

# The Dark Side of Caffeine: Going Beyond Arrhythmias

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## Introduction

- Caffeine is one of the most commonly used psychostimulants throughout the world.
- Consumed by almost 90% of United States population.
- Toxicity and fatalities have been seen with intake of large amounts.

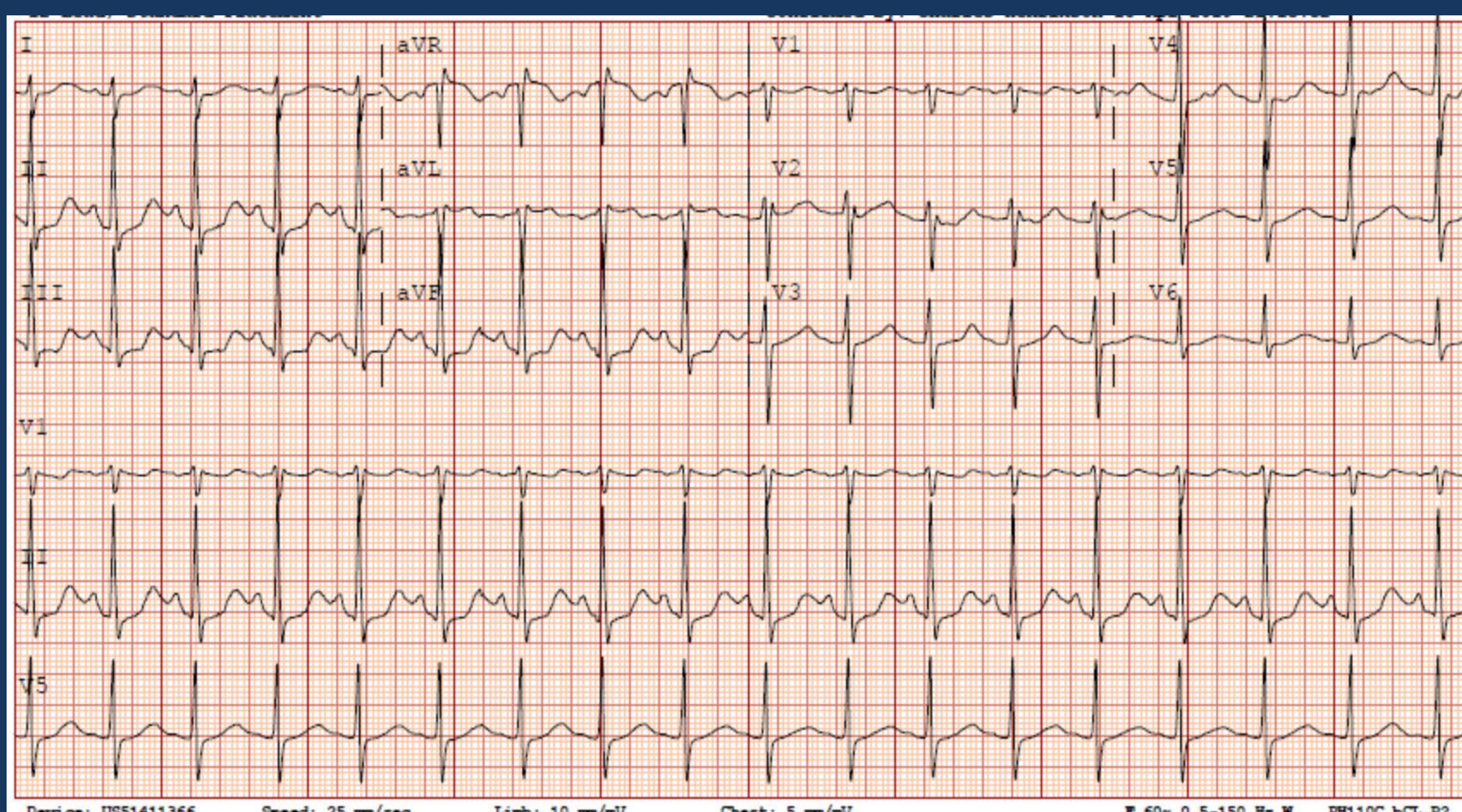
## Case Description

- A 22-year-old, previously healthy foreign male student ingested approximately 12 grams of caffeine (200 mg tablets x 60) and one energy drink, 26 hours prior to presentation.

### Notable Vital Signs and Labs:

BP149/79, HR118, T99.7 °F, RR20, 100% Sa

- Leukocytes: 30,000/mm<sup>3</sup>
- Potassium: 2.8 mmol/L
- Phosphate: 1.5 mg/dL
- Lactate: 6.1 mmol/L
- VBG: pH 7.6/PCO<sub>2</sub> 27, HCO<sub>3</sub> 29
- Caffeine: 70 ug/ml
- ECG: Sinus Tachycardia, Prolonged QTc & QRS



- Electrolytes were replaced, and he received lactated ringers, sodium bicarbonate, and lorazepam as needed for anxiety & nausea.
- Charcoal was not given (aspiration risk).
- Over 48 hours, his anxiety and emesis abated, lactic acid, electrolytes, QRS and QTc normalized.
- Leukocytosis remained, but improved.
- On HD4 following a psychiatric evaluation, he was discharged with family member, planning to return to his country the next day.

