DURATION AFFECTS MULTIPLE PACING STRATEGY COMPONENTS DURING A HIGH-INTENSITY FUNCTIONAL TRAINING WORKOUT

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INTRODUCTION

Consistency of effort is a key strategy when trying to maximize performance in high-intensity functional training (HIFT) workouts (8). For instance, a common workout design requires trainees to complete '*as many repetitions as possible*' (AMRAP) of a specified circuit within a set duration (2, 8, 9). This is best accomplished by performing exercise repetitions at the fastest rate possible while minimizing transition times between exercises and avoiding failed repetitions and breaks (8). Fatigue will surely limit success in this endeavor if the trainee's physiological capacity does match their chosen pacing strategy.

Muti-ingredient pre-workout supplements might also aid in this endeavor. Many formulations contain ingredients known to enhance blood flow and provide nutrients to exercising muscle (4 – 6, 11). The one study that examined the effect of any pre-workout formulation (extracts of pomegranate, tart cherry, green and black tea) on HIFT reported improved performance in the second of two consecutive workouts after for 6 weeks of supplementation (10). Meanwhile, others have assessed the acute effects of the specific formulation under investigation (see Table 1) and reported no effect on vertical jump performance (3), but more repetitions completed across 5 sets of bench press (1). Though maintaining effort was more important to completing more bench press repetitions, performance was aided by 2 minutes or rest between sets. In contrast, rest is autoregulated in HIFT (2, 8, 9) and no study has examined the effect of any supplement on the consistency of effort during HIFT.

PURPOSE

Examine the effect of a pre-workout supplement, workout duration, and sex on exercise kinetics variability during a HIFT-style AMRAP.

METHODS

Participants
- Men (n=12: 27.6 ± 8 years, 175 ± 7.4 cm, 89.1 ± 12.1 kg)
- Women (n=10: 31.3 ± 5.5 years, 167.2 ± 4.7 cm, 70.2 ± 13.2kg)
- ≥ 2 years of HIFT experience.

Study Design
- Four weekly experimental visits on the same day and time
- Participants consumed either supplement (S; see Table 1) or non-caloric placebo (P) 40 minutes before completing a 5- or 15-minute AMRAP in randomized, cross-over fashion.

Kinetic Measures
- Rowing strokes per minute and power (W) recorded by Concept2 (Model D) microcomputer.
- Thruster barbell velocity (m/sec) and power monitored by3D Camera (PERCH).
- Box jump impulse (N*sec), peak force (N), and rate of force development (N/sec) assessed by in-ground force plate (Accupower, AMTI).

Workout Analysis
- Variability defined by each measure's standard deviation (SD) and slope across rounds.
- Effect of the supplement condition, workout duration, and sex on each variable assessed with 3-way analysis of variance.

Table 1. Supplement ingredient list

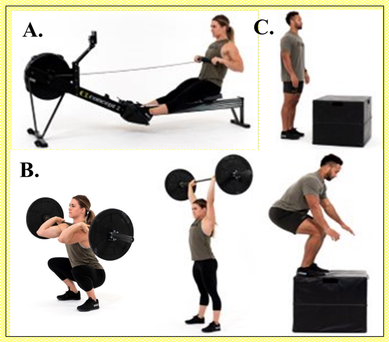
Serving Size: 1 scoop (30 g)

Ingredients	Amount per serving	% DV
Calories	5	
Total Carbohydrate	1 g	≤1%*
Niacin (as Nicotinic Acid)	15 mg	94%
Vitamin B6 (as Pyridoxine HCl)	1 mg	59%
Vitamin B12 (as Methylcobalamin)	100 mcg	4167%
Iron	1 mg	6%
Magnesium (from Red Spinach Leaf Extract and Dimagnesium Malate)	9 mg	2%
Sodium (as Pink Himalayan Sea Salt)	40 mg	2%
Potassium (from Red Spinach Leaf Extract and Potassium Chloride)	248 mg	5%
L-Citrulline	8 g	**
Creatine Monohydrate	5 g	**
Taurine	3 g	**
Beta-Alanine (as CarnoSyn®)	2.5 g	**
Betaine Anhydrous	2.5 g	**
L-Tyrosine	2 g	**
Red Spinach Leaf Extract (as Oxystorm®)	1 g	**
Beet Root Extract	1 g	**
Alpha-GPC (Alpha-Glycerol Phosphoryl Choline 50%)	300 mg	**
Caffeine Blend		
Caffeine Anhydrous (250 mg)		
zümXR® Delayed Release Caffeine (50 mg)		
L-Theanine	150 mg	**
ElevATP® (Ancient Peat and Apple Fruit Extract)	150 mg	**
Pink Himalayan Sea Salt	100 mg	**
Rhodiola rosea (root) Extract	100 mg	**
Co-Enzyme Q10	25 mg	**
AstraGin® [Astargalus membranaceus (root) Extract & Panax notoginseng (root) Extract]	25 mg	**
BioPerine® (Black Pepper Fruit Extract)	5 mg	**

