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M E D I C I N E

# *The Buzz on Caffeine:* Laboratory and Treatment Studies

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# Introduction to caffeine



- Most widely consumed mood-altering drug
- Absorbed by the body from foods and beverages
- 12 oz of soda = 40 mg  
(Typical Range: 22-69 mg)
- 12 oz of brewed tea = 80 mg  
(Typical Range: 60-180 mg)
- 12 oz of brewed coffee = 200 mg  
(Typical Range: 107-420 mg)

Photo by [Mike Baker](#) on [Unsplash](#)

# Introduction to caffeine

- Lower doses (20-200 mg) can produce positive effects  
*Increased well-being, happiness, energy, alertness, sociability, decreased sleepiness*
- Higher doses (300-500 mg) can produce negative effects  
*Jittery, anxious, upset stomach, trouble sleeping*
- In moderation (for example, up to 400 mg per day), caffeine is not associated with negative health effects.
- Potential health benefits and therapeutic uses.

# Problematic caffeine use?

- Consumption of caffeinated energy drinks is associated with problematic alcohol use and increased risk behaviors.
- For some individuals, caffeine consumption can worsen health problems or cause severe withdrawal, and it may be difficult to quit or cut down in spite of these problems.



# Study 1: Combined caffeine and alcohol

- Associated with increased alcohol consumption and negative consequences of drinking.
- Experimental studies are lacking.
- Examined whether caffeine increases alcohol self-administration and positive effects of drinking in healthy adults (31 participants).

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ORIGINAL INVESTIGATION

## **Effects of caffeine on alcohol reinforcement: beverage choice, self-administration, and subjective ratings**

Mary M. Sweeney<sup>1</sup> · Steven E. Meredith<sup>1,2</sup> · Daniel P. Evatt<sup>1,3</sup> · Roland R. Griffiths<sup>1,4</sup>

# Self-administration

- Exposure to caffeine + alcohol OR alcohol only
- Allowed to self-administer
- Asked to report subjective effects and made a choice



# Results

- Most participants (65%) chose the caffeinated alcohol drink.
- Caffeine did not increase the number of self-administered drinks.
- Caffeine increased stimulant ratings (elated, energized) and decreased sedative ratings (sluggish, down).
- Choosers reported greater drinking behavior outside of the laboratory.

<b>Alcohol Use History</b>	<b>Caffeine Choosers</b>	<b>Nonchoosers</b>
Days per month*	9.4 (3.3)	5.8 (2.9)
Drinks per month*	22.4 (9.4)	14.1 (9.6)

- Overall, this study suggests caffeine increases the positive effects of drinking, and that those who prefer caffeinated alcohol drinks may already be different.

# Study 2:

## Energy drinks and risk behavior

- Popular combined with alcohol, but also popular alone.
- What is the relation between regular energy drink consumption and risk behaviors?
- Online nationwide sample of 874 young adults

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### **Weekly Energy Drink Use Is Positively Associated with Delay Discounting and Risk Behavior in a Nationwide Sample of Young Adults**

Steven E. Meredith, PhD,<sup>1,2</sup> Mary M. Sweeney, PhD,<sup>1</sup> Patrick S. Johnson, PhD,<sup>1</sup>  
Matthew W. Johnson, PhD,<sup>1</sup> and Roland R. Griffiths, PhD<sup>1,3</sup>



# Study 2: Energy drinks and risk behavior



- Weekly energy drink users (one-third of sample) showed:
  - More past-year drug use*
  - More problematic alcohol use*
  - More drunken driving, physical fights, arrests*
  - More impulsive on behavioral decision-making tasks*  
*(Chose smaller-sooner money rewards)*
  - (Less likely to wait for condom in hypothetical sex scenario)*
- Not necessarily causal, but other studies show energy drink precedes alcohol problems and stimulant misuse
- May be a useful early marker for substance use problems

# What about caffeine use that is problematic in itself?

- DSM-5 listed caffeine use disorder for further study

## Case study

### Caffeine Use Disorder: A Comprehensive Review and Research Agenda

Steven E. Meredith,<sup>1</sup> Laura M. Juliano,<sup>2</sup> John R. Hughes,<sup>3,4</sup> and Roland R. Griffiths<sup>1,5</sup>

Mrs. B, a 46 year-old woman seeking treatment for caffeine use.

