



Presented by:
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Caffeine Supplementation Increases Upper Extremity Strength in Resistance-Trained Women

CAFFEINE



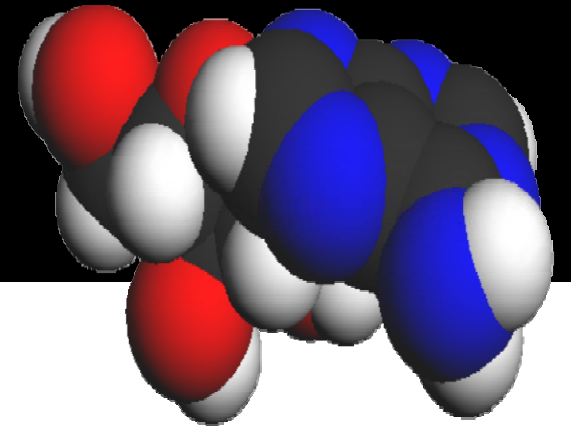
- Water soluble; readily absorbed by intestinal tract
- ↑ plasma levels: 15-45 min
- Peak concentration: 1 hr post consumption
- Metabolized by liver
- Clearance from bloodstream relatively fast:
 - ↓ by 50-75% at 3-6 hrs
- Excreted by kidneys: ~3-10% expelled unchanged
- ↑ lipid solubility: easily passes blood-brain barrier

DID YOU KNOW?



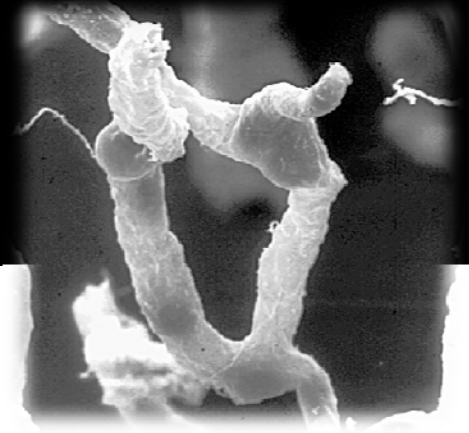
	Lab	Design	Outcome
Source/Form	Graham et al. (1998)	Comparison of coffee to capsule	CAFFEINE CAPSULE ↑ ENDURANCE BEYOND OTHER 4 TREATMENTS
Habituation	Bell and McLellan (2002)	Users: ≥ 300 mg/d Nonusers: ≤ 50 mg/d	Users only showed significant ↑ at 1 and 3 hr post ingestion; 6 hrs for <i>nonusers</i>

