

Acute Effects of an Investigational Pre-Workout Supplement on Neuromuscular and Exercise Performance in Resistance Trained Males:

A Proof-of-Concept, Randomized, Controlled, Crossover Study

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Introduction

Caffeine-containing multi-ingredient pre-workout supplements (MIPS), marketed as improving physical performance acutely, are a particularly popular category within sports nutrition and yet finished products are rarely clinically evaluated.

PURPOSE: The purpose of this randomized, controlled, crossover study was to examine the acute effects of an investigational MIPS formula when used by experienced resistance trained consumers of high-stimulant MIPS.

Methods

Healthy, resistance-trained, high-caffeine consuming (>200 mg/d), adult male, US military veterans were recruited to complete familiarization and 2 randomly assigned and counter-balanced lab visits to assess the acute effects of 16 fl ozs H₂O (CTL; positive control) or H₂O+MIPS (C4A; C4[®] Alpha Bomb; Nutrabolt; Austin, TX).

PSYCHOMOTOR PERFORMANCE (RT): Both PreTRx and ~55 mins PostTRx, reaction time and visuomotor response was assessed using a Dynavision D2 Visuomotor Training Device (Dynavision Global Holdings; Loveland, OH, USA) light board. After a 5-sec visual countdown, subjects used either hand to strike as many randomly illuminated targets as possible within 60 secs. Only 1 target illuminated at a time and the target only remained illuminated for 1 sec. Subjects completed 3 sets, with 30-sec rest between sets.¹

REPEATED SPRINTS (6x10s): Repeated sprints were performed on a Monark LC7 TT novo (Monark Exercise AB; Vansbro, Sweden) electronically controlled cycle ergometer, initiated 2 mins after RT. After a 5-min warm-up and 5-min seated rest period, resistance was set at 7.5% of the subject's BM and the subjects performed 6 sets of 10-second maximal effort sprints at a cadence of 110 ± 20 RPMs, with 30-sec rest between sets.²⁻⁴

LOWER BODY MAXIMAL STRENGTH (3x3s): Maximal voluntary contraction (MVC) of the right knee extensors and flexors were performed on a Biodex System 4 (Biodex Medical Systems Inc; Shirley, NY, USA) isokinetic dynamometer, initiated 2 mins after 6x10s. After a warm-up set and 2-min rest, subjects performed 3 sets of 3-rep, concentric-concentric MVC attempts at an angular velocity of 60°•sec⁻¹ and through a total ROM of 90°-105°, with 2-min rest between sets.⁵⁻⁶

LOWER BODY MUSCULAR ENDURANCE (3x30s): Muscular endurance of the right knee extensors and flexors were also performed on the Biodex System 4, initiated 2 mins after 3x3s. After a warm-up set and 2-min rest, subjects performed 3 sets of 30-rep, concentric-concentric MVC attempts at an angular velocity of 180°•sec⁻¹ and through a total ROM of 90°-105°, with 2-min rest between sets.⁵⁻⁷

STATISTICAL ANALYSIS: Within-within 2x2 (TRx x time) repeated measures ANOVAs were used to compare RT PreTRx v PostTRx effects. 2x6 (TRx x set) mixed-effects with Geisser-Greenhouse corrections were used for 6x10s. Within-within 2x3 (TRx x set) repeated measures ANOVAs with Geisser-Greenhouse corrections were used for 3x3s and 3x30s. Multiple comparisons used LSD tests. Paired-samples t-tests were used for comparing totals across all sets. $\alpha \leq 0.05$.

