THERMOGENIC AND HEMODYNAMIC EFFECTS OF INGESTING A PRE-WORKOUT SUPPLEMENT WITH AND WITHOUT SYNEPHRINE

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Abstract

Background

A number of nutritional strategies have been developed to optimize nutrient delivery prior to exercise. As a result, a number of pre-workout supplements have been developed to increase energy availability, promote vasodilation, and/or positively affect exercise capacity. The purpose of this study was to examine the acute effects of ingesting a pre-workout dietary supplement with and without synephrine on energy metabolism and cardiovascular hemodynamics.

Methods

In a double-blind, crossover, randomized and placebo-controlled manner; 25 apparently healthy and recreationally active men and women (21.76±3.00 yr, 15.24±5.26% fat, 25.09±3.03 kg/m^2) had resting blood pressure (BP), heart rate (HR), 12-lead electrocardiographs (ECG), and resting energy expenditure (REE) measured for 10 minutes. Participants then ingested in a randomized and counterbalanced manner a dextrose flavored placebo (P); a pre-workout supplement (PWS) containing 3.0 g beta alanine, 2 g creatine nitrate, 2 g arginine AKG, 300 mg of N-acetyl tyrosine, 270 mg caffeine, 15 mg of Mucuna pruriens; or, the PWS with 20 mg of synephrine (PWS+S). Metabolic changes were measured continuously while BP, HR, and ECG's were obtained every 10 minutes during the REE test. Participants repeated the experiment after a one week washout period with the alternate supplements in a randomized and counterbalanced manner. Data were analyzed by repeated measure MANOVA and are presented as means ± SD or SEM from baseline.

Results

MANOVA analysis revealed a significant overall Wilks' Lambda time (p<0.001) and time x group interactions (p<0.001) for oxygen uptake (VO_2), carbon dioxide production (VCO_2), minute ventilation (V_E), respiratory exchange ratio (RER), and REE values. MANOVA Greenhouse-Geisser univariate analysis revealed significant interactions among groups in VCO_2 (p=0.003) and RER (p<0.001) with a trend toward significance in REE (p=0.098). Delta analysis revealed significant differences among groups in mean change in VO_2 (P: 3.8±5.2; PWS: 15.4±5.2; PWS+S: 23.5±5.2 ml/min; p=0.03), VCO_2 (P: 12.5±5.1; PWS: 31.8±5.1; PWS+S: 37.7±5.1 ml/min; p=0.002), RER (P: 0.033±0.009; PWS: 0.071±0.009; PWS+S: 0.071±0.009; p=0.005), and REE (P: 0.034±0.025; PWS: 0.095±0.025; PWS+S: 0.132±0.025 kcal/min; p=0.02) with significant differences observed among the P group and both supplemented groups. PWS+S ingestion promoted a more prominent increase in VO_2, VCO_2, and REE during the initial 5-10 minutes after ingestion with differences minimizing thereafter. Area under the curve (AUC) analysis of changes from baseline revealed that PWS+S and PWS supplementation resulted in significantly greater AUC values than P in VO_2 (PWS+S: 1,034±584; PWS: 802±434; P: 684±376; p=0.01); VCO_2 (PWS+S: 1,372±604; PWS: 1,151±604; P: 634±262; p<0.01); and RER (PWS+S: 2.79±0.89; PWS: 2.44±0.98; P: 1.46±0.66; p<0.01). There were no significant interaction effects for HR (p=0.77), SBP (p=0.35), or DBP (p=0.65) and there was no evidence of an increase in ECG assessed arrhythmias during the REE assessment.

Conclusion

Ingesting a PWS containing beta alanine, creatine nitrate, arginine AKG, N-Acetyl Tyrosine, caffeine, and Mucuna pruriens increased resting VO_2, VCO_2, RER, and tended to increase REE values in comparison to a placebo. Addition of 20 mg of synephrine to the PWS resulted in a greater increase in the metabolic response during the first 5-10 minutes after ingestion but differences were not as apparent thereafter and AUC values were not significantly different between the PWS and PWS+S groups. PWS and PWS+S ingestion did not result in a significantly different HR or BP responses during the REE test in comparison to P responses. Results indicate that ingestion of these pre-workout supplements promoted modest thermogenic response and that addition of 20 mg of synephrine to the PWS provided limited additional benefit.