POTENTIAL MECHANISMS

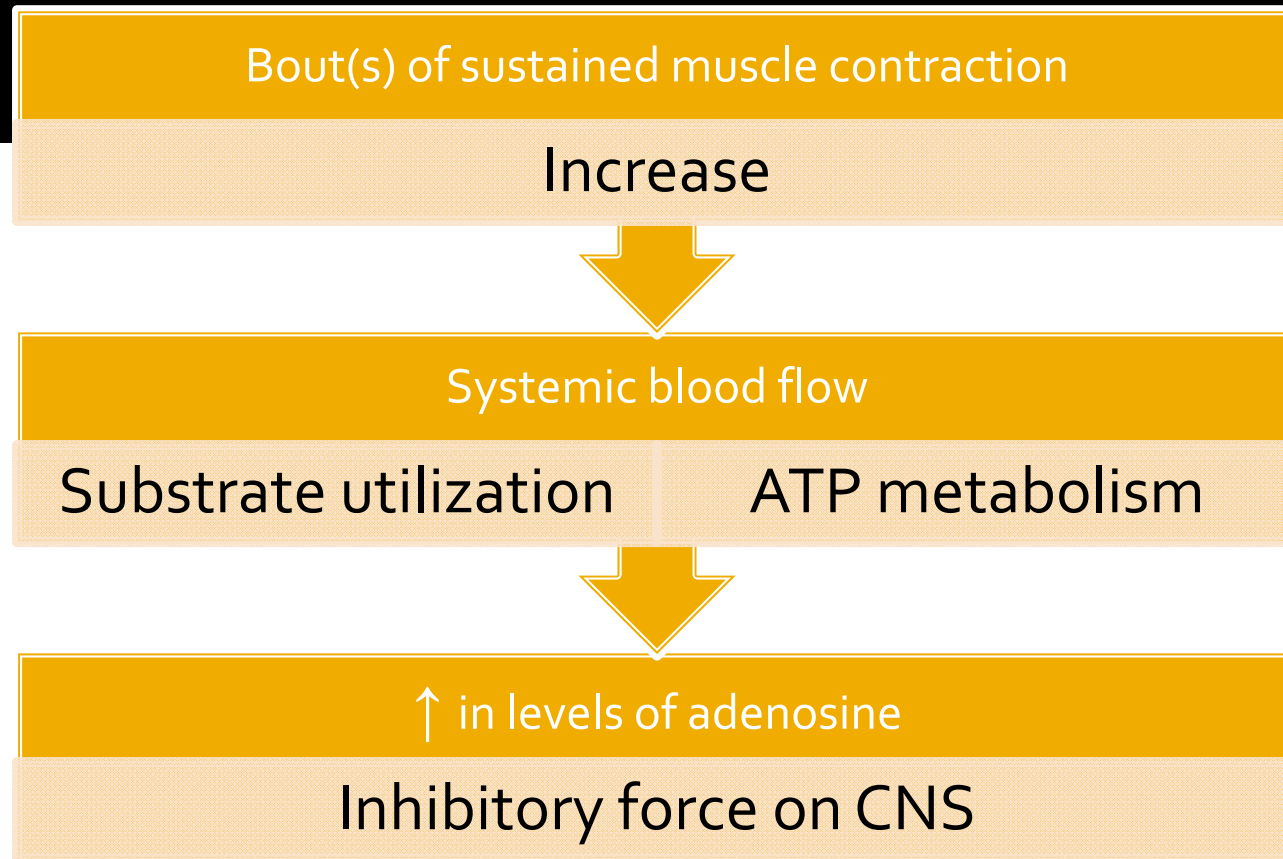


- ✓ Modulation of specific neurotransmitter processes
- ✓ Alteration of substrate metabolism during exercise
- Enhanced plasma catecholamine levels: ↑ in fat oxidation and subsequent sparing of glycogen utilization
- Results conflicting

POTENTIAL MECHANISMS



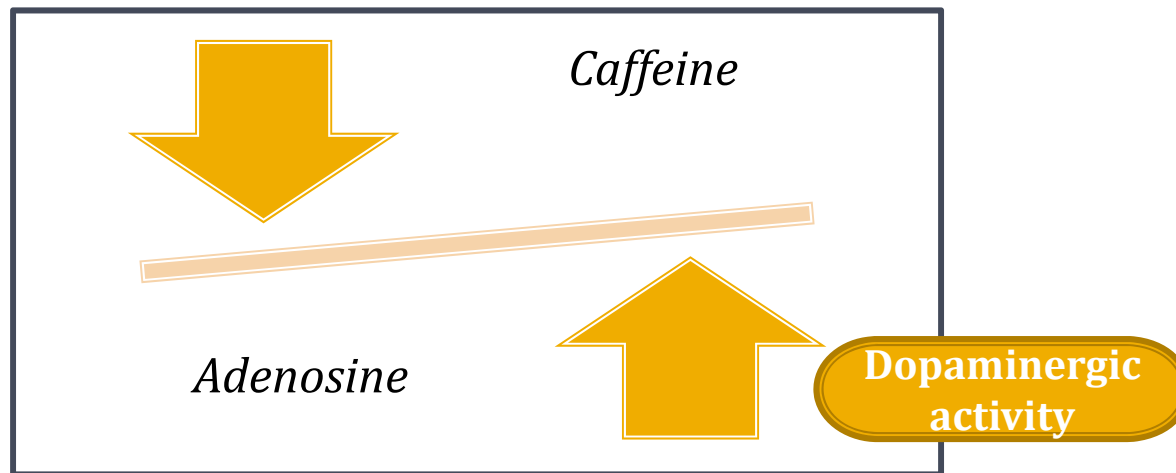
- Pharmacological reviews have suggested caffeine acts to *compete* with adenosine at receptor sites
- *Adenosine* is an inhibitory neurotransmitter
- Acts to compete with or diminish concentration of other neurotransmitters, *dopamine*
- **Dopamine**, responsible for feelings of arousal, motor control