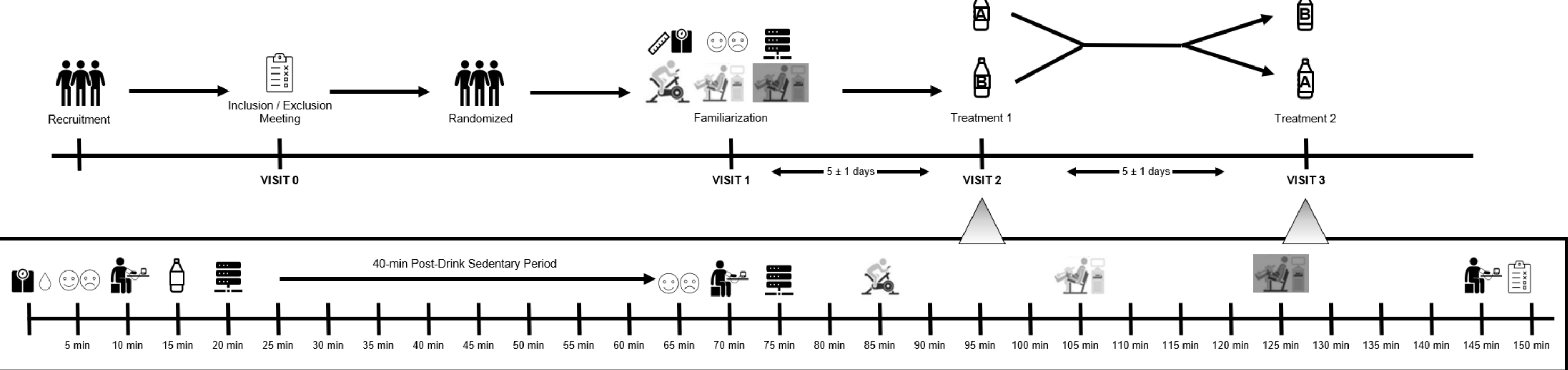
Table 1. Subject Characteristics (n=18)

	MEAN	SEM (±)	95% CI (±)
AGE (yrs)	40.6	1.7	3.4
BODYMASS (kg)	90.2	2.2	4.4
BMI (kg/m ²)	28.7	0.6	1.1
CAFFEINE EXPECTANCY (B-CaffEQ)			
Withdrawal - Dependence (0-15)	5.8	0.7	1.5
Energy - Work Enhancement (0-15)	11.0	0.5	0.9
Appetite Suppression (0-15)	5.6	0.5	1.1
Social - Mood Enhancement (0-15)	8.0	0.5	1.1
Physical Performance Enhancement (0-15)	10.8	0.6	1.2
Anxiety - Negative Physical Effects (0-15)	4.6	0.5	1.0
Sleep Disturbances (0-10)	4.9	0.4	0.7

Table 2. Study Procedures by Lab Visit

PROCEDURES	0	1	2	3
Pre-Qualification Questionnaire	X			
Caffeine Expectancy Questionnaire	X			
Inclusion/Exclusion Meeting	X			
Informed Consent	X			
Familiarization		X		
Weight		X	X	X
24-Hr Pre-Test Controls (e.g., 5-7 hr Fast before Visit)		X	X	X
Hydration Status (HyDEX)		X	X	X
Hemodynamic Safety (HR, BP, RPP)		X	X	X
Consume Treatment		X	X	X
40-min Post-Treatment Latent Period			X	X
Profile of Mood States Questionnaire (POMS-2)		X	X	X
Psychomotor Performance (Dynavision)		X	X	X
Repeated Sprint Testing (Cycle Ergometer)		X	X	X
Lower Body Maximal Strength Testing (Biodex)		X	X	X
Lower Body Muscular Endurance Testing (Biodex)		X	X	X
Adverse Events Questionnaire			X	X
Compensation				X