Rationale

Among active young and athletes, multi-ingredient pre-workout supplements are extremely popular [1, 2], and a number of nutritional strategies have been developed to optimize nutrition delivery prior to exercise [3, 4]. Synephrine is widely used in dietary supplements for sports performance, and it also extensively consumed in various juices and foods derived Citrus species [5]. In a 60 days doudble-blind and placebo-controlled study, adverse effects of Citrus aurantium were not found [6].

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6. Kaats, Miller, Preuss, & Stohs. Food & Chem Toxi 55, 2013

Purpose: Examine the acute effects of ingesting a pre-workout dietary supplement with and without synephrine on energy metabolism and cardiovascular hemodynamics.

Methods & Procedures

- A double-blind, crossover, randomized and placebo-controlled manner
- 25 apparently healthy and recreationally active men and women (21.76±3.00 yr, 15.24±5.26% fat, 25.09±3.03 kg/m2)

Supplements

- Placebo (P): a dextrose flavored
- Pre-workout (PWS): 3.0 g beta alanine, 2 g creatine nitrate, 2 g arginine AKG, 300 mg of N-acetyl tyrosine, 270 mg caffeine, 15 mg of Mucuna pruriens
- Pre-workout with synephrine (PWS+S): PWS with 20 mg of synephrine

- At pre-ingestion, resting BP, resting HR, 12-lead ECG, and REE were measured for 10 minutes, and then post-supplement, BP, HR, 12-lead ECG, and REE were monitored for 30 minutes.

Statistical Analysis

Data were analyzed by repeated measure MANOVA and are presented as means ± SD or SEM from baseline (SPSS 22.0).

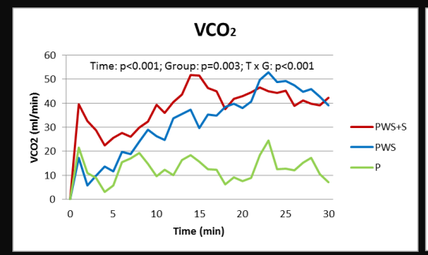
Results

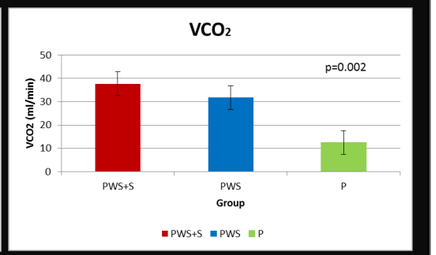
- MANOVA analysis revealed a significant overall Wilks' Lambda time (p<0.001) and time x group interactions (p<0.001) for VO_2, VCO_2, V_E, RER, and REE values.
- MANOVA Greenhouse-Geisser univariate analysis revealed significant interactions among groups in VCO_2 (p=0.003) and RER (p<0.001) with a trend toward significance in REE (p=0.098).
- PWS+S and PWS supplementation resulted in significantly greater AUC values than P in VO_2, VCO_2, and RER.

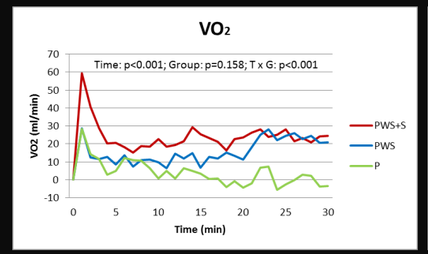
Conclusion

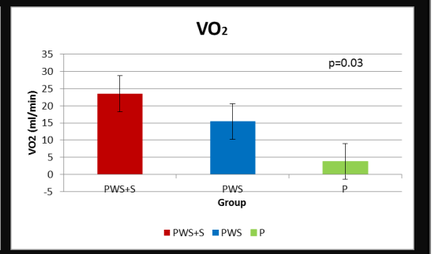
- Ingesting a PWS increased resting VO_2, VCO_2, RER, and tended to increase REE values in comparison to a placebo.
- Ingestion of a PWS promoted modest thermogenic response and that addition of 20 mg of synephrine to the PWS provided limited additional benefit.