- ↑ in adenosine levels in exercising muscle interstitium (Hellsten et al. (1998))
- potentially lead to ↑ CNS fatigue
- Process can potentially be altered by: caffeine supplementation

ADENOSINE ANTAGONIST

- Adenosine and Dopamine receptors colocalized: functionally interact (Garrett and Griffiths, 1997)



- Potential ↑ neuroexcitability

STRENGTH (RT MALES)



Lab	Design	Outcome
Beck et al. (2006) <i>n</i> = 37	<ul style="list-style-type: none">✓ 1 year, 3-4 d/w✓ BP and LE 1RM✓ 80% 1RM reps to max✓ 201 mg	<ul style="list-style-type: none">✓ ↑ BP, but not LE 1RM✓ No ↑ muscular endurance
Astorino et al. (2008) <i>n</i> = 22	<ul style="list-style-type: none">✓ TB Minimum 2 d/w✓ BP and LP 1RM✓ 60% reps to max✓ 6 mg/kg	<ul style="list-style-type: none">✓ No ↑ BP or LP 1RM✓ No ↑ muscular endurance
Williams et al. (2008) <i>n</i> = 9	<ul style="list-style-type: none">✓ 3 d/w✓ BP and LD 1RM✓ 80% 1RM reps to max✓ 300 mg	<ul style="list-style-type: none">✓ No ↑ BP or LD 1RM✓ No ↑ muscular endurance

STRENGTH, CAFFEINE, AND CV RESPONSE



Lab	Design	Outcome
Astorino et al. (2007)	<ul style="list-style-type: none">✓ RT TB 2 d/w, 6 years✓ Consumed caffeine 4 d/wk✓ 30-600 mg p/d✓ BP and LP 1RM✓ 60% reps to max✓ 6 mg/kg	<p>Acute caffeine ingestion significantly ↑ SBP:</p> <ul style="list-style-type: none">✓ At rest✓ Immediately after RT✓ ↑ HR by 10 bpm (pre-ex and post bench press)✓ No difference for DBP
Astorino et al. (2008)	<ul style="list-style-type: none">✓ RT males✓ TB Minimum 2 d/w✓ BP and LP 1RM✓ 60% reps to max✓ 6 mg/kg	<ul style="list-style-type: none">✓ SBP also significantly ↑ pre-exercise

CAFFEINE AND WOMEN



Lab	Design	Outcome
Bruce et al. (2000) <i>n</i> = 8	✓ Competitive oarswomen ✓ 6 and 9 mg/kg ✓ 2,000-m row	✓ Women responded favorably to 9 mg/kg (sig. improvement in time trial performance)
Ahrens et al. (2007) <i>n</i> = 26	✓ Untrained women ✓ 8 min treadmill walking at 3.5 mph ✓ 3 and 6 mg/kg	✓ Had to pull 9 mg dose from design ✓ 6 mg = Sig. ↑ energy expenditure of 7 kcals/30 min of walking ✓ No changes for 3 mg/kg
Ahrens et al. (2007) <i>n</i> = 20	✓ Untrained women ✓ Aerobic dance bench stepping ✓ 3 and 6 mg/kg	✓ No changes for 3 or 6 mg/kg

WHAT DO WE KNOW?