Figure 1. Study Schematic & Procedures by Lab Visit



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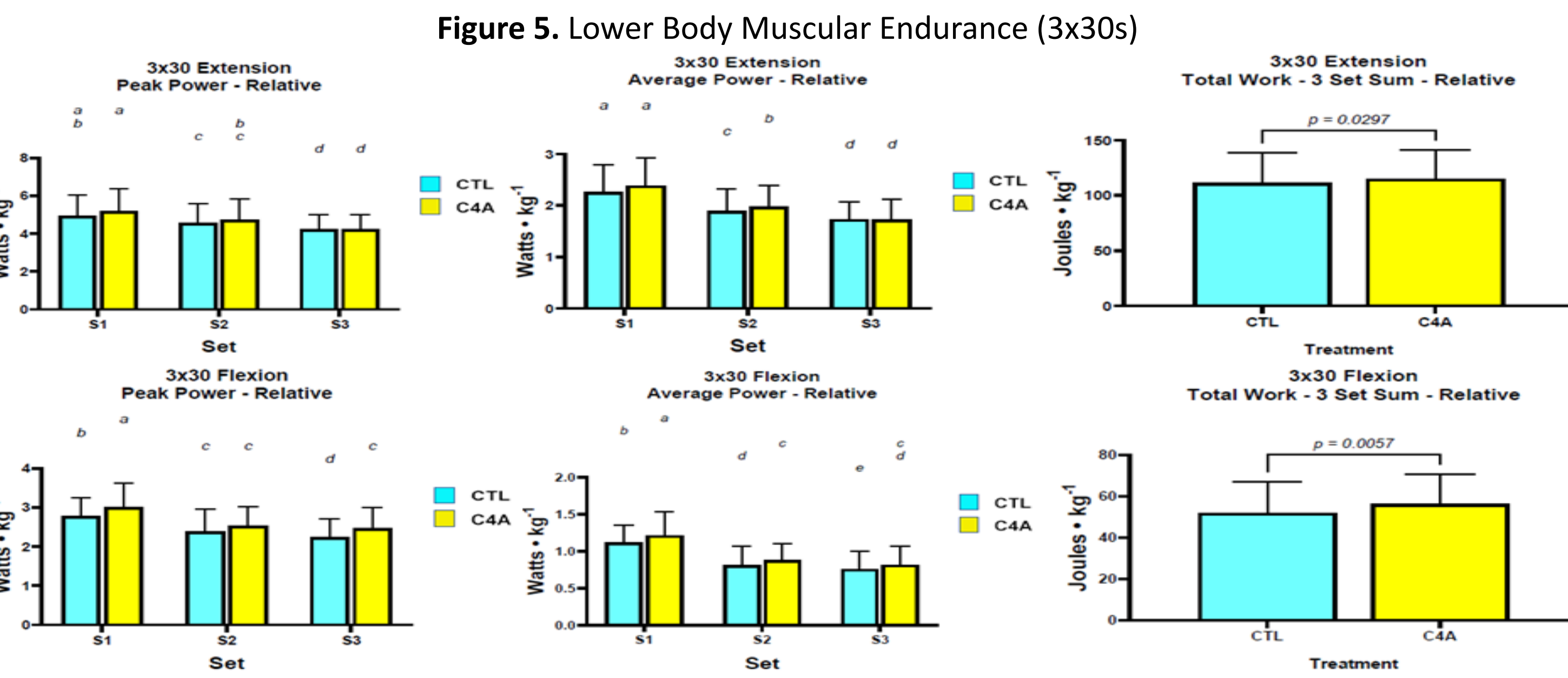
