MISSISSIPPI STATE UNIVERSITY™
HUMAN ENERGETICS AND THERMOREGULATION

Impact of Frequent Sweet Potato Ingestion on Gut Microbiome, Cholesterol, and Exercise Performance

JohnEric W. Smith[1], Shawn P. Brown[2], Marissa L. Bello[3], Alexis Gallegos[2], Richard E. Baird[1].

[1]Mississippi State University, Mississippi State, MS. [2]University of Memphis, Memphis, TN. [3]University of Alabama at Birmingham, Birmingham, AL.

Abstract

The importance of the gut microbiome is being explored in relation to multiple facets of health. Numerous pre- and probiotics are being explored to determine their potential to improve health.

PURPOSE: The purpose of this study was to explore the impact of frequent sweet potato ingestion on alterations to the gut microbiome which might in turn alter cholesterol levels and exercise performance.

METHODS: Thirteen recreationally trained males had fecal and blood samples collected to determine baseline gut microbiome communities and cholesterol and follow-up samples after 4 weeks of no-intervention. Participants then performed cycling exercise to exhaustion at 65% VO_{2PEAK} while ingesting a placebo (PLA) or a carbohydrate-electrolyte beverage (CHO; 60 g/h) separated by 7-days, in a randomized, cross-over design. Following preliminary testing, participants began a 6-week diet incorporating one sweet potato each day. After 28 days of the diet, participants provided fecal and blood samples and repeated cycling exercise to exhaustion with PLA and CHO in a randomized, cross-over design. DNA was extracted from fecal samples and bacterial communities were sequenced using Illumina NovaSeq. Blood samples were analyzed for Total Cholesterol (TC), HDL-C, LDL-C, and Triglycerides (TGL). Performance was analyzed comparing changes in time-to-exhaustion when ingesting PLA compared to CHO.

RESULTS: Thirteen bacterial OTUs saw changes in abundance related to sweet potato ingestion including increases in the genera *Faecalibacterium*, *Bacteroides*, *Parasutterella*, *Alistipes*, *Phascolarctobacterium*, *Oscollibacter*, and *Clostrodium XlVa* and decreases within the genera *Dorea*, *Asaccharobacter*, and *Butyricicoccus*. There were no differences observed in cholesterol (TC: 149 ± 36 mg/dL vs. 154 ± 25 mg/dL; p = 0.57; HDL-C: p = 0.72; LDL-C: p = 0.76; TGL: p = 0.35) or cycling time-to-exhaustion with and without carbohydrate (2.1 ± 10.3 min vs -1.3 ± 10.6 min; p = 0.43) following frequent sweet potato ingestion.

CONCLUSIONS: These finding demonstrate the efficacy of frequent sweet potato ingestion in shifting key bacterial abundances in the gut, including those known to play major roles in gut health through short-chain fatty acid production. These changes however did not elicit significant changes cholesterol or exercise performance.

Background and Rationale

There is growing interest in the role of intestinal bacteria on many components of health and the influence of dietary habits on diversity, abundance, and function of intestinal microbes. The ingestion of prebiotics and probiotics has been shown to:

- Positively influence antioxidant levels (Martelli et al 2011)
- Reduce inflammatory markers (Aoun et al 2020)
- Reduce triggers promoting obesity (Aoun et al 2020)
- Improve immune function (Jager et al 2019)
- Improve insulin sensitivity (Parnell & Reimer 2012)
- Improve cholesterol (Vourakis et al 2021)

Variations in intestinal bacteria have been shown to have a role in the uptake and metabolism of carbohydrates (Wood and Trayhum 2003) which may potentially positively influence fuel utilization during exercise.

Methods

13 recreationally active males 18-34 y.

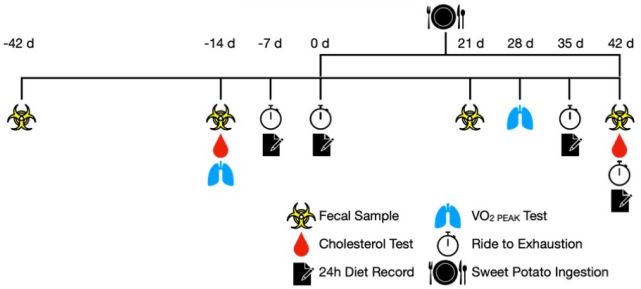
Baseline (-42 d), Pre (-14 d), During (21 d), and Post (42 d) gut microbe assessment via fecal sample.

Ingestion of one medium sweet potato daily prepared as desired by the participant.

Cholesterol assessed via fingerstick and analyzed with Cholestech LDX™ Pre (-14 d) and Post (42 d) sweet potato ingestion.

