

Beverage Hydration Index comparison of enterade®, oral rehydration solution, and sports drink

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Abstract

Background

Beverage retention is affected by many factors (e.g., osmolality, electrolytes, etc.). The “Beverage Hydration Index” (BHI) was created to assess the degree to which beverages “hydrate”, by measuring fluid retention after ingesting a 1 liter bolus and comparing it to water. Drinks with carbohydrates and electrolytes score higher on the BHI due to glucose-sodium cotransport at the gut and osmolality approaching isotonicity with blood. Recently, a hypotonic rehydration beverage (enterade®) was developed to take advantage of amino acid-sodium cotransport, thus obviating the need for carbohydrate. The purpose of this investigation was to assess BHI of enterade® in comparison to a carbohydrate-containing sports drink and an oral rehydration solution (ORS).

Methods

In a repeated-measures design, forty study participants (males, n=17; females, n=23), age (mean ±SD): males 19.7 ±0.7 y; females 20.3 ±0.9 y, BMI: males 23.7 ±2.8; females 22.5 ±2.7, were studied in a euhydrated state (first morning void USG < 1.025) after an overnight fast. They emptied their bladders, recorded their body mass and then ingested 1 L of fluid over 30 minutes (4 x 250 mL boluses every 7.5 minutes). The beverages, with corresponding osmolalities and kcal content, were as follows: distilled water (~0 mmol/kg; kcal/L), enterade® (195 mmol/kg; 21 kcal/L), ORS (270 mmol/kg; 105 kcal/L) and a sports drink (330 mmol/kg; 237 kcal/m). Each trial was separated by ~1 week. Urine output was collected and measured immediately, and each hour following the first collection for 2 hours, following fluid ingestion. Individual hour cumulative urine mass and BHI were compared by repeated measures one-way ANOVA with a Dunnett’s multiple comparison test to determine which drinks differed from water (P<0.05).

Results

Mean (±SD) total urine mass losses over 2 hours for enterade® (1013 ±288 g) and the ORS (959 ±234 g) were significantly less than water (1118 ±242 g; P<0.05) while the sports drink (1075 ±293 g; P>0.05) was not. The calculated BHI of enterade® (1.15 ±0.28) and the ORS (1.21 ±0.28) were greater than water (1.0 ±0.0; P<0.05) while the sports drink (1.09 ±0.26; P>0.05) was not.

Conclusions

Based upon these data, enterade® and a traditional ORS are superior to water to optimize rehydration, while sports drink was not. Importantly, the high BHI for enterade® was achieved without carbohydrate, making it a low-calorie alternative for effective rehydration.

Acknowledgements

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Introduction

- Recently, investigators created a metric called the “beverage hydration index” (BHI) to reflect the hydrating potential of commonly consumed fluids (1).
- The BHI data demonstrated that many beverages have a higher hydrating potential (i.e., more fluid is retained after ingestion) compared to water. One such beverage was an oral rehydration solution (ORS).
- Typically, ORS are comprised of water, electrolytes and glucose and can contain a significant amount of calories.
- A new ORS (enterade®) has come to market that uses amino-acid-coupled sodium transport to enhance water absorption across the gastrointestinal track.
- enterade® is unique because it contains no sugar; thus, making it advantageous for various populations.
- The purpose of this investigation was to assess the BHI of enterade® in comparison to other commonly consumed hydration beverages.

Methods

- Forty euhydrated participants completed the study (morning USG ≤1.025; **Table 1**).
- The following bullets describes the basic overview of the procedures (**Figure 1**).
 - ❖ Participants ingested 2 L of water between 1800-2230 hrs the night before trials.
 - ❖ Upon waking, participants collected a urine aliquot for USG measure and drank an additional 500 mL water.
 - ❖ Once at the lab, subjects ingested 1 L of the test beverages (**Table 2**) over 30 mins.
 - ❖ Urine was collected immediately and each hour for 2 hours following the fluid ingestion.
- Using the 2 hour urine production values, the BHI values were calculated as previously described (1).

