The Effects of Low-Fat Skim Chocolate Milk on Urinary Hydration Indices in a Sample of Division 1-AA Cross Country Runners

Jamie Ghigiarelli, Katie Sell, Michelle Blum, Nicholas Dagastino, Peter Alfano
Department of Physical Education and Sports Sciences, Human Performance Lab
Hofstra University, Hempstead NY 11549

Introduction

One area receiving widespread attention due to its carbohydrate-protein combination is the use of bovine milk to improve post exercise hydration status, glycogen re-synthesis, and performance capacity. Prior studies report flavored (chocolate) milk drinks enhance exercise performance measures such as, time to exhaustion and total work output in endurance trials to fatigue, when compared to fluid replacement and carbohydrate meal replacement drinks (Karp 2006). One of the more prominent effects is milk's ability to decrease urine volume output post exercise indicating a greater degree of fluid retention (Shirreffs, 2007). A further potential benefit of milk is its high electrolyte content of Na+ and K+, supporting the literature regarding the advantage of Na+ based drinks on post exercise hydration (Roy, 2008).

Beverage drinks with sodium (Na+ .5-.7 g per L) versus electrolyte free solutions (i.e. water) maintain plasma osmolality levels, reduce urine output, and sustain the sodium-dependent osmotic drive to drink (Maughan, 1995; McArdle, 2007; Shirreffs, 1998). In most cases athletes will be rehydrating in this environment (i.e. practices, competitions, and weight room sessions); consequently, if milk does show superior improvements comparing it to carbohydrate-electrolyte drink (CHO-E) and water, then it is possible more athletic populations will make milk their drink of choice post exercise.

Materials and Methods

Nine male and two female volunteers from the Hofstra University cross country team agreed to participate in this investigation. At the time of the study all subjects will be taking part in their respective off season training program. Due to the nature of the investigation, those with known lactose intolerance will be excluded.

Subject's urine was tracked two days per week (Tuesday and Thursday) for a period of six weeks, with one week off at week 2 and week 4. Due to the structure of the off season training program, Tuesday and Thursday were the experimental days because training intensity was highest on these days. Data collection began January 26th and ceased approximately April 1, 2009. Typical climatic temperatures estimated to be approximately 3o C to -3o C during this (Jan-Feb) calendar year (weather.com).

The sample size of twelve was divided up into three groups of four (n = 4) in a counter balanced cross over randomized experimental design to eliminate order effect. All groups ingested the experimental drinks consisting of commercial available low-fat skim chocolate milk (CHC), carbohydrate electrolyte drink (CHO-E), and water (W). Two hours prior to each practice session, subjects were instructed to hyper-hydrate with 400-600 ml of water to ensure they will be in an euhydrated state upon arrival to workout sessions . After each practice session, subjects immediately rehydrated with either low-fat skim chocolate milk (CHC), carbohydrate-electrolyte sports drink (CHO-E), or water (W). Drink volume ingested was equal to 150% of body mass loss during exercise partitioned into two drink sessions, immediate post exercise (IPE) and 60 minutes post exercise.

Urine samples were collected pre exercise, immediate post exercise, 60 minutes post exercise, and a midnight sample. Urine osmolality, urine specific gravity, and urine color analysis were examined in an attempt to establish a correlation between the different hydration measures. Subjects self-reported their individual urine output throughout the evening once they departed the practice facility.

Results

Rehydration of low-fat skim chocolate milk post exercise exhibited a non-significant decrease (p = .08) of approximately 35% in urine volume output throughout the evening in the CHC group (346 ± 95 ml) when compared to CHO-E (476 ± 188 ml) and W (549 ± 240 ml) groups. Urine osmolality, specific gravity, and color scores gradually decreased across all drinks from 60 minute recovery to nightly urine samples with a more significant drop observed in the control (W) group (p = .03osmo, p = .01color) This indicates rehydration occurred after exercise using all the drinks however, it appears a slower rate of hydration occurred in the chocolate milk and CHO-E groups. A secondary finding was a significant correlation did exist between urine osmolality and urine specific gravity (r = 0.83*), while weak non-significant correlations occurred between urine osmolality and urine color (r = .557) as well as urine specific gravity and urine color (r = .367).

Figure 1. Urine Color

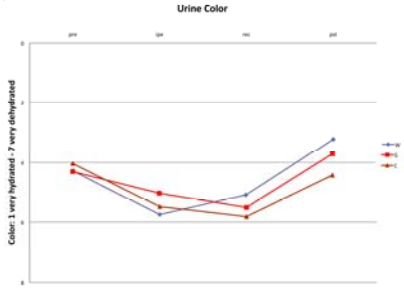


Figure 2. Urine Osmolality

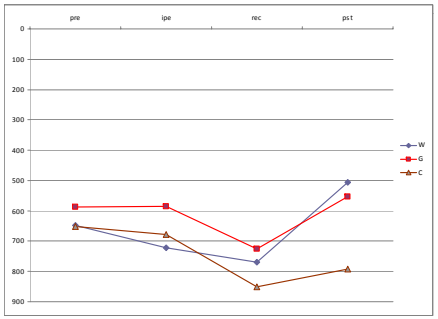


Figure 3. Urine Specific gravity

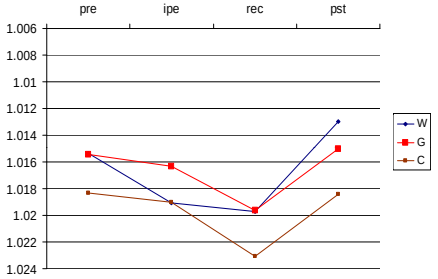
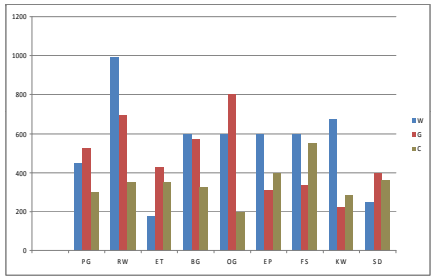


Figure 4. Volume of Urine Output



Correlation Matrix: Osmolality, Specific Gravity, & Color

	Urine Osmo	Urine Specific Gravity	Urine Color
Urine Osmo	1.00	0.83*	0.56
Urine SG	0.83*	1.00	0.36
Urine Col	0.56	0.36	1.00

Conclusions

The results of this study suggest that implementation of a nutrient dense drink (chocolate milk) post exercise will show a non-significant trend to reduce urine output. Due to its high macronutrient and electrolyte content chocolate milk may be a viable way to reduce urine output and increase water retention which may allow one to maintain a more euhydrated state post exercise for lactose tolerant individuals.

Previous studies examined the effects chocolate milk has on establishing a better status of hydration by calculating net fluid balance. In the present study, this became more difficult to assess because of the field nature of the experimental design and allowing subjects to drink *ad libitum* throughout the evening. If a true measurement of hydration status was to be assessment a more controlled setting needs to be implemented so one can eliminate various confounding factors such as amount of drink ingested and type of drink ingested.

It is also concluded the indices of urine osmolality and urine specific gravity indicate a strong relationship as markers of hydration status as opposed to urine color. This information could be applicable when using different modalities to assess hydration status

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Acknowledgments

The authors would like to thank the American Dairy Association Dairy Council Inc for the grant funding of this research project. In addition, we would also like to thank Matt Pikosky, Director of Research Transfer of Dairy Management Inc (Rosemont, IL) for his assistance in writing of the manuscript.

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