

A MULTI-INGREDIENT PRE-WORKOUT SUPPLEMENT AFFECTS ROWING PERFORMANCE WITHIN A 5- AND 15-MINUTE HIGH-INTENSITY FUNCTIONAL TRAINING WORKOUT

Miranda Chapa, Christopher Staples, Jacob Fanno, Ashley Hines, James Henley, Wysmark Chaves, Jacob Grazer, Tiffany A Esmat, J McLester, and Gerald T Mangine
Department of Exercise Science and Sport Management, Kennesaw State University, Kennesaw, GA

INTRODUCTION

The ‘as many repetitions as possible’ (AMRAP) circuit format is common in high-intensity functional training (HIFT) (8). Performance is dependent on sustaining the necessary power to complete each movement at a pace that also minimizes breaks due to fatigue (7), and this ability is thought to improve with training and HIFT experience.

Multi-ingredient pre-workout supplements contain several components known to improve energy availability to enhance force production and better sustain power (1, 4 – 6, 9 – 10). However, pre-workout formulations are numerous and immensely variable. Only one study has examined the effect of one on CF performance (10) and noted improved aerobic capacity, anaerobic power, and repeated HIFT-style workout performance after consuming a pre-workout supplement (extracts of pomegranate, tart cherry, green and black tea) for 6 weeks. The specific formulation (see Table 1) under investigation has been documented to improve bench press volume complete (1) but not vertical jump performance (3).

PURPOSE

To examine the acute effects of a pre-workout supplement on power expression and HIFT workout performance.

METHODS

Men (n=12) and women (n=10) with HIFT experience (≥ 2 years) (29.3 ± 7.1 years, 171 ± 7 cm, 80.5 ± 15.6 kg) completed four randomized visits after fasting 2-3 hours, once per week, over 4 consecutive weeks at their normal workout time.

Participants randomly consumed either supplement (S, Maximum Pre-workout Formula, Shifted, LLC, Eugene, OR – see Table 1) or a non-caloric placebo (P) and rested 40 minutes before completing a workout condition.

Rowing ergometer (Concept2, model D) recorded strokes per minute, 500-m split pace, calories per hour, and power. A 3D camera (PERCH, Catalyft Labs) measured barbell thruster velocity and power. Box jump peak force, mean impulse, and rate of force development (RFD) collected from in-ground force plates (Accupower, AMTI).

The average, standard deviation (SD), and slope of each exercise’s kinetics, measured within each round, were calculated across each round of all four conditions.

Figure 1. Workout designs

Participants completed 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]) for a 5- or 15-minute AMRAP using movement standards (2).