*Percent Daily Values (DV) are based on a 2,000-calorie diet
** Daily value not established
OTHER INGREDIENTS: Citric acid, Natural Flavor, Calcium Silicate, Malic Acid, Silicon Dioxide, Sucralose, Spirulina Powder

Figure 1. The AMRAP Circuit

Participants repeated a circuit of **(A.)** rowing calories (men = 9, women = 7), **(B)** six barbell thrusters (men = 95 lbs. [43.1 kg]; women = 65 lbs. [29.5 kg]), and **(C)** three box jumps (men = 24 in [0.61 m]; women = 20 in [0.51 m]) while maintaining previously described movement standards (2).



RESULTS

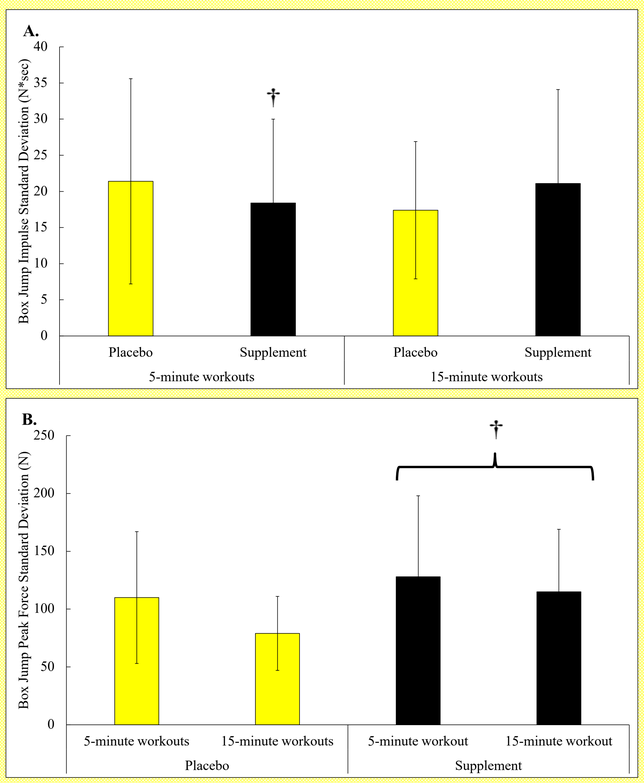
- **Rowing Performance**
  - SD: No differences.
  - Slope: Greater reduction in power across minutes during 5-minutes bouts.
- **Barbell Thruster Performance**
  - SD: Velocity and power were more variable during 5-minute workouts.
  - Slope: Greater reduction in velocity and power across rounds in 5-minute bouts.
- **Box Jump Performance**
  - SD: Impulse was less variable during the 5-S compared to 5-P, with men being more variable than women during all conditions. Meanwhile, peak force was less variable during placebo conditions (Figure 2).
  - Slope: Greater declines in peak force and RFD across the 5-minute bouts.
- **No other differences were observed.**