- Results vary, RT Men
- Significant improvement in performance (2,000-m row) with high dose of caffeine, trained women
- Varied results with moderate dose of caffeine, untrained women

METHODS

Me



METHODS

- Double-blind placebo controlled crossover research design
- $n = 15$
- Resistance-Trained women
- Age: 18-45
- Determined as: ability to bench press 70% of bodyweight



METHODS



- SUPPLEMENTATION:
- 6 mg/kg of caffeine
Anhydrous powder form
(Scivation, Graham, NC)
- 16.9 fluid ounces Propel flavored water
(20 kcal; 5 g CHO)
- Packaging and taste was masked
- Prepared by someone not associated
with data collection and analysis

METHODS



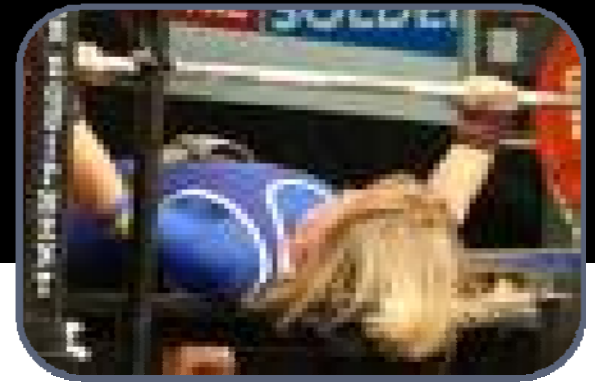
✓ 1RM

- Standardized barbell bench press
- Review of proper technique and mechanics, NSCA
- **Warm-up:** 12-15 reps at 50% of anticipated max

Familiarization	
50%	5
60%	3
70%	?

Exercise Trials	
60%	5
75%	3
90%	1
100%	Est. 1RM

METHODS



- 1RM determined in 3-6 sets
- 2-min rest intervals between sets
- *Rest for 5 minutes*
- *Complete test for muscular endurance*
- Complete as many BP reps as possible at 60% 1RM
- Within 5 sec of final rep: HR, BP, and RPE recorded
- **TOTAL WEIGHT LIFTED** = repetitions x weight

RESULTS

- One-way ANOVA for repeated measures
- $p < 0.05$
- PHYSICAL DEMOGRAPHICS OF FEMALE SUBJECTS
(MEANS \pm SD):
 - ✓ Age: 25 ± 7 years
 - ✓ Body mass: 64 ± 8 kg
 - ✓ Height: 166 ± 9 cm

RESULTS: STRENGTH AND ENDURANCE



Table 1. Strength and endurance data (means \pm SD)

	Placebo	Caffeine
Bench Press		
1RM (kg)	52.1 \pm 11.7	52.9 \pm 11.1*
60% 1RM	23.0 \pm 7.1	23.1 \pm 6.2

RESULTS: CV PARAMETERS

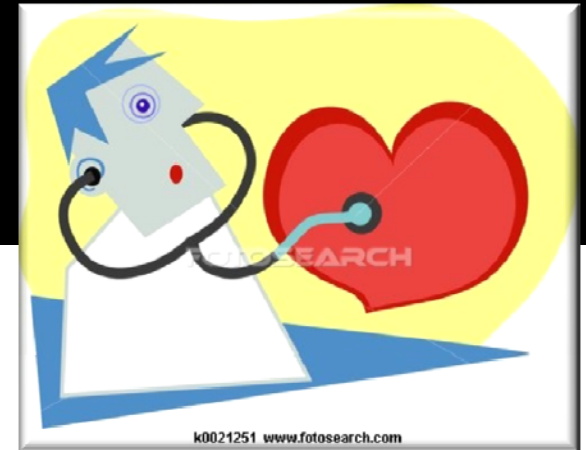


Table 2. Heart rate data (means \pm SD)

	Placebo	Caffeine
Heart rate (bpm)		
Rest	68.3 \pm 10.3	68.5 \pm 13.3
60-min post supplementation	67.3 \pm 10.2	70.0 \pm 10.4
Immediately post exercise	90.0 \pm 14.0	94.0 \pm 16.0

