Fluid retention properties of carbohydrate/protein and carbohydrate-only sports drinks

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Introduction
Receptors in the hypothalamus respond to changes in blood osmolality, fluid volume, and blood pressure during disruptions in fluid balance. For example, as blood osmolality increases during dehydration, signals are ultimately sent to the kidney to retain fluid. Restoring fluid balance quickly is crucial for optimal physiological function, performance, and recovery, especially if multiple bouts of exercise are required. Nose et al. (1988) reported that beverage osmolality, and ultimately blood osmolality, is one of the key factors in determining fluid retention rates during rehydration. Compared to a diluted state, as blood osmolality is maintained during rehydration, a greater amount of fluid is retained by the kidney. Many previous investigations have focused on the integral role of water, carbohydrate, and sodium to aid in fluid retention during rehydration. In fact, makers of some sports drinks tout their products as better fluid replacement beverages than plain water because of the combination of water, carbohydrate, and sodium. However, other compounds may also influence osmolality, and ultimately, fluid retention. The purpose of this study was to compare two popular sports drinks, carbohydrate + protein and carbohydrate-only beverages, and water in fluid retention following 2% BW loss.

Methods
Following approval from the IRB, data collection began with 13 subjects. Subjects cycled at 25C to dehydrate to 2% of starting BW during three counterbalanced conditions. They then ingested one of the beverages, within 20 minutes, at a volume equal to BW loss. Subjects ingested either a 6% CHO + 1.5% protein + 190 mg/240 mL sodium sports drink (CP, Accelerade®), a 6% CHO + 100 mg/240 mL sodium sports drink (CHO, Gatorade®, PepsiCo), or plain water (WA) during a three hour seated recovery period. Beverage osmolality for CP was 305 mOsm/kg water, 285 mOsm/kg for CHO, and 4 mOsm/kg for WA. Blood samples, urine samples and volume, and BW were measured at seven time points during each condition.

Results
Subjects averaged 1.74 kg weight loss (2.5 ±.06 %) from exercise. Fluid retention was significantly (p=.000) greater for CP (88 ±1.3%) than CHO (75 ±4%) and WP (53 ±4.5%). Average serum osmolality was greater (p=.000) for CP (284.7 ±1.4 mOsm/kg) than CHO (282.6 ±1.4 mOsm/kg) and WA (280.6 ±1.7 mOsm/kg). Consequently, average urine osmolality was also greater (p=.001) for CP (569.4 ±43.5 mOsm/kg) than CHO (472.9 ±31 mOsm/kg) and WA (303.7 ±42 mOsm/kg). Serum protein was lower for CP (7.39 ±.3 g/L) and CHO (7.33 ±.2 g/L) than WA (7.63 ±.2 g/L).

Discussion/Conclusion
Results indicate that a CP may be a preferable choice when fluid retention is a concern. Fluid retention for CP was 15% greater than CHO and 40% greater than WA. It is apparent that CP maintained a slightly higher serum osmolality during the 3 hr recovery period that resulted in fluid retention being improved over CHO and WA. It is not possible, however, to discern if it was the protein, sodium, or combination that added to the osmolality that significantly enhanced fluid retention with CP. Urine osmolality data points to the fact that urinary fluid loss for CP (209 mL lost) was 48% less than CHO (435 mL lost) and 75% less than WA (818 mL lost). Plain water ingestion, however, led to a significant dilution of the serum that resulted in only 53% fluid retention and greater fluid loss than CP and CHO.

References