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Evidence-based nutritional strategies to improve performance among recreational athletes is in demand. Most ketone supplementation research was investigated under submaximal exercise conditions with inconsistent results. Whether ketone supplementation could have meaningful impacts on both sprint and endurance performance is uncertain.
PURPOSE: To determine if exogenous ketone ingestion (R-1,3-butanediol (BDO)) could improve critical power (CP, maximum steady state), W' (finite anaerobic energy reserve) derived from a three-minute-all-out-test (3MAOT), fatigue index (FI), maximum oxygen consumption (VO_2max), and power output.
METHODS: Recreationally active adults (male n=12, female n=12, mean ± SD: 21±2 years) completed counterbalanced, double-blind trials consisting of ingesting R-1,3-BDO (0.5 g/kg of body weight) or volume-matched placebo 30 min prior to performing a 3MAOT on a cycle ergometer; trials were separated by 48-72 hrs. Expired respiratory gases, blood glucose, lactate, and ketone levels were measured prior to ingestion, and immediately pre-and post-exercise. Normality was ensured before data from male and female subjects were analyzed separately and together using paired t-tests (2 tailed), descriptive statistics and Cohen's d. Significance was set at $p<0.05$.
RESULTS: Ketone ingestion resulted in a significantly higher CP in males (193.5±50.3 vs.182.4±44.7 W; p=0.029, d=0.24), but not females (140.56±39.08 vs. 140.62±39.08 W; p=0.960). As a group, CP was significantly higher with ketone ingestion (167.0±51.7 vs. 161.5±46.3 W, p=0.041, d=0.11). W' was not different between groups ($p>0.05$). Although FI, peak power and mean power were not significantly different between trials, they tended to be higher with ketones (FI: 69.1±11.2 vs. 67.5±12.0% W, p=0.425; peak power: 586.2±197.1 vs. 548.2±196.4 W, p=0.372; mean power: 231.2±56.5 vs. 228.5±52 W, p=0.248). VO_2max was significantly lower with ketones in all subjects (3.4±1.0 vs. 3.5±1.0 L/min, p=0.026), suggesting that supplementation affected peripheral (substrate availability) but not cardiorespiratory factors.
CONCLUSIONS: Ketone supplementation enhanced maximum steady state capacity in males. The large variance in power output and FI may have masked meaningful changes, thus requiring additional research.

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Dietary Exogenous Ketone Ester Preserves Motor Units And Improve Neuromuscular Function During Aging

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INTRODUCTION: Aging causes a gradual decline in neuromuscular function, muscle quality, and coordination, leading to independence loss. Ketone bodies like beta-hydroxybutyrate provide energy and neuroprotective benefits, but their long-term effects on neuromuscular health remain unclear.**PURPOSE**: To investigate if a chow diet supplemented with 25% ketone ester (KE), provided *ad libitum*, could improve neuromuscular function, preserve motor units, and enhance muscle and motor performance in aged mice.**METHODS:** Aged C57BL/6J mice (22-25 months; n = 20; 10 females, 10 males) were randomly assigned to standard chow or chow with 25% KE for 12 weeks *ad libitum*. Diets were isocaloric, with ketones displacing carbohydrates while maintaining balance. Blood β-hydroxybutyrate confirmed ketosis. Neuromuscular function was assessed using compound muscle action potential (CMAP) and motor unit estimation (MUNE). Muscle quality was evaluated by electrical impedance myography (EIM) phase angle, and coordination tested on rotarod. Data were analyzed using mixed-effects and ANOVA ($p < 0.05$).**RESULTS:** Exogenous KE supplementation produced improvements during the 12-week intervention in aged C57BL/6J mice. Blood β-hydroxybutyrate concentrations were higher in the KE group (0.92 ± 0.05 mmol/L) than controls (0.40 ± 0.03 mmol/L), with effects of diet, time, and interaction ($p < 0.0001$), confirming nutritional ketosis. CMAP amplitude was greater in ketone-fed mice (68.01 vs. 53.73 mV; Δ = 14.29; +26.6%; $p = 0.0071$), indicating improved neuromuscular transmission. MUNE was higher (494.7 vs. 313.6; Δ = 191.1; +60.9%; $p = 0.0097$), suggesting preservation of motor units. EIM (50 kHz phase angle) increased in the KE group, with gains of +22.2% at week 4 (23.65 vs. 19.35), +28.0% at week 8 (21.84 vs. 17.06), and +36.9% at week 12 (23.79 vs. 17.38), demonstrating improved muscle integrity. Rotarod performance rose +68.9% at week 8 (12.83 vs. 7.59 s) and +67.2% at week 12 (14.45 vs. 8.63 s) with a diet × time interaction ($p = 0.0342$), reflecting enhanced coordination and endurance.**CONCLUSION:** Ketone ester supplementation improved metabolic efficiency, neuromuscular communication, muscle integrity, and motor performance in aged mice, suggesting a promising nutritional approach to counteract age-related neuromuscular decline.
Supported by: Financial support for research was provided by the University of Wisconsin–Madison, School of Education.