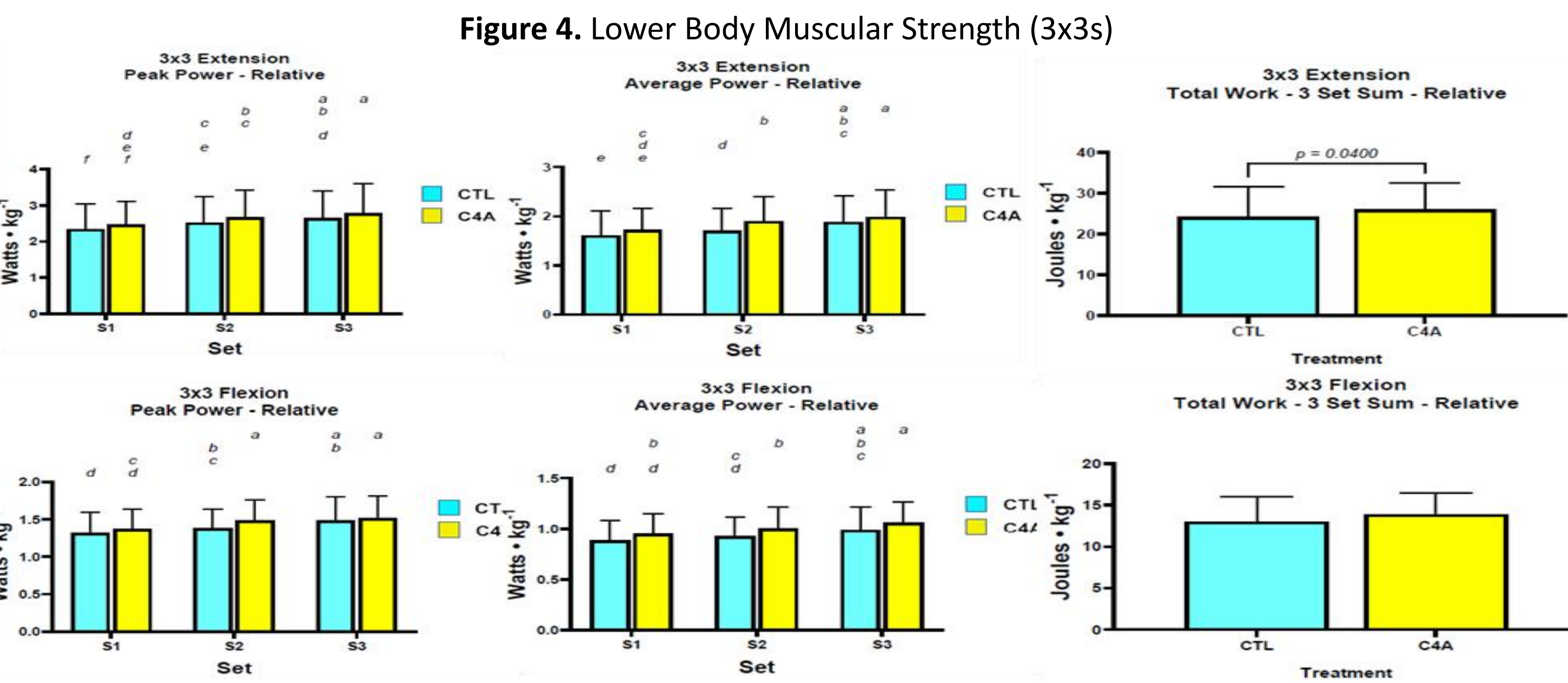
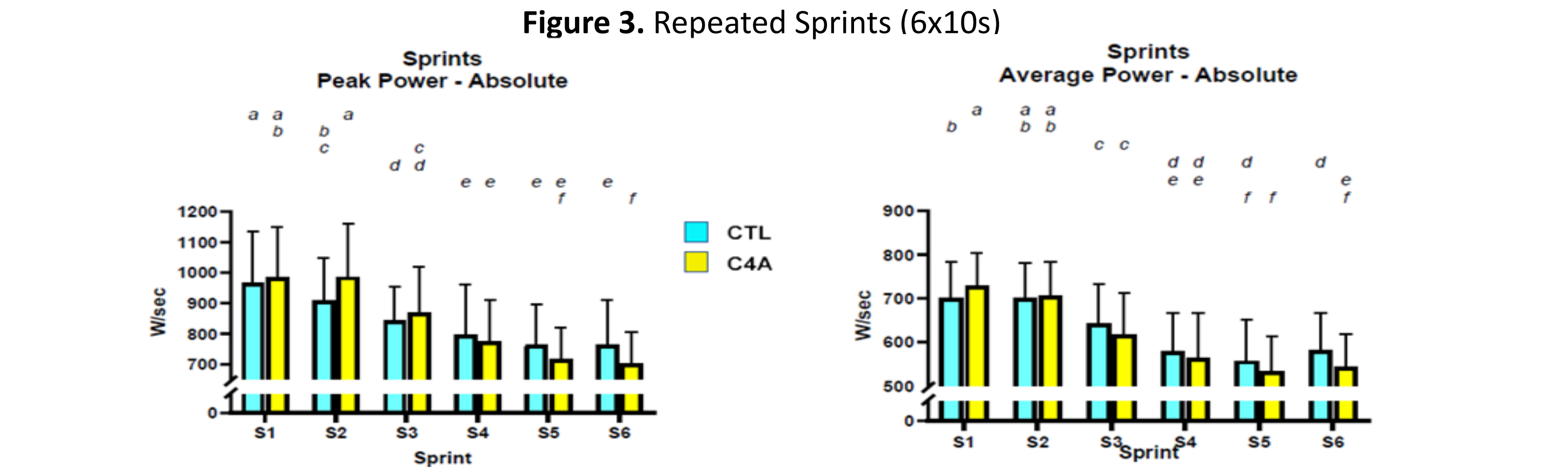
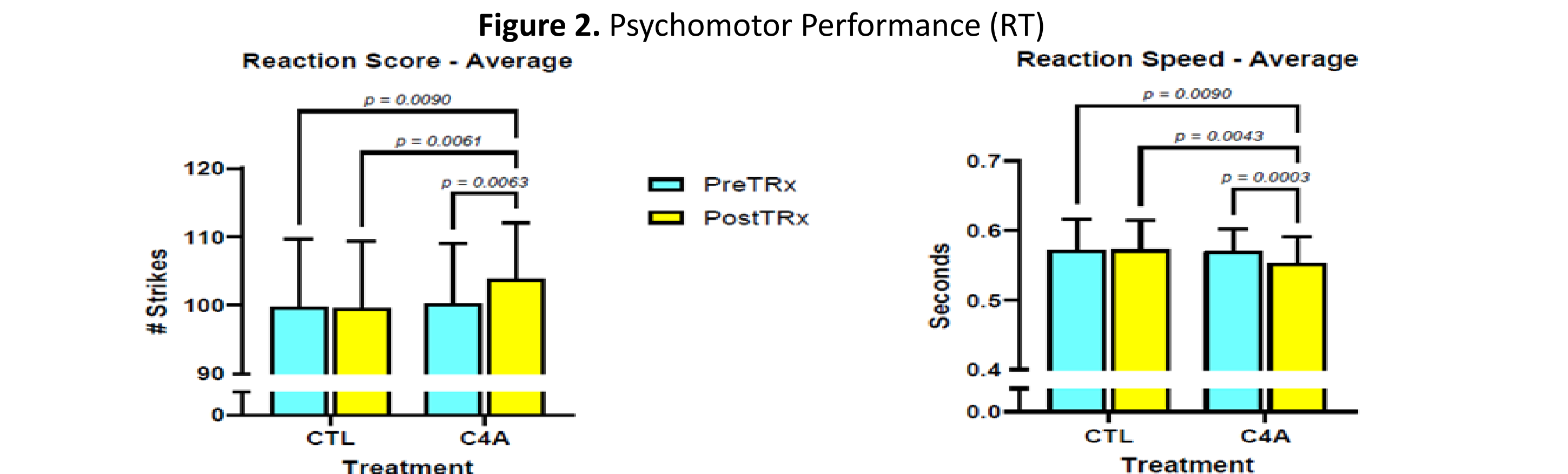
Results