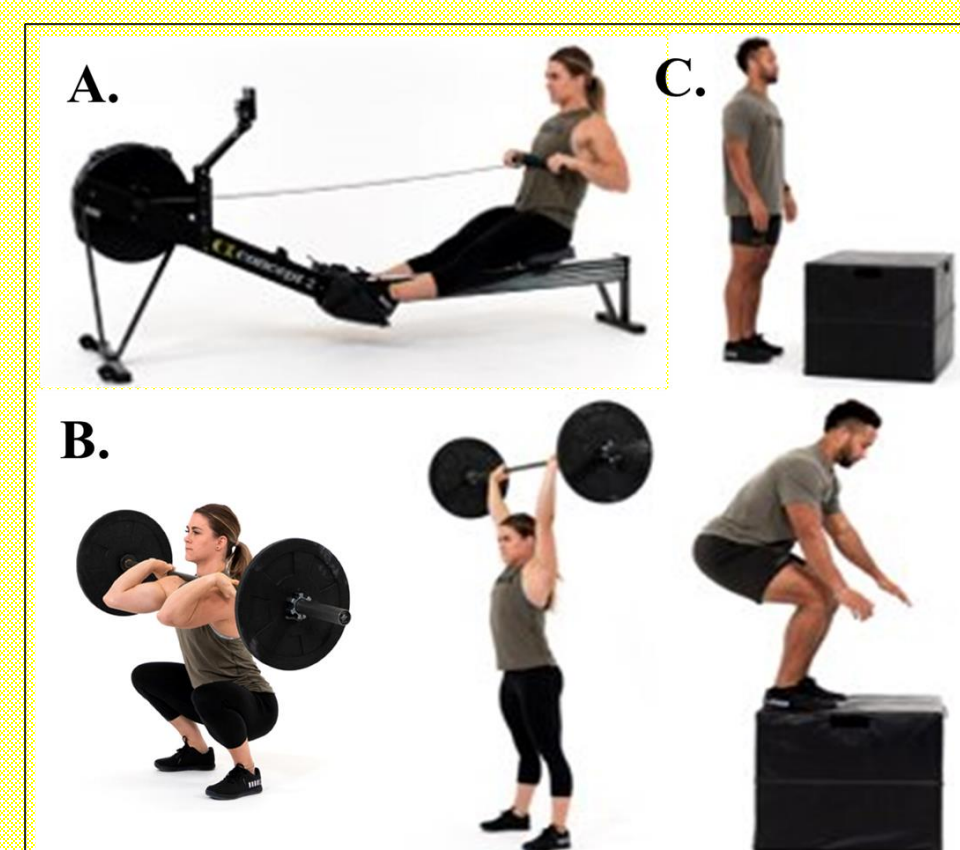


Table 1. Supplement ingredient list

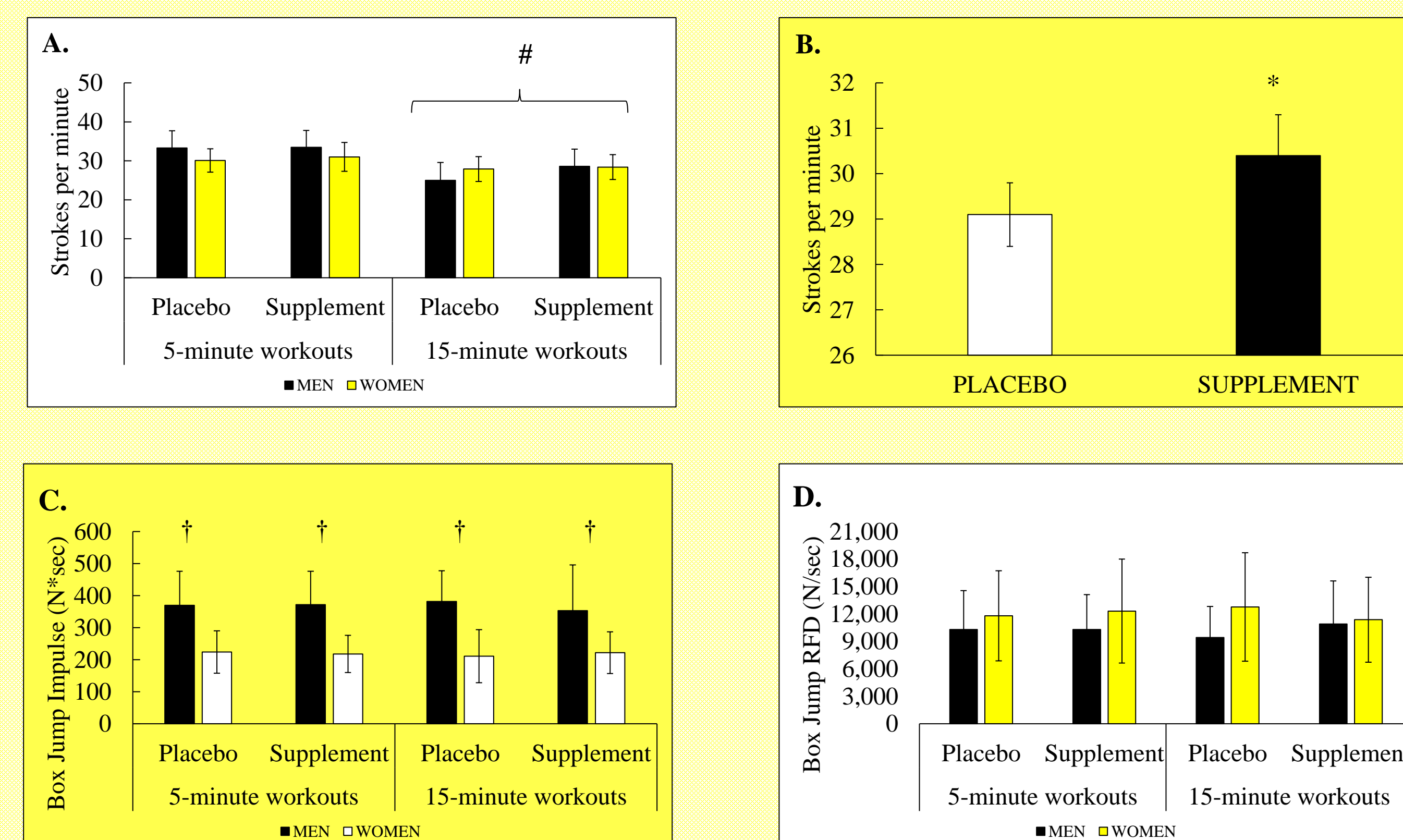
Serving Size: 1 scoop (30 g)	Ingredient	Amount per serving	% DV
	Calories	5	
	Total Carbohydrate	1 g	<1%*
	Niacin (as Nicotinic Acid)	15 mg	94%
	Vitamin B6 (as Pyridoxine HCl)	1 mg	59%
	Vitamin B12 (as Methylcobalamin)	100 mcg	4167%
	Iron	1 mg	6%
	Magnesium (from Red Spinach Leaf Extract and Dimagnesium 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)	300 mg	**
	zimXR® Delayed Release Caffeine (50 mg)		
	L-Theanine	150 mg	**
	ElevATP® (Ancient Pear and Apple Fruit Extract)	150 mg	**
	Pink Himalayan Sea Salt	100 mg	**
	Rhodiola rosea (root) Extract	100 mg	**
	Co-Enzyme Q10	25 mg	**
	AstraGin® (Astragalus 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