Table 1. Participant characteristics. Values are mean±SD

Group	Age (y)	Height (m)	Body Mass (kg)	BMI (kg/m ²)
Males (n=17)	19.7±0.7	1.8±0.1	76.6±11.7	23.7±2.8
Females (n=23)	20.3±0.9	1.7±0.1	61.5±9.7	22.5±2.7
All (n=40)	20.1±0.9	1.7±0.1	67.9±12.9	23.0±2.8

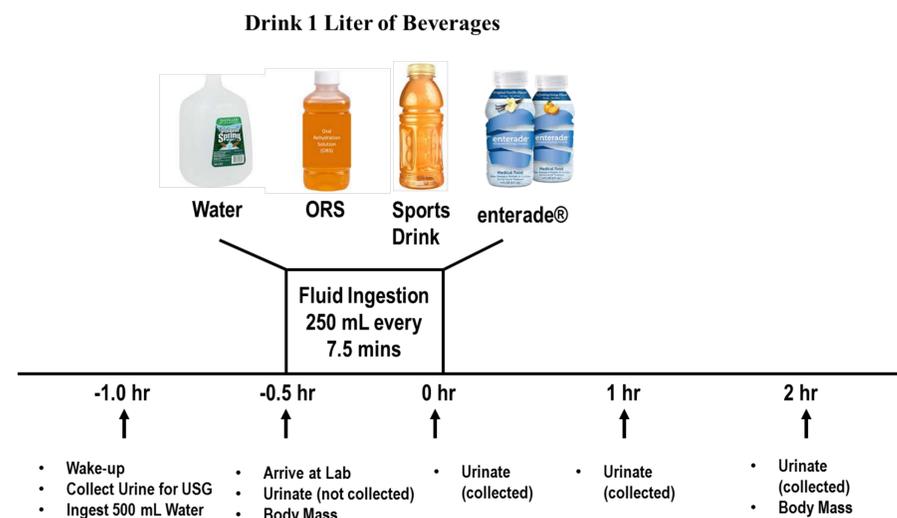


Figure 1: Overview of experimental procedures

Table 2. Comparison of the test beverage composition.

	Caloric Content (kcal/L)	Carbohydrate (g/L)	Sodium (mmol/L)	Potassium (mmol/L)
enterade®	21	0	55	10
ORS	105	25	44	20
Sports drink	237	61	20	3

Results

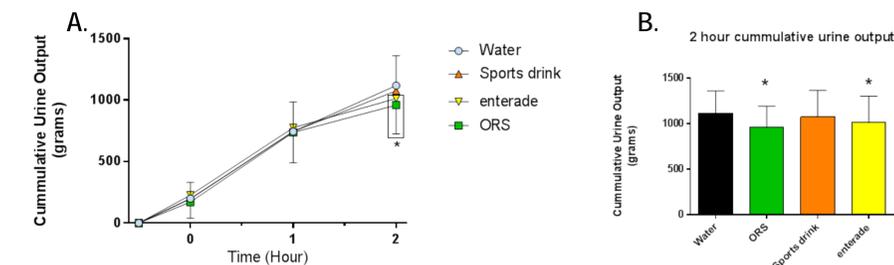


Figure 2: (A) Cumulative urine mass and (B) total urine loss over 2 hours. Values are expressed as mean ± SD. *Indicates significant difference (P<0.05) of ORS and enterade® compared to water.

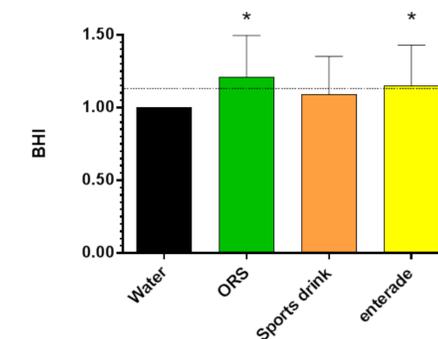


Figure 3: Beverage hydration index (BHI) calculated from the cumulative urine masses at the 2 hour time point. The dotted line is positioned at a BHI value of 1.13, which represents the urine variation observed after drinking just water (±130 mL; pilot data not shown) and thus is the threshold for a difference of practical significance. Values are expressed as mean ± SD. *Indicates significant difference (P<0.05) from water.

Summary

- This investigation demonstrates that enterade® and a commercially available ORS hydrate better than water.
- Importantly, enterade® causes fluid retention without using sugar
- enterade® may be advantageous as a rehydration beverage for various populations (both clinical and athletic) that seek to minimize their consumption of sugar while optimizing their hydration.
- The present results support the original investigation demonstrating that electrolyte and macronutrient composition plays a major role in fluid retention and thus the BHI value (1).

REFERENCES

1. Maughan RJ, Watson P, Cordery PA, Walsh NP, Oliver SJ, Dolci A, et al. A randomized trial to assess the potential of different beverages to affect hydration status: development of a beverage hydration index. *Am J Clin Nutr.* 2016;103(3):717-23.