Table 2. Exercise kinetics variability comparisons

		Standard Deviation				Slope			
		5-minute workouts		15-minute workouts		5-minute workouts		15-minute workouts	
		Placebo	Supplement	Placebo	Supplement	Placebo	Supplement	Placebo	Supplement
Rowing	Strokes (per minute)								
	Men	2.72 ± 2.06	2.5 ± 1.00	2.66 ± 1.99	2.37 ± 1.29	-0.90 ± 1.81	-0.66 ± 1.26	-0.24 ± 0.55	-0.16 ± 0.57
	Women	1.60 ± 0.84	1.60 ± 0.90	1.95 ± 0.80	2.13 ± 0.81	-0.17 ± 0.89	-0.43 ± 0.68	-0.25 ± 0.31	-0.19 ± 0.43
	Power (W)								
	Men	64.4 ± 50.6	55.3 ± 39.1	52.2 ± 54.4	44.7 ± 30.5	-34.0 ± 35.9	-29.3 ± 28.2	-11.0 ± 13.9	-10.5 ± 10.6
	Women	32.1 ± 15.0	36.1 ± 16.0	30.9 ± 13.0	32.8 ± 11.3	-16.8 ± 12.8	-20.3 ± 12.1 #	-5.9 ± 5.0	-6.6 ± 4.2
Thrusters	Velocity (m/sec)								
	Men	0.06 ± 0.03	0.07 ± 0.04 #	0.04 ± 0.02	0.04 ± 0.01	-0.03 ± 0.03	-0.04 ± 0.02 #	0.00 ± 0.01	0.00 ± 0.01
	Women	0.06 ± 0.03	0.06 ± 0.02	0.05 ± 0.02	0.05 ± 0.03	-0.02 ± 0.02	-0.02 ± 0.03	0.00 ± 0.01	-0.01 ± 0.01
	Power (W)								
	Men	26.4 ± 11.6	29.5 ± 15.3 #	17.8 ± 8.2	17.1 ± 5.7	-11.0 ± 14.0	-16.0 ± 9.5 #	-1.4 ± 4.4	-1.5 ± 3.5
	Women	24.7 ± 29.0	16.4 ± 7.1	13.8 ± 6.7	13.7 ± 8.2	-9.6 ± 20.8	-5.4 ± 7.9	-0.4 ± 2.0	-1.4 ± 2.0
Box Jumps	Impulse (N*sec)								
	Men	26.5 ± 11.5*	23.9 ± 9.4*	21.6 ± 7.7*	25.2 ± 13.9*	-0.2 ± 17.4	5.4 ± 16.0	-2.8 ± 6.4	0.7 ± 8.6
	Women	15.4 ± 15.4	11.2 ± 10.4	11.7 ± 9.0	16.3 ± 10.5	-1.5 ± 8.1	-1.5 ± 3.3	-1.0 ± 4.3	-4.3 ± 5.9
	Peak Force (N)								
	Men	124 ± 67	148 ± 67	76 ± 26	128 ± 56	-46 ± 65	-76 ± 75 #	-14 ± 37	3 ± 131
	Women	94 ± 40	102 ± 68	83 ± 40	100 ± 49	-18 ± 41	-40 ± 60	23 ± 61	24 ± 76
	RFD (N/sec)								
	Men	1646 ± 1093	1745 ± 1154	1028 ± 449	1722 ± 1059	-252 ± 1046	-814 ± 1022 #	167 ± 544	-30 ± 1010
	Women	1426 ± 771	1292 ± 877	1358 ± 801	1578 ± 833	-204 ± 642	-365 ± 652	298 ± 812	422 ± 1089

* = Significantly ($p < 0.05$) different between men and women; # = Significantly ($p < 0.05$) different between workout durations.

Figure 2. Variability comparisons in box jump A) impulse and B) peak force



† = Significantly ($p < 0.05$) different from placebo condition

CONCLUSIONS

The multi-ingredient supplement led to greater consistency in box jump impulse during the 5-minute AMRAP, but the opposite was true overall with peak box jump force expression. The lack of agreement between impulse and peak force may be due to variable stability. Impulse reflects all forces expressed during a jump, whereas peak force only represents the highest force expressed within a 1-millisecond window of a single jump (7). Within the context of a HIFT workout, slight differences in how athletes step back down onto the force plate before immediately jumping back onto the box would seem to make peak force naturally more volatile. Additionally, the lower repetition scheme for this exercise and rowing, compared to what is more commonly programmed (2, 8, 9), might have also influenced the agreement amongst measures.

PRACTICAL APPLICATIONS

These data provide evidence of a potential benefit from a multi-ingredient pre-workout supplement on consistency in exercise kinetics during HIFT. Athletes might consider using this pre-workout supplement when shorter-duration HIFT workouts contain plyometric-style movements that also require efficient negotiation of an obstacle (e.g., box). Consistent force expression might aid balance and stability when landing onto the box and efficiently stepping down for the next repetition or to transition to another exercise.

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