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The Effects of Caffeine Ingestion and the -163 A>C CYP1A2 Polymorphism on Long Anaerobic Exercise Performance

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Caffeine Overview

- Chemical name: trimethylxanthine

- Metabolic byproducts:
  - Paraxanthine
  - Theophylline
  - Theobromine

- Functions:
  - CNS stimulant
  - Adenosine antagonist
CYP1A2 Overview

- **Function:** metabolizes caffeine

- **Site of production:** liver

- **Variants**
  - **Homozygous AA:** fast caffeine metabolism
    - More paraxanthine $\rightarrow$ enhanced adenosine antagonism
  - **Heterozygous AC/Homozygous CC:** slow caffeine metabolism
Wingate (WaNT90) Overview

- Duration: 90 seconds

- Reliance on multiple energy systems
  - ATP-PCR system
  - Glycolytic system
  - Oxidative system

- Power → Endurance continuum
  - WaNT90 captures both variables

http://www.2015.handmadebicycleshow.com/exhibitor/dhd/
Purpose

- To examine the effects of caffeine on maximal anaerobic exercise performance during a 90 second Wingate (WaNT 90) with respect to the different CYP1A2 polymorphisms

- **WaNT90**
  - 5.5% body weight resistance

- **Conditions**
  - Placebo: maltodextrin
  - Experimental: 6 mg/kg caffeine anhydrous
Subjects

• 34 subjects
  • 19 male, 15 female

• Genetic variability
  • 24 AA, 10 AC/CC

• All recreationally active
Wingate Protocol

- Familiarization Session
  - Anthropometric data
  - Buccal cells
  - Modified Wingate: 30 sec, 5.5% body weight resistance

- Testing Sessions
  - Caffeine log, caffeine abstinence
  - Caffeine or maltodextrin consumption (1 hour prior)
  - Warmup with intermittent sprints (5 min)
  - WaNT 90
CYP1A2 Protocol

- Saline mouth rinse (0.9% NaCl)
- DNA isolation
- Polymerase chain reaction (PCR)
- Restriction digestion
- Gel electrophoresis
Results

![Graph showing peak power comparison between Placebo and Caffeine. The Placebo group has a higher peak power compared to the Caffeine group.](image)
Results
Results

The graph shows the peak power output across different conditions and genotypes. The x-axis represents different time periods: 0-30 sec, 30-60 sec, and 60-90 sec. The y-axis represents peak power (W). The conditions are labeled as AA and AC/CC. The bars are color-coded to indicate Placebo (solid) and Caffeine (hatched). The error bars indicate the variability in the data.
Results

The graph illustrates the total work performed under different conditions and genotypes over various time intervals (0-30 sec, 30-60 sec, 60-90 sec). The y-axis represents the total work (in J), while the x-axis indicates the time intervals.

- AA PLA: Represented by a dashed line.
- AC/CC PLA: Represented by a solid line.
- AA CAF: Represented by a dotted line.
- AC/CC CAF: Represented by a dash-dotted line.

The graph shows a decrease in total work over time for all conditions and genotypes, with AA PLA generally maintaining a higher total work across all time intervals compared to the other conditions.
Conclusions

- Caffeine does not have any significant ergogenic benefit on long anaerobic exercise regardless of CYP1A2 polymorphism variant
  - Non-significant (1-4%) increase in AA caffeine performance

- Future directions:
  - Increased variability between subjects
  - Adenosine receptor activity
Acknowledgements

Co-authors Rachel Steckbeck, Madison Wright, Brian Shenk, & Dr. Michael Shin

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References