Physiological, Perceptual and Performance Effects of a Novel Energy-dense Ketogenic Bar

James D. Minor¹, Micah T. Sterrett¹, Christopher A. Brooks¹, Tanner R. Niemann¹, Margaret P. Troxel¹, Jeffrey D. Buxton¹, Hayden D. Gerhart¹, Alex Buga², Jeff S. Volek², Philip J. Prins¹.
¹Grove City College, Grove City, PA, USA. ²Ohio State University, Columbus, OH, USA.

We recently demonstrated that a novel ketogenic nutrition bar (KB), consumed 3h before rucking exercise (~50% of VO₂max; 14% grade, 2mph, 30% of body weight rucksack), produces similar time-to-exhaustion results to isocaloric high carbohydrate bars (CB). Based on our prior findings, we hypothesized that these results could be extrapolated to a 5-km running time trial (TT).

PURPOSE: To explore whether acute ingestion of carbohydrate or lipid-based nutritional bars before a 5-km TT elicit unique advantages that can augment aerobic exercise performance.

METHODS: In a randomized single-blind crossover design, recreational male distance runners (n = 11; age: 22± 4 yrs., height: 180.1 ± 10.2 cm, mass: 80.1 ± 12.3 kg, VO₂max: 58.0 ± 6.9 ml/kg/min) completed two sessions – a 5-km running TT familiarization and a VO₂max test – followed by two subsequent 5-km TTs, 3h after consuming 1000 kcal from a novel energy-dense KB (%en from carbohydrate/fat/protein: 5/83/12) or isocaloric CBs (52/30/18). Conditions were separated by a 1-week washout. Blood R-βHB, glucose, lactate, plus subjective measures of fullness and thirst, were measured at baseline, 30 min post-ingestion, pre-exercise, and post-exercise. Total time to completion, heart rate (HR), rating of perceived exertion (RPE), affect, respiratory exchange ratio (RER), oxygen consumption (VO₂), carbon dioxide production (VCO₂) was measured throughout exercise.

RESULTS: The 5-km TT performance was similar between conditions (CB: 23.9 ± 2.5 min, KB: 23.4 ± 2.6 min, p = 0.177). No differences were detected in HR, VO₂, VCO₂, RPE, and affect (all p > 0.05). The RER was significantly higher after CB ingestion (CB: 0.95 ± 0.04, KB: 0.90 ± 0.04, p = 0.002). Substrate oxidation rates for fat (CB: 0.3 ± 0.3 g/min; KB: 0.6 ± 0.3 g/min; p = 0.003) and carbohydrate (CB: 5.7 ± 0.9 g/min; KB: 6.2 ± 0.9 g/min; p < 0.0001) were augmented by KB ingestion. Capillary R-βHB increased modestly after the KB ingestion (p = 0.009), while blood glucose increased after CB only (p = 0.010). Lactate increased during the TT independent of the condition (p < 0.0001). Participants perceived the KB as 59% more filling than the CB (p = 0.002). CONCLUSION: A novel KB produced equivalent 5-km TT results and elicited greater metabolic flexibility compared to an isocaloric CB.

SIGNIFICANCE/NOVELTY: Individual responses to alternative, pre-race nutritional snacks – varying in lipid and carbohydrate content – may prospectively help coaches to develop precision nutrition strategies for athletes who wish to maximize their 5-km TT performance.

Supported the Grove City College Exercise Science Department and Keto Brick Inc. (Bryant, AR, USA).