynamic effects in patients with LQTS, specifically in acute increase in blood pressure.
Evaluating the Research

**Strengths**

- Participants are their own controls with 1 week washout period
- QT measurements performed by 2 independent blinded cardiologists
- No drop out

**Limitations**

- Most were symptomatic and receiving beta blocker therapy
- Small sample size

Cardiovascular Effects of Energy Drinks in Familial Long QT Syndrome: A Randomized Cross-over Study
Gray et al., International Journal of Cardiology, 2016
Cardio- and Cerebrovascular Responses to the Energy Drink Red Bull in Young Adults: A Randomized Cross-over Study

* Erik K. Grasser * Gayathri Yepuri * Abdul G. Dulloo *
* Jean-Pierre Montani *

Springerlink.com 2014
To determine the effects of the popular energy drink, Red Bull on cardiovascular and hemodynamic variables.
Design

25 young adults ages 20-31 years
- Recruited from local University student population in Fribourg, Switzerland
- Mean height 68 inches
- Mean body weight 154 pounds
- BMI 23.3

13 men
12 women

Cardio- and Cerebrovascular Responses to the Energy Drink Red Bull in Young Adults: A Randomized Cross-over Study
Springerlink.com, Grasser et al, 2014
Inclusion:

- Usual daily caffeine intake of 150 mg or less from both coffee or energy drinks
- Overnight fast
- Avoid caffeine for 24 hours prior to the test

Exclusion:

- BMI greater than 30
- Competition athletes
- Individuals with a daily exercise workout load exceeding 60 min/day
Procedure

Test subjects sat in an arm chair during procedures and were allowed to watch neutral documentaries.

Over 4 minutes, subjects consumed either:
- 355 mL of degassed Red Bull containing both caffeine and taurine
- 355 mL of tap water

Subjects were monitored for 20 minutes prior to energy drink consumption and for 2 hours after.
Blood Pressure

*\( p < 0.05 \)  **\( p < 0.01 \)  ***\( p < 0.005 \)
Heart Rate

Red Bull O
Water

*p = <0.05  **p = <0.01  ***p = <0.005
Conclusions

Findings noted that Red Bull drinks result in an increase in both systolic and diastolic blood pressure associated with increased heart rate and cardiac output.
Evaluating the Research

**Strengths**
- Used continuous beat-by-beat hemodynamics monitoring
- Low usual caffeine intake for participants
- Participants are their own controls
- No dropout

**Limitations**
- Control unable to be blinded
- Small sample size
- Only 2 day washout period between arms
- Stopped monitoring even while BP change still significant

Cardio- and Cerebrovascular Responses to the Energy Drink Red Bull in Young Adults: A Randomized Cross-over Study
Springerlink.com, Grasser et al, 2014
Randomized Controlled Trial of High-Volume Energy Drink Versus Caffeine Consumption on ECG and Hemodynamic Parameters

* Emily A. Fletcher, PharmD * Carolyn S. Lacey, MD *
* Melenie Aaron * Mark Kolas, MD * Andrew Occiano, PharmD *
* Sachin A. Shah, PharmD *

Journal of the American Heart Association 2017
To determine the effects of the additional ingredients in energy drinks

Randomized Controlled Trial of High-Volume Energy Drink Versus Caffeine Consumption on ECG and Hemodynamic Parameters, Journal of the American Heart Association 2017
Randomized Controlled Trial of High-Volume Energy Drink Versus Caffeine Consumption on ECG and Hemodynamic Parameters
Journal of the American Heart Association 2017

Design

18 participants

- 9 regular coffee drinkers of > 1 cup per day
- 4 regular energy drink users
- 5 occasional coffee drinkers
- 5 occasional energy drink users
- 4 no coffee consumption
- 9 no energy drink users

12 men

6 women

Ethnicities

- 11 White
- 3 Asian
- 2 Hispanic
- 1 Black
- 1 Undisclosed
Inclusion:

- Healthy volunteers between the ages of 18 and 40 years living on a US Airforce Base in the US
- 12 hour fast
- Avoid caffeine for 48 hours prior to the test

Exclusion:

- Diagnosed with abnormal heart rhythm
- BP > 140/90mm Hg
- History of substance abuse
- Taking medications that could interact with study drinks
- Renal or hepatic dysfunction
- Pregnant or breastfeeding
Procedure

Over 45 minutes, participants consumed 320 mg caffeine through either:

- 32 oz of energy drink containing vitamins, and a proprietary energy blend of ingredients including taurine, panax ginseng extract, L-carnitine, caffeine, guarana extract
- 32 oz caffeinated control drink including 40 ml of lime juice, and 140 ml cherry syrup in carbonated water

All drinks presented in identical containers

ECG and BP obtained after consumption at

- Baseline, 1, 2, 4, 5, 24 hours
QT Interval

Randomized Controlled Trial of High-Volume Energy Drink Versus Caffeine Consumption on ECG and Hemodynamic Parameters, Journal of the American Heart Association 2017
Results
Conclusions

The QTc interval and systolic blood pressure were significantly higher post high-volume energy drink consumption when compared to caffeine alone.
Evaluating the Research

Strengths

- Randomized, controlled, double blind crossover study
- Minimum 6 day washout between arms
- Various ethnicities included
- Variability of usual caffeine intake by participants

Limitations

- 32 ounce of energy drink in 45 minute span may not be normal intake – still available in these doses
- Small sample size
In Review

• Studies show that energy drinks affect the heart in multiple ways
  • Blood Pressure
  • Heart Rate
  • QTc interval

• People who drink energy drinks put themselves at risk of having cardiovascular effects
  • Particular concern for those with undiagnosed heart issues
  • Drinking multiple energy drinks in a day

• Minimal studies showing the effects of additives in energy drinks
How Can We Keep Our Patients Safe?

▪ Ask about energy drink intake when people admit with cardiovascular emergencies?

▪ Possible routine question of energy drink consumption on hospital admission?

▪ How do we educate?
  • Ask questions
    o Family history?
  • Public Health Outreach?
  • Add to school curriculum?
Thank You!

https://uwgbresearchreviews.weebly.com