A 2 x 2 x 2 (Condition x Time x Sex) analysis of variance with repeated measures and Greenhouse Geisser adjustments were performed on averaged (across rounds) expression of all variables.

- **Main condition effect:** rowing strokes per minute ($p = 0.41$), where a faster rate was noted in the supplement condition versus placebo (Figure 2).
- **Condition x time x sex interactions:** box jump impulse ($p = 0.050$) and rate-of-force development ($p = 0.028$), but post-hoc analysis indicated the interaction was driven by sex differences or unclear, respectively (Figure 2).
- All other observed differences were not related to the supplement condition (Table 2).

Figure 2. Comparisons between conditions, workout durations, and sexes for A) strokes per minute [time x sex], B) strokes per minute [condition], C) box jump impulse [condition x time x sex], and D) box jump RFD [condition x time x sex].



= Significantly ($p < 0.05$) different from 5-minute condition; * = Significantly ($p < 0.05$) different than placebo; † = Significantly ($p < 0.05$) different between men and women.

RESULTS

Table 2. Comparisons between workout kinetics

		5-minute workouts		15-minute workouts	
		Placebo	Supplement	Placebo	Supplement
Thruster Velocity (m/sec)	Men	1.25 ± 0.17	1.27 ± 0.17	1.23 ± 0.17	1.24 ± 0.16
	Women	1.09 ± 0.17	1.1 ± 0.17	1.12 ± 0.16	1.1 ± 0.15
	Total	1.18 ± 0.18	1.19 ± 0.19	1.18 ± 0.17	1.17 ± 0.17
Thruster Power (W)	Men	529 ± 71	537 ± 71	520 ± 71	523 ± 67
	Women	319 ± 53	318 ± 49	323 ± 47	317 ± 42
	Total	434 ± 124	438 ± 127	430 ± 117	429 ± 119
Rowing 500-m split pace (minutes)	Men	1.75 ± 0.12	1.72 ± 0.1	2.34 ± 0.9	2.06 ± 0.24
	Women	2 ± 0.12	1.96 ± 0.15	2.38 ± 0.5	2.18 ± 0.17
	Total	1.86 ± 0.17	1.83 ± 0.17	2.36 ± 0.73	2.11 ± 0.22
Rowing calorie pace (per hour)	Men	1397 ± 214	1442 ± 208	986 ± 190	1046 ± 150
	Women	1016 ± 122	1078 ± 177	847 ± 137	871 ± 129
	Total	1225 ± 261	1278 ± 265	923 ± 179	967 ± 164
Rowing power (W)	Men	319 ± 62	332 ± 60	199 ± 55	217 ± 44
	Women	208 ± 36	226 ± 51	159 ± 40	166 ± 37
	Total	269 ± 76	284 ± 77	181 ± 52	194 ± 48
Box Jump Peak Force (N)	Men	2735 ± 359	2736 ± 370	2730 ± 355	2685 ± 405
	Women	2241 ± 495	2255 ± 532	2214 ± 522	2207 ± 489
	Total	2537 ± 476	2544 ± 492	2524 ± 491	2493 ± 491

