Letter to the Editor

Important Considerations for Recommending Hydration Studies

Dear Editor,

We read with interest the study by Sun and colleagues[1] published in the recent April Sports Medicine edition. The study investigated fluid balance associated with endurance kayaking and evaluated the efficacy of hydration with water versus a commercially available sports drink. We congratulate the authors for profiling the fluid loss incurred during kayaking, in which information specific to the sport has not been well documented. However, we are concerned with the proposed hydration recommendations made by the authors. While several of the limitations in the study are already mentioned by the authors, we would like to highlight other concerns to ensure a more balanced reading of the "take home message" for the readers.

In both trials, it was reported that the paddlers were dehydrated by 0.72 ± 0.38% (~ 0.44 kg) and 1.10 ± 0.52% (~ 0.68 kg) when consuming (*ad libitum*) the sports drink and water respectively. Based on this observation, the authors recommended that paddlers should replace about 1.04 L/h of sports drinks (an additional of ~ 0.46 L above the 0.58 L ingested by the subjects during the sports drink trial) to prevent a loss in body mass. With the recent debates on evidence-based hydration guidelines,[2-4] and the revision in Position Stand/Statement on fluid guidelines during exercise[5,6] such that "the goal of drinking during exercise is to prevent excessive (>2% body weight loss from water deficit) dehydration",[6] it is hard to understand the recommendation proposed by Sun and colleagues.[1] The body masses lost in both the water and the sports drink trials reported in this study were within the 2% threshold. Indeed, the authors had correctly pointed out in the opening paragraph that only in events of longer distance, hence longer duration, are dehydration likely to have a negative impact on performance. And this degree of dehydration is in the order of at least 2% body mass loss. Complete fluid replacement should not be confined to the exercise period, but should be extended to the period after exercise. To suggest replacing 100% of fluid loss during exercise, especially when the magnitude of dehydration is <2% of body mass, is excessive. Moreover, for optimal fluid replenishment, consensus in the literature suggests replacing 150% (including the recovery period) and not 100% of the fluid lost during exercise.[6]

In this study, sweat losses was calculated from the differences in body masses before and after exercise, fluid intake and urine output. The precision of the weighing scale used to measure body mass needs to be sensitive enough, with a resolution of at least 50 g for meaningful interpretations.[7] The scale used in the study has a resolution of 100 g, which does not meet the criterion resolution. Since sweat loss corresponds with exercise intensity, the inconsistency in exercise intensity between trials will have implications for the authors' conclusions that '*athletes undergoing water rehydration lost significantly more body mass as compared to rehydrating with the sports drink*', since part of the difference can be attributed to the differences in sweat losses between the 2 trials (although the mean difference of ~ 180 g was not statistically different in this instance). This disparity will help to explain why body mass loss was significantly lower in the sports drink trial despite similar rehydration volumes.

Another weakness in the study design is the absence of a placebo group for the sports drink. Without accounting for the placebo effects of ingesting the sports drink, it is technically unsound to make claims about better performance and lower ratings of perceived exertion with the sports drink than with water. The failure of the study to counterbalance the water and sports drink treatments also confounds the effects of day-to-day variations. Each trial should have a balanced representation of sports drink and water experiments, and not either treatment alone. The consistency between the climatic conditions in the trials and in the actual race conditions would also need to be supported by climatic data before the external validity of the results, and its recommendations, can be supported. For example, radiative heat exchange is absent in the sheltered condition of the experiment, but the influence of radiative heat is present in the daylight hours of the race.

Other points to note include the use of urine specific gravity as a marker of hydration status. Measurement of urine indices immediately post-exercise has been shown to be invalid in providing any indication of hydration status, i.e. a concentrated urine sample does not necessarily reflects hypohydration.[8] This is probably due to an increase in plasma levels of antidiuretic hormone and aldosterone that result in sodium and water retention by the kidney during exercise. Interestingly, while this index is useful as a pre-exercise hydration marker, no attempt was made to evaluate the subjects' hydration status prior to the commencement of each trial. This control before each trial is important in hydration-related studies since any inconsistency in hydration status prior to the commencement of trial is likely to confound the efficacy of the hydration medium.

Based on our comments in this communication and the limitations stated by the authors, we suggest that the results of the study, though may be useful, are not ready for prescribing fluid intake guidelines during endurance kayaking.

REFERENCES

1. Sun JMF, Chia JKK, Aziz AR, Tan B. Dehydration rates and rehydration efficacy of water and sports drink during one hour of moderate intensity exercise in well-trained flatwater kayakers. Ann Acad Med Singapore 2008;37:261-5.
2. Noakes TD. Drinking guidelines for exercise: what evidence is there that athletes should drink "as much as tolerable", "to replace the weight lost during exercise" or "ad libitum"? J Sports Sci 2007;25:781-96.
3. Noakes TD, Speedy DB. Time for the American College of Sports Medicine to acknowledge that humans, like all other earthly creatures, do not need to be told how much to drink during exercise. Br J Sports Med 2007;41:109-111.
4. Roberts WO. Fractured fairy tales: hyponatraemia and the American College of Sports Medicine fluid recommendations. Br J Sports Med 2007;41:109.
5. Hew-Butler T, Verbalis JG, Noakes TD; International Marathon Medical Directors Association. Updated fluid recommendation: position statement from the International Marathon Medical Directors Association (IMMDA). Clin J Sport Med 2006;16:283-292.
6. American College of Sports Medicine, Sawka MN, Burke LM, Eichner ER, Maughan RJ, Montain SJ, Stachenfeld NS. American College of Sports Medicine position stand. Exercise and fluid replacement. Med Sci Sports Exerc 2007;39:377-90.
7. Parsons KC. Measurement methods and assessment techniques. In: Human Thermal Environments: The Effects of Hot, Moderate and Cold Environments on Human Health, Comfort and Performance. 2nd ed. London: Taylor and Francis, 2003:93-128
8. Francesconi RP, Hubbard RW, Szlyk PC, Schnakenberg D, Carlson D, Leva N, et al. Urinary and hematologic indexes of hypohydration. J Appl Physiol 1987;62:1271-6.

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