## Discussion

- Caffeine induces excessive sympathetic stimulation which can lead to hyperglycemia, hypokalemia, leukocytosis and metabolic acidosis.

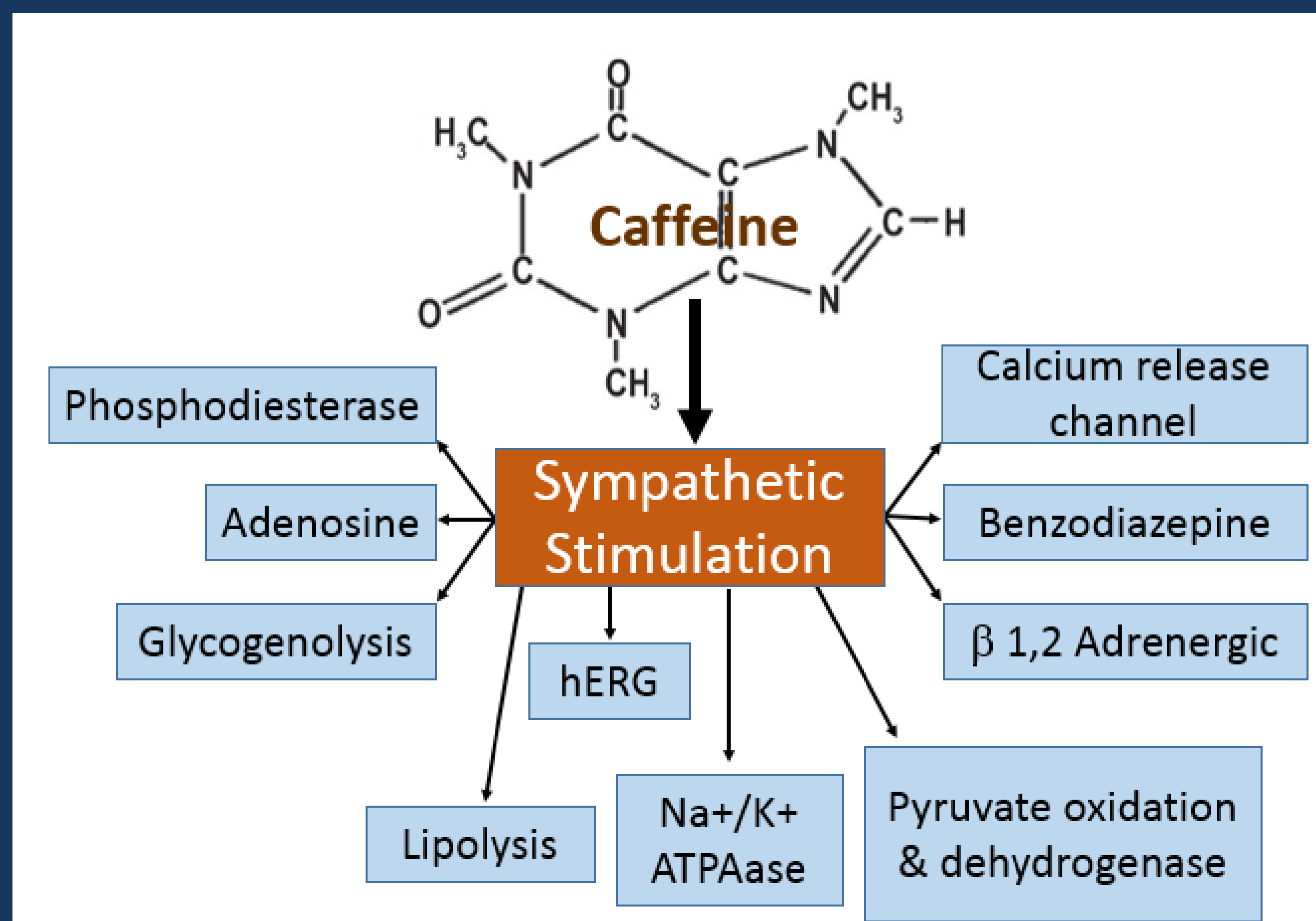


Figure 1: The effect of caffeine on different biochemical pathways

- Proposed mechanisms are an increase in glycogenolysis and lipolysis, inhibition of pyruvate oxidation and pyruvate dehydrogenase, activation of the Na<sup>+</sup>/K<sup>+</sup> pump or Na<sup>+</sup>/K<sup>+</sup> - ATPase.
- Inhibition of the Human Ether-a-go-go (hERG) potassium channel, β<sub>1</sub>, 2- adrenergic agonism & adenosine antagonism are also among the other proposed mechanisms.

- Caffeine is known to have generally dose-dependent effects.
- Positive or desirable effects are seen at ≤ 400 mg.
- At doses of 250 mg increased arousal, alertness, concentration and well-being have been noted.
- At doses of 500 mg increase tension, nervousness, anxiety, excitement, irritability, nausea, paresthesia, tremor, perspiration, palpitations, restlessness and possibly dizziness are seen.
- At a dose of around 1 g, toxic symptoms begin to manifest, 2 g requires hospitalization.
- Lethal dose of Caffeine is usually above 5 grams.