= Significantly ($p < 0.05$) different from 5-minute condition; * = Significantly ($p < 0.05$) different than placebo; † = Significantly ($p < 0.05$) different between men and women.

CONCLUSIONS

The supplement enabled a faster stroke rate to be maintained without negatively impacting rowing power or round completion time. Previous research on multi-ingredient formulations failed to see improved vertical jump power (3) but greater volume load completed (1) and repeated HIFT-style workout performance (10). The lack of clear advantages in all workout aspects, however, contrast reports of improved acute performance whenever caffeine is involved (1, 5, 9). It is possible that the standard caffeine dosage (300 mg regardless of body size) in this heterogenous sample might explain the lack of agreement (5).

PRACTICAL APPLICATIONS

The data suggest a potential benefit from this multi-ingredient pre-workout supplement during a HIFT-style AMRAP. A faster stroke rate would alleviate the effort needed on each stroke to maintain the same power output. This seems to support the idea that consistent effort is more likely to be maintained whenever a greater volume load is assigned; a relevant view when considering daily variation in HIFT programming (7, 8).

REFERENCES

- Beyer, Kyle S., et al. "A single dose multi-ingredient pre-workout supplement enhances upper body resistance exercise performance." *Frontiers in Nutrition* 11 (2024).
- CrossFit. Open Workouts, in: CrossFit Games. 2023.
- Curtis J et al. (2022). The Effects of a Pre-workout Supplement on Measures of Alertness, Mood, and Lower-Extremity Power. *Cureus*, 14 (5).
- Kreider RB et al. (2017) International Society of Sports Nutrition position stand: safety and efficacy of creatine supplementation in exercise, sport, and medicine. *Journal of the International Society of Sports Nutrition*, 14 (1): 18.
- Goldstein ER et al. (2010). International society of sports nutrition position stand: caffeine and performance. *Journal of the International Society of Sports Nutrition*, 7 (1): 5.
- Gonzalez AM et al. (2020). Emerging nutritional supplements for strength and hypertrophy: an update of the current literature. *Strength & Conditioning Journal*, 42 (5): 57-70.
- Mangine GT and Seay TR (2022). Quantifying CrossFit®: Potential solutions for monitoring multimodal workloads and identifying training targets. *Frontiers in Sports and Active Living*, 4(949429).
- McDougle JM et al. (2023). Acute physiological outcomes of high-intensity functional training: a scoping review. *PeerJ*, 11, e14493. Gonzalez AM et al. (2020). Emerging nutritional supplements for strength and hypertrophy: an update of the current literature. *Strength & Conditioning Journal*, 42 (5): 57-70.
- Outlaw, J. J., Wilborn, C. D., Smith-Ryan, A. E., Hayward, S. E., Urbina, S. L., Taylor, L. W., & Foster, C. A. (2014). Effects of a pre-and post-workout protein-carbohydrate supplement in trained crossfit individuals. *Springerplus*, 3(1), 1-7.
- Trexler ET et al. (2015) International society of sports nutrition position stand: Beta-Alanine. *Journal of the International Society of Sports Nutrition*, 12 (1): 30.

ACKNOWLEDGEMENTS

This study was funded by SHIFTED, LLC (Eugene, OR) and the Kennesaw State University Office of Undergraduate Research.