RESULTS: CV PARAMETERS



Table 3. Diastolic blood pressure data (means \pm SD)

	Placebo	Caffeine
Diastolic Blood Pressure (mmHg)		
Rest	63.3 \pm 5.0	65.0 \pm 6.5
60-min post supplementation	63.0 \pm 4.4	64.4 \pm 5.3
Immediately post exercise	63.0 \pm 4.5	64.3 \pm 5.2

RESULTS: CV PARAMETERS



Table 4. Systolic blood pressure data (means \pm SD)

	Placebo	Caffeine
Systolic Blood Pressure (mmHg)		
Rest	109.4 \pm 5.5	110.3 \pm 5.2
60-min post supplementation	111.6 \pm 6.8	111.0 \pm 5.6
Immediately post exercise	112.9 \pm 4.9	116.8 \pm 5.3 *

RESULTS:

NUTRIENT CONSUMPTION



Table 5. Nutrient consumption three days prior to each experimental protocol (means \pm SD)

	Placebo	Caffeine
Total energy (kcal)	2160 \pm 1008	2083 \pm 1095
Protein (g)	103 \pm 46	102 \pm 39
Carbohydrate (g)	252 \pm 144	256 \pm 186
Fat (g)	145 \pm 274	117 \pm 181

DISCUSSION

- Major finding of this study:
 - ✓ *Acute caffeine supplementation (6 mg/kg) appears to be effective for enhancing strength performance in resistance-trained women*
 - ✓ As demonstrated by significant ↑ in bench press 1RM

DISCUSSION

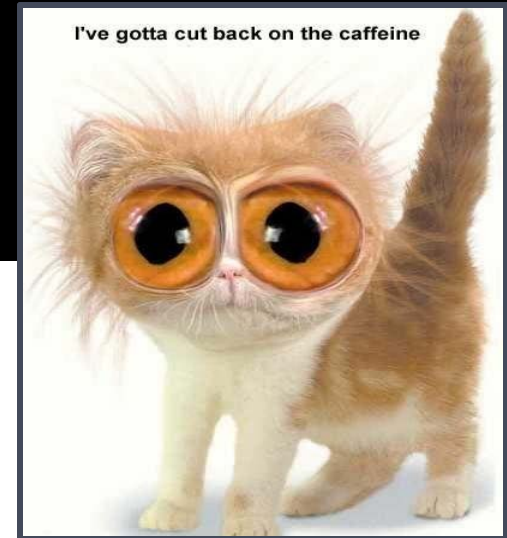


- ✓ *Data gathered from the Daily Caffeine Intake Questionnaire (Appendix D):*
- ✓ Participants consumed caffeine on a daily basis in range of 0-416 mg/d
- ✓ 3 of 15 participants
- ✓ Consumed either 0-41 mg/d
- ✓ Exhibited intense emotional responses: expressed inability to verbally communicate, focus, and/or remain still, feeling of wanting to cry

DISCUSSION

- 2 of 3 participants, who experienced an intense emotional response...
- ✓ Performed more repetitions to failure at 60% of individual 1RM

DISCUSSION



- *Astorino et al. (2008):*
 - ✓ 13 of 22 subjects
 - ✓ Reported symptoms:
 - ✓ Restlessness, tremor, greater energy, and elevated heart rate
 - ✓ Feelings augmented in subjects who consumed little caffeine on a daily basis
 - ✓ Possible, the magnitude of effect is greater for those individuals non-habituated to caffeine
 - ✓ Bell et al. (2002)