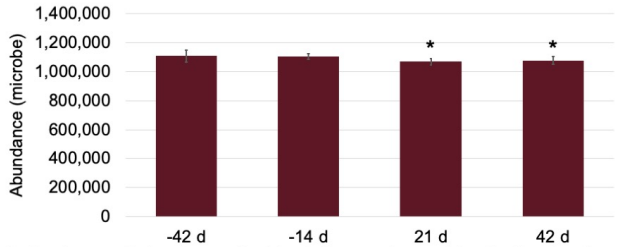
Exercise until volitional fatigue at 60% of $VO_{2\ PEAK}$ with commercially available sports drink with (6%) and without carbohydrate. Ingesting 250 mL every 15 minutes throughout exercise.

Methods cont.



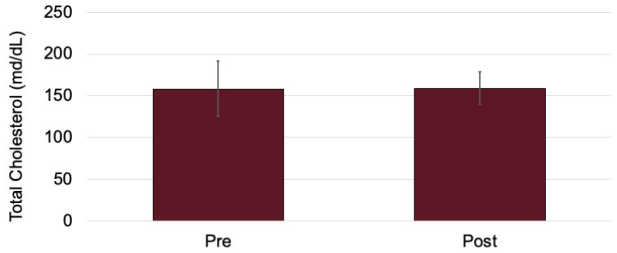
Results

No difference in overall bacterial diversity was observed throughout the study (F = 5.653, p = 0.189, η_p^2 = 0.278) with -42 d, -14 d, 21 d, and 42 d reporting 937 ± 295, 969 ± 150, 1,092 ± 193, and 1,087 ± 197 Operational Taxonomic Units (OTUs) measured at each collection point, respectively.

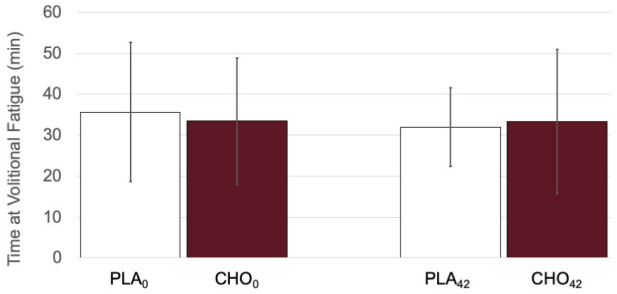


A decline in overall abundance of gut bacteria was observed in microbe abundance from with -42 d and -14 d significantly higher than 21 d and 42 d (F = 1.660, p = 0.002, η_p^2 = 0.102).

Increases in abundance were observed in a number of genera including increases in *Faecalibacterium*, *Bacteroides*, *Parasutterella*, *Alistipes*, *Phascolarctobacterium*, *Oscollibacter*, and *Clostrodium XlVa* and decreases within the genera *Dorea*, *Asaccharobacter*, and *Butyricicoccus*.



Results cont.



Conclusions

Six weeks of daily sweet potato ingestion influenced gut microbial.

- Reductions in dietary diversity may have negatively impacted the microbial abundance.
- A variety of probiotic/prebiotic foods is likely important for optimal gut microbial adaptation.

Six weeks of daily sweet potato ingestion did not alter total cholesterol, HDL-cholesterol, LDL-Cholesterol, or Triglycerides.

Six weeks of daily sweet potato ingestion did not alter exercise performance to volitional fatigue.

Dietary manipulation may need to be longer than six weeks to fully elucidate changes to the gut microbial community and corresponding health and performance responses.

References

Aoun, A., Darwish, F., & Hamod, N. (2020, Jun 30). The influence of the gut microbiome on obesity in adults and the role of probiotics, prebiotics, and synbiotics for weight loss. *Prev Nutr Food Sci, 25*(2), 113-123.

Jager, R., Mohr, A. E., Carpenter, K. C., Kerksick, C. M., Purpura, M., Moussa, A., Townsend, J. R., Lamprecht, M., West, N. P., Black, K., Gleeson, M., Pyne, D. B., Wells, S. D., Arent, S. M., Smith-Ryan, A. E., Kreider, R. B., Campbell, B. I., Bannock, L., Scheiman, J., Wissent, C. J., Pane, M., Kalman, D. S., Pugh, J. N., Ter Haar, J. A., & Antonio, J. (2019, Dec 21). International Society of Sports Nutrition Position Stand: Probiotics. *J Int Soc Sports Nutr, 16*(1), 62.

Martarelli, D., Verdenelli, M. C., Scuri, S., Cocchioni, M., Silvi, S., Cecchini, C., & Pompei, P. (2011, Jun). Effect of a probiotic intake on oxidant and antioxidant parameters in plasma of athletes during intense exercise training. *Curr Microbiol, 62*(6), 1689-1696.

Parnell, J. A., & Reimer, R. A. (2012, Jan-Feb). Prebiotic fiber modulation of the gut microbiota improves risk factors for obesity and the metabolic syndrome. *Gut Microbes, 3*(1), 29-34.

Vourakis, M., Mayer, G., & Rousseau, G. (2021, Jul 28). The role of gut microbiota on cholesterol metabolism in atherosclerosis. *Int J Mol Sci, 22*(15).

Wood, I. S., & Trayhurn, P. (2003, Jan). Glucose transporters (GLUT and SGLT): expanded families of sugar transport proteins. *Br J Nutr, 89*(1), 3-9.