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Effects Of KM2-HPB01 Consumption And Training Program For 8 Weeks On Muscular Maximum Strength And Running Endurance

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PURPOSE: KM2-HPB01 is a heat-treated lyophilized powder obtained by culturing *Lactiplantibacillus plantarum* KM2. We examined the effects of KM2-HPB01 consumption and a combined exercise program for 8 weeks on muscular strength and running performance. **METHODS**: A randomized, double-blind, placebo-controlled trial is adopted. Twenty-nine healthy men are randomly assigned either one of two groups; control (CON, n=13, 24.5±2.3 yrs, 173.3±6.1 cm, 75.6±10.2 kg, 25.1±2.6 kg/m^2, 19.4±5.8 %fat) or experimental (EX, n=16, 24.4±3.2 yrs, 178.2±5.9 cm, 75.1±8.7 kg, 23.6±2.0 kg/m^2, 15.9±4.9 %fat). Participants in EX are administered with KM2-HPB01 (twice a day, 4.5 gram each) while CON with placebo for 8 weeks. All participated in a 8-week training program consisted of resistance training (7 types of exercise, 8-12 reps for 3 sets for 60-min per session) once a week and 60-min treadmill running (at intensity ranged 60-65% of maximal aerobic capacity (VO2max)) twice a week. Before and after training, physical characteristics, muscular strength (1-repetition maximum (1RM) of bench press, squat, and deadlift) and running performance (running time during VO2max test) are examined. **RESULTS**: Physical characteristics including muscle mass, fat mass, and circumference (upper arm, waist, hip, and thigh) are not different between groups at both before and after the program. 1RM of squat and bench press are increased after program, but no group difference is noticed (ANOVA, p>0.05). 1RM of deadlift increases from 115.0±20.3 to 126.0±16.7 kg in EX after program, but not in CON (from 116.5±17.2 to 119.2±15.9 kg), and group difference is noticed after program (ANOVA, p<0.05). VO2max after program is not changed in both groups,

but the running time after program increases greater (t-test, $p<0.05$) in EX (from 751.1±64.2 to 818.4±62.8 sec) than CON (from 774.6±70.5 to 815.1±70.0 sec).
CONCLUSIONS: KM2-HPB01 clearly demonstrates its effect on an enhancement of both muscular maximum strength and running endurance. This substance can be a potential candidate for enhancing both anaerobic and aerobic exercise capacity.
Supported by: This research was financially supported by the R&D Center of KookminBio Corporation (Seoul, Korea) through the project 'KL-Biome' (initiated in September 2023) for the development of innovative new drug candidate.

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Creatine Supplementation To Increase Exercise Performance At Simulated Altitude

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Exercise performance significantly decreases at high altitudes. Creatine supplementation increases exercise performance at sea level; but few studies have examined the effects at high altitude. **Purpose:** To determine the effects of creatine supplementation on exercise performance at a simulated altitude of 3,800m. **Methods:** Sixty-two healthy, physically active college students (51M, 11F; age: 21.0 ± 2.0 years; BMI: 24.1 ± 2.7 kg•m^2) have completed the study to date. At sea-level baseline, participants completed a repeated sprint exercise test (six, 10-second sprints with 60-seconds recovery between each sprint) on a cycle ergometer. Participants were then randomly assigned in a double-blind fashion to placebo (Pl; dextrose) or creatine (Cr; 20g/day) for 2 days. After the 2-day supplementation period, participants completed the repeated sprint exercise test while breathing a hypoxic gas mixture containing 12.9% oxygen (3,800m elevation). Performance, assessed as relative mean power and relative peak power, was analyzed using repeated measures ANOVA. **Results:** Preliminary data indicated a trend towards decreased exercise performance at simulated altitude compared to sea level for both groups in relative peak power ($F = 2.97$, $p = 0.07$) but not relative mean power (F=0.1038, p= 0.9017). For relative mean power, from baseline to simulated altitude, there was no difference between Pl (9.02±1.3W/kg; 8.70±1.5W/kg) and Cr (9.03±1.3W/kg; 8.78±1.6W/kg) across sprints (p>0.05). Also, there was no differences between Pl (10.47±1.2W/kg; 10.13±1.4W/kg) and Cr (10.46±1.4W/kg; 10.42±1.4W/kg) for relative peak power (p>0.05). Analyses accounting for individual sprints and other exercise performance variables is ongoing. **Conclusion:** To our knowledge, this is the first study to investigate the effects of creatine supplementation on exercise performance at simulated altitude.
Supported by: Bill and Linda Frost Scholarship