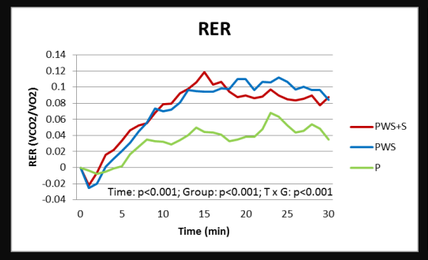
Figures

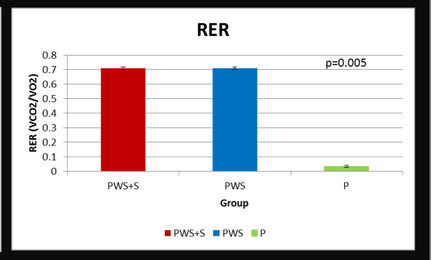


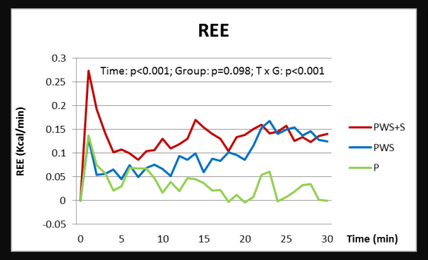


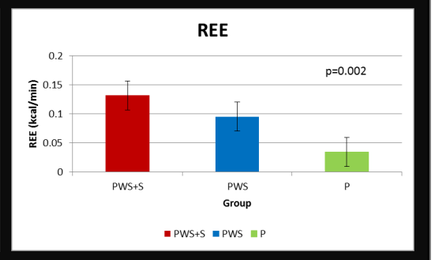












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EFFECTS OF INGESTING A PRE-WORKOUT SUPPLEMENT WITH AND WITHOUT SYNEPHRINE ON COGNITIVE FUNCTION, PERCEPTIONS OF READINESS TO PERFORM, AND EXERCISE PERFORMANCE

M Cho, YP Jung, C Goodenough, A O'Connor, R Dalton, K Levers, E Galvan, N Barringer, F Ayadi, J Carter, M Koozechian, S Simbo, A Reyes, B Sanchez, A Coletta, C Rasmussen, RB Kreider, Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX 77843

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A number of nutritional strategies have been developed to optimize nutrient delivery prior to exercise. As a result, a number of pre-workout supplements have been developed to increase energy availability, promote vasodilation, and/or positively affect exercise capacity. The purpose of this study was to examine the acute effects of ingesting a pre-workout dietary supplement with and without synephrine on cognitive function, perceptions of readiness to perform, and exercise performance.

Methods
In a double-blind, crossover, randomized and placebo-controlled manner; 25 apparently healthy and recreationally active men and women (21.76±3.00 yr, 15.24±5.26% fat, 25.09±3.03 kg/m2) performed a Stroup-Color cognitive function test (CFT) and rated perceptions of readiness to perform on a visual analogue scale (RTP-VAS). Participants then ingested in a randomized and counterbalanced manner a dextrose flavored placebo (P); a pre-workout supplement (PWS) containing 3.0 g beta alanine, 2 g creatine nitrate, 2 g arginine AKG, 300 mg of N-acetyl tyrosine, 270 mg caffeine, 15 mg of Mucuna pruriens; or, the PWS with 20 mg of synephrine (PWS+S). Approximately 30 minutes following ingestion of the supplements, participants performed a second CFT, completed a RTP-VAS, and then performed 3 sets of 10 repetitions at 70% of 1 repetition maximum (1RM) on the bench press and leg press with 2 minutes recovery between sets and 5 minutes recovery from exercise modes. Participants completed as many repetitions as possible during the final set. Following a 5-minute recovery, subjects also performed a 30-sec Wingate Anaerobic Capacity test on a cycle ergometer for determination of peak power (PP), mean power (MP), and total work (TW). Lastly, subjects performed a third CFT and RPT-VAS test. Participants repeated the experiment after a one week washout period with alternate supplements provided in a randomized and counterbalanced manner. Data were analyzed by repeated measure MANOVA or ANOVA and are presented as means ± SEM from baseline.

