

Energy drink consumption impairs oral glucose tolerance in adolescents: a randomized, double-blind, crossover pilot study

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Background

- Adolescents are key consumers of small-format, caffeine containing "energy shots"; no data on their metabolic responses to caffeine-containing energy drinks exists.
- In adults, co-administration of a carbohydrate load in the presence of caffeine impairs whole body glucose disposal by ~20-30%.
- It is presumed caffeine exposure causes insulin resistance in adolescents to an equivalent level to that observed in adults, although there is no data to support this conclusion.

Objectives

To investigate the metabolic impacts of caffeinated and decaffeinated energy drink consumption on insulin sensitivity and whole-body glucose disposal in adolescents.

Methods

Participants were included if aged 13-19 y and no history of chronic medical conditions affecting glucose tolerance.

Visit I. Screening and initial measurements

- Anthropometrics (height, weight, waist circumference, blood pressure, DEXA scan)
- Treatment dose calculated:
 - 5mg caffeine/kg body weight
 - Decaffeinated matched by volume

Visit II and III. Treatment and Oral Glucose Tolerance Test (OGTT)

- Participants arrived fasted (10-12 h), following abstinence from caffeine and vigorous exercise (24-48 h). An indwelling catheter was placed in the antecubital vein for blood draws.
- Participants received either 5 Hour Energy® or 5 Hour Energy Decaf® (randomized, double-blinded treatment order), followed 40 min later by a standard 2 hour OGTT.
- Both drinks were sugar free but contained a mixture of vitamins and minerals.
- Blood samples were collected at -40 (baseline), 0 (initiation of OGTT), 30, 45, 60, 90, and 120 min and assessed for plasma glucose and insulin concentrations.
- Area under the curve (AUC) was calculated using the trapezoid method, and compared between treatments using a paired t-test (significant if $p < 0.05$; 2-tailed)

Results

Marketed to Adolescents



'quick, simple and effective'

'fast and easy to consume'

'for when it's due tomorrow and you haven't started'

<http://5hourenergy.com>

Participant Characteristics

Participants	Mean ± SD (Range)
Age (years)	17.0 ± 2.2 (13.4-19.9)
Gender (%)	10 Male, 10 Female
BMI (kg/m ²)	22.6 ± 4.4 (13.6 – 31.5)

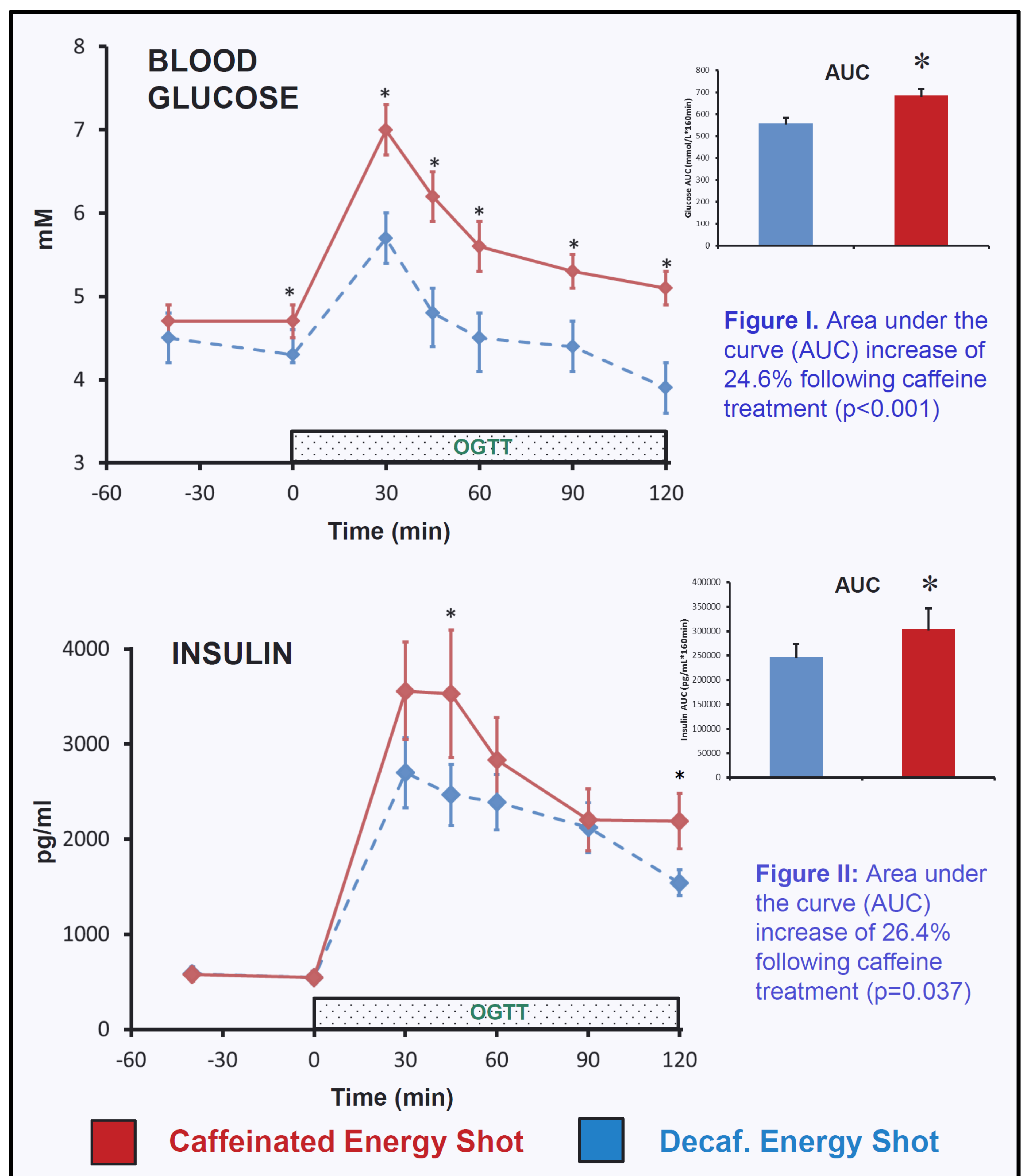


Figure I. Area under the curve (AUC) increase of 24.6% following caffeine treatment ($p < 0.001$)

Figure II: Area under the curve (AUC) increase of 26.4% following caffeine treatment ($p = 0.037$)

Discussion & Conclusion

- In adolescents, consumption of a caffeinated energy shot followed by an OGTT impairs whole-body glucose disposal by 24.6%.
- Caffeine containing energy shots increase circulating insulin levels by 26.4%.
- Continuous and prolonged (caffeine half-life = 4-6h) insulin resistance associated with chronic caffeine-containing energy drink consumption in adolescents could contribute to increased metabolic risk in susceptible individuals later in life.

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