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The Effect Of Topical Carnosine Gel On Anaerobic Power

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Carnosine is a dipeptide found in skeletal muscle that contributes to buffering intramuscular pH during high-intensity exercise. The topical application of carnosine has been suggested to enhance buffering capacity and delay fatigue, yet limited evidence exists for its ergogenic efficacy. Purpose: The purpose of this study was to evaluate whether application of topical carnosine gel (CAR) impacts Wingate Anaerobic Power Test (WAPT) performance in collegiate athletes. Methods: Twenty Division II collegiate athletes (age 20.4 ± 1.8 yr; height 70.0 ± 4.0 in; weight 81.0 ± 15.4 kg) participated in a randomized, double-blind, crossover, placebo-controlled design. Each participant completed a familiarization trial followed by two experimental trials separated by ≥72 hours. Five pumps of (CAR) or placebo gel (PLA) were applied to the quadriceps, hamstrings, adductors, and gastrocnemius 45 minutes prior to completing the WAPT on a cycle ergometer. Peak power (PP), mean power (MP), fatigue index (FI), blood lactate concentration (LA), and rating of perceived exertion (RPE) were recorded. Data were analyzed using one-way ANOVA ($p<.05$). Results: Statistical analysis showed no significant differences between CAR and PLA for PP (1212.85 ± 294.70 W vs. 1228.70 ± 302.18 W), MP (807.91 ± 160.12 W vs. 819.49 ± 167.91 W), FI (59.82 ± 6.51 vs. 58.48 ± 8.34), LA (8.51 ± 5.32 vs. 8.50 ± 5.00 mmol/L immediately post), or subsequent 5- and 10-minute lactate values (p>.05). Conclusion: The application of topical CAR does not significantly enhance WAPT performance. These findings suggest that acute topical carnosine supplementation, in its current form, is unlikely to provide an ergogenic benefit for collegiate athletes during high-intensity exercise.

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Effects Of Sodium Bicarbonate Supplementation On Cerebral Oxygenation During Variable Intensity Exercise

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INTRODUCTION: Sodium bicarbonate (SB) supplementation induces a temporary metabolic alkalosis, which may alter cerebrovascular regulation and oxygen delivery during exercise. The cerebrovascular effects of SB are not well understood; alkalosis may promote cerebral vasoconstriction, whereas transient increases in arterial CO2 immediately following SB administration, or during intense exercise, may conversely induce vasodilation.
PURPOSE: The purpose of this study was to determine the effects of SB supplementation on cerebral oxygenation across varying exercise intensities and on cognitive performance assessed before and after exercise. **METHODS**: Thirteen participants (2 females) completed a 4-visit randomized crossover study. Following initial testing and familiarization visits, participants ingested either 0.3/kg of SB (Maurten™) or a placebo (PLA) 60 minutes prior to each of the two experimental sessions. Blood samples were analyzed for acid-base balance before and after exercise. Participants cycled on an ergometer for two 30-minute bouts, separated by a 3-minute break, at a clamped rating of perceived exertion (RPE) of 9, 12, and 15 for 10 minutes each. Additionally, the second series of efforts included a single 5-minute bout at RPE 17. Participants were blinded to all feedback, except for cycling cadence. Cerebral oxygenation was measured continuously over the prefrontal (PFC) and motor control (MC) cortices using near-infrared spectroscopy. Cognitive performance was assessed using the Attention Network Test (ANT) and Stroop Test (ST) before and after exercise.
RESULTS: Alkalosis was confirmed in the SB condition compared to PLA before (SB: 28.5 mmol/L vs PLA: 25.5 mmol/L, $p < 0.001$) and after exercise (SB: 23.9 mmol/L vs PLA: 20.2 mmol/L, $p < 0.001$). Cerebral oxygenation differed between conditions, with higher PFC O_2HHb ($p = 0.002$) in the PLA condition, whereas MC-O_2HHb was similar between conditions ($p = 0.56$). Oxygen availability (O2Hb) was not affected by exercise intensity in either condition or cerebral area ($p > 0.05$). Cognitive function was not affected by SB supplementation (ANT: $p = 0.36$, ST: $p = 0.91$).
CONCLUSIONS: Sodium bicarbonate supplementation enhances cerebral oxygenation during higher intensity cycling but does not alter cognitive performance under these conditions.