Results
Repeated measures MANOVA analysis revealed significant interactions among supplementation groups in ratings of "I am optimistic about my future performance" (P: 3.70±0.95; PWS: 4.05±0.73; PWS+S: 4.21±0.63; p<0.01), "I feel vigorous and energetic" (P=3.35±0.91; PWS: 3.77±0.79; PWS+S: 3.89±0.74; p=0.01), and "I have little muscle soreness" (P=3.42±1.00; PWS: 3.81±1.36; PWS+S: 3.27±1.29, p=0.04) 30 minutes after ingestion. MANOVA revealed an overall Wilks' Lambda time (p<0.001) and time x group interaction (p=0.003) effect on the CFT results. Delta analysis revealed that mean changes in word (P=0.64±1.1; PWS: 3.57±1.1; PWS+S: 7.40±1.1; p=0<0.001), color (P=1.41±0.7; PWS: 4.01±0.7; PWS+S: 5.08±0.7; p=0.002), and word-color (P=1.8±1.0; PWS: 3.28±1.0; PWS+S: 5.41±1.0; p=0.03) were greater in the PWS and PWS+S groups than P with PWS+S word responses greater than PWS. There were no significant differences among groups in Wingate PP (P: 1,579±510; PWS: 1,502±561; PWS+S: 1,491±516 W; p=0.46), MP (P: 602±132; PWS: 596±145; PWS+S: 583±188 W; p=0.60), or TW (P: 17,663±4,605; PWS: 17,850±4,341; PWS+S: 18,203±4,658 J; p=0.49). MANOA revealed significant Wilks' Lambda time and time x group (p<0.001) effects in bench press and leg press lifting volume in the final set of exercise. MANOVA univariate analysis revealed no significant Greenhouse-Geisser differences among groups in third set bench press lifting volume (P: 4,749±1,606; PWS: 4,889±1,614; PWS+S: 4,870±2,000 lbs; p<0.51). Leg press lifting volume differed among groups (P: 27,607±9,608; PWS: 28,905±9,859; PWS+S: 19,342±4,855 lbs; p<0.00) but PWS supplementation did not provide greater benefit than P.

Conclusion
Ingesting a PWS and PWS with 20 mg of synephrine 30-minutes prior to exercise enhanced perceptions of readiness to perform and cognitive function with no significant effects on anaerobic capacity or isotonic lifting volume.

Rationale

Among active young and athletes, multi-ingredient pre-workout supplements are extremely popular [1, 2], and a number of nutritional strategies have been developed to optimize nutrition delivery prior to exercise [3, 4]. Synephrine is widely used in dietary supplements for sports performance, and it also extensively consumed in various juices and foods derived Citrus species [5]. In a 60 days doudble-blind and placebo-controlled study, adverse effects of Citrus aurantium were not found [6].

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- At pre-ingestion, the first CFT and RTP-VAS were performed, and then the second and third CFT and RTP-VAS were measured at post-ingestion and at the end of test, respectively. 1RM BP and LP. and a 30-sec Wingate Anaerobic Capacity test were performed at the post-ingestion.

Statistical Analysis

Data were analyzed by repeated measure MANOVA or ANOVA and are presented as means ± SEM from baseline (SPSS 22.0).