RT: C4A improved RT average score and reaction time (speed) from PreTRx to PostTRx [+3.6% ($p=0.0063$) and -3.0% ($p=0.0003$), respectively] and vs CTL at PostTRx [+4.2% ($p=0.0061$) and -3.3% ($p=0.0043$), respectively].

6x10s: Absolute and relative peak power for 6x10s was greatest for C4A vs CTL [+5.4% ($p=0.0343$) and +5.7% ($p=0.0263$), respectively], but Sprint1 (S1)-to-Sprint6 (S6) fatigue index was greater for C4A than CTL [+8.73% ($p=0.0009$) and +8.09% ($p=0.0014$), respectively].

3x3s: Quadriceps absolute and relative total work (volume) for 3x3s was greatest for C4A vs CTL [+8% ($p=0.0412$) and +7.3% ($p=0.0400$), respectively], but did not achieve significance for hamstrings [Abs: +6.6% ($p>0.05$); Rel: +6.6% ($p>0.05$)].

3x30s: Absolute and relative total work output for both quadriceps and hamstrings for 3x30s were significantly increased by C4A vs CTL [Abs: +3.42% ($p=0.0217$) and +8.05% ($p=0.0048$); Rel: +3.49% ($p=0.0297$) and +8.19% ($p=0.0057$), respectively].



Conclusion

This pre-market proof of concept study suggests that C4A can acutely increase psychomotor performance, peak power output, and total work (volume) capacity when used by experienced resistance trainers that regularly consume caffeine-containing MIPS. Placebo-controlled follow-up studies are needed.

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