Chief complaints of sleep problems and heart palpitations that she attributed to caffeine. Doctor advised reducing caffeine.

Reported fatigue, anxiety, and depressed mood when she abstained from caffeine.

Average daily caffeine intake was 702 mg/day.

Husband complained that caffeine use adversely affected their relationship.

Repeatedly attempted to cut back, but withdrawal symptoms interfered.



# Study 3: Clinical trial for problematic caffeine use

- We tested a gradual (six-week), manual only caffeine reduction program in 36 treatment-seekers.
- A program that gradually reduces caffeine intake may reduce withdrawal symptoms.



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GUIDE TO  
CAFFEINE  
REDUCTION  
AND  
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journal homepage: [www.elsevier.com/locate/drugalcddep](http://www.elsevier.com/locate/drugalcddep)



A randomized controlled trial of a manual-only treatment for reduction and cessation of problematic caffeine use



Mary M. Sweeney<sup>a,\*</sup>, Steven E. Meredith<sup>a</sup>, Laura M. Juliano<sup>b</sup>, Daniel P. Evatt<sup>a</sup>,  
Roland R. Griffiths<sup>a,c</sup>

# Study 3: Clinical trial for problematic caffeine use

- Reduced caffeine consumption
- Decreased caffeine-related problems

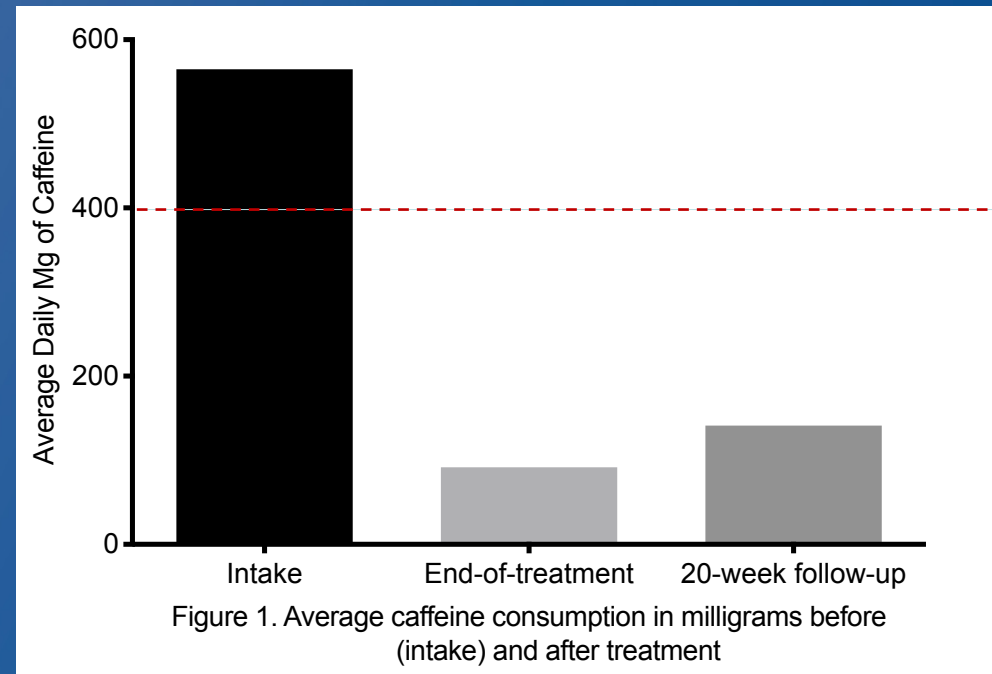
*Withdrawal, use in spite of a problem, using more than intended*

- Conclusions:

*Treatment was effective among those who reported multiple failed quit attempts*

*Manualized treatment did not require intensive counseling*

*May be useful for a wide range of clinicians*



# Summary and Future Directions



- Caffeine is a useful model system for understanding substance use disorders.
- Differences in the effects of caffeine may help us understand individual differences in vulnerability to substance use.
- Ongoing research questions:
  - How does caffeine use relate to or predict other drug use?*
  - How common is caffeine use disorder?*
  - How meaningful is its clinical impairment?*
  - How does caffeine affect other conditions, like anxiety?*
- Thank you: NIDA R01DA003890, Johns Hopkins colleagues