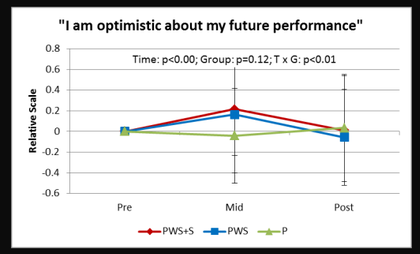
Results

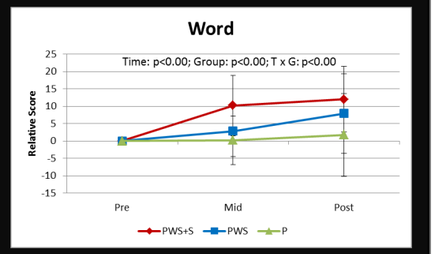
- MANOVA revealed an overall Wilks' Lambda time (p<0.001) and time x group interaction (p=0.003) effect on the CFT results.
- Delta analysis revealed that mean changes in word (P=0.64±1.1; PWS: 3.57±1.1; PWS+S: 7.40±1.1; p=0<0.001), color (P=1.41±0.7; PWS: 4.01±0.7; PWS+S: 5.08±0.7; p=0.002), and word-color (P=1.8±1.0; PWS: 3.28±1.0; PWS+S: 5.41±1.0; p=0.03) were greater in the PWS and PWS+S groups than P with PWS+S word responses greater than PWS.
- MANOA revealed significant Wilks' Lambda time and time x group (p<0.001) effects in bench press and leg press lifting volume in the final set of exercise.

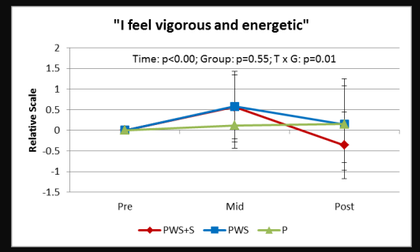
Conclusion

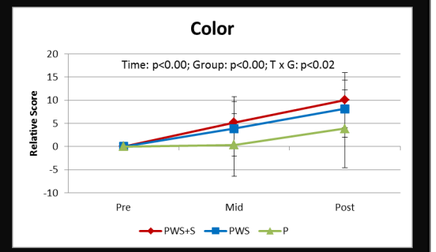
Ingesting a PWS and PWS with 20 mg of synephrine 30-minutes prior to exercise enhanced perceptions of readiness to perform and cognitive function with no significant effects on anaerobic capacity or isotonic lifting volume.

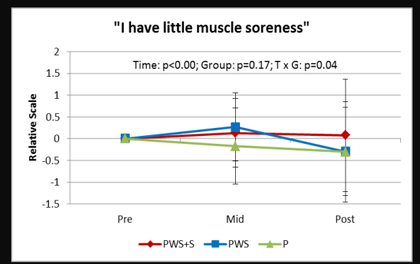
Figures

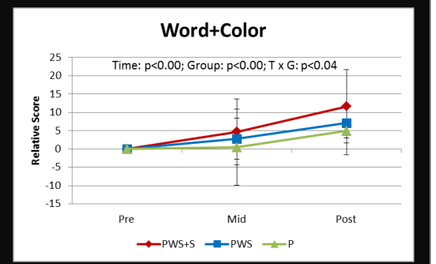


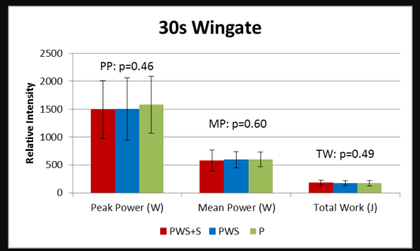


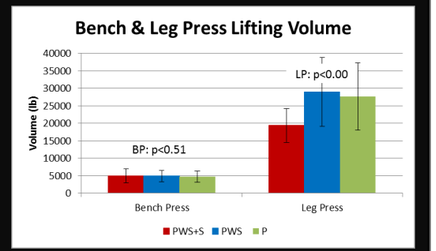












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