DISCUSSION

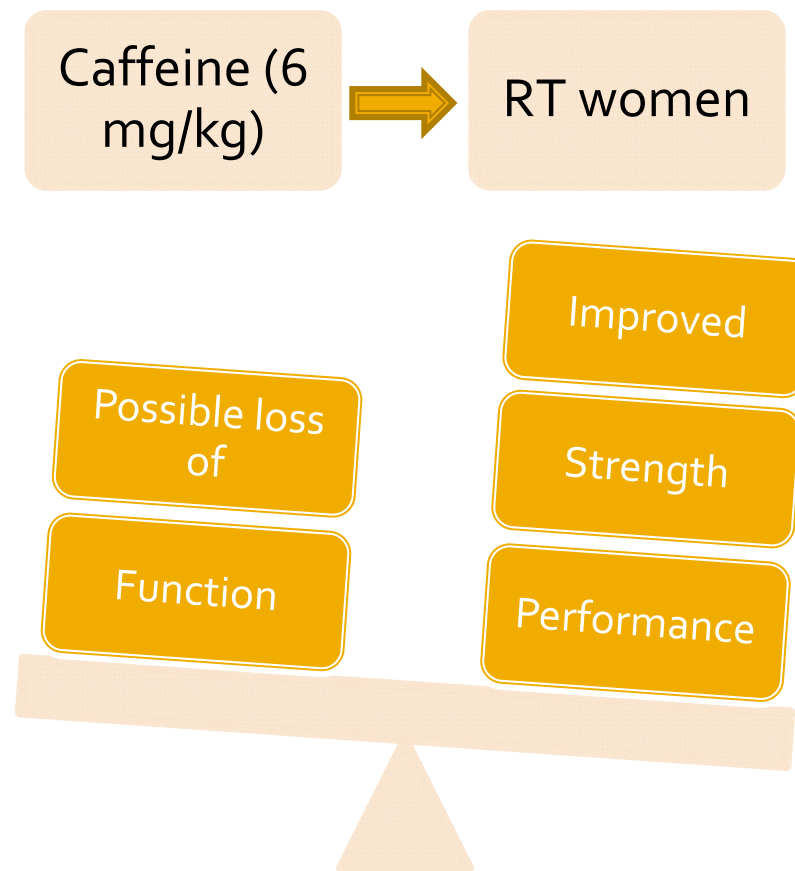
- Graham and Spriet (1995):

“On the basis of subjective reports of some subjects it would appear that at that high dose [9 mg/kg] the caffeine may have stimulated the central nervous system to the point at which the usually positive ergogenic responses were overridden”

DISCUSSION

- *Findings of current study indicated:*

Results may not be applicable to all RT women, specifically those who exhibited or may exhibit an intense emotional response



On the other hand, a moderate dose of caffeine may be an effective strategy for enhancing strength performance in RT women

DISCUSSION

- *Astorino et al. (2007):*
 - ✓ SBP ↑ ~8-10 mmHg following caffeine ingestion and RE
- *Astorino et al. (2008):*
 - ✓ Following caffeine ingestion, SBP significantly ↑ pre-exercise
- *Results comparable to present investigation*
 - ✓ Sig. ↑ SBP, ~4 mmHg

DISCUSSION

- *Clinical relevance* of \uparrow in pressure (~ 4 mmHg) can be significant, depending on population
- Specifically, in persons diagnosed as hypertensive
- Possible that in a non-normotensive population, supplementing with caffeine while participating in RE may adversely affect parameters of CV functioning
- In normal, healthy trained individuals, \uparrow in SBP does not seem to warrant concern as a potential health-related risk factor

CONCLUSION

- *Major finding of this study:*
- ✓ 6 mg/kg dose of caffeine was effective for enhancing strength but not muscular endurance in RT women
- ✓ This is a novel finding: the 1st investigation to examine caffeine supplementation in this population (*RT women*)



IMPLICATIONS FOR FUTURE RESEARCH

- It is of interest to determine: if lower dose of caffeine would stimulate similar \uparrow in strength performance (*as indicated by results of this study*) but without intense emotional response experienced by some of the participants
- It is of importance to examine: if lower dose of caffeine would prevent an \uparrow in SBP following RE, without subsequent loss of performance

QUESTIONS?