## Learning Points

- Clinical features of caffeine intoxication includes cardiovascular, gastrointestinal, psychological, neurological symptoms, metabolic symptoms, musculoskeletal symptoms (weakness, rigidity, tremor, rhabdomyolysis), pulmonary symptoms (respiratory failure, hyperventilation), and death.
- Decontamination with activated charcoal is preferred if within 1-2 hrs of ingestion.
- Hemodialysis has also previously been successful.
- Reducing sympathomimetic effects with benzodiazepines and beta blockers has been recommended.
- Timely recognition and management of Caffeine overdose leads to a good prognosis.

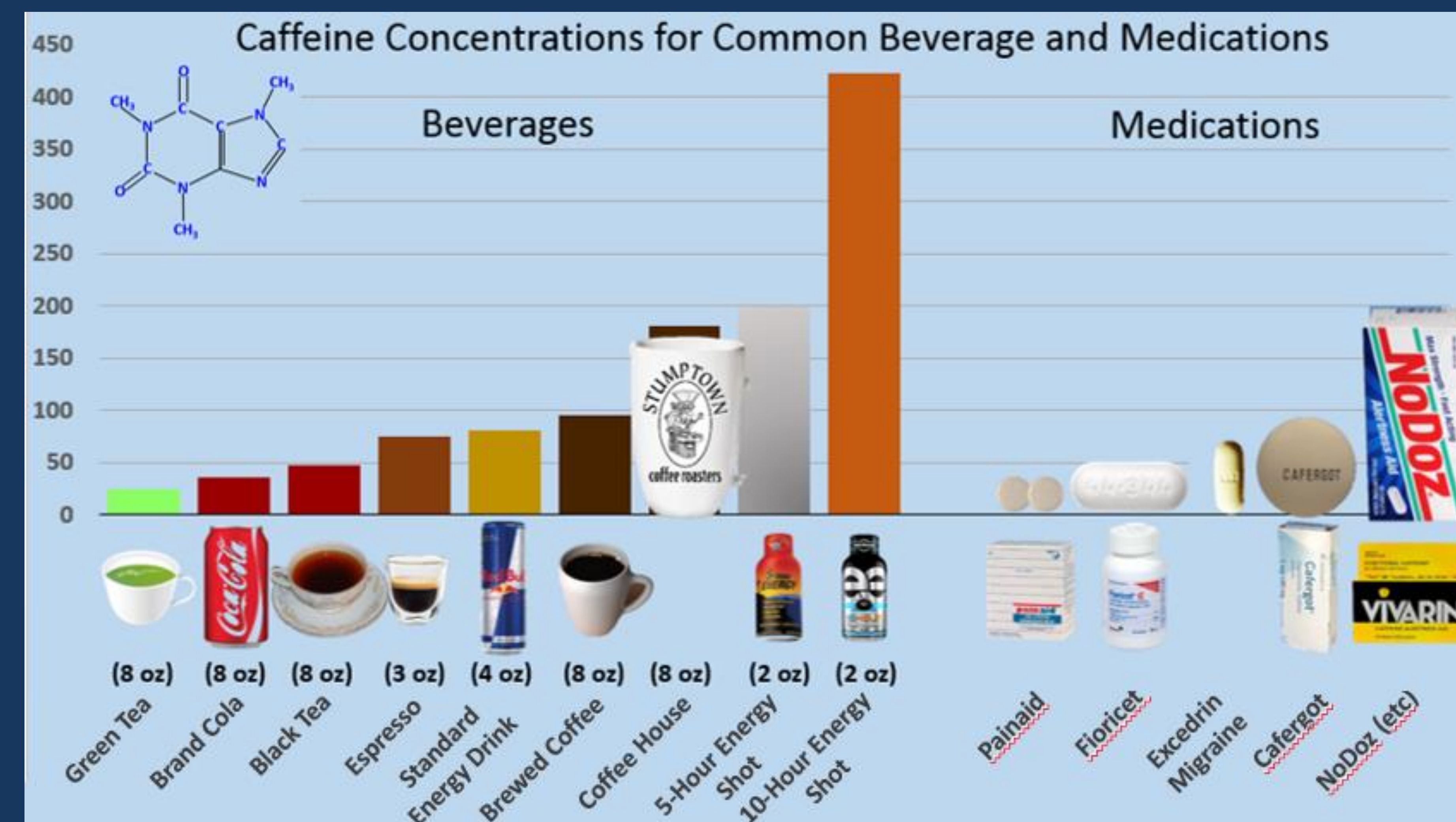


Figure 2: The Caffeine Concentration in Common Substances

- Most mortalities are due to arrhythmias or stroke, but metabolic derangements should not be overlooked.
- Caffeine has been safely consumed for centuries, yet with increasing use of the natural and synthetic compounds, it is important to recognize the signs and severity of high dose